GREEN DISPOSAL PRACTICE INTENTION AMONG MILLENNIAL HOUSEHOLDS: A STUDY OF PERAK

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2023

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THESIS SUBMITTED IN FULFILMENT
OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

INSTITUTE FOR ADVANCED STUDIES
UNIVERSITI MALAYA
KUALA LUMPUR

2023

UNIVERSITI MALAYA

ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: **DHANABALAN S/O SANDRA SEGARAN**

Matric No: **17050713/1**

Name of Degree: **DOCTOR OF PHILOSOPHY**

Title of Thesis ("this Work"):

GREEN DISPOSAL PRACTICE INTENTION AMONG MILLENNIAL HOUSEHOLDS: A STUDY OF PERAK

Field of Study: **SOCIAL AND BEHAVIOURAL SCIENCE (ECONOMICS)**

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GREEN DISPOSAL PRACTICE INTENTION AMONG MILLENNIAL HOUSEHOLDS: A STUDY OF PERAK

ABSTRACT

Malaysia's waste generation has drastically increased due to rapid urbanisation caused by economic and population growth. Besides, the increased generation of municipal waste by households in Malaysia has exhausted landfills well before their maturity period. This study seeks to identify the factors that could motivate millennial households to engage in green disposal practices. Using an extended version of the theory of planned behaviour, this study incorporates institutional motivations (IM), green disposal technology (GDT) and disposal awareness (DA) as predictors that may influence the intention of millennials to adopt green disposal practices. In addition, the study examines the perceived behavioural control (PBC) capacity to strengthen the interaction between attitude (ATT) and subjective norms (SN) towards intention. Also, the study evaluates the indirect influence of IM using positive ATT and green disposal technology through PBC. Using a sample of 671 responses collected from Perak's urban and rural millennial households, the study deploys the Partial Least Squares Structural Equation Modelling (PLS-SEM) to test fourteen hypotheses: one, ATT positively influencing intention; two, SN positively influencing intention; three, PBC positively influencing intention; four, PBC moderating the relationship between ATT and intention; five, PBC moderating the relationship between SN and intention; six, DA positively influencing intention; seven, IM positively influencing intention; eight, formal institutions positively influencing intention; nine, informal institutions positively influencing intention; ten, IM indirectly influencing intention via positive ATT; eleven, GDT positively influencing intention; twelve, reverse vending machine positively influencing intention; thirteen, mobile application positively influencing intention; and finally, fourteen, IM indirectly influencing intention via PBC.

The results support all the hypotheses with the expected signs, except for formal institutions and mobile application support. Also, all supported hypotheses are statistically highly significant, suggesting that it is highly possible to change millennials' intention towards adopting green disposal practices. Furthermore, PBC had the highest coefficient value, demonstrating its strong ability to motivate millennials to participate in green disposal activities. However, PBC showed a negative moderating effect on the relationship between ATT and SN. Thus, the moderating impact of PBC significantly strengthened the interactions of ATT x PBC and SN x PBC on intention when PBC was at a low level. Additionally, the total effect coefficient value (combination of direct and indirect effects) of green disposal technology and institutional motivations also had a highly significant impact on improving green disposal practices. Moreover, the total effect of mediation of institutional motivations through the influence of positive ATT and green disposal technology through the influence of PBC showed a more comprehensive impact on millennials' intention than their direct or indirect impact. Therefore, the overall findings of the thesis lead to the conclusion that PBC (convenience and skills), institutional motivations, green disposal technology, and awareness about improper disposal are capable of changing millennials' behaviour to participate in green disposal activities. Such a shift in millennials' behaviour can potentially prevent more than 35% of recoverable municipal waste from landing in landfills.

Keywords: Millennials' conduct, theory of planned behaviour, institutional motivation, green disposal technology, disposal awareness

NIAT AMALAN PELUPUSAN SAMPAH SECARA KAEDAH HIJAU DALAM KALANGAN ISI RUMAH MILENIAL: KAJIAN DI PERAK

ABSTRAK

Kegiatan pembuangan sampah di Malaysia telah meningkat secara mendadak akibat pertumbuhan ekonomi, pertambahan penduduk dan urbanisasi. Selain itu, peningkatan aktiviti pembuangan sampah perbandaran oleh isi rumah telah menyebabkan kapasiti tapak pelupusan sampah mencapai tahap maksimum lebih awal dari tarikh jangkaan. Oleh itu, kajian ini bertujuan untuk mengenal pasti faktor-faktor yang boleh mendorong isi rumah milenial untuk melibatkan diri dalam amalan pelupusan hijau. Dengan menggunakan versi lanjutan teori tingkah laku terancang, kajian ini menggabungkan motivasi institusi (IM), teknologi pelupusan hijau (GDT), dan kesedaran pelupusan sampah (DA) sebagai faktor peramal yang berkebolehan mempengaruhi niat milenial untuk mengamalkan amalan pelupusan hijau. Di samping itu, tesis ini meneliti kebolehan persepsi kawalan tingkah laku (PBC) untuk mengukuhkan interaksi antara sikap (ATT) dan norma subjektif (SN) terhadap niat. Turut dinilai ialah pengaruh secara tidak langsung oleh IM menggunakan ATT positif dan GDT melalui PBC. Dengan menggunakan sampel 671 respons yang di kumpul daripada isi rumah milenial bandar dan luar bandar Perak, kajian ini menggunakan *Partial Least Squares Structural Equation Modelling* (PLS-SEM) untuk menguji empat belas hipotesis: satu, ATT mempengaruhi niat secara positif; dua, SN mempengaruhi niat secara positif; tiga, PBC mempengaruhi niat secara positif; empat, PBC *moderate* hubungan antara ATT dan niat; lima, PBC *moderate* hubungan antara SN dan niat; enam, DA mempengaruhi niat secara positif; tujuh, IM mempengaruhi niat secara positif; lapan, institusi formal mempengaruhi niat secara positif; sembilan, institusi tidak formal mempengaruhi niat secara positif; sepuluh, IM secara tidak langsung mempengaruhi niat melalui ATT positif; sebelas, GDT mempengaruhi niat secara positif;

dua belas, mesin layan diri terbalik mempengaruhi niat secara positif; tiga belas, aplikasi mudah alih mempengaruhi niat secara positif; dan empat belas, IM secara tidak langsung mempengaruhi niat melalui PBC. Keputusan menyokong semua hipotesis dengan tanda yang dijangkakan, kecuali institusi formal dan sokongan aplikasi mudah alih. Di samping itu, semua hipotesis yang disokong adalah sangat signifikan secara statistik, menunjukkan bahawa kemungkinan untuk mengubah tingkah laku milenial ke arah mengamalkan amalan pelupusan hijau adalah sangat tinggi. Tambahan, PBC mempunyai nilai pekali tertinggi, menunjukkan keupayaan kukuh untuk menggalakkan golongan milenial mengambil bahagian dalam aktiviti pelupusan sampah secara hijau. Walau bagaimanapun, PBC menunjukkan kesan *moderator* negatif terhadap hubungan antara ATT dan SN. Oleh itu, impak PBC sebagai *moderator* secara signifikan mengukuhkan interaksi ATT x PBC dan SN x PBC terhadap niat apabila PBC berada pada tahap rendah. Di samping itu, jumlah efek nilai pekali (gabungan kesan langsung dan tidak langsung) GDT dan IM juga mempunyai impak yang sangat signifikan terhadap penambahbaikan amalan pelupusan hijau. Malahan, jumlah kesan *mediator* terhadap motivasi institusi melalui pengaruh ATT positif dan GDT melalui pengaruh PBC menunjukkan impak yang lebih komprehensif terhadap niat milenial daripada kesan langsung atau tidak langsung mereka. Oleh yang demikian, penemuan keseluruhan tesis ini membawa kepada kesimpulan bahawa PBC (kemudahan dan kemahiran), IM, GDT, dan DA yang tidak betul mampu membawa perubahan pada tingkah laku milenial untuk mengambil bahagian dalam aktiviti pelupusan hijau. Peralihan sedemikian dalam tingkah laku milenial ini berpotensi mengelakkan lebih 35% sisa perbandaran yang boleh di kitar semula daripada mendarat di tapak pelupusan sampah.

Kata kunci: Tingkah laku milenial, teori tingkah laku terancang, motivasi institusi, teknologi pelupusan hijau, kesedaran pelupusan sampah

ACKNOWLEDGEMENTS

I would like to begin by expressing my utmost gratitude to the Almighty GOD (Lord Shokkanathar Meenakshima) for enabling me to complete this challenging task. Throughout the research process, I am indebted to my supervisors, Distinguished Professor Dato' Dr Rajah Rasiah and Associate Professor Dr Santha Chenayah, who both deserve the highest honour for their unwavering encouragement and guidance to me. I am also appreciative of the Public Service Department, Prime Minister's Department, Putrajaya for funding my research through the In-Service Courses Scholarship (HLP). A special thanks to Professor Dr VGR Chandran Govindaraju (UM) and Professor Dr Muhammad Shujaat Mubarik from the Institute of Business Management, Karachi for their insightful feedbacks and suggestions.

No adequate words can describe how indebted I am to both my parents, Sandra Segaran Muniappan Pillai and Rajeswary Srinivasam Pillai. In addition, I would like to express my gratitude to my beloved family for the moral support they have given me. Hence, I would like to dedicate this thesis to my lovely daughter, Rithya Dhanabalan as she has been my source of inspiration and kept me going to complete my research despite the many challenges I had to face throughout. Thank you, maa. Lastly, I would like to express my sincere appreciation to all my friends. Here, I would like to thank Saravanan Subramaniam, Soothesan Apalasamy and Gayathri Devi Ramakrishnan, to name a few, as other inspiring individuals are too numerous for me to mention. Not to forget are the millennial households that participated in my study. Thank you very much for your time and consideration.

"*Man is made by his belief. As he believes, so he is*!"

- Bhagavad Gita

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

ATT	:	Attitude
AVE	:	Average Variance Extracted
CA	:	Cronbach's Alpha
CB-SEM	:	Covariance-based Structural Equation Modeling
CMB	:	Common Method Bias
CR	:	Composite Reliability
CVI	:	Content Validity Index
CVR	:	Content Validity Ratio
DA	:	Disposal Awareness
FI	:	Formal Institution
FIMIX-PLS	:	Finite Mixture Partial Least Squares
GDT	:	Green Disposal Technology
GIT	:	Green Information Technology
HOC	:	Higher-order Construct
HTMT	:	Heterotrait-Monotrait Ratio Correlations
I-CVI	:	Item Content Validity Index
II	:	Informal Institution
IM	:	Institutional Motivations
INT	:	Intention
IT	:	Information Technology
LM	:	Linear Regression Model
MAE	:	Mean of Absolute Value of Errors
MCA	:	Missing at Random
MCAR	:	Missing Completely at Random

MGA	:	Multigroup Analysis
MICOM	:	Measurement Invariance of Composite Models
MNAR	:	Missing Not at Random
MSW	:	Municipal Solid Waste
MVA	:	Missing Values Analysis
PBC	:	Perceived Behavioural Control
PET	:	Polyethylene Terephthalate
PLS-MGA	:	Partial Least Squares Multigroup Analysis
PLS-SEM	:	Partial Least Squares Structural Equation Modeling
RMSE	:	Root of the Mean of the Square of Errors
RVM	:	Reverse Vending Machines
SD	:	Standard Deviation
SEM	:	Structural Equation Modeling
SN	:	Subjective Norms
SPSS	:	Statistical Package for the Social Sciences
SWCorp	:	Solid Waste and Public Cleansing Management Corporation
TPB	:	Theory of Planned Behaviour
TRA	:	Theory of Reasoned Action
VIF	:	Variance Inflation Factor

LIST OF APPENDICES

CHAPTER 1: INTRODUCTION

1.1 Background of Study

All living organisms and human-created products will eventually perish and become waste when they have achieved their life expectancy. Simply put, a product is considered waste when it is no longer valuable to humans (Mahmood, 2000). A rapid economic growth and a structural change from primary to secondary economic activities with its concomitant impact on increasing living standards have resulted in a mounting problem in waste production (Hoornweg & Bhada-Tata, 2012; Matsuda et al., 2018; Meng et al., 2019; Singh, 2019; Wilson & Velis, 2015). As with other rapidly industrialising countries, Malaysia has experienced a substantial increase in municipal waste. According to a Malaysian Investment Development Authority (2021) report, Malaysia's municipal waste per day increased by 102.25% (within a sixteen year period), from 19 thousand tonnes per day (SWCorp, 2019) in 2005 to 38,427 thousand tonnes per day in 2021.

While significant advances have been made in developed countries such as Germany and Japan, over 80% of the waste is still disposed of through landfills without any recovery process (Michel Devadoss et al., 2021), thus threatening to exhaust maximum capacity well ahead of their projected deadlines (Agamuthu & Fauziah, 2011). Typically, municipal solid waste (MSW) in Malaysia is made up of 70% to 80% of organic waste, and Asian nations in general, generate a comparable amount of organic waste which is approximately 60% (Malakahmad et al., 2018). As a result, waste in landfills which are dominated by organic waste has contributed to significant environmental deterioration including leachate discharge, toxic waste build-up and greenhouse gas emissions, amongst other types of pollution.

Although several governmental and non-governmental policies have since been implemented to minimise waste generation which includes monitoring, enforcement and

public awareness through dissemination (Agrawal, 2001; Coleman, 2009), landfills have continued to be the primary waste disposal methods in Malaysia. Consequently, a growing body of research has emerged to investigate the impact of institutions on shaping individuals toward a behaviour shift from dumping to recycling or reusing waste. For example, Zhang and Zhao (2019) confirmed that interactions among housing communities influence people's attitudes in minimising improper waste dumping. Similarly, Xiao et al. (2017) found that community regulations significantly influence the participation of households in waste separation activities. However, despite several interventions being introduced by institutions to mitigate the increase in waste landing in landfills, little is known about their interventional influences on millennials.

Furthermore, a lack of awareness about waste disposal has emerged as the major contributor to an unsustainable waste generation. It is alarming to learn that 39% of the world's population does not properly dispose their waste (Shahzadi et al., 2018). Waste disposal that is not handled correctly poses significant health risks to individuals and contributes to environmental degradation, all of which are caused directly or indirectly by a lack of awareness on appropriate waste disposal (Sakawi et al., 2013). Instead of focusing on preventing waste from being disposed of in landfills or reducing it, most governments worldwide emphasise on utilising technologies to treat waste.

When it comes to treating municipal waste, there is a diverse variety of options available. Nevertheless, most of them are not suitable for usage at the home level since municipal waste treatment is more effectively managed by waste management institutions which are also more financially equipped. Only a few ways of handling household waste such as composting, recycling, waste separation and reuse are suitable for home users' implementation. Traditionally, municipal waste is dumped directly into landfills or transported to an incinerator plant, both of which are severely constrained in Malaysia's

municipal waste disposal infrastructure (Munir et al., 2018). As such, managing waste disposal has posed challenges and caused a financial strain on local waste management authorities, primarily due to the increasingly financial demands placed on their waste management budgets as a result of treating the municipal waste.

Thus, this study aims to elucidate the factors that motivate millennial households from Perak, Malaysia, to improve their disposal practice by emphasising on environmentally-friendly disposal activities. Besides that, based on a report from the Department of Statistics Malaysia (2020b), Malaysia's millennials constitute the largest population which is 26.6% of the total population. Meanwhile, Perak's millennials accounted for 23.7% of the total population in the 2020 estimation. Aside from that, several earlier scholars have characterised millennials as environmentally conscious and responsible consumers who are concerned about the environment (Jerome et al., 2014a; Williams & Page, 2011). In fact, Bathmanathan and Rajadurai (2017) indicated that millennials are more environmentally conscious and have a greater potential to generate waste since they have more purchasing power than other generational cohorts.

It is therefore in the interest of this study to attempt to encourage the largest segment of Malaysia's population, which has the ability to impact the behaviour of the future generation to practise safe disposal because millennials are also considered parents of young children in the current period of investigation (Hume, 2010). Moreover, this study employs the theory of planned behaviour model as its foundational theoretical framework. In doing so, it suggests the possibility of planned behaviour by incorporating disposal awareness, institutional motivations and green disposal technology as predictors to foresee factors that influence millennials' household intention to practise green disposal. Also, this study is expected to contribute to the body of knowledge regarding millennials'

disposal behaviour and capture the factors that may potentially reduce the amount of recoverable waste that ends up in landfills.

1.2 Problem Statement

The tragedies that have been experienced over the course of several years as a direct result of improper waste disposal have had a significant impact on human health and the environment. To quote a few, for example, on 7 March 2019, an incident involving the unlawful dumping of hazardous chemicals at Kim Kim River in Johor, Malaysia, caused 4,000 individuals to become ill (Sim, 2019). In a separate incident in 2018, authorities in Malaysia discovered several businesses that were operating illegally near the industrial zone in Pulau Indah. It was found that the companies were importing a large amount of plastic waste from various countries, including the United Kingdom, Australia, the United States of America, Germany and many others. This improper handling of plastic waste and improper disposing of the waste resulted in the contamination of the environment during the processing of the waste and had strongly drawn the attention of Malaysians (New Straits Times, 2018).

Moreover, data compiled by waste management authorities indicate that the amount of municipal waste produced across the world rises in tandem with the growth of both the population and the economy. Based on the most recently available statistics, in 2018, the world produced around 2.01 billion tonnes of municipal waste, of which 33% was not managed in an environmentally friendly manner (Kaza et al., 2018). Despite this, less than 20% of waste is recycled annually and enormous quantities are still transported to landfills (Tiseo, 2022). If current trends continue, this figure is projected to increase to 69.2 % (3.40 billion tonnes) by 2050. Furthermore, a significant portion of the waste will likely be disposed of in landfills (Kaza et al., 2018) or by open dumping at unregulated sites (Modak et al., 2015). The East Asia and Pacific regions are the regions in the world

that generate the most waste, accounting for 23% of the total waste produced in the world (Kaza et al., 2018).

On average, between 65% and 80% of waste from developing countries are dumped into landfills (Agamuthu, 2012). Likewise, 80% of the states in Malaysia use landfills as their primary option for waste disposal (Chien Bong et al., 2017; Fazeli et al., 2016; Siti Wahidah, 2017). As a result, most landfills reached their maximum capacity earlier than what was initially scheduled (Agamuthu & Fauziah, 2011; Ghazali et al., 2014; Sin et al., 2016). In 2016, it was reported that Malaysia's landfills had already reached more than 50% of their capacity. This situation put it on the edge of a crisis (Sin et al., 2016) and made it incredibly challenging to identify a suitable replacement landfill (Mohamad et al., 2016; Sin et al., 2016).

Hence, landfills being the most prevalent waste disposal method have considerably contributed to environmental deterioration. Among the detrimental consequences of the landfill include the discharge of leachate, toxins and greenhouse gases (Anthraper et al., 2018) as well as the contamination of water bodies (Jayanthi et al., 2017; Pastore et al., 2018). Health complications also occur due to pathogens from waste, massive metal discharge to soil (Munir et al., 2018), seawater pollution with landfill debris through rivers that flow into the seas (Jambeck et al., 2015) and other types of environmental contamination.

There are a number of contributing factors that lead to an increase in the quantity of municipal waste generated by households and the act of improper waste disposal. Unsustainable waste treatment practices and poor disposal infrastructure, including a weak institutional and regulatory framework are among the challenges that manifest to a noticeable degree in most developing nations. In addition to the factors already mentioned, the selection of disposal technology, inadequate collection and transportation

systems (Longe et al., 2009), lack of easy access to disposal bins and the inefficiency of services (Babaei et al., 2015) are also factors that are common in developing countries. With regard to other contributing factors, there are aspects of physiology that lead to the improper practice of waste disposal, such as a lack of awareness (Akil et al., 2015) and an attitude of "Not In My Back Yard" (Rogoff & Screve, 2019). Other factors that contribute to improper waste disposal practices and unsustainable waste production include a lack of information about safe disposal activities, inadequate safe waste disposal programmes (Ferronato & Torretta, 2019), levels of education and household income (Troschinetz & Mihelcic, 2009).

A few drawbacks are associated in the engaging of environmentally friendly disposal practices, which indirectly decrease the waste recovery rate. Among these are activities that require more time and a significant amount of manual labour, such as preparing materials for reuse. For example, cleaning, testing, inspecting, repairing, refurbishing, and sorting are tasks that will take place before an item is used through the reuse technique (Gusmerotti et al., 2018; Sadrnia et al., 2020). Moreover, an inadequate collection and transportation infrastructure will pose some obstacles to the implementation of efficient reuse practices (Haupt et al., 2018; Messmann et al., 2019). These disadvantages or limitations have led to increased expenses for transportation and an increase in the amount of pollution released into the environment (Haupt et al., 2018).

Also, the process of preparing waste for reuse or recycling is a pro-environmental activity that requires a lot of labour-intensive processes and is not cost-effective (Zacho et al., 2018). Furthermore, practising separation at the source necessitates physical resources such as space in their own house which some people do not have, making the process impractical (Omran et al., 2009). Besides that, modernising the facilities that manage municipal solid waste and keeping their operations up to date might result in an

increase in financial burden for the government (Chifari et al., 2017). Thus, households are discouraged from engaging in green disposal practices due to the difficulties (as mentioned above) that they encounter in doing so. As a consequence, there is a low rate of waste recovery and a significant quantity of waste that is disposed of in landfills.

Despite all the current information on improper waste disposal related issues, the waste disposal practices of millennial households have not been adequately studied. As of 11 February 2022, only 5.94% (167) of the 2,813 publications in the Web of Science database are dedicated to environmental research that includes millennial households as a sample population. Some examples of pro-environmental studies that involve millennial households are the green product purchasing behaviour (Anvar & Venter, 2014; Kanchanapibul et al., 2014), green consumer social interaction (Muralidharan & Xue, 2016), selection of the green restaurant (Jang et al., 2011) and environmental knowledge transfer from parents to children (Casaló & Escario, 2016; Meeusen, 2014). Nevertheless, studies referring to collective green disposal practices (such as waste separation, reduction, reuse and recycling) among millennial households are lacking in previous environmental studies.

Contemporary scholars urge for more studies on the behavioural shift of millennials toward green environmental practices, such as green disposal and green consumption (Bathmanathan & Rajadurai, 2017; Chui Teo et al., 2018; Wilson & Velis, 2015). For instance, Bathmanathan and Rajadurai (2017) highlighted in their review that a further study on millennials is required to understand their spending power, which indirectly contributes to waste production since this generation has greater purchasing power. Therefore, this study aims to address the unsustainable and improper waste disposal approach by investigating the factors that may motivate the millennial generation to adopt green disposal practices. Among the factors considered for investigation in this study are

the millennials' disposal awareness, their attitude towards green disposal practice, the influence of social actors and the element of behavioural control. Aside from that, the investigator will also examine the institutional motivations and the influence of green disposal technologies on a household's intention to engage in green disposal practices.

1.3 Research Questions

In view of the challenges highlighted in the problem statement that was mentioned earlier in relation to the improper disposal of waste and the identified gaps (see Section 2.8), the thesis was designed to provide answers to the following research questions (RQ) in order to achieve the goals of this study:

a) Which predictors of the theory of planned behaviour significantly influence millennials' intention to engage in green disposal activities? (RQ1)
b) Could control beliefs as moderator able to strengthen the relationship among predictors? (RQ2)
c) Does disposal awareness affect millennials' intention to practise green disposal activities? (RQ3)
d) Can institutional motivations cause a behavioural shift in millennials to the green disposal practice? (RQ4)
e) Can institutional motivations indirectly impact millennials' intention to engage in green disposal activities through a positive attitude? (RQ5)
f) Does the adoption of green disposal technology encourage millennials to dispose of waste in a more ecologically responsible manner? (RQ6)
g) Can green disposal technology indirectly affect the intention of millennials to participate in green disposal activities via the element of control belief? (RQ7)

1.4 Research Objectives

After a comprehensive review of a prior literature pertinent to the research questions, this thesis outlined the following specific research objectives:

a) To evaluate the influence of TPB predictors in predicting the millennial's intention to practise green disposal.
b) To investigate the potential of control belief to strengthen the association between TPB predictors through a moderator interaction.
c) To examine whether disposal awareness could encourage green disposal practices among millennial households.
d) To examine if the motivation of an institution (formal and informal institutions) could mould millennial households' behaviour to practise green disposal.
e) To examine if institutional motivation indirectly affects the millennial households' intention to engage in green disposal practices through a positive attitude.
f) To investigate whether the adoption of green disposal technology such as reverse vending machines and mobile applications can encourage millennial households' intention to practise green disposal.
g) To examine if green disposal technology indirectly impacts the millennial households' intention to engage in green disposal practices through control belief.

1.5 Research Hypothesis

In consideration of the suggested research questions and research objectives, the thesis was intended to test the fourteen hypotheses (H) listed below (developed based on

identified gaps – refer to Section 2.8), all of which would contribute in answering the research questions and fulfilling the study's objectives:

a) H1a : Attitude positively influences millennial households' intention to practise green disposal.

H1b : Subjective norm positively influences millennial households' intention to practise green disposal.

H1c : Perceived behavioural control positively influences millennial households' intention to practise green disposal.

b) H2a : Perceived behavioural control moderates the association between attitude and green disposal practice intention.

H2b : Perceived behavioural control moderates the association between subjective norm and green disposal practice intention.

c) H3 : Disposal awareness positively influences millennial households' intention to practise green disposal.

d) H4a : Institutional motivations positively influence millennial households' intention to practise green disposal.

H4b : Formal institutions (sanctions) positively influence millennial households' intention to practise green disposal.

H4c : Informal institutions (community support) positively influence millennial households' intention to practise green disposal.

e) H5 : Institutional motivations indirectly influence millennial households' intention to participate in green disposal activities through the mediation effect of positive attitudes.

f) H6a : Green disposal technology positively influences millennial households' intention to practise green disposal.

H6b : The use of the reverse vending machine as a green disposal technology positively influences millennial households' intention to practise green disposal.

H6c : Mobile application usage as a green disposal technology support positively influences millennial households' intention to practise green disposal.

g) H7 : Green disposal technology indirectly influences millennial households' intention to engage in green disposal activities through the mediation effect of perceived behavioural control.

1.6 Significance of Research

It is disturbing to learn that more than 82% of Malaysia's household waste in 2021 still ended up in landfills, with deficient waste recovery procedures carried out on the waste (Malaysian Investment Development Authority, 2021). Moreover, the amount of waste that was recycled in Malaysia in 2021 was 31.5% of the total municipal waste (Bernama, 2022). However, this recycling rate is still relatively low compared to that of several other nations, which have already surpassed the percentage before 2018. For example, Hong Kong achieved a recycling rate of 52% in 2013, Singapore 59% recycling rate in 2011 and Germany 60% recycling rate in 2010 (Bueno et al., 2015; Giannis et al., 2017; Lee et al., 2016; Woon & Lo, 2013). Besides, landfills in Malaysia have already reached more than 50% of their capacity in 2016 (Sin et al., 2016), which has led to 174 landfills ceasing operations and only 137 landfills remaining active as of 2021 (Malaysian Investment Development Authority, 2021).

Thus, the outcome of this study is relevant to the goal of maximising waste recovery rate in which waste is recovered through the implementation of green disposal practices.

These practices encompass activities such as reducing waste, reusing materials, recycling waste and sorting waste. This study focuses on disposal awareness, institutional motivations and green disposal technologies as well as attitude, social influences and perceived behavioural control in an effort to identify factors that will encourage millennial households to participate in green disposal activities. The investigator has recognised a need to study the aforementioned areas on the Malaysian population of millennial households based on gaps identified in a prior literature and believes that such unexplored areas will contribute to effective waste recovery practices. It is expected that millennial households would significantly reduce the quantity of municipal waste sent to landfills by engaging in green disposal practices and as such, indirectly reduce the demand for new landfill sites.

This study's outcome is also expected to benefit the government in developing policies related to green disposal practices and determining the type of intervention that effectively reduces waste from landing in landfills. These interventions will indirectly minimise the government's financial burden associated with the treatment of household waste. In addition, it will further protect the environment from pollution, reduce reliance on landfills and stimulate economic growth by lowering the price of raw materials, which will eventually result in lower product costs and indirectly will increase millennial households' spending power. Also, waste management authorities can also profit from green disposal practices in light of the global Covid-19 outbreak, since this will lessen the likelihood that their employees will be exposed to the virus while handling municipal waste and reduce the financial stress for the government to manage municipal waste. Moreover, through this study, the theoretical understanding of millennials' perspectives on green disposal practices will lead to the possibility of they contributing to the body of knowledge in the fields of waste management and generation cohort studies.

1.7 Definition and Operationalisation of Variables

In this section, the investigator presented the definitions of all the variables used in this thesis. It is necessary to provide a brief explanation of the variables and their operationalisation. Thus, the following sub-sections take on this task by providing a brief explanation of the concept and the operationalisation of all the proposed variables.

1.7.1 Attitude

Attitude is viewed as the result of readily-available beliefs about the anticipated consequences of a behaviour, which are referred to as behavioural beliefs (Ajzen, 2020). The term "behavioural beliefs" refers to an individual's perceptions of the perceived positive or negative effects of engaging in a particular behaviour, as well as their assessment of these beliefs (Abrahamse, 2019). In other words, attitude reflects an individual's positive or negative assessment of a given behaviour. Besides, Bezzina and Dimech (2011) referred to "attitude" as a term related to a psychological state of mind.

In this study, attitude assumes the role of an independent and a mediation variable. The variable attitude is measured by asking participants to rate their degree of agreement with statements concerning disposal behaviour on a scale ranging from "strongly disagree" to "strongly agree". Among the disposal behaviour statements are "Waste separation at its source is useful", "It is necessary to carry out green disposal practice", and "I am interested in carrying out green disposal practice". Hence, the variable attitude in this study is intended to examine participants' views about engaging in environmentally friendly waste disposal activities such as green disposal.

1.7.2 Subjective Norm

Normative beliefs, which include the perceived expectations of significant individuals and an individual's willingness to comply with these expectations are the foundation of the subjective norm (Abrahamse, 2019). It has been postulated by Ajzen (2020) that normative beliefs can be categorised into two types: injunctive and descriptive normative belief. The injunctive normative belief refers to the anticipation of approval or disapproval from relevant individuals such as friends, family members and co-workers when executing the investigated behaviour whereas descriptive normative belief refers to the views of significant persons and taking their perspectives into account when executing the studied behaviour. These two forms of normative beliefs combine to form a subjective norm, which is referred to as perceived social pressure to engage in or abstain from a particular behaviour (Ajzen, 1991).

In this study, the subjective norm is regarded as an independent variable. It assesses the respondents' social influence in terms of their willingness to engage in pro-environmental activities such as green disposal. Furthermore, the social influences examined in this study are between the respondents and family members, friends, and co-workers. The investigator measured the subjective norm variable by having respondents rate statements such as "My family members encourage me to practise green disposal at home", "My friends encourage me to practise green disposal", and "My colleagues encourage me to practise green disposal at my workplace" on a scale ranging from "strongly disagree" to "strongly agree". Hence, the subjective norm in this study refers to the social influences that affect respondents in their participation of green waste disposal activities.

1.7.3 Perceived Behavioural Control

It is greatly considered that perceived behavioural control is based on beliefs about control that are easily accessible. In this context, the term "control belief" refers to the extent to which the individual believes that there is the existence of circumstances that may assist or impede their capability to execute the investigated behaviour (Abrahamse, 2019; Ajzen, 2020). An individual's capability to perform the behaviour in question is influenced by various circumstances that include time, skills, money and capabilities which can either help or hinder their ability (Abrahamse, 2019). Thus, perceived behavioural control is defined as an individual's assessment of how easy or difficult it is to complete a particular task (Ajzen, 1991).

In this study, perceived behavioural control serves as an independent variable as well as a mediator and moderator variable. Three components, skills, convenience and confidence were used to measure perceived behavioural control by the investigator. All the respondents are asked to rate the survey statements on a scale of "strongly disagree" to "strongly agree". The statements, "I have the skills and abilities to practise green disposal in my daily life", "I feel it is easy and convenient to practise green disposal in my daily life", and "I have confidence that if I want to practise green disposal in my daily life, I can do it" are among those used to measure perceived behavioural control. Therefore, in this study, perceived behavioural control is defined as the ease or difficulty that respondents experience in their intention to engage in green disposal practices.

1.7.4 Disposal Awareness

The term "awareness" is frequently used to refer to the behaviours of other individuals and relates to the ability to preserve some information about the situation and the activities of others (Liechti & Sumi, 2002). According to Dourish and Bellotti (1992), awareness is

defined as an individual's comprehension of one's frame of reference through the actions of others. At the same time, Alexander et al. (2009) argued that the individuals' awareness is shaped by their knowledge, which in turn shapes their attitude, behaviour or practice. Disposal awareness is constructed based on the definition of awareness and it serves as an independent variable in this study.

The investigator measured disposal awareness using a series of statements that represent the respondent's understanding of the impact and location of waste disposal. On a scale ranging from "not aware" to "extremely aware", respondents are requested to score each of the statements. The four statements used to assess disposal awareness are as follows: "Are you aware that improper waste disposal can result in pollution of the environment?", "Are you aware that improper waste disposal can be harmful to human health?", "Are you aware of recycle bins placed at public places?", and "Are you aware that improper waste disposal is a problem in our country?". Thus, in this study, disposal awareness refers to the respondents' level of awareness regarding the impact of waste disposal and the location.

1.7.5 Institutional Motivations

The term "institution" is defined by North (1991, 1994) as one that has been founded and is regulated by a set of rules or constraints that have an impact on the social structure. Meanwhile, Scott (2001) defined an institution as a structure composed of legal, social and cultural cognitive components that contribute to the betterment of social life. On the other hand, the term "motivation" refers to a process that begins with a physiological or psychological need and results in the activation of behaviour targeted at achieving a goal or incentives. Motivation can be categorised into two types: extrinsic motivation and intrinsic motivation. Extrinsic motivations are apparent to others and consist of benefits,

punishments, tangible rewards and other comparable incentives whereas intrinsic motivations are formed within an individual and include components such as a sense of obligation, competitiveness and other similar motivations (Luthans, 2011).

For the purpose of this study, motivation refers to extrinsic motivations. Thus, the motivation from institution denotes the aspect of a sanction imposed by formal institutions and community support provided by informal institutions in encouraging households to participate in pro-environmental activities. Furthermore, the institutional motivation variable is regarded as a higher-order construct in the study. It is formed by the combination of two dimensions, in this case, formal and informal institution variables. Additionally, the institutional motivation variable serves as an independent and mediating variable. Moreover, the investigator evaluated the institutional motivation variable through formal institution (sanction) and informal institution (community support) statements. The following sub-topics will discuss the definitions and measurements of formal and informal institutions.

1.7.5.1 Formal institutions (Sanctions)

The formal institution is a representation of the regulatory category of an institution. According to North (1990), the regulatory category consists of recommendations and prohibitions that take the form of written and unwritten rules that acts as the enforcer. Apart from that, Adomako et al. (2015) claimed that formal institutions define the political and economic forces which influence the society or a nation. The formal institution variable is treated as an independent variable in this study and a lower order construct to the institutional motivation variable. It examines the formal institution's influence on respondents' intention to participate in environmentally friendly disposal practices, such as green disposal. The investigator aimed to investigate the influence of

formal institutions on respondents' behaviour through the use of sanctions imposed on them in order to encourage respondents to participate in green disposal activities. Three statements are used to assess formal institutions: "It will make me separate my waste if the Government makes it mandatory", "Fines should be imposed on people who pollute the environment through improper waste disposal", and "It will change the way I handle my household waste if there is a penalty for non-compliance". Each of the three statements is rated on a five-point scale ranging from "strongly disagree" to "strongly agree".

1.7.5.2 Informal institutions (Community support)

The informal institution is a depiction of a normative pillar within the concept of an institution. North (1990) describes the normative pillar, also known as the norm's pillar as an informal rule that supports, motivates and regulates the group participants' collaborative action. Religious belief systems, volunteer groups and social organisations are all examples of what is commonly referred to as informal institutions. Additionally, according to Adomako et al. (2015), informal institutions also frequently explain the socio-cultural factors. In this study, informal institutions refer to the community support provided by non-governmental organisations (NGOs) to assist the respondents in practising green disposal in their residential areas. Furthermore, the variable of informal institutions is included as an independent variable and a lower order construct to the institutional motivation variable in this study.

Therefore, the informal institution variable is measured by asking respondents a series of statements about NGO assistance in supporting pro-environmental activities in the vicinity of their place of residence. For example, "I will be encouraged to separate my waste if my residential community has regulations for household waste sorting", "I will

be influenced to donate unused products if there is a reuse programme conducted by NGOs near my residential area", and "I will be influenced to separate my household waste if there is a recycling programme conducted by NGOs near my residential area" are some of the statements. Each respondent is asked to score each statement on a scale ranging from "strongly disagree" to "strongly agree".

1.7.6 Disposal Technology Support

According to Ulrich (2004) and Li et al. (2010), based on their field of study, green technology has been defined as technology that does not have an adverse effect on the environment when it is used to dispose of waste. On the other hand, according to the National Green Technology Policy, green technology is defined as technology that minimises ecological damage, generates low greenhouse gas, saves energy and natural resources, decreases emissions and encourages the use of renewable energy (Chien Bong et al., 2017). Existing technologies in municipal waste management that meet the criteria outlined above include sanitary landfills, anaerobic digestion, aerobic digestion, composting, gasification, pyrolysis and hydrothermal. However, some recent technologies have potential uses in municipal waste management, such as reverse vending machines and mobile disposal applications.

As a result, in this study, the investigator denotes green disposal technology as disposal technologies that minimise the environmental effect of disposal activities. Apart from that, the green disposal technology variable is regarded as a higher-order construct in this study since it is generated by the combination of two technologies as sub-dimensions: reverse vending machines and mobile applications. Also, the green disposal technology variable serves as an independent variable. Furthermore, the investigator assessed the variable of green disposal technology through reverse vending machines and mobile

applications variables. The definitions and measurements of the two dimensions described above will be discussed in detail in the following sub-topics.

1.7.6.1 Reverse Vending Machines

According to Tiyarattanachai (2015), reverse vending machines are widely used in the United States to recycle beverage containers, particularly those subjected to Bottle Bills whereas vending machines such as those seen in convenience stores and fast-food restaurants are used to sell products after receiving payment from the buyer. Reverse vending machines unlike vending machines accept recyclable materials (for example, empty plastic bottles) and reward the user with cash or a deposit receipt in return for the recycled items. In this study, the investigator refers to reverse vending machines as vending machines that accept recyclable materials from households in exchange for rewarding the households with incentives. Also, in this study, the reverse vending machine variable serves as an independent variable and a lower order construct to the green disposal technology variable.

The aim of studying the adoption of reverse vending machines is to determine if the element of incentives and convenience associated with reverse vending machines could influence millennial households' intentions to engage in green disposal activities. Three statements are used to evaluate the influence of reverse vending machines: "I will send recyclable materials at designated RVM points if there are financial incentives", "I will send recyclable materials at designated RVM points if it is near to me", and "I will be encouraged to recycle my waste if there are vending machines that can accept recyclable waste and turn it into rewards". The statements are measured by asking respondents to rate them on a scale ranging from "strongly disagree" to "strongly agree".

1.7.6.2 Mobile Applications

In terms of mobility, location-based services and their accessibility, mobile devices and their applications provide substantial advantages to their users (Nayebi et al., 2012). Similarly, study by Rakhmanov and Ibrahim (2019) confirmed that mobile applications can facilitate users in discovering nearby waste disposal bins where they can conveniently dispose of their waste using location finder services. As a result, the investigator employed the mobile application variable in this study to determine if millennial households can be motivated to participate in green disposal activities through mobile applications. The mobile application variable is evaluated based on its capacity to locate the nearest recyclers, its ability to notify users of upcoming recycling days and its accessibility to information about pro-environmental activities. Besides that, in this study, the mobile application variable is treated as an independent variable and a lower order construct to the green disposal technology variable.

Moreover, a series of statements that indicate the usefulness of a mobile application in performing pro-environmental activities are measured by the investigator. With this in line, respondents are asked to evaluate the following statements: "Mobile application will be useful if the application can identify and alert me on the days in which recyclable waste is collected", "The use of mobile application can guide households and enhance the effectiveness on waste separation activity", and "I will be encouraged to recycle my waste if there is a mobile application that can alert the nearest recycle collector to collect my recycle waste at my home". Subsequently, using a scale ranging from "strongly disagree" to "strongly agree", respondents are asked to rate each statement based on their perception of the effectiveness of mobile applications in encouraging pro-environmental behaviour.

1.7.7 Millennial Household

According to the definition provided by Dimock (2019), millennials are those who were born between the year 1981 and 1996. While Department of Statistics Malaysia (2010) defined a "household" as a group of related and/or unrelated individuals who generally live together and share food and other essentials of life. In this study, a "millennial household" is therefore defined as an individual (millennial) who resides in a house or apartment and shares common resources.

1.8 Organisation of Thesis

The investigator divided the thesis into eight chapters. In the first chapter, the investigator discussed the problem of improper waste disposal and the impact that improper disposal practice has on humans, the government and the environment. The problem statements then give the rationale for the study, leading to the research questions that guide the remaining chapters of the thesis.

Chapter 2 briefly reviews the prior empirical literature on the description of green disposal, awareness, institutional motivations, green disposal technology, the theory of planned behaviour and millennials or generation Y. The chapter also incorporates summaries of the gaps that were discovered in the reviewed literature and discusses the study's conceptual framework.

Chapter 3 explains the methodologies used to collect, prepare and analyse data to answer the research questions. Among others, the chapter presents a discussion on sample population, sampling process, calculation of sample size, data collection strategy and the time frame employed for this study. Also included are the discussions on the analytical framework, an explanation of the data analysis tools that were employed, the development

of questionnaires, the process of data preparation and the generation of higher-order constructs. Meanwhile, in the same chapter, the investigator discussed the model's assessment results. The discussion on model assessment includes information on common method bias, assessments of measurement models for lower-order constructs and assessments of measurement models for higher-order constructs. In addition, the chapter also reveals the findings of the robustness check of the structural models, the structural model assessment and respondents' demographic results.

The analytical sections of the thesis are covered in chapters 4 to 7 respectively. Chapter 4 offers the empirical findings and discussion on the predictors' effect of the theory of planned behaviour on intention. In addition, the chapter explains the influence of control belief as a moderator between attitude and subjective norms on intention. The empirical findings and discussion of the impact of disposal awareness on intention are reported in Chapter 5.

Furthermore, in Chapter 6, the empirical findings and discussion on the influence of institutional motivations on intention and the indirect effect of institutional motivations on intention via attitude are presented. Next, the empirical evidence and discussion on the effect of green disposal technology on intention and the green disposal technology's indirect influence on intention through perceived behavioural control are provided in Chapter 7. Finally, Chapter 8 concludes the thesis with the overall findings, policy implications and suggestions for future study.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The objectives of the study and the hypotheses outlined in the preceding chapter were proposed based on the literature reviewed in this chapter. This chapter aims to present a review of a theoretical understanding of millennials' disposal behaviours. Moreover, the focus of this chapter is to conduct a systematic and logical analysis of previous empirical works to identify possible gaps and develop a novel contribution to the waste management literature, particularly in the field of development studies. Additionally, this chapter also provides information that will enable the investigator to formulate the research concept and framework. This section is organised into eight subsections to address the following topics: green disposal, disposal awareness, institutional motivations, green disposal technologies, Theory of Planned Behaviour, millennials, research gaps and conceptual framework.

2.2 Green Disposal

Reducing the potential hazards of pollution from improper municipal waste disposal is a critical issue. As the population continues to rise and waste generation increases, protecting the environment has become increasingly important in the safe disposal of municipal waste (Bailey et al., 2002). The adoption of the green disposal concept for municipal waste disposal is regarded as the most environmentally friendly disposal method. Furthermore, the term "green" in green disposal is synonymous with the term "sustainability" in that it refers to reducing environmental contamination, conserving resources and improving human wellbeing (Li, Wang, et al., 2020).

Several authors in previous studies have defined the term 'green disposal'. For example, Chou and Chou (2012) and Murugesan (2008) defined green disposal as the

practice of reusing or refurbishing old computers to accommodate new technological advances and recycle unwanted computer components safely. Likewise, Li et al. (2021) considered recycling computer components as an environmentally friendly disposal method. Furthermore, in the chapter on green computing written by Franca et al. (2021), green disposal is defined as the disposal of e-waste in an environmentally friendly manner through reuse or recycling activities. Besides that, Ola-Adisa et al. (2015) defined the green disposal method in medical waste management as an activity that leads to waste reduction, compost and waste segregation. Meanwhile, Li, Wang, et al. (2020) defined green disposal as recycling and waste sorting activities in pesticide packaging wastes motivated by ecological and environmental protection principles.

However, due to the lack of a well-defined description for green disposal in the literature pertaining to municipal waste disposal, the investigator opted to limit and define green disposal in accordance with the definition provided by previous authors and the National Strategic Plan for Solid Waste Management, Malaysia (Local Government Department, 2005). Therefore, in this study, green disposal is defined as any action that leads to safe waste disposals such as separation at source, reduction or prevention of waste generation, reuse and recycling without the need to treat the waste. The investigator explored the following subtopics in further details: source separation, reduction, reuse and recycling activities associated with the concept of green disposal.

2.2.1 Separation at Source Concept

Waste separation, sometimes referred to as pre-sorting waste (Axsen & Kurani, 2012) is a process that results in the separation of waste and grouping of comparable waste together or categorising waste based on its characteristics (Agovino et al., 2018; Ramachandra, 2011). It has several benefits, the most significant of which is a rise in the

market value of recyclable materials. In addition, separating the waste can help to eliminate residual contamination of the material that might reduce the value of recyclable materials (Basri et al., 2017; Hoornweg & Bhada-Tata, 2012; Ramachandra, 2011; Sheau-Ting et al., 2016). According to Zhang and Wen (2014), recycling rates will increase due to improved recycling efficiency achieved through waste separation. Likewise, Knickmeyer (2020) reaffirmed that sorting municipal waste based on the waste category will increase the total recycling rates by maximising the recovery of valuable materials and minimising contamination.

Additionally, source separation will benefit the production of high-quality compost. One of the primary challenges with the composting process is the difficulty of sorting waste at the source to the required quality. The availability of high-quality organic waste directly impacts the quality of compost produced (Heyman et al., 2019; Menyuka et al., 2020). Besides that, waste sorting minimises the volume of waste sent to landfills. Furthermore, cost saving is associated with waste collection and the pre-treatment process (Fazeli et al., 2016). Also, other benefits of waste separation include reduced environmental impacts, reduced leachate and greenhouse gas emissions caused by organic material diverted from landfills and a consistent supply of materials to recycling industries (Owusu et al., 2013).

Separation at source is a form of disposal that is considered environmentally friendly. It should be seen as a behaviour that is manifested as a result of households' or communities' obligations (Axsen & Kurani, 2012). In relation to such behaviour, Malaysia is still lagging behind in terms of encouraging the waste separation culture among households (Moh & Abd Manaf, 2017). Specifically, a lack of enforcement (Ridzuan et al., 2018) and physical infrastructure (e.g., space at home and accessibility) are among the factors that have contributed to the lack of practice (Omran et al., 2009).

Moreover, at present, Malaysia has not mandated the source separation practice (Kumaran et al., 2016) because the Solid Waste and Public Cleansing Management Act 2007 (Act 672) has not been adopted by all states in Malaysia. Based on the review of the previous research, the investigator discovered that relatively, few studies had been undertaken on millennials' behaviour towards waste separation at the source separation practice.

2.2.2 Reduce

Reduction or prevention is the first principle in the waste hierarchy and is considered the most preferred way to avoid materials from becoming waste (Gharfalkar et al., 2015). Based on the Waste Framework Directive 2008/98/EC, waste reduction is referred to as an activity that prevents products from becoming waste by reducing household consumption (Gharfalkar et al., 2015). Furthermore, the European Environment Agency (2002) defined waste reduction as prevention and minimisation. Waste prevention includes reuse and reduction at the source, while waste minimisation includes recycling and quality improvements.

Several previous authors used a similar definition in their studies. For example, Williams (2015) in his article mentioned that the practice of reusing products and keeping out unnecessary purchasing and repairing are considered waste reduction activities. Likewise, Lu et al. (2018) defined reduce as the product that never changes the user's ownership even after the product has gone through the reconditioning or repairing process. A recent article by Magrini et al. (2020) confined waste reduction to any activity that leads to waste reduction at the source, reuse of any material and waste avoidance. In other words, the product is not considered waste but has extended its original use once the product reaches the end of its life cycle.

By reducing waste, resource efficiency could improve and contribute to the circular economy (Magrini et al., 2020). Meanwhile, Hogg and Ballinger (2015) argued that from an environmental point of view, reducing waste could have greater potential in minimising carbon dioxide emissions compared to recycling and is considered an environmentally friendly method. However, it is difficult to measure waste reduction directly as the waste generation volume that would have been generated can only be indirectly measured if no prevention measures had been taken (Bartl, 2014; Sharp et al., 2010).

In reference to an article authored by Sharp et al. (2010), no single approach is sufficient to monitor waste prevention. Therefore, it is recommended to use a 'hybrid' method using several monitoring approaches such as surveys, monitoring of campaigns and monitoring waste tonnage data. Among the activities that effectively reduce waste are 'Deposit-Refund Systems' and 'Pay as You Throw' schemes and taxes (Magrini et al., 2020). Hence, previous literature on reducing municipal waste has established that reducing waste or preventing it from generating is a more favourable way in preventing the environment from getting polluted.

2.2.3 Reuse

A product will become waste once discarded or decided to be disposed of, or when it reaches the end of its beneficial life cycle (Messmann et al., 2019). There are five tiers of hierarchy to consider when it comes to disposing of waste. Reuse is ranked second after waste avoidance or reduction (European Parliament, 2008). The practice of reuse is regarded as one of the most effective techniques for reducing waste generation (Gusmerotti et al., 2018). It is also considered an essential strategy for waste prevention (Fortuna & Diyamandoglu, 2017).

The European Parliament (2008) defined reuse as the process of reusing products or components from any recovery operation after having reached the end of their useful life-cycle. Subsequently, the product is to be used again for the same purpose, with or without restoration. Similarly, Gelbmann and Hammerl (2015) defined reuse as the act of reusing items that have been recovered from the waste stream for the same function that the items were originally designed for. The term 'reuse' has several variations. In a study by Lu et al. (2018), they listed the variance of reuse from several other studies such as preparing for reuse, reselling, repairing, reconditioning, refurbishing, rebuilding, upgrading, remanufacturing, repurposing, recovery and recycling. Reuse is regarded as the preferred method of disposal over recycling since recycling often requires raw materials or energy to process (Sadrnia et al., 2020), whereas reuse is easier to carry out (Rizzi et al., 2020).

Through a process called 'prepare for reuse', the ownership of items is transferred to another user, hence extending the product's life cycle (Fortuna & Diyamandoglu, 2017; Gelbmann & Hammerl, 2015; Lu et al., 2018). Reuse involves disposing of items via a process known as preparing for reuse, after which they are sold as second-hand products to new users, donated to those in need, or sent to recycling centres (Fortuna & Diyamandoglu, 2017; Gelbmann & Hammerl, 2015). Preparing for reuse is a process that includes cleaning, inspecting, repairing and reconditioning activities before the item is sold or donated to a new recipient. By preparing waste for reuse, a significant proportion of waste may be moved to the circular economy at a low cost and contribute to a positive environmental effect (Sadrnia et al., 2020).

Numerous studies on reuse have demonstrated that it has more advantages than disadvantages in terms of economy (Nußholz et al., 2019) and the environment (González et al., 2017; Lapkin et al., 2004). Reuse activity directly contributes to the avoidance of waste from production (Messmann et al., 2019; Zacho et al., 2018) as well as the reduction

for waste disposal demand (Fortuna & Diyamandoglu, 2017; Gelbmann & Hammerl, 2015; Messmann et al., 2019; Milovantseva & Fitzpatrick, 2015; Zacho et al., 2018). Additionally, reuse indirectly minimises the demand for new products (Messmann et al., 2019; Zacho et al., 2018), the establishment of new businesses (Nußholz et al., 2019), the use of raw materials for new products (González et al., 2017; Messmann et al., 2019; Nußholz et al., 2019; Zacho et al., 2018) and the consumption of resources and energy (Chirayil et al., 2019; Lapkin et al., 2004; Messmann et al., 2019).

Despite the numerous benefits of reuse, several studies have documented the challenges and drawbacks of reuse activities. Preparing for reuse activities includes cleaning, testing, inspecting, repairing, refurbishing and sorting (Gusmerotti et al., 2018; Sadrnia et al., 2020) and is also associated with transportation and collecting of the items. Inefficient collection and transportation systems will create certain hindrances to effective reuse practices (Haupt et al., 2018; Messmann et al., 2019). Furthermore, Haupt et al. (2018) emphasised in their article that in order to enhance the rate of reuse, transportation and collection systems play a significant role which indirectly results in increased transportation costs and emissions into the environment. In another study, Zacho et al. (2018) argued that preparing waste for reuse is a labour-intensive operation that is not economical.

However, reuse contributes significantly to reducing the amount of waste that enters the waste stream (Cole et al., 2014). According to Cox et al. (2010), the primary objective of waste avoidance at the household level should be product reuse since this will contribute to waste minimisation. Rizzi et al. (2020) further suggested that public awareness programmes targeted at households will help to increase reuse practices and gradually allow a shift of the household focus on reuse practices and its social impact. In general, waste management practices that promote reuse have more benefits than

drawbacks. Likewise, multiple studies have documented the benefits of reuse in the different types of waste, such as household appliances by Sadrnia et al. (2020), wastewater by Vera-Puerto et al. (2019), electrical equipment by Pini et al. (2019) and industrial material such as batteries and oil filters by Canals Casals et al. (2019).

2.2.4 Recycling

Recycling is a form of waste disposal that is widely known to be ecologically beneficial as well as advantageous to long-term economic development and the creation of sustainable industries (Bezzina & Dimech, 2011; Chang, 2009). Besides, recycling is the process of collecting and sorting waste with the aim of converting or remanufacturing it into marketable resources (Tarmudi et al., 2012). Moreover, it is viewed as the optimal method of waste disposal when source minimisation or product reuse is not practised in waste management (Chang, 2009). According to Abd'Razack et al. (2017), recycling can help minimise solid waste, maintain the environment, conserve costs and resources and provide employment opportunities for some individuals.

When a programme is combined with a reward system, it promotes a more positive reaction from participants. As a result, incentives have emerged as a significant component that can impact the participation of households in recycling programmes. In fact, given enough time, this type of programme may even help to develop a positive attitude that will ultimately become a habit (Agamuthu & Fauziah, 2011; Li et al., 2017). In addition to incentives, there are components of penalties that may be imposed to improve recycling. For example, penalties may be enforced on people who violate rules requiring the public to separate waste. Such regulations have been shown to enhance recycling rates merely because of wanting to avoid fines (Wadehra & Mishra, 2018).

Malaysia's recycling rate in 2019 was 28.1% (Department of Statistics Malaysia, 2020a) which was lower than Singapore (59%) in 2019 (Singapore National Environment Agency, 2020), Taiwan (53.5%) in 2018 (Sung et al., 2020), Hong Kong (30%) in 2018 (Hong Kong Environmental Protection Department, 2019) and Germany (68%) in 2017 (Germany Federal Ministry for the Environment - BMU, 2018). Several reasons contributed to the low recycling rate in Malaysia and these included a lack of efficient recycling management, low public awareness, inadequate recycling laws and the absence of recycling bins in many locations (Che Osmi et al., 2013). Furthermore, Abdul Jalil (2010) also emphasised the difficulties associated with disposing of, collecting and recycling organic waste which had caused Malaysia's municipalities to spend millions of ringgit.

Practising or participating in recycling activities can provide several benefits to the nation. An increase in recycling rates may be translated into more sustainable landfills, which will contribute to the life span extension of landfills. Not only that, it may also be a source of revenue for individuals that recycle (Agamuthu & Fauziah, 2011). In general, several earlier researchers have concluded and indicated in their articles that recycling is the most practical and cost-effective technique for the disposal of municipal waste (Abu Eusuf et al., 2011). Thus, the existing literature on municipal waste recycling activities has demonstrated that recycling is more beneficial to the environment.

2.3 Disposal Awareness

Inadequate knowledge on the correct way of waste disposal has become the key reason for inappropriate and irregular waste disposal. According to Shahzadi et al. (2018), approximately 39% (2.6 billion) of the world's population does not dispose of their waste correctly. Furthermore, Kaza et al. (2018) reported that in 2016, 2.01 billion tonnes of

municipal waste were produced, with 33% of the waste disposed of in open dumping sites. Waste that has been improperly disposed of has caused substantial health risks for humans and environmental deterioration, all of which have been directly or indirectly caused by a lack of awareness (Sakawi et al., 2013).

When it comes to defining awareness, there are two different approaches. The first approach is purely objective. In this, Merikle (1984) defined awareness as the ability to make forced-choice judgments that are better than a chance level of performance. In contrast, the second approach proposed by Henley (1984) is more subjective and merely equates awareness with self-report suggesting that an observer "consciously sees" the stimuli. However, Dourish and Bellotti (1992) provided a more straightforward definition of awareness, which they described as the action of others in which the individuals will understand themselves in their frame of reference. Nevertheless, Alexander et al. (2009) highlighted that individuals' awareness is moulded by their knowledge, which influences their attitude, behaviour or practice. In other words, an individual's awareness is influenced by their knowledge, which contributes to action depending on their understanding of that knowledge.

In the pursuance of altering an individual's behaviour, Williams and Gunton (2007) stated that awareness is a critical component of that process. Even earlier studies such as the study by Maloney and Ward (1973) have demonstrated that individuals with a high level of environmental awareness are more likely to engage in pro-environmental behaviour. Hornik et al. (1995) added that environmental awareness will lead to a long-term commitment to pro-environmental behaviour engagement compared to other variables such as monetary incentives. Numerous strategies have raised the common people's awareness of environmental issues. The mass media (Idamah, 2015) and social media (Rwitabrata & Shri Prakash, 2019) are a few of the strategies used to raise

environmental awareness among the general public. Various authors have already examined the effectiveness of the mass media and social media in raising the level of awareness.

One example is the argument made by De Feo and De Gisi (2010) that the media such as the internet and reading material (newspapers and books) promote a form of awareness among those who participated in the study. Moreover, in the same study, respondents who had limited access to the media were found to have a low level of awareness. Correspondingly, Olufemi et al. (2019) discovered that respondents' sources of knowledge about the environment include reading materials, television and internet usage. These findings are in line with articles authored by De Feo and De Gisi (2010).

As argued by Maloney and Ward (1973), individuals who have a high level of environmental awareness are more likely to practise pro-environmental behaviour. Evidence from several earlier researches has found that environmentally conscious people are more likely to participate in pro-environmental activities than those who are not. A few such examples are provided by Wan et al. (2012) who conducted a research on Hong Kong's university population and Wan et al. (2014) who conducted a research on Hong Kong's general population. Both studies revealed that the respondents' awareness of the consequences significantly influenced their decision to participate in recycling activities. Furthermore, in a research undertaken by Gonul Kochan et al. (2016), it was discovered that consumers' awareness of e-waste recycling was substantially associated with their pro-recycling intentions. In comparison, a study on battery pack recycling by Lizin et al. (2017) revealed that the Belgian households' awareness of the consequences significantly influenced the intention to recycle battery packs.

Besides, a study on households' waste separation and recycling behaviour by Meng et al. (2019) showed that environmental awareness significantly impacted the household's

intention to practise waste separation and recycling of their domestic waste. Also, research findings by Khan et al. (2019) demonstrated that awareness of the consequences significantly impacted customers' willingness to return or recycle plastic waste. Other studies such as by Nguyen and Watanabe (2019) examined the negative impact of waste awareness, and Olufemi et al. (2019) investigated the influence of disposal awareness on university students, all of which showed that awareness had a significant effect on the studied intention.

Additionally, empirical evidence suggested that awareness could influence an individual's attitude to participate in pro-environmental activities. For instance, Mishra et al. (2014) revealed that an individual's level of awareness about the environmental impact caused by information technology (IT) has a substantial effect on attitude toward green information technology practices (GIT). Also, a study by Ojo and Fauzi (2020) on participating in GIT activities found that the environmental awareness of IT professionals influenced the GIT attitude positively. Furthermore, a study by Mohiuddin et al. (2018) on the intentions of business students to obtain green automobiles demonstrated that the awareness of consequences significantly influenced the students' attitude towards preserving the environment.

Likewise, according to the findings by Zhang et al. (2019), awareness of consequences had a substantial impact on Chinese residents' attitudes towards sorting their household waste. Moreover, Rezaei et al. (2019) confirmed that farmers' awareness about integrated pest management significantly affected their attitude towards using an environmentally friendly pest control approach. However, it is observed that earlier studies explored various aspects of awareness, but awareness of improper disposal is still scarce. Therefore, it is reasonable to argue that millennials must possess adequate waste disposal awareness (DA) to engage in effective waste disposal practices.

2.4 Institutional Motivations

Despite the attempts made by several authors in the past to describe institutions, there has been no consensus on their applicative definition. However, among the authors, the definition given by North (1991, 1994) for institution is well acknowledged; he defined institution as one that is established and governed by a set of rules or constraints that influences the social structure. In comparison, Scott (2001) described institution as a framework comprising of legal, social and cultural cognitive components that contribute to the stability of social life. Meanwhile, evolutionary economists have opted to retain the definition of institution by expanding it to include the structures or forces that form behavioural patterns or social technologies (Nelson, 2008; Nelson & Sampat, 2001).

Institutions can be divided into three categories: regulative, normative and cultural or cognitive (Scott, 2005). These pillars work in unison but via distinct methods. The regulative pillar comprises recommendations and prohibitions that take the shape of written and unwritten game rules, and it serves as the enforcer (North, 1990). Normative pillar, also known as the norm's pillar, is an informal rule that facilitates, inspires and controls the group participants' joint action (North, 1990). It is most commonly seen in religious belief systems, voluntary relationships and social groups. Meanwhile, the cultural-cognitive pillar is comprised of common concepts that represent the framework that results in a specific meaning (Scott, 2005). It refers to the cognitive structures and social knowledge that people in a certain culture or place share (Busenitz et al., 2000; Hoffman et al., 2002).

The set of rules that governs an institution may be formal or informal, depending on the structure and implementation framework (North, 1990; Williamson, 1998). Furthermore, in a similar vein, Adomako et al. (2015) argued that formal institutions

define the political and economic factors, whereas informal institutions explain the socio-cultural factors. It has been demonstrated in previous scholars' works that institutions were able to influence how individuals behave within a social structure. For example, Armijos et al. (2017) reported that the interactions between formal and informal institutions have facilitated and improved the evacuation processes during volcanic eruptions. In a study by Rye et al. (2018), they found that formal and informal institutions are highly complementary in impacting public transport use. Besides, in the study authored by Jiang et al. (2019), it was discovered that synergy between formal and informal institutions is needed for the tourism industry to develop sustainably. Also, Rasiah (2017) argued that institutions and institutional change have a critical role in stimulating learning and innovation.

An in-depth examination of institutional impacts based on numerous previous studies has confirmed that formal and informal institutions can independently affect the individuals' behaviour. The following are a few examples of studies carried out in formal institutions: a research in Malaysia conducted by Amini et al. (2014) showed that penalty (fines) and rewards (incentives) by the government significantly influenced the households' intention to practise recycling. The same study revealed that sanctions substantially affected the household's attitude. A similar study in Malaysia by Ogiri et al. (2019) found that mandated waste separation policies that include a penalty for non-compliance have a positive effect on household behaviour. It was discovered that penalty measures had a substantial effect on households' waste separation behaviour in a study reported by Zheng et al. (2020). Other studies such as by Dur and Vollaard (2019) on the effectiveness of law enforcement and Wong et al. (2008) on the fines for traffic violations demonstrate that formal institutions significantly influenced individuals' behaviour.

Likewise, studies related to informal institutions have uncovered the following evidences: the findings by Du et al. (2016) indicated that religious environment as an informal institution significantly influences the increase of corporate social responsibility (CSR) programmes and may serve as a substitute to formal institutional enforcement. Besides, in a study by Xiao et al. (2017), results confirmed that informal institutions (community) have a greater impact on the willingness to participate in pro-environmental activities than formal institutions (environmental law). Also, studies such as by Jimoh et al. (2012) on wildlife conservation, Roberts et al. (2017) on traditional institutions and cultural domestic waste management and Akpabio and Subramanian (2012) on information dissemination have demonstrated that informal institutions can influence an individual's behavioural change on water and sanitation.

Additionally, it has also been established that institutions may directly influence an individual's attitude. For instance, a study conducted by Revilla and Salet (2018) discovered that 47.6 % (10 out of 21) of the households' (informal institutions) food rituals (religious and secular practice of handling food) were shown to substantially influence the attitudes of households toward reducing food waste in their homes. Furthermore, the results of a study by Li, Jin, et al. (2020) show that the mandatory waste separation policy implemented by the Shanghai government in China had a positive effect on residents' attitudes. Other similar studies such as by Amini et al. (2014) on penalties and rewards towards household recycling intention and an article authored by Brown and Johnstone (2014) on the pay-as-you-throw (penalty) revealed that formal authorities significantly influenced the attitude of an individual to participate in pro-environmental behaviour. Therefore, it is reasonable to suggest that formal and informal institutions could influence and mould millennials' behaviour by encouraging them to practise green disposal.

2.5 Green Disposal Technologies

In a different industry, the question of what constitutes green technology has been posed repeatedly. Thus, it is critical to define the phrase "green technology" in the sector in which it is used. For example, Ulrich (2004) defined green technology in the chemical industry as production that consumes the least resources and at the same time avoids the release of hazardous chemicals into the environment. It includes the consumption of low energy, the production of little or no waste and the avoidance of dangerous gases or chemicals. Similarly, Li et al. (2010) described green technology in manufacturing as equipment, methods and processes that assist humans by minimising activities that endanger the ecology and environment. In Malaysia, based on The National Green Technology Policy, green technology has been defined as technology that minimises environmental degradation, produces low greenhouse gas, conserves energy and natural resources, reduces emissions and promotes the use of renewable energy (Chien Bong et al., 2017).

Several technologies currently used in municipal waste management are considered green technologies following the above descriptions. These methods could be classified into two types: biological and thermal treatment. Sanitary landfills, anaerobic digestion, aerobic digestion, composting and vermicomposting are all examples of biological treatment technologies. Sanitary landfills are used to manage solid waste by using anaerobic composting engineering principles that do not harm the environment and are closed or covered on a daily basis (Agamuthu, 2001; Raghab et al., 2013). Anaerobic digestion, alternatively referred to as bio methanation (Kumar & Samadder, 2017) or methane digester (Demirbas, 2008) is considered the most effective technique for the disposing of organic waste on a large scale (Romero-Güiza et al., 2016) and is mainly

organic waste originating from municipal waste. It is widely used to recover renewable energy from organic waste (Romero-Güiza et al., 2016; Uçkun Kiran et al., 2014) by producing biogas and is recognised as an economically and environmentally beneficial waste treatment option (Cesaro & Belgiorno, 2014; Chua et al., 2019; Romero-Güiza et al., 2016; Siti Wahidah, 2017; Yan et al., 2019). Similar to the anaerobic process, aerobic digestion is a microbiological process that happens in the presence of oxygen. Under aerobic conditions, organic matter is oxidised.

Composting and vermicomposting are two other forms of biological treatment that may be employed on a small scale, such as in houses to treat household's waste. Both approaches are based on biological decomposition to degrade organic material, except that the vermicomposting method utilises earthworms to accelerate the decomposition process (Lim et al., 2016). Nevertheless, vermicomposting is favoured over composting because it produces minimum odour, has lesser heavy metals and retains greater nutrients (Pankanti, 2018; Sharma & Garg, 2018). In contrast to biological treatment, thermal treatment technology includes gasification, pyrolysis and hydrothermal which use the heating element to treat the waste. Gasification and pyrolysis are thermal conversion technologies (Kumar & Samadder, 2017) whereas hydrothermal is wet oxidation technology (Anthraper et al., 2018).

Waste disposal technologies that are popular today such as incineration and non-sanitary landfills have resulted in substantial environmental degradation (Chua et al., 2019). Non-sanitary landfills discharge leachate, pollutants and greenhouse gases into the environment (Anthraper et al., 2018) which contribute to global warming (Agamuthu, 2012). Likewise, during the burning process, the burner will emit emissions that comprise a wide variety of polluting substances. These substances include Sulphur Oxides (SOx), Nitrogen Oxides (NoX), Carbon Dioxide (Co2) and others that are harmful to the

environment (Abu Eusuf et al., 2011; Chen et al., 2016; Chen & Wang, 2017; Fodor & Klemes, 2012; Kumar & Samadder, 2017).

Apart from thermal and biological waste treatment technology, reverse vending machines (RVM) and smartphone applications could also promote safe municipal waste disposal. The first RVM was developed in the United States of America in 1920 and it was known as the "Bottle return and handling machine" (Amantayeva et al., 2021). The first prototype of RVM was initially created in 1972 by TOMRA Systems ASA, Norway. It is commonly used in the United States to recycle beverage containers, particularly those that are subjected to Bottle Bills (Tiyarattanachai, 2015). RVMs are vending machines that accept empty plastic bottles and compensate the consumer with cash or a deposit receipt in exchange for the bottles. Over 100,000 RVMs are in operation globally (Pramita et al., 2019). However, based on a literature review on the use of RVM in shaping behaviour, the investigator found minimal studies on it, although several studies on the mechanical design of the RVM have been reported. Here, the studies that suggest RVM could encourage households to practise safe disposal are as follows.

The study conducted by Tiyarattanachai (2015) on the impact of RVM on consumer behaviour when recycling Polyethylene Terephthalate (PET) bottles showed that approximately 21% of PET bottles are recycled more when the recycle bins are accompanied by an RVM. Furthermore, the case study of Tehran City by Koushki et al. (2020) found that a minimum of 10% of the citizens' participation using RVM would reduce 15 tonnes of waste from going to landfills and would save 2,250 USD in waste management costs. Likewise, research findings by Sambhi and Dahiya (2020) revealed that implementing a low-cost RVM machine in India may encourage people to use it more frequently as the cost is much reduced and because of the ability to recycle more bottles in a given limited space. Besides, the study by Amantayeva et al. (2021) confirmed that

most respondents are eager to use RVM as it allows easy access to recycling facilities in Kazakhstan. Moreover, Pramita et al. (2019) found that RVM significantly increases the willingness to recycle because of the convenience of using RVM.

In addition to RVM technology, mobile applications have lately emerged as a tool for encouraging pro-environmental behaviour. According to Nowakowski et al. (2020), removing regional barriers and ensuring that recyclable waste is collected directly from households via an online portal have transformed traditional waste recycling methods into more on-demand collection methods. A similar approach of an online portal is used in smartphones which advocates the pro-environmental concept through a mobile application. The effectiveness of mobile applications in encouraging households' effort to dispose of waste safely has received considerable evidence.

For instance, Rosa-Gallardo et al. (2018) indicated that mobile applications (Sustainable WAsTe Collection-SWAT) can provide information about the status of nearby waste containers' usability. Besides, the results found by Rakhmanov and Ibrahim (2019), imply that mobile applications can assist communities in addressing problems of finding waste bins by locating the nearest waste disposal containers to which they can dispose of their waste. Meanwhile, findings by Gu et al. (2019) suggested that the disposing of electronic waste using mobile applications has resulted in the maximisation of precious metal recovery and contributed to environmental savings. Similarly, Kang et al. (2020) discovered that mobile application implementation could efficiently improve the way households handle and manage their waste disposal. Finally, Huang et al. (2020) reported in their study that the mobile application system has successfully provided adequate support on the life cycle of the products through the reuse approach.

Based on a previous study, the investigator discovered that there is very little data on the shaping of millennial households' pro-environmental behaviour through the use of

RVM and mobile applications in municipal waste disposal research. Additionally, RVM and mobile applications are also considered green technologies that adhere to the requirements outlined in The National Green Technology Policy. Also, the adoption of both technologies to manage municipal waste encourages pro-environmental behaviour among households. Additionally, to reduce the probability of individuals being exposed to the Covid-19 virus when handling municipal waste, "green disposal practices" are the best concept to implement during the globe confronting Covid-19 outbreak. Though Giardullo (2019) confirmed that RVM or similar technologies can improve household waste recycling practices, little research on Asian millennials' household use of RVM and mobile applications has been done.

2.6 Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) relies on the individual introspection, which entails the capacity to examine one's own beliefs, attitudes, perceptions of an individual's behaviour and the extent to which such behaviour will be executed (Ajzen, 1991). To assist in the individual's reflection, TPB provides a theoretical framework that enables a systematic investigation of factors influencing behavioural selections or choices (Mahmud & Osman, 2010). For example, a significant number of people who care for the environment engage in a variety of environmentally friendly actions that conserve nature, such as recycling and reusing waste. As a result, understanding what motivates this behaviour is critical in effectively promoting it.

One of the most often-used models for predicting and explaining pro-environmental behaviours is TPB (Abrahamse, 2019; Poskus, 2015). Numerous earlier works of literature have employed TPB to investigate pro-environmental behaviour by predicting and explaining the observed phenomenon (Akil et al., 2015; Li, Yue, et al., 2018; Poskus,

2015). As of April 2020, a search of the Web of Science bibliographic database revealed that TPB has 4,230 publications that are subject to empirical investigation. Of the 4,230 publications, 69.8% (2,952) could be categorised under the ten most covered thematic areas.

Among the areas covered are public environmental and occupational health (583), business (344), multidisciplinary psychology (338), environmental science (280), management (280), applied psychology (262), environmental studies (228), educational research (205), hospitality, leisure, sport and tourism (238) and psychology (194) (Bosnjak et al., 2020). According to the bibliographic database search results, the theory is frequently employed in studies relating to the environment, with the ten most topic areas covered and cited by researchers in their research framework in more than 36% of the publications. It is evident that pro-environment studies and especially studies that examine the rational choice of an individual use the TPB framework as their research foundation.

The TPB is an extended version of the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which believes that people react rationally (Ajzen & Fishbein, 1980). When the TRA was formulated by Ajzen and Fishbein (1980), it was confined explicitly to behaviour prediction with people who have complete voluntary control. However, Ajzen (1991) realised that the model was too severely limited to predict the studied behaviour, even under complete volitional control. Given the limitations of the TRA, the concept of behavioural control was considered and as a result, perceived behavioural control was incorporated as a new component into the original TRA model (Ajzen, 1985). Thus, the TPB was developed to improvise behaviour prediction (Ajzen, 1987, 1991).

It is worth noting here that Ajzen (1991) believes that three distinct types of beliefs impact human behaviour. Among the beliefs are behavioural beliefs, normative beliefs and control beliefs. Behavioural belief is assumed to induce a favourable or unfavourable attitude toward the behaviour under consideration. Normative belief is concerned with the expectations of others and which develops into perceived social pressure or subjective norm. At the same time, control belief is associated with the elements that may facilitate or hinder behaviour performance (Ajzen & Driver, 1991; Bosnjak et al., 2020). Apart from the three beliefs, behavioural intention is a critical component of the TPB framework since it influences actual behaviour and is used as a proxy for actual behaviour (Ajzen, 1991). Besides that, perceived behavioural control may also directly affect the actual behaviour (Sorkun, 2018). Therefore, in the TPB framework, attitude (ATT), subjective norms (SN) and perceived behavioural control (PBC) are the predictors that influence an individual's intention (INT) to engage in studied behaviour. The components of TPB (ATT, SN, PBC, INT and behaviour) as well as criticisms and extended TPB performance will be discussed more in depth in the following sub-topics.

2.6.1 Attitude

Throughout its history in the field of social psychology, the attitude (ATT) construct has been defined in countless studies. Generally, ATT has been described as assessing behaviour on a scale ranging from positive to negative (Ajzen & Fishbein, 2005). Moreover, "attitude" refers to a psychological feeling (Bezzina & Dimech, 2011). ATT usually determines an individual's preferences by supporting or opposing a particular behaviour (Ajzen, 1991; Ajzen & Driver, 1991; Bezzina & Dimech, 2011; Karim Ghani et al., 2013; Mahmud & Osman, 2010). Hence, ATT is viewed as a determining element that influences an individual's inclination to engage in a particular behaviour (Rezaei et

al., 2018; Yadav & Pathak, 2017) compared to other components in TPB (De Groot & Steg, 2007).

The impact of ATT on INT or behaviour has been extensively researched and reported in previous works of literature. For instance, Karim Ghani et al. (2013) found that employees at University Putra Malaysia, Serdang, Selangor have a positive ATT towards the INT to separate food waste at home. Likewise, findings by Wang et al. (2020) on Chinese households' waste sorting intention and Razali et al. (2020) on Malaysian households' waste sorting behaviour were shown to be positively impacted by positive ATT. Furthermore, Pakpour et al. (2014) discovered that Iranian households' ATT substantially impacted their willingness to engage in community recycling initiatives. Besides, Hou et al. (2016) found that ATT positively influenced China's wheat farmers in reducing the use of pesticide residues in wheat farming. Similarly, Rezaei et al. (2019) in his Integrated Pest Management (IPM) study found that Iranian farmers' ATT towards the intention to use IPM as a safe farming method was positively significant. Moreover, research conducted by Echegaray and Hansstein (2017), Kumar (2019) and Ramzan et al. (2020) on e-waste recycling behaviours revealed that ATT significantly influenced respondents (young adults or millennials) toward INT to engage in recycling activities.

In other studies, Ertz et al. (2017) discovered that ATT positively influenced the consumer's intention to increase the usage of reusable containers. Also, research findings by Yadav and Pathak (2017) revealed that consumers' intention to buy green products was significantly influenced by positive ATT, which in turn influenced their green purchase behaviour. Meanwhile, Hu et al. (2018) in a study on Chinese tourists' litter management and Li, Zuo, et al. (2018) in China's construction of waste reduction indicated that the respondents' intention to practise waste reduction was significantly impacted by ATT. In a research by La Barbera and Ajzen (2020a), case studies 1 and 3

have shown that ATT has a significant association with the intention of studied behaviour. Likewise in recent researches by Shi et al. (2021) on the rural and urban-rural integration waste sorting behaviour among Chinese households, Abadi et al. (2021) on fruit and vegetable waste management and Wang et al. (2021) on recyclable packaging intention among young Chinese consumers, it was found that their investigated behaviour was impacted by ATT.

Based on the studies cited above, the investigator observed that in several studies, ATT had a stronger impact on INT than other TPB predictors. For instance, Karim Ghani et al. (2013), Yadav and Pathak (2017), Ramzan et al. (2020) and Shi et al. (2021) have established that ATT had the strongest influence on examined INT when compared to other TPB predictors. These studies demonstrate that ATT is a critical factor in influencing an individual's pro-environmental behaviour. In contrast, a number of researchers including Pakpour et al. (2014), Hou et al. (2016), Kumar (2019), Wang et al. (2020), Razali et al. (2020) and Abadi et al. (2021) have found that ATT has the lowest beta value when compared to other TPB constructions. Additionally, there are studies demonstrating that ATT has no influence on the INT under investigation. For instance, case study 2 by La Barbera and Ajzen (2020a) found that ATT did not influence food waste behaviour. Similarly, Arı and Yılmaz (2016) found that ATT has no influence on household waste recycling behaviour. However, based on well-established studies, it is reasonable to conclude that ATT is suitable for use as a general behavioural evaluation tool.

2.6.2 Subjective Norm

Subjective norms (SN) state social influence in the TPB framework (Ajzen & Driver, 1991). The component refers to the perceived social pressure to engage in or refrain from

engaging in the behaviour (Ajzen, 1991). Based on this construct, an individual's view of a notion is usually impacted by other individuals who are significant or by social pressure, and this then leads to the individual determining whether or not to respond to the behaviour in question (Ajzen & Driver, 1991; Ajzen & Fishbein, 1980; Bezzina & Dimech, 2011; Chen & Tung, 2014; Ma et al., 2018; Mahmud & Osman, 2010; Shin & Hancer, 2016). Often individuals are motivated to engage in certain behaviours by their belief in the normative expectations of others (Karim Ghani et al., 2013). Hence, SN with a highly perceived social value might increase the likelihood that a particular behaviour will be carried out in a given situation (Gao et al., 2017).

Numerous earlier researches have established the critical role of social pressure in facilitating the intensification of investigated behaviours. For example, Ramayah et al. (2012) discovered that family and friends strongly influence respondents from the University of Science Malaysia to develop their recycling behaviours. Moreover, research findings by Arı and Yılmaz (2016) revealed that the recycling behaviours of homemakers in Eskisehir, Turkey, were positively impacted by the people in their immediate social circle whose opinions they value. Similarly, Oztekin et al. (2017) found that respondents from Turkey's public universities with recycling facilities were significantly influenced in having the INT to practise recycling by those who are important to them. In the same social context, a study conducted by Ramzan et al. (2020) on e-waste recycling behaviours revealed that people who are close and important to young adult respondents have a substantial influence on their willingness to engage in recycling activities.

Besides that, research findings by Hu et al. (2018) on Chinese tourists' litter management behaviour, Li, Zuo, et al. (2018) on construction waste reduction behaviour, Wang et al. (2020) on Chinese households' waste sorting intention and Razali et al. (2020) on Malaysian households' waste sorting behaviour had all shown they were positively

impacted by the respondents' social circle of friends. Other studies which are not related to pro-environment behaviour also showed that the studied behaviour was influenced by people close to respondents. For example, Yzer and van den Putte (2014) reported that smokers' intentions to stop smoking were favourably influenced by those who matter to them. Also, according to the findings of the study by Kothe and Mullan (2015), respondents' views of those important to them substantially influence their intention to consume fruits and vegetables. It was discovered in the study conducted by Hou et al. (2016) that SN had a significant impact on Chinese wheat farmers' perceptions about lowering pesticide residues in wheat cultivation.

Even in a recently published research, SN continues to demonstrate that social pressure directly influences an individual's intention or behaviour. For instance, in the study conducted by Shi et al. (2021), the rural and urban-rural integration of waste sorting behaviour among Chinese households were seen to be significantly influenced by their friends, family and other known persons. Besides, a study on fruit and vegetable waste management in the wholesale market by Abadi et al. (2021) revealed that respondents' acquaintances had significantly impacted their intention to reduce fruit and vegetable waste. Also, research findings by Wang et al. (2021) on the use of recyclable express packaging among young Chinese consumers showed that the young Chinese consumers' intention to use recyclable packages were substantially impacted by people they regard as important to them.

However, it should be emphasised that an earlier research has also demonstrated a pattern in which subjective norms have a weak or non-significant influence on the prediction of INT. Examples of studies that indicated a weak but significant beta value of SN towards studied INT are by Yzer and van den Putte (2014), Oztekin et al. (2017) and Shi et al. (2021). Likewise, there are several studies indicating a non-significant

relationship between SN and studied INT. For instance, Earle et al. (2019) discovered a non-significant association between SN and INT in their study on the willingness to participate in cannabis-related driving behaviours. An investigation on factors that influence the household's waste separation behaviour in Guilin, China by Ma et al. (2018) showed that the individuals' INT did not affect their separating of municipal waste in their immediate vicinity. According to the findings of the study by Zhang et al. (2019), individuals within the family, friends or work colleagues had no significant impact on Chinese residents' INT to sort household waste. Furthermore, research findings by La Barbera and Ajzen (2020a) indicated that the voters' social support (people who are important to the voters) does not influence their INT to vote in favour of European integration in case study 1. Also, Dalvi-Esfahani et al. (2020) found that SN does not have a significant impact on intention to practise Green IT.

All of the researches mentioned above that found a non-significant or weak association between INT and SN are consistent with a meta-analysis study done by Armitage and Conner (2001), which found that SN is frequently the weakest component within the TPB model. Aside from the fact that several studies suggest SN has a weaker or non-significant relationship with the examined INT, there are also some studies that reveal a very strong relationship between SN and the INT in question. Among the studies that demonstrated a strong relationship are the ones by Ramayah et al. (2012), Echegaray and Hansstein (2017), Li, Zuo, et al. (2018) and Wang et al. (2021). As a result, based on previous studies, SN has shown strong evidence to support the notion that social pressure may affect individuals to engage in investigated behaviour, even though some studies suggest weaker associations with the TPB's framework.

2.6.3 Perceived Behavioural Control

Perceived Behavioural Control (PBC) is the third component in the TPB framework. It is used to evaluate an individual's ability to have the INT or engage in actual behaviour under investigation. TPB was formed after incorporating PBC into the TRA framework and it is established as a theory capable of predicting individuals' INT whilst considering their limited voluntary control over their actions (Ajzen, 1991; Fishbein & Ajzen, 1975). An individual's assessment of ease or difficulty in doing a specific task is referred to as PBC (Ajzen, 1991). It is also the element that evaluates an individual's beliefs about the presence of circumstances that may facilitate or impede their ability to perform the investigated behaviour (La Barbera & Ajzen, 2020b).

In general, the greater the perceived level of control, the more likely an individual will have a stronger INT to engage in the behaviour under consideration (Bosnjak et al., 2020). The element of PBC reflects the extent to which individuals believed they were in control of their actions and behaviours (Mahmud & Osman, 2010). PBC is reliable to a degree as it has the ability to serve as a proxy for actual control and contribute to the likelihood of studied behaviour (Ajzen, 2019). According to Ajzen (1991), apart from having a direct impact on INT, PBC can also directly impact actual behaviour. It is worth mentioning here that compared to the other components of TPB such as ATT and SN, only PBC has a direct interaction with actual behaviour.

It has been demonstrated in numerous researches that there is a significant relationship between PBC and INT. A few examples of such studies include the following. Yzer and van den Putte (2014) reported that smokers' self-control significantly influences their INT to quit smoking. In addition, the findings of Kothe and Mullan (2015) which measured participants' willingness to consume two portions of fruit and five servings of vegetables indicated that PBC had an impact on their INT to consume fruits and vegetables. Besides,

Arı and Yılmaz (2016) measured PBC by evaluating the possibility and difficulty of practising recycling at home and found that PBC positively impacted the recycling INT of homemakers in Eskisehir, Turkey. Moreover, Wan, Shen, and Choi (2017) discovered that PBC substantially affected the recycling INT of randomly chosen respondents from Hong Kong prior to any disposal. Other comparable researches on recycling, such as Oztekin et al. (2017) and Wang et al. (2021) discovered that PBC which assessed respondents' perceived ease of executing an action had a significant influence on INT to recycle. Some recent studies such as Govindan et al. (2022) also discovered that PBC positively and significantly affect the waste sorting intentions of Shanghai residents. While findings publish by Cai et al. (2022) reveal that PBC significantly impacted waste-mask source separation intention of Macau city residents.

Likewise, some studies discussed in subparagraphs 2.6.1 and 2.6.2 by Ertz et al. (2017), Li, Zuo, et al. (2018), Hu et al. (2018), Wang et al. (2020), Razali et al. (2020), La Barbera and Ajzen (2020a) and Abadi et al. (2021) demonstrated a significant association between PBC and the examined INT. Furthermore, the investigator found that PBC can be a more significant predictor of INT than other TPB predictors in multiple studies, as evidenced by the publications cited above. For instance, Yzer and van den Putte (2014), Arı and Yılmaz (2016), Oztekin et al. (2017), Ertz et al. (2017), Tan et al. (2017), Hu et al. (2018), La Barbera and Ajzen (2020a) in case study 2, Abadi et al. (2021), Govindan et al. (2022) and Dhanabalan et al. (2023) found that PBC was the strongest construct in affecting the studied INT. Also, in some studies carried out by researchers such as Arı and Yılmaz (2016), Wang et al. (2021) and Abadi et al. (2021), it was shown that PBC had a considerable impact on both INT and the actual behaviour.

Meanwhile, there appears to be evidence suggesting that PBC does not have a significant relationship with INT but does directly affect the observed behaviour. For

example, Klöckner and Oppedal (2011) discovered that the control element of students from four Norwegian institutions had no effect on their INT but directly impacted their actual behaviour to engage in local recycling initiatives near the students' residences. In a similar context, the individuals from Guilin, China showed no significant association between PBC and INT, according to a study by Ma et al. (2018); however, PBC did have a substantial influence on their actual behaviour when sorting municipal waste. PBC may not contribute to the effect of INT for various reasons, including the unavailability of access to facilities and a lack of fair experience in promoting the studied INT.

However, in contrast to the findings of the studies conducted by Klöckner and Oppedal (2011) and Ma et al. (2018), a few published studies have confirmed that PBC has no association with actual behaviour but does have a substantial influence on INT. For instance, the findings of Kothe and Mullan (2015) and Li, Zuo, et al. (2018) refuted the claim that PBC has a direct effect on the actual behaviour, although the studies indicate that PBC has a significant influence on the studied INT.

Moreover, several adjustments were made to TPB's initial structural diagram (refer to Figure 2-1), which was proposed in 1991 by Ajzen (1991) in order to reflect the role of PBC better. Among them, in 2002, actual behavioural control as shadow variable was added between PBC and behaviour in question (Ajzen, 2002). In 2006, Ajzen further updated his structural diagram by introducing PBC as a moderator to INT and actual behaviour. Finally, adjustment to the theory was made again in 2019 in the article entitled "TPB questionnaire construction: Constructing a Theory of Planned Behaviour questionnaire" (Ajzen, 2019). The TPB framework was adjusted by Ajzen (1985) based on the theoretical concept of PBC as a moderating variable that impacts the ATT and SN, potentially increasing the effect on INT.

Nevertheless, at that point in time, empirical research appeared to reveal only major effects of ATT, SN and PBC on INT, as reported by Ajzen (1991). As a result, most empirical research models discussed in the preceding articles have only treated behavioural control as a direct predictor of INT with a position equal to that of ATT and SN (Ajzen, 2020). However, on the basis of several empirical evidences, Ajzen (2019) reintroduced his previous theoretical approach in which PBC was assigned the role of moderator to interact between ATT x PBC and SN x PBC with PBC having no direct interaction with INT (refer to Figure 2-2).

Numerous prior investigations have established evidences supporting the proposed interactions of ATT x PBC and SN x PBC. For instance, in the researches by Hukkelberg et al. (2014) and Yzer and van den Putte (2014) in assessing smoking behaviour, Kothe and Mullan (2015) in predicting fruit and vegetable consumption INT, La Barbera and Ajzen (2020a) in studying INT to vote in favour of EU integration (case study-1) and INT to reduce individual energy consumption (case study-3), all reported significant interaction relationships of ATT x PBC in the prediction of studied INT. Only one case study from La Barbera and Ajzen (2020a) on INT to reduce household food waste (case study-2) was found to have an insignificant relationship between ATT x PBC towards the INT.

Several earlier authors who explored the SN x PBC interaction discovered that there was a non-significant or weak influence on the prediction of INT. For example, Earle et al. (2019) in his studies on cannabis-related driving behaviours and Kothe and Mullan (2015) discovered SN to have a weak influence over INT when PBC moderated the relationship. Nonetheless, contrary to studies by Kothe and Mullan (2015), Earle et al. (2019), Yzer and van den Putte (2014) and all the 3 case studies by La Barbera and Ajzen (2020a), there was a significant positive relationship of SN x PBC towards INT instead.

Furthermore, according to La Barbera and Ajzen (2020a), the previous studies may have failed to consider the distributions of variables which were supposed to interact and this aspect was not carefully considered. In addition, La Barbera and Ajzen (2020a) stated that the studies of Kothe and Mullan (2015) and Earle et al. (2019) were considered to portray individualistic behaviours, contrary to their three studies which were collective in nature.

Therefore, earlier studies have demonstrated that PBC has strong evidence of influencing the individuals' INT to engage in researched behaviour, even though a small number of studies claim that there is no relationship between PBC and INT. However, in the case of a linear prediction model, the three determinants (ATT, SN and PBC) of INT are typically treated as independent factors. But theoretically, PBC moderates the impact of ATT and SN on INT. In other words, positive ATT and SN contribute to the development of an INT to engage in behaviour to the extent that individuals believe they can perform the studied behaviour (Tornikoski & Maalaoui, 2019).

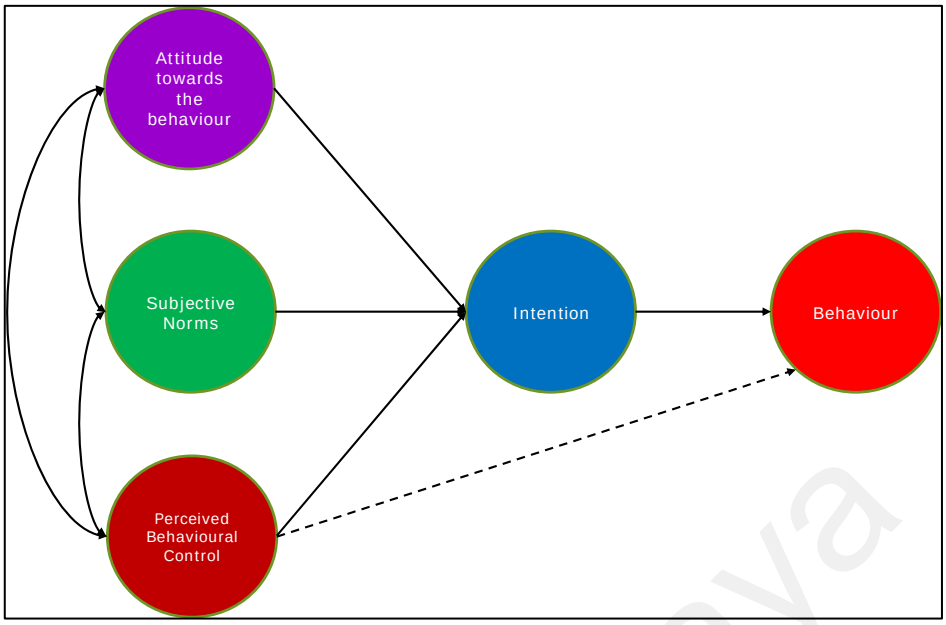

Figure 2-1: TPB original structural diagram

Source: Ajzen (1991)

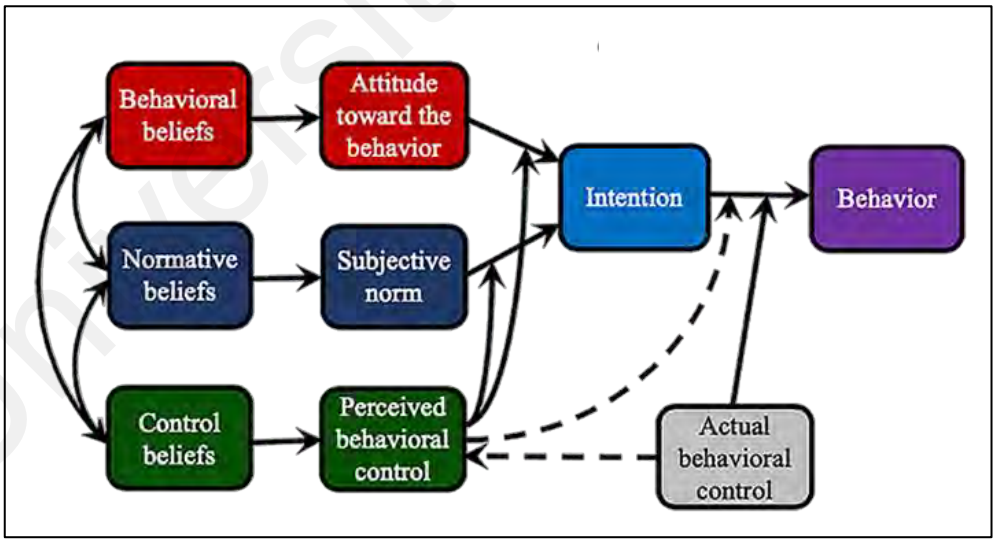

Figure 2-2: Adjusted TPB framework

Source: Ajzen (2019)

2.6.4 Intention and Behaviour

According to Ajzen (1991), intention (INT) is the capability of attaining the motivational factors that influence any behaviour. Besides, INT is derived from the individuals' mental framework and relates to their planning in studied behaviour engagement. In addition, it should be highlighted that INT is the sole evidence of the psychological impact that defines human behaviour (Ajzen & Driver, 1991). Furthermore, Ajzen (2012) mentioned that the combination of ATT, societal influences and control beliefs would lead to the formation of behavioural INT. In other words, those who demonstrate a greater commitment by having a positive ATT, supportive social environments and the capacity to perform studied behaviour are more likely to have the INT to carry out the behaviour under examination. Meanwhile, referring to the TPB framework, the impact of actual behaviour is typically guided by INT (Ajzen, 1991, 2012). Thus, the INT is assumed to be the immediate antecedent of examined behaviour.

Several studies discussed in subparagraphs 2.6.3 such as that of Klöckner and Oppedal (2011), Kothe and Mullan (2015), Arı and Yılmaz (2016), Oztekin et al. (2017), Ma et al. (2018), Li, Zuo, et al. (2018), Hu et al. (2018), Wang et al. (2020), Wang et al. (2021) and Abadi et al. (2021), Govindan et al. (2022) have established that respondents' INT is translated into actual behaviour studies. These studies confirm the assumption that INT is the immediate antecedent of actual behaviour. However, INT can only reasonably translate to actual behaviour when two criteria are satisfied. First, the measurement of INT available to the investigator must reflect respondents' INT accurately prior to performing the studied behaviour; and second, the behaviour must be under the control of the respondent's will (Ajzen, 1985).

Although certain behaviours can easily fit these criteria, the majority depends on non-motivational variables such as the availability of required opportunities and resources

(Ajzen, 1991). INT is seen to govern the actions, nevertheless, not all INT are carried out; some of these INT are abandoned entirely whereas others are modified to accommodate changing circumstances (Ajzen, 2012). There are evidences from previous studies indicating a discrepancy between INT and studied behaviour. For example, Zhang et al. (2019) found that poor access to facilities or a lack of government stimulus in China is the reason for the discrepancy between INT and actual waste sorting behaviour. Based on the above-cited studies, there is strong evidence to support the assumption that INT is a proxy for actual behaviour, even though in some cases, INT may not translate into actual behaviour due to control belief issues. Therefore, the strength of an attempt to accomplish the behaviour is defined by the INT to perform the investigated behaviour.

2.6.5 Critiques and Extended TPB Model

The concept of measuring decision-making is the foundation of the rational choice theory, which we refer to as TPB in this study. Nonetheless, according to McDonald (2014), TPB has come under increased scrutiny over the last half century, with academics arguing that non-rational factors such as habits and emotions must be addressed in order to justify pro-environmental behaviour. Besides, the equilibrium between concept and validity has been challenged: is it possible to sufficiently describe a theory of all volitional behaviour using only three explanatory components (ATT, SN and PBC)? A common criticism about TPB is that it emphasises logical reasoning while disregarding implicit behavioural elements (Sheeran et al., 2013) and the importance of emotions beyond their predicted behavioural effects (Conner et al., 2013). Furthermore, the static explanatory structure of the TPB does not necessarily contribute to explaining the evidence of behavioural repercussions on perception or predicted behaviour (McEachan et al., 2011).

Meanwhile, based on the transcript by Professor Icek Ajzen, published by Tornikoski and Maalaoui (2019), TPB is a reliable and time-tested model for predicting behaviour on its own. However, Poskus (2015) asserted that the theory fails to account for non-rational factors such as the moral component, which as demonstrated in his research, may potentially be a significant predictor of INT or actual behaviour. Moreover, McDonald (2014) reported in his paper that two theories had extended Ajzen's and Fishbein's model to include non-rational variables such as habits and emotions in order to account for pro-environmental behaviour. First, Triandis (1980) extended TPB by integrating emotional and habitual elements, resulting in the formation of the Theory of Interpersonal Behaviour (TIP). Second, to deal with the multidimensionality of human behaviour, the Comprehensive Action Determination Model (CADM) which incorporated variables from the TPB and the Norm Activation Model (NAM) were developed, as well as the inclusion of habit as a non-rational variable (Lülfs & Hahn, 2014).

Nevertheless, in order to produce a more reliable prediction model, researchers have extended the original TPB framework to optimise its predictive power by incorporating additional variables. Besides, Professor Icek Ajzen has also mentioned that TPB is an open theory and that more variables may be incorporated if a significant amount of behavioural variation can be captured (Tornikoski & Maalaoui, 2019). Also, there was a tendency among previous researchers to expand the original TPB framework, and these approaches generally appear to produce better results. For example, a study by Earle et al. (2019) discovered an increase of 2.3% variance in INT in cannabis-related driving behaviours when the original TPB framework was extended to include a sex variable and interaction effects between the variables.

Similarly, Wang et al. (2020) discovered that when personal moral norms, waste sorting knowledge and incentive measures are included, the new studied model boosts the

capacity to increase waste sorting INT from 39.37% to 48.2% and waste sorting actual behaviour from 33.23% to 35.26%. Furthermore, Dalvi-Esfahani et al. (2020) revealed that adding moral obligation to the research model resulted in it being the most significant variable compared to other variables, and this contributed to the examined INT having a more substantial influencing power. Therefore, it is worth mentioning at this point that the incorporation of new variables from previous studies has increased the ability of TPB to predict the INT under consideration. Despite various criticisms, the TPB continues to be a widely employed theory in a large number of previous pro-environmental studies (Jokonya, 2017).

2.7 Millennials or Generation Y

In this section, the investigator reviewed the related literature on Generation Y, also known as the millennials. The broad meaning of a generation refers to the idea of a growing family cycle (Papenhausen, 2009). Modern generational research is focused on two distinct perspectives: the social forces perspective and the cohort perspective (Lyons & Kuron, 2014). The social forces perspective considers generations to be interconnected and multi-dimensional social categories that take shape due to the progression of history. On the other hand, the cohort perspective views generations as mere collections of people born at a specific period (Gilleard, 2004; Laufer & Bengtson, 1974). However, in this study, the term generation is characterised as groups of people with common personalities or values in the same age group (Duh & Struwig, 2015; Krbova, 2016). Also, they have no direct link with genealogy or lineage (Duh & Struwig, 2015; Littrell Mary et al., 2005; Papenhausen, 2009).

According to the Pew Research Center (2011), millennials comprise the largest generation with high technological capabilities and are expected to play a vital role in

leading the society. Besides, Hume (2010) considered millennials as the parents of tomorrow's children in the growing era of globalisation. Millennials live in an environment whereby nearly every choice they make throughout their adolescent years is documented and stored in social media or other digital platforms. This information allows us to understand and gain a better understanding of the millennials' perspectives, beliefs and attitudes than other generations (MacKenzie & Scherer, 2019). The millennials are not just a group of homogenous individuals but they also share common recollections of significant external experiences throughout their early and late adolescent years (15-25 years of age are often referred to as the formative years) (Ryder, 1965).

Many such experiences have been documented in several articles affirming similar external events witnessed by the millennials. For example, Wiedmer (2015) in his article reported that millennials had observed various significant historical events such as the Oklahoma Federal Building bombing, Nelson Mandela's prison release, the death of Princess Diana, the Iraq invasion, the Columbine high school shootings, Katrina's Hurricane and the tsunami disaster. In another example given by MacKenzie and Scherer (2019), the millennial generation witnessed events such as the 9/11 tragedy, the labour force dynamics faced during the Great Recession, the election of the first African-American President of the United States, wars in Afghanistan and Iraq, gay marriages and school shooting tragedies.

Bearing in mind the generation's certainty and real-world experiences, scholars began to evaluate the importance of incidences encountered and recorded by millennials in their countries. In Malaysia, Ting et al. (2018) argued that millennials' perceptions of critical external events and their associated references demonstrate that the defining events that millennial Malaysians encountered during their formative years were markedly different from those that the millennials experienced in the United States. For instance, according

to Ting et al. (2018), Malaysian millennials had mostly witnessed events such as the implementation of GST, advancements in the use of technology in communication, advancements in information technology, political reformation, the 9/11 terrorist attack and the financial crisis. Since each cohort generation is developed collectively, individuals within the same cohort are likely to have shared experiences that are similar yet different from those within different cohorts (Ting et al., 2018). The following sub-topics are explored in detail: the age range of millennials, their traits and past researches on millennials.

2.7.1 Millennials Year of Birth

In an article written by Lyons and Kuron (2014), generational research is focused on two separate viewpoints: similarities in significant event experiences and by prescription based on the year of birth. Even so, a substantial amount of generational research maintains that generation cohort representation is determined by the year of birth (MacKenzie & Scherer, 2019). Millennials' age range or reference to their year of birth has been observed to be not so consistent in numerous authors' work. Table 2-1 includes randomly chosen studies with a specified year of birth for millennials. All studies were done between 2010 and 2020, with millennials divided into several age groups. Based on the evidence compiled in Table 2-1, it appears that there is a lack of uniformity in what defines the birth year of millennials. Although millennials' birth years vary, they do not differ significantly from one another.

According to Dimock (2019), president of the Pew Research Center, it is not an exact science to determine what generational cut-off points should be used. Instead, they are generally employed as a reference period to enable researchers to conduct studies on a particular generational cohort of individuals. Thus, their boundaries are not absolute. In

addition, generational cohorts are expected to have duration, but the formula for determining that duration is unclear. In accordance with the preceding viewpoint, the Pew Research Center in the United States set the reference year for millennials as 1981 to 1996, based on a 16 year period equivalent to that of their predecessor generation, Generation X (1965 to 1980). Therefore, in this study, the investigator based the millennials' birth year starting from 1981 to 1996, which was established by Dimock (2019).

Table 2-1: Millennials' birth year references

YEAR OF BORN	LOCATION OF STUDIES	AUTHORS
1989 – 2000	Australia	Hume (2010)
1977 – 1994	USA	Williams and Page (2011)
1979 – 1994	Malaysia	Ling et al. (2011)
1976 – 1994	USA	Harrington et al. (2012)
1982 – 2000	India	Rai (2012)
1979 – 1994	USA	Obal and Kunz (2013)
1980 – 2000	USA	Polzin et al. (2014)
1981 – 1991	Italy	Nadeem et al. (2015)
1979 – 1995	USA	Garikapati et al. (2016)
1981 – 1998	Italy	Sogari et al. (2017)
1980 – 2000	USA	Bedard and Tolmie (2018)
1981 – 1999	Poland	Suchanek and Szmelter-Jarosz (2019)
1982 – 2002	China	Ramzan et al. (2020)
1980 – 2000	Indonesia	Genoveva and Syahrivar (2020)
1977 – 1994	Malaysia	Jegatheesan et al. (2021)

Source: Investigator

2.7.2 Characteristics of Millennials

Due to each generation's obvious specific social development and the persistence of its micro analytic traits, its cohort acquires coherence and continuity over time. Differentiating factors among generations include changes in peer-group socialisation, changes in the education system and similarities in unique historical experiences (Ryder, 1965). Moreover, collecting information on the characteristics that distinguish the generations will enable researchers to understand their traits better. In the case study of millennials, the power of information technology has enabled academics to investigate millennials' behaviour, views and beliefs with the boundless recorded material on social media platforms in contrast to earlier generations' cohorts (MacKenzie & Scherer, 2019). Meanwhile, Paulin (2018) mentioned that many millennial characteristics might have been attributed to their relative youth compared to previous generations.

Numerous previous studies have documented a number of millennials' shared characteristics. For example, Mangold and Smith (2012) argued that millennials are among the earliest generations to grasp and experience technological advancements such as the internet in its infancy. They are also known to have incorporated new technology (computers, smartphones and others) (Nusair et al., 2013; Wiedmer, 2015) into their life as necessary norms. As a result of their exposure to technological advancements, millennials have significantly greater access to knowledge than any previous generation in terms of information acquisition (MacKenzie & Scherer, 2019). According to Jain and Pant (2012), millennials prefer information sources that are instantly available instead of traditional media such as books or newspapers. They also prefer reading content from electronic media to conventional media such as books or newspapers. Thus, they consider that one's accomplishment in life is the result of steadfast commitment and the acquisition of necessary abilities through the attainment of knowledge, which entails continuous

development and participation in various fields (Bednarska-Olejniczak & Olejniczak, 2018).

Furthermore, millennials strongly believe in a diverse social network (Bathmanathan & Rajadurai, 2017). As reported by Bednarska-Olejniczak and Olejniczak (2018) in their article, millennials have more than 40 friends on average and a more extensive network of associates with an average of more than 200 contacts, compared to the earlier generations with whom they maintain frequent interactions. With regards to the work culture, Jerome et al. (2014b) emphasised that this cohort possesses a strong work ethic, a more remarkable entrepreneurial ability and a strong feeling of commitment. Also, Bathmanathan and Rajadurai (2017) discovered that millennials are overconfident and almost arrogant, requiring justification before accepting any command or request from anyone. Apart from that, according to Duh and Struwig (2015) and Ordun (2015), when it comes to consumerism, millennial consumers are conscious of their purchasing power and are frequently seen to embrace shopping as a new medium of entertainment and social connection. As a result, some past researchers have reported that this group is highly beneficial to marketers (Jerome et al., 2014b; Rahulan et al., 2015; Williams & Page, 2011).

Likewise, many past scholars have described millennials as consumers who are environmentally conscious and responsible and who place a high value on environmental protection (Jerome et al., 2014b; Williams & Page, 2011). It is further iterated in an article written by Bathmanathan and Rajadurai (2017) that millennials respond positively to environmentally responsible lifestyles and are significantly more motivated in engaging in sustainable consumption practices than the earlier generations. Besides, millennials are widely recognised as the most knowledgeable and activist generation by the United States Census Bureau (2015) when it comes to environmental concerns. They are also perceived

as being more concerned with environmental issues such as climate change and advocating for more rigorous environmental regulations or policies (Pew Research Center, 2011). In fact, Lu et al. (2013) mentioned that millennials are prepared to pay extra for environmentally friendly goods so as to encourage firms that use environmentally friendly manufacturing practices. This behaviour of supporting ecologically friendly products is reinforced by the fact that they are frequently more curious, take more time to make buying decisions and pay close attention to the search for product information (Rahulan et al., 2015). As a result, millennials are also often regarded to have a low level of brand loyalty and a high tendency to switch brands frequently (Jain & Pant, 2012). In conclusion, besides being technologically sophisticated, educated and belonging to a broad social network generation, evidence reveals that millennials are more positive towards a better environment.

2.7.3 Previous Studies on Millennials

There are 2,813 journal articles concerning millennials that have been published in the Web of Science database as of February 11, 2022, according to statistics from the database search (based on keywords: "millennials" OR "Gen-Y" OR "Generation-Y" OR "Gen Y" OR "Generation Y"). The majority of the articles were published in the top three categories: business (584 articles), management (477 articles) and tourism (221 articles). Only 5.94% or 167 of the 2,813 articles are classified as environmental studies in the Web of Science database. In the next paragraph, the investigator will discuss issues about pro-environmental behaviour studies in some relevant articles.

For example, in an environment-related research, Ramzan et al. (2020) discovered that Chinese millennials generally have positive INT when employing an online e-waste collecting platform, with perceived usefulness being the most vital determinant in their

decisions. In relation to the green product study, Smith (2010) investigated a marketing strategy that has an impact on millennials and discovered that millennials pay attention to the reputation of a brand, analyse product information and look for indications as to whether the product is environmentally friendly. Additionally, in the same study, appropriate symbols and words effectively convince millennials to purchase green products. Besides that, the findings of Lu et al. (2013) confirmed that millennials are more inclined to purchase green products. Examples of green products include those that contain biodegradable materials, products made from recyclable or re-usable materials, products that contain a positive health message and products labelled as eco-friendly.

In comparison, Muralidharan et al. (2015) in their study on green product consumption found that millennials in India and the United States are more susceptible to social effects. This tendency is a significant contributor to the rise in environmental concerns among millennials and their desire to use environmentally friendly products. Bedard and Tolmie (2018) revealed similar findings, indicating that millennials who are often active in social media platforms and social engagement through online platforms had a favourable relationship with their INT to purchase environmentally friendly products. Even a recent study by Ogiemwonyi (2022) on the factors influencing millennials' behaviour toward green products in Nigeria showed that price sensitivity had the most significant effect, followed by green behavioural control. Based on the findings, millennials patronise and prefer green products even though green products have high price sensitivity, which is remarkable given Nigerian consumers' lower socioeconomic status.

Furthermore, a study conducted by Bathmanathan and Rajadurai (2019) on millennials redefining value proposition through green promotions and green corporate image revealed that Malaysian millennial consumers have a positive and significant relationship with the purchasing of green products as a result of the green corporate image. The

findings indicate that Malaysian millennial consumers are impacted more when they feel the products they purchase do not harm the environment and are created by environmentally conscious businesses. Likewise, a study conducted by Jegatheesan et al. (2021) on the online purchasing behaviour of green products reveals that Malaysian millennials' part-time postgraduate students are greatly impacted by societal influence and a willingness to pay higher costs for green products purchased online. Studies such as the ones cited above support the argument made by Bathmanathan and Rajadurai (2017) that millennials are more interested in green product purchases than previous generation cohorts as they may have greater purchasing power to acquire green products. Also, according to a study carried out by Dhanapal et al. (2015) in Malaysia, millennials comprise the largest segment of the population that opts for sustainable shopping methods such as internet shopping.

Sogari et al. (2017) who did another study on sustainability awareness revealed that Italian millennial consumers are influenced through the participation of social media support to purchase wine bottles with vineyard labelled wine-based energy-saving certifications. Furthermore, a study by Fuentes-Moraleda et al. (2019) on Boutique Hotel with environmental management systems revealed that millennials are very much willing to spend more on hotels that adhere to environmentally friendly practices. Lee et al. (2020) in their study of millennials' psychological proximity reported that they have a positive ATT toward recycling activities. In addition, the same study indicates that millennials are more likely to share and leave comments related to recycling information on social media platforms which may encourage others to participate in recycling activities.

A study on environmental concerns by Genoveva and Syahrivar (2020) showed that Indonesian millennials with strong environmental concerns frequently have high INT

toward green consumption. Besides, research findings by Moslehpour et al. (2021) on the purchasing of green personal care products revealed that Thai millennials' favourable ATT toward green packaging and green marketing awareness significantly influenced their INT to purchase green personal care products. Moreover, investigation by Kowalska et al. (2021) on millennials' ATT and behaviours toward organic food revealed that respondents from the United Kingdom are significantly more environmentally conscious with higher environmental ATT when it comes to consuming organic food. On the other hand, the same study revealed that respondents from Poland are less environmentally conscious than United Kingdom respondents.

In summary, the majority of the above-cited articles on millennials are published in the field of environmental studies, with an emphasis on millennials' purchasing of environmentally friendly or green products (Heo & Muralidharan, 2017; Lu et al., 2013; Smith & Brower, 2012). This behaviour is confirmed by Bathmanathan and Rajadurai (2017) whose study on behavioural and sustainable consumption of baby boomers, generation X and millennials showed that only the millennial generation, as opposed to other generations, is inclined toward environmentally friendly practices. However, the investigator observed that studies associated with millennials' disposal activities, notably in the Asia region are relatively scarce in prior environmental-related studies. Therefore, this study will explore the green disposal practice among millennials living in urban and rural Malaysia.

2.8 Research Gap and Hypothesis Formation

This section summarises the gaps identified in the literature review in subsections 2.2 to 2.7 of this thesis. The important aspect of identifying and bridging knowledge gaps is recognised as a critical component of survival and knowledge advancement. Knowledge

in general, is not a source to be moved but rather a source to be shared. Hence, applying existing knowledge and creating new knowledge is predicated to bridge the knowledge gap associated with a problem or issue (Holbrook, 2002). Based on the observations and to the best of the investigator's knowledge, the primary research gap that merits investigation is the scarcity of research on millennial households' practice of collective behaviour. This collective behaviour or green disposal behaviour includes reducing, reusing, recycling and waste separation. The following sub-topics will address the gaps discovered in the reviewed literature with regards to the primary research gap, which serves as the foundation for the research hypothesis (H) of the study.

2.8.1 Research Gap for TPB and Hypothesis Formation

The TPB framework is frequently employed to predict and explain pro-environmental behaviour (Poskus, 2015). It is evident from the results of a bibliographic database search which revealed that over 36% of publications in the top 10 Web of Science database categories employed the TPB framework in their research. According to Ajzen (1991), three distinct types of beliefs (behavioural belief - ATT, normative belief - SN, and control belief - PBC) have an effect on the individuals' INT and behaviour. These three beliefs function as predictors of the INT or behaviour under investigation. Using insight gained from previous studies such as by Hu et al. (2018), Li, Zuo, et al. (2018), Kumar (2019), Ramzan et al. (2020), Wang et al. (2020), Razali et al. (2020), Shi et al. (2021), Abadi et al. (2021) and Wang et al. (2021), there is compelling evidence that all TPB predictors have a significant direct impact on the studied INT.

Furthermore, in addition to studies relating to direct TPB's predictive ability on INT, Ajzen (2019) reintroduced his original theoretical concept from 1985, in which PBC was proposed as a moderator variable. He argued that PBC's moderating effects on ATT and

SN may amplify their effect on INT. Previous studies have established evidence for the postulated interactions of ATT x PBC and SN x PBC. For instance, Hukkelberg et al. (2014), Yzer and van den Putte (2014), Kothe and Mullan (2015) and La Barbera and Ajzen (2020a) revealed statistically significant interaction results of ATT x PBC in the prediction of examined INT. Nevertheless, only case study-2 from La Barbera and Ajzen (2020a) was shown to have a statistically insignificant relationship between ATT x PBC towards the INT. Likewise, several previous authors who investigated the SN x PBC interaction reported that it had a considerable effect on the prediction of INT. For example, studies by Yzer and van den Putte (2014) and all the 3 case studies from La Barbera and Ajzen (2020a) confirmed a statistically significant association between SN x PBC and INT.

However, based on the literature review, the investigator discovered several research gaps relevant to the application of TPB's model in a study. Among these, TPB is used in most researches to predict one or two types of pro-environmental behaviour. Nonetheless, to the best of the investigator's knowledge, there have only been a very small number of studies that used the TPB framework to predict collective pro-environmental behaviour such as green disposal practices. Also, minimal studies were done to examine the impact of ATT x PBC and SN x PBC interactions on pro-environmental behaviour INT. Moreover, only the Razali et al. (2020) study included millennials as respondents, whereas the other cited studies included respondents from mixed generations. Therefore, it is reasonable to examine millennials' ATT, social influence, and capacity to engage in pro-environmental activities through the lens of the TPB framework. Bathmanathan and Rajadurai (2017) believed that millennial households are distinct from the preceding generation cohort in terms of pro-environmental behaviour. As a result, the investigator proposed the following research hypotheses:

H1a:

Attitude positively influences millennial households' intention to practise green disposal.

H1b:

Subjective norm positively influences millennial households' intention to practise green disposal.

H1c:

Perceived behavioural control positively influences millennial households' intention to practise green disposal.

H2a:

Perceived behavioural control moderates the association between attitude and green disposal practice intention.

H2b:

Perceived behavioural control moderates the association between subjective norm and green disposal practice intention.

2.8.2 Research Gap for Disposal Awareness and Hypothesis Formation

Awareness is seen as an essential element in changing an individual's behaviour, according to Williams and Gunton (2007). Previous scholars have examined the level of awareness resulting from an act, activity or practice. For example, Wan et al. (2012), Wan et al. (2014), Lizin et al. (2017), Corsini et al. (2018) and Khan et al. (2019) had all examined awareness through an awareness of consequences of the studied behaviour. In

other words, if an individual perceives his or her actions have favourable outcomes, it is highly probable that the individual will engage in the investigated behaviour. Likewise, different awareness measures have been utilised in prior researches to assess the level of awareness. Among the studies are recycling awareness by Gonul Kochan et al. (2016), knowledge of waste disposal by Shahzadi et al. (2018), awareness of the negative effects by Nguyen and Watanabe (2019), disposal awareness by Olufemi et al. (2019) and environmental awareness by Meng et al. (2019). All of the studies mentioned above contended that awareness considerably influences a respondent's willingness to engage in pro-environmental behaviour.

Following a review of a previous research on awareness, the investigator was able to identify research gaps worth emphasising in this study. To the best of the investigator's knowledge, studies related to disposal awareness among Asian millennial households from urban and rural areas are limited in the pool of studies on awareness. Despite the fact that Olufemi et al. (2019) conducted a study on disposal awareness, their respondents (African university students) did not represent the millennial generation. Meanwhile, Shahzadi et al. (2018) examined awareness indirectly through their knowledge of waste disposal among rural households in Lahore, Pakistan. Respondents were also not from millennial households. Furthermore, there is a scarcity of studies on the impact of disposal awareness on collective pro-environmental INT. Thus, it is necessary to consider millennials' awareness of municipal waste disposal in order to encourage them to engage in pro-environmental actions. As a result, the investigator suggested the following research hypothesis:

H3:

Disposal awareness positively influences millennial households' intention to practise green disposal.

2.8.3 Research Gap for Institutional Motivation and Hypothesis Formation

The researches carried out by Amini et al. (2014), Ogiri et al. (2019), Dur and Vollaard (2019) and Zheng et al. (2020) on influencing individuals' INT to participate in investigated pro-environmental activities have shown they were significantly impacted by penalties imposed by formal institutions. Similarly, studies on informal institutions have revealed that informal group support considerably increases an individual's likelihood to engage in the examined behaviour. For instance, Du et al. (2016) discovered that a religious setting could serve as a substitute for formal enforcement in driving organisations to implement more CSR programmes.

Besides, the study conducted by Xiao et al. (2017) showed that community support influences the willingness of respondents to participate in pro-environmental activities. Also, other studies on informal institutions, such as by Jimoh et al. (2012) on traditional law, Akpabio and Subramanian (2012) on religious institutions and Roberts et al. (2017) on traditional institutions have all indicated a substantial impact towards an individual's behaviour. Moreover, numerous studies have revealed that the motivation of an institution has a significant impact on individual behaviour through the influence of positive ATT. For instance, Amini et al. (2014) and Li, Jin, et al. (2020) have revealed that the motivation of an institution has a positive impact on an individual's ATT.

However, after evaluating all the above articles on the motivational influence of institutions on the individuals' behaviour, the investigator was able to discover research gaps that were worthy of being highlighted in this study. To the investigator's knowledge, relatively few studies have examined the effect of institutional motivation (sanction and community support) on millennial households' pro-environmental behaviour. Despite the fact that the studies conducted by Amini et al. (2014) and Ogiri et al. (2019) involved

Malaysian households' pro-environmental activities, it was discovered that both studies only examined the influential motivation of formal institution on non-millennials respondents. The investigator also noticed a lack of research on the institutional motivation on millennials' collective pro-environmental activities such as green disposal. Therefore, it is vital to investigate millennials' responses to the sanctions and community support elements in motivating them to participate in pro-environmental activities. As such, the investigator proposed the following research hypotheses be established:

H4a:

Institutional motivations positively influence millennial households' intention to practise green disposal.

H4b:

Formal institutions (sanctions) positively influence millennial households' intention to practise green disposal.

H4c:

Informal institutions (community support) positively influence millennial households' intention to practise green disposal.

H5:

Institutional motivations indirectly influence millennial households' intention to participate in green disposal activities through the mediation effect of positive attitudes.

2.8.4 Research Gap for GDT and Hypothesis Formation

When it comes to treating municipal waste, there is a wide range of approaches. Some of the technologies are recognised as green technology because they use environmentally friendly techniques. In contrast, others are classified as non-green technology as they do not use eco-friendly methods. Environmentally friendly methods of treating municipal waste include sanitary landfills, anaerobic digestion, aerobic digestion, gasification, pyrolysis and hydrothermal treatment, which are all capable of recovering energy from waste (Fodor & Klemes, 2012). On the other hand, composting and vermicomposting technologies are referred to as waste recycling or reuse techniques, which are also considered green technology (Pankanti, 2018). In addition, recent technological advancements have brought a number of innovative technologies that are capable of reducing the amount of waste that lands in landfills such as RVM and smartphone/mobile applications.

Several previous studies have found evidence that the application of RVM can motivate households to practise safe disposal. For instance, studies by Tiyarattanachai (2015) on the impact of RVM on PET bottle recycling in Thailand and Koushki et al. (2020) on a participation scheme involving RVM in Tehran City have confirmed that RVM significantly increases respondents' INT to practise pro-environmental behaviour. Also, research findings by Pramita et al. (2019) on the challenges associated with RVM adoption in Bengaluru, India, revealed that RVM encourages respondents to practise safe disposal. Similarly, studies on the use of RVM by Sambhi and Dahiya (2020) and Amantayeva et al. (2021) have demonstrated that the implementation of RVM increases respondents' INT to recycle their waste more than the conventional method of recycling by sending recycled items to recycling facilities. Furthermore, the previous studies have found that the installation of RVM heightened the level of convenience among respondents to engage in pro-environmental behaviour.

Likewise, studies on the usage of mobile applications in municipal waste management have demonstrated a significant influence on the respondents' INT to engage in pro-environmental activities. Examples of such studies include those by Rosa-Gallardo et al. (2018) and Rakhmanov and Ibrahim (2019), which provide evidence that mobile application usage through smartphones has aided the respondents' efforts to locate the nearest recycling container for waste disposal. Besides, mobile applications have also been shown to promote waste disposal in an environmentally friendly manner, according to studies conducted by Kang et al. (2020) and Huang et al. (2020). Meanwhile, a study by Gu, Zhang, Guo and Hall (2019) indicates that the adoption of mobile applications for electronic waste disposal has increased precious metal recovery.

Based on the analysis of the above literature, the investigator observed that there is very little information on the subject of shaping pro-environmental behaviour among millennial households in municipal waste disposal research through the use of RVM and mobile applications. This lack of information on the impact of RVM and mobile application on millennials' behaviour has been identified as a gap in a millennial-related research. Thus, the following research hypotheses were established.

H6a:

Green disposal technology positively influences millennial households' intention to practise green disposal.

H6b:

The use of the reverse vending machine as a green disposal technology positively influences millennial households' intention to practise green disposal.

H6c:

Mobile application usage as a green disposal technology support positively influences millennial households' intention to practise green disposal.

H7:

Green disposal technology indirectly influences millennial households' intention to engage in green disposal activities through the mediation effect of perceived behavioural control.

2.9 Conceptual Framework

A conceptual framework can be broadly described as a theory or a literature review, or it can be more strictly defined as the components and variables that are examined in a study (Maxwell, 2017; Miles et al., 2019). Numerous authors including Maxwell (2013), Marshall and Rossman (2015), Ravitch and Riggan (2017) and Miles et al. (2019) have defined conceptual frameworks in their publications. However, Crawford (2019) discovered that the definition given by Ravitch and Riggan (2017) offered a more comprehensive understanding of conceptual framework than the others. According to Ravitch and Riggan (2017), a conceptual framework is about making a case on why the issue being studied is important and why the methods used to examine it are suitable and thorough. Additionally, it contains the theoretical framework incorporated into the conceptual framework as a subset.

After thoroughly assessing the theories and empirical literatures, the investigator developed the conceptual framework that serves as the basis for this study's concept (refer to Figure 2-3). Malaysia's population and economic growth have both expanded

significantly over time, and the country had generated 38,000 tonnes of waste per day in 2018, representing a 50% increase from 2005 (SWCorp, 2019). Hence, it is disturbing to learn that approximately 80% of Malaysia's municipal waste is disposed of in landfills with minimal attempts to recover any of it (Chien Bong et al., 2017; Fazeli et al., 2016; Siti Wahidah, 2017). As a result, more landfills in Malaysia will reach their maximum capacity earlier than scheduled (Agamuthu & Fauziah, 2011; Ghazali et al., 2014; Sin et al., 2016). Meanwhile, only 24.6% of municipal waste got recycled, according to the 2018 statistics (SWCorp, 2019). Thus, the need to investigate and improve the waste recovery rate through green waste disposal practices becomes even more necessary. In this study, the phrase "green disposal" refers to any action that results in safe waste disposal, which includes waste separation at the source, reduction, reuse and recycling operations that do not necessitate the waste to be treated prior to disposal.

The investigator employed TPB as the theoretical framework embedded in this study as a guiding theory. TPB provides a framework for investigating elements that influence an individual's behavioural selection in a systematic manner (Mahmud & Osman, 2010). According to Poskus (2015), the TPB is the most used method for predicting and explaining the pro-environmental behaviour of an individual. The framework consists of ATT, SN and PBC as the predictors to predict the studied INT. Furthermore, to build a more trustworthy prediction model, Professor Icek Ajzen encourages scholars to extend the original TPB framework to optimise its predictive potential by including additional variables (Tornikoski & Maalaoui, 2019). As a result, the investigator in this study introduced three additional variables based on empirical evidence: disposal awareness, institutional motivation (formal and informal) and technology support (RVM and mobile application) to strengthen the prediction power of the TPB framework and hence encourage respondents to practise green disposal.

The inclusion of disposal awareness as an added variable in this study was motivated by the claim made by Williams and Gunton (2007), suggesting that awareness is a vital component in influencing an individual's behaviour. Also, according to Maloney and Ward (1973), individuals who have a high level of environmental awareness are more likely to engage in pro-environmental behaviour. Furthermore, a number of previous studies such as those conducted by Wan et al. (2012), Wan et al. (2014), Gonul Kochan et al. (2016) and Lizin et al. (2017) have demonstrated that raising environmental awareness can motivate individuals to participate in pro-environmental activities.

Aside from that, the institution's motivation variable has been included in this framework to examine whether households can be motivated to engage in pro-environmental actions through formal institutions (sanction) and informal institutions (support). Several previous authors, such as Wong et al. (2008), Akpabio and Subramanian (2012), Du et al. (2016), Xiao et al. (2017), Roberts et al. (2017), Ogiri et al. (2019), Dur and Vollaard (2019) and Zheng et al. (2020) have established evidence in their investigations that formal and informal institutions encourage respondents to participate in pro-environmental behaviour.

Finally, this study incorporates a technology support variable with two sub-dimensions: RVM and mobile applications. These variables are proposed on the basis of empirical evidences from earlier studies by Tiyarattanachai (2015), Rosa-Gallardo et al. (2018), Pramita et al. (2019), Nowakowski et al. (2020) and Amantayeva et al. (2021), which have demonstrated that RVM and mobile applications are capable of enhancing pro-environmental behaviours.

However, the investigator found that there is a scarcity of information on the issue of developing pro-environmental behaviour among millennial households through disposal awareness, institution's motivation and technology support in municipal waste disposal

studies. As a result, millennial households were chosen as respondents for this study because millennials account for 26.6% of the overall Malaysian population and are regarded as the country's largest group of people (Department of Statistics Malaysia, 2020b). Moreover, millennials are viewed as the parents of tomorrow's children (Hume, 2010), and they are more motivated to adopt environmentally-conscious lifestyles than previous generations (Bathmanathan & Rajadurai, 2017). Therefore, in an effort to promote green disposal practices among millennial households, the investigator will investigate all identified variables to see which factors have an influence on strengthening the INT to practise green disposal behaviour.

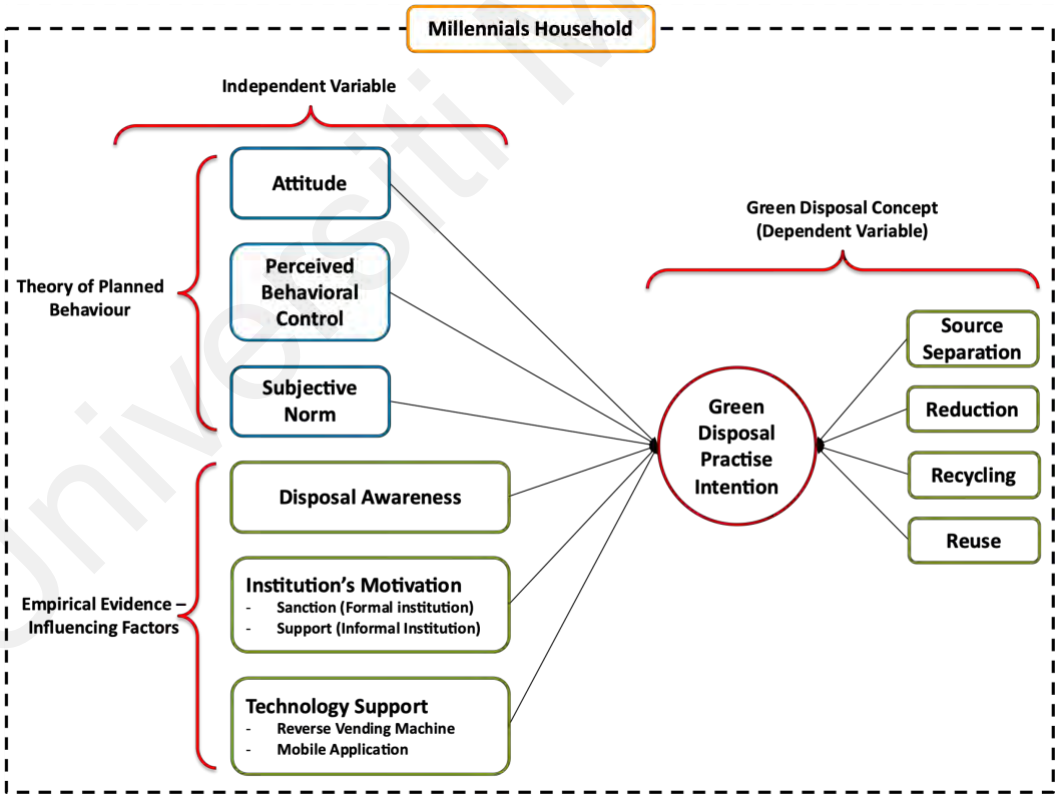

Figure 2-3: Conceptual framework

Source: Investigator

2.10 Summary

Chapter 2 discussed a review of previous literature, emphasising the study's antecedents. The topics covered in this chapter are green disposal, disposal awareness, institution's motivation, disposal green technology, Theory of Planned Behaviour, millennials' behaviour and research gaps with a focus on the concept of pro-environmental behaviours. Based on the discussion of the preceding topics, the investigator developed research objectives and hypotheses which define the purpose of this study. Additionally, this chapter also provides readers with an overview of the study's framework via the conceptual framework, which was developed in response to research gaps identified in earlier studies. In the subsequent chapter, the investigator will outline the current study's approach in detail.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In the previous chapter, the investigator reviewed the works of literature pertaining to the objectives of this study. Thus, in this chapter, the investigator fully described the procedure that was followed from the point at which data collection was planned to the point at which data could be analysed rigorously. Furthermore, the investigator also analysed the data set for model assessment to check the predictability of the proposed model. Among the discussions covered in model assessment subsections are the evaluation of the investigated model and the assessment of the model's robustness. Consequently, the investigator employed a two-step analysis when addressing the measurement model analysis. The first step measures lower-order construct and the second step measures higher-order construct**.** Additionally, in this chapter, the description of the demographic information provided by respondents will be analysed. As a result, the investigator has divided the content of the chapter into several subsections by addressing the methodological framework, common method bias issues, measurement model assessment (lower-order construct), measurement model assessment (higher-order construct), model robustness, structural model assessment (excluding hypothesis testing) and demographic data results.

3.2 Research Philosophy

A combination of research philosophy (ontology and epistemology) was employed in this study. This study aims to get an understanding of the green disposal practices among millennial households. For this purpose, the investigator attempts to check the relationship between several variables as suggested in section 3.9.1 and green disposal practices based on positivism. Given that positivism postulates the existence of a single

reality (Saunders et al., 2016), the investigator evaluates the direct and indirect (moderating and mediating) association between the proposed variables. A similar approach was also employed by Agrawal et al. (2023) in their study on generation Z's green practices.

3.3 Research Design

In the domain of research, the phrases quantitative and qualitative are commonly used to differentiate data-gathering methodologies and data-processing procedures. One way to distinguish the difference between the two is whether or not the importance is placed on numeric (numbers) or non-numerical (words) data. Quantitative and qualitative research are both effective research methodologies that can provide useful insights into various parts of a research question. According to Saunders et al. (2016), quantitative research is preferable than qualitative research in certain circumstances, such as:

a) Objective measurement:

   When the study subject necessitates exact measurement and quantification of data, quantitative research is preferable. Quantitative research uses statistical approaches to examine numerical data, which can lead to more objective and detailed outcomes.

b) Large sample sizes:

   Quantitative research is preferable when the research issue demands a large sample size. Quantitative research is commonly performed by means of surveys or experiments, which can create large datasets that can be statistically examined.

c) Generalisation:

   If the study question necessitates the generalisation of the findings to a broader population, quantitative research is preferable. Quantitative research can give

statistical evidence to support generalisation, but qualitative research may provide more in-depth insights but may not be applicable to a larger population.

d) Hypothesis testing:

When the research question includes examining a hypothesis or a particular theory, quantitative research is more appropriate. Quantitative research uses statistical methods to evaluate hypotheses and provides data to either support or refute a hypothesis.

e) Cause and effect relationships:

When the research question needs to examine the cause-and-effect relationships between variables, the quantitative approach is more suitable. Quantitative research may make use of experimental designs in order to determine the relationships of cause and effect between variables.

In light of the aforementioned criteria, the investigator have come to the conclusion that the best approach for this study would be to use a quantitative research design. The application of a quantitative approach is appropriate given the characteristics of this study, which include the use of large sample sizes, generalisation, the testing of hypotheses, and the investigation of cause-and-effect relationships among variables.

3.4 Population

The target population for this study are the millennial households. Many of the earlier authors have characterised the millennial generation based on their year of birth. For example, Dimock (2019) and Jang et al. (2011) indicated that individuals born between 1981 and 1996 are considered millennials. Thus, referring to the year of birth, millennials in 2020 should be 24 to 39 years old. According to the 2020 report from the Department of Statistics Malaysia (2020b) on a current Malaysian population estimate, the population

size for millennials in Malaysia is 8,694,000 (based on the age group of 25–39 years old). Based on the report, millennials constitute 26.6% of the total Malaysian population. In the context of Perak, the millennial population size is 594,800 (based on the age group of 25–39 years old), which constitutes 23.7% of the total Perak population. Since the research location is in Perak, the total population size of this study is 594,800 millennial households.

3.5 Sampling Method

Identifying the most suitable sampling method requires researchers to consider several decisions. Meanwhile, adopting one sample technique over another does not enhance the quality of research. Though probability sampling is excellent in its sampling generalisation, it is often not suitable and required in many cases (Brick, 2011; Memon et al., 2017). The probability sampling method is only suitable when the sampling framework is fully available. In other words, it is essential to acquire the complete list of all samples within the study population (Cooper & Schindler, 2011; Saunders et al., 2016). Although probability sampling is assumed to be preferable in research, most studies on social science rely heavily on non-probability sampling methods (Rowley, 2014). Due to its cost and flexibility advantage, non-probability sampling has always been preferable in academic research (Etikan et al., 2016; Sarstedt et al., 2018). Moreover, Calder et al. (1981) have long argued that generalisation of sampling is undesirable when the research objective is to investigate and apply a theory. Therefore, when the purpose of the study is to assess the hypothesised theoretical assumptions, a non-probability sampling approach is more appropriate in most social science studies (Hulland et al., 2017).

In non-probability sampling, the population does not have a known probability of being included in the sample framework; thus, the sample's generalisability can be undermined (Burns et al., 2008; Rowley, 2014). In choosing a specific population for a given study, selecting a sample based on subjective criteria is frequently used. As such, this strategy does not ensure that all individuals or units within the population have equal opportunities (Etikan et al., 2016). There are several reasons that researchers consider in using non-probability sampling. First, it is less expensive than probability sampling and can be performed more quickly (Etikan et al., 2016). Second, investigators often have no clear understanding of the population they attempt to generalise, due to ambiguous parameters determining who may or may not be included in the sample framework (Etikan et al., 2016; Rowley, 2014). Third, even in the event that an investigator can obtain an adequate sampling framework and apply the probability sampling method, it is not very likely that a 100% response rate can be achieved. A non-response is also another element that can cause possible biases (Rowley, 2014). Finally, compiling a comprehensive sample framework is extremely challenging, as various organisations or government institutions may maintain inadequate population listings (Burns et al., 2008; Etikan et al., 2016; Rowley, 2014).

There are several types of non-probability sampling methods. According to Sarstedt et al. (2018), convenience sampling, quota sampling and purposive sampling are among the essential non-probability methods of sampling. Many textbooks do not provide a formal definition of convenience sampling but offer group convenience sampling methods with other types of non-probability methods instead. Convenience sampling is often defined as a type of sampling in which the primary consideration is the ease of identifying the potential respondents. As the name implies, the respondents will be recruited according to the investigator's convenience rather than any formal framework (Baker et al., 2013). Common convenience sampling methods include mall-intercept sampling (Sarstedt &

Mooi, 2019), river sampling, observational sampling, voluntary sampling and snowball sampling (Baker et al., 2013; Sarstedt et al., 2018). Moreover, according to Etikan et al. (2016), convenience sampling is applicable in qualitative and quantitative studies yet is often used in quantitative studies.

In quota sampling, investigators often pre-define the control parameters and evaluate their distribution to the study population. The specification of control parameters is on the investigator's judgment, and in doing so, most of the sample selection process is at the investigator's discretion. Once the investigator has established the quotas, the sample units will be chosen at the investigator's discretion or convenience, ensuring that the final composition of the sample is comparable to the target population composition based on the pre-determined characteristics (Sarstedt et al., 2018).

The purposive sampling method, also referred to as judgment sampling, is the investigator's conscious preference based on the respondents' characteristics (Bernard, 2017). Identifying the target respondents is dependent on the judgement or expertise of the investigator. The investigator only uses elements that he or she finds necessary to assess the impact under study (Sarstedt et al., 2018). In other words, the investigator decides what needs to be learnt and determines individuals who are qualified and willing to give evidence based on expert knowledge or experience (Bernard, 2017; Etikan et al., 2016). There are many purposive sampling forms, such as homogeneous sampling, maximum variation sampling, critical case sampling, typical case sampling, extreme case sampling, expert sampling and total population sampling (Etikan et al., 2016). Besides, Etikan et al. (2016) argued that purposive sampling is more suitable for qualitative studies than quantitative studies.

However, evidence from previous studies suggests that the purposive method is often used in quantitative studies. For example, Noviantoro et al. (2020) used a purposive

sampling method to identify potential respondents in measuring the impact of green behaviour. Ali et al. (2019) used a purposive sampling method to select samples when measuring customers' motivation on purchase intention of a green luxury car. Similar studies by Helmy et al. (2019), Tiew et al. (2019) and Widayanto et al. (2018) employ the purposive sampling method in quantitative studies. Besides, some studies focus on the millennial population using the purposive method. For example, Kaya et al. (2020) looked at the home-buying behaviour model of millennials, Yaakob et al. (2020) identified levels of teacher professional development across generation cohorts including millennials and Bhattacharya and Gandhi (2020) analysed the millennial workforce of IT companies in India. All of the studies mentioned above are quantitative, and the authors have used purposive sampling to identify potential millennial respondents.

Furthermore, Bryman and Bell (2015) mentioned that non-probability sampling is a commonly used approach and likely more suitable for fieldwork study. Memon et al. (2017) took a similar position, arguing that the method used for data collection by investigators in Malaysia frequently undermines the basic principles of probability sampling. Hence, based on the above review, the investigator has decided to use purposive sampling in this study to identify potential respondents.

3.6 Sample Size and Locations

The sample size is the subset of a population necessary to ensure adequate data for inferencing (Sekaran & Bougie, 2014). Before determining the right sample size, numerous aspects must be considered. Various factors contribute in determining sample size, including the analytical tool used, the sample size of prior studies, the amount of time available, the availability of resources, the number of variables and the research approach (Memon et al., 2020). Several methods are used to calculate the sample size for

studies that employ the Partial Least Squares Structural Equation Modelling (PLS-SEM), such as the 10-times rule by Barclay et al. (1995) and inverse square root and gamma-exponential methods by Kock and Hadaya (2018). Likewise, the power tables by Hair, Hult, Ringle and Sarstedt (2017), Kline's sample size by Kline (2005, 2016), multilevel model sample size by Kreft (1996) and later modified by Hox et al. (2018) and other rules of thumb are used.

Recent evidence indicates that investigators can determine the sample size by employing a more frequently used technique, which is power analysis (Hair, Babin, et al., 2018; Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019; Kline, 2016; Ringle et al., 2018; Uttley, 2019). Power analysis can be performed using G*Power application (Erdfelder et al., 1996; Faul et al., 2009; Faul et al., 2007). Moreover, calculating the sample size using the power analysis approach is recommended for the non-probability sampling method (Cohen, 1992; Hair, Babin, et al., 2018; Hair, Risher Jeffrey, et al., 2019; Ringle et al., 2018; Uttley, 2019). G*Power application is also the first alternative tool for business and social science researchers (Hair, Babin, et al., 2018).

Power analysis calculates the minimum sample size by considering the highest number of predictors pointing to the dependent variable (Hair, Hult, Ringle, & Sarstedt, 2017; Uttley, 2019). Thus, it needs details relevant to power, effect size and significance level to calculate the minimum required sample size (Hair, Babin, et al., 2018). As such, following the recommendation by Memon et al. (2020) in using G*POWER software, the setting below is used to calculate the minimum required sample size:

a) Test family : F test

b) Statistical test : Linear multiple regression: fixed model, R^2 deviation from zero

c) Type of power analysis : A-priori: compute required sample size – (given α, power and effect size)

d) Effect size (f^2) : 0.15

e) α error probability : 0.05

f) Power : 80%

g) Number of predictors : 8

Hence, a minimum required number of 109 respondents was suggested by G*POWER (refer to Figure 3-1). However, 713 valid survey forms were collected from 800 forms that were distributed (89.1% response rate) from September 2020 to December 2020.

The sample size was drawn from millennials living in urban residential areas (Ipoh and Kuala Kangsar) and rural residential areas (Batu Gajah and Kampar) of Perak. The urban and rural area classification is based on the Department of Statistics Malaysia (2020c) and Department of Statistics Malaysia (2010) reports. An urban area is referred to as a gazetted area and their adjoining built-up areas with a combined population of 150,000 or more and administered by a city council or municipal council. In contrast, rural areas are gazetted areas with a population of less than 150,000 and are governed by a district council. Within the scope of these research locations, the investigator collected data from government departments, non-government organisations and nearby shop residences. Table 3-1 shows the sample size distribution of each residential area and participation size based on valid survey forms.

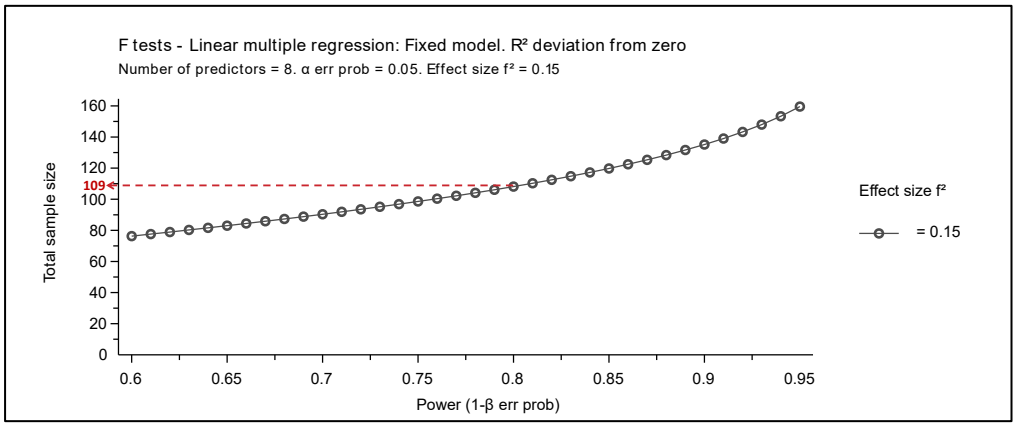

Figure 3-1: Power analysis plot graph

Source: G*POWER

Table 3-1: Distribution and participation size

Residential Location	Distribution Size (N=800)	Participation Size (N=713)
Urban - Ipoh • Government schools • Government hospitals/clinics • State Secretary Office • Residential associations • Government land office • Local authority office • Residential nearby sundry shops/ shopping mall	200	200
Urban - Kuala Kangsar • Government schools • Government hospitals/clinics • Residential associations • Local authority office • Residential nearby sundry shops/ shopping mall	200	162
Rural – Batu Gajah • Government schools • Government clinics • Residential associations • Local authority office • Residential nearby sundry shops	200	196
Rural – Kampar • Government schools • Government hospitals/clinics • Residential associations • Local authority office • Residential nearby sundry shops	200	155

Source: Investigator

3.7 Data Collection Techniques

The investigator collected data using a self-administered questionnaire. The questionnaire in this study uses close-ended questions. Close-ended questions are those in which respondents respond solely by marking the answers provided (Dawson, 2002). Given that the targeted population is likely to be proficient in Bahasa Malaysia, the investigator translated both the English version consent form (refer to **Appendix-A**) and survey questionnaires (refer to **Appendix-C**) into Bahasa Malaysia (refer to **Appendix-B** and **Appendix-D**) and used language that the average person easily understands. Next, the questionnaires were distributed to the respondents through hardcopy or an online link depending on the respondent's preference. The English version link is https://survey.sogosurvey.com/r/wbcrRB and the Bahasa Malaysia version link is https://survey.sogosurvey.com/r/3pQfXz. However, most of the respondents chose to use an online survey link since it allows them to complete the forms at their preferred location and convenience.

Several methods were used to reach the potential respondents. To identify the respondents in residential areas, the investigator approached the village headman (*penghulu* or *ketua kampung*) and the chairman of the residential association. Before meeting the village headman or residential association chairman, permission to conduct the study at the selected residential area was obtained from the nearest police station. In addition, approval from the Universiti of Malaya Research Ethics Committee (UM.TNC2/UMREC - 955) was acquired prior to data collection. Subsequently, the potential respondents' details, such as their phone number or their available information were collected through the village headman. Finally, the investigator visited the potential respondents' houses or contacted them through phone.

When surveying a shopping mall or other retail establishments near a residential area, the investigator randomly approached possible respondents depending on the sample criterion established by the investigator. The investigator also approached government employees from schools, hospitals, clinics, the State Secretary's Office, the land office and local authorities. The investigator obtained consent from the appropriate head of departments or school principals prior to data collection. After obtaining a department's approval, the investigator circulated the consent forms to the potential respondents. Only respondents who had given their approval to participate in the study were contacted.

3.8 Time Horizon

After determining the most appropriate research technique, the investigators must decide whether to analyse an event at a single point or throughout a specific period that includes changes in events. The time horizon of the study is critical in determining the amount of time needed to collect data (Iovino & Tsitsianis, 2020). There are two types of time horizon: cross-sectional studies and longitudinal studies (Bryman & Bell, 2015; Sekaran & Bougie, 2016).

The cross-sectional studies' data are gathered in a single session and correspond to a specific moment in the time specified by the investigator in addressing the research question (Bryman & Bell, 2015). Cross-sectional studies are sometimes referred to as snapshot or one-shot studies (Bryman & Bell, 2015; Sekaran & Bougie, 2016). The intention of such studies is to explore an event at a certain point in time without considering the trend or history of the phenomenon under investigation. For instance, a respondent completes a set of 50 questions in a questionnaire and the answers to the questions are provided at the same time.

In comparison, a longitudinal time horizon is when the data is collected over an extended period in order to verify the changes that occur throughout time (Bryman & Bell, 2015; Schinka & Velicer, 2012). Longitudinal studies enable the analysis of an event's progress through time. Such studies require the investigators to monitor the evolution of the investigated events and study their impact on the participants over time (Bryman & Bell, 2015; Sekaran & Bougie, 2016). For example, the investigator may wish to examine students' behaviour prior to and following a change in the school's schedule in order to determine whether the schedule influences students' attendance behaviour. This sort of study necessitates the collection of data over two time periods (before and after).

Based on the time horizon mentioned above, the investigator opted to use a cross-sectional approach in this study. The cross-sectional approach was chosen because this study will only focus on millennials' intentions to practise green disposal and not the actual behaviour changes. Thus, between June 2020 and December 2020, the investigator collected data to determine the elements that impact millennials' intention to practise green disposal. Furthermore, due to the covid-19 movement restriction, the data collection procedure took a much longer time.

3.9 Data Analysis Tools

Data analysis is the process of extracting meaningful information from data obtained through a survey. The acquired data were analysed descriptively and inferentially to address the study's research questions. Descriptive analysis was conducted to highlight the data's general qualities or describe the sample population's characteristics. The investigator used the Statistical Package for the Social Sciences (SPSS) version 26.0 software to perform descriptive analysis.

On the other hand, the inferential analysis seeks to draw conclusions from obtained data. The investigator employed the structural equation modelling (SEM) technique to analyse the studied framework. SEM does not refer to a single statistical approach but rather to a collection of closely-related procedures (Kline, 2016). Also, the SEM technique is a comprehensive family of statistical methods for analysing the relationship between multiple variables simultaneously (Hair et al., 2010).

Two approaches have been extensively employed in the realm of SEM by previous authors. Among the two types of SEM are covariance-based SEM (CB-SEM) developed by Jöreskog (1973) and PLS-SEM by Wold (1975). The CB-SEM approach takes advantage of the data's covariance matrix and estimates model parameters by considering only the common variance, often executed through AMOS or LISREL software packages. In comparison, PLS-SEM is referred to as variance-based since it considers the total variance and applies it to estimate parameters (Hair, Hult, Ringle, Sarstedt, et al., 2017). PLS-SEM method can be performed using SmartPLS, R software, Mplus, PLS-Graph or WrapPLS (Memon et al., 2017). Moreover, CB-SEM is primarily used to confirm or refute theories, while PLS-SEM is primarily employed in exploratory research to establish theories (Hair, Hult, Ringle, & Sarstedt, 2017).

There are several reasons why PLS-SEM was chosen as the method of analysis in this study. Firstly, the focus of this study is to predict the millennials' intention to practise green disposal based on the proposed constructs. Secondly, two formative measurements of higher-order construct such as institutional motivations and green disposal technology are used with other reflectively-measured latent variables. Finally, the studied model is explored by extending the TPB theoretical framework. The investigator's decision to use PLS-SEM is based on the recommendation of Hair, Hult, Ringle and Sarstedt (2017) and Hair, Risher Jeffrey, et al. (2019). In addition, several previous authors, including Liu et

al. (2017), Lizin et al. (2017), Zhang et al. (2017), Tan et al. (2017), Wang et al. (2019) and Ramzan et al. (2020) held similar considerations. As a result, the investigator chose the PLS-SEM approach since it is well-suited for investigations aimed at predicting respondents' intentions.

3.10 Questionnaire Development

The questionnaire is one of the most used forms in survey studies. Thus, many scholars in social sciences and other fields associate surveys with questionnaires that enable the gathering of information. Surveys are reasonably easy to design and plan. Questionnaires are usually used in a study because of their ability to gather data from a larger number of respondents. According to Rowley (2014), survey questionnaires are often employed in research for a number of reasons. The primary reasons for survey questionnaires are as follows:

a) profiling and descriptive research in which the aim is to produce a profile of the sample's characteristics;
b) predictive and analytical research in which the aim is to understand the relationships between variables; and
c) measurement scales for measuring and evaluating to produce a set of statements that can assess a complex attribute.

Scales in the questionnaires are a representation of latent constructs; they quantify research variables and hypothetical outcomes that we anticipate would occur as a result of our theoretical understanding of the world in which investigators are unable to measure directly (DeVellis, 2016). For example, in contrast to certain physical traits such as length or mass, behavioural attributes are not directly measurable (Raykov & Marcoulides,

2011). Thus, scales are frequently used to measure characteristics that are difficult to describe in a single item such as behaviour, opinion, emotion or action. By incorporating multiple items into a scale to measure a single variable, the scale's accuracy may be increased (Boateng et al., 2018). To establish more accurate scale measurements, the investigator used the recommendations proposed by Hinkin (1995) to develop a comprehensive scale. There are three stages in developing a measurement scale: the development of items, the development of scales and the assessment of scales, which are further broken down into several stages as shown below.

3.10.1 Latent Construct Identifications

The study of behavioural traits requires scholars to quantify attributes that cannot be directly observed. For example, the investigator will need to measure the attribute using a sequence of questions indirectly if the focus is on traits such as self-efficacy, attitudes, self-concept, beliefs or awareness. Such attributes cannot be directly observed or measured, and it is commonly referred to as latent construct (Haynes et al., 1995; McCoach et al., 2013). Thus, the latent construct that is to be studied needs to be determined and established before identifying the items or questions that measure the latent construct (Raykov & Marcoulides, 2011). A well-defined construct can provide three advantages: first, a comprehensive understanding of the phenomena being studied; second, the ability to specify the domain's parameters and third, the ability to simplify the item development and validation process. The identification of latent construct is often based on a comprehensive review of the prior literature or on a theory that guides the research (McCoach et al., 2013).

Based on a previous literature review, the investigator has identified seven latent constructs, with two constructs having two dimensions each. Out of seven latent

constructs, four latent constructs were derived from the Theory of Planned Behaviour (attitude, subjective norms, perceived behavioural control and green disposal practice intention). Besides that, the remaining three latent constructs (disposal awareness, institutional motivations and green technology support) were discovered through a prior literature review. Moreover, the institutional motivations were formed based on two sub-dimensions: formal institutions (sanction) and informal institutions (community support). Similarly, the technology support construct was developed based on two sub-dimensions: reverse vending machine (RVM) and mobile application. All the proposed constructs in this study are believed to have the potential to increase an individual's intention to practise green disposal. After identifying the constructs to be studied, the investigator proceeded to the next step, which is items development.

3.10.2 Item Generation

Once the latent constructs are defined, the identification of questions (hereinafter referred to the item[s]) related to the studied construct can be performed. This process is often referred to as item generation (Hinkin, 1995) or question development (Kline, 2013). According to Hinkin (1995), deductive and inductive techniques are two approaches that can be used to recognise the relevant items. The deductive approach, also known as cataloguing from above or logic partitioning is usually built around the concept of the related latent constructs. This method will require an investigator to develop the theoretical definition of the studied construct or assess existing scales found from the review of previous literature (Hinkin, 1995; Raykov & Marcoulides, 2011). Meanwhile, the inductive approach, also known as classification from below or grouping, involves the generation of items through individual responses in an attempt to describe the proposed latent construct (Hinkin, 1995).

In this study, multi-source methods, also a deductive approach, were used to produce the pool of items. The investigator adopted and adapted questions from several previous studies to build a collection of relevant items. Based on the recommendations by Schinka and Velicer (2012) and Kline (2013), the initial pool of items should be twice the number suggested by the investigator for each latent construct. Therefore, the total initial number of items polled was 82 (refer to Table 3-2).

Table 3-2: Number of initial pool of items

NO.	CONSTRUCT NAME	ITEM POOLED
1.	Attitude	8
2.	Subjective Norms	13
3.	Perceived Behavioural Control	13
4.	Disposal Awareness	8
5.	Formal Institution (Sanction)	10
6.	Informal Institution (Community support)	8
7.	Reverse Vending Machine	5
8.	Mobile Application	7
9.	Green Disposal Practise Intention	10
	Total	**82**

Source: Investigator

Furthermore, in the development of items, the structure of the items, the terminology or language and the types of responses that the item is intended to create should be considered (Schinka & Velicer, 2012). Likewise, Boateng et al. (2018) suggested that items should be straightforward, simple and follow the usual conversational sentence

format. Regarding the responses to these items, the investigator employed a five-point Likert-type scale for all independent constructs and a seven-point Likert-type scale for the dependent construct. Meanwhile, Krosnick and Presser (2009) also mentioned that a five and seven-point Likert-type scale would have better reliability and response rate than two, three or more than seven-points Likert-type scales.

3.10.3 Content Validity

Content validity is a process that ascertains whether the items adequately assess the content to which it is purported to be measuring (Hinkin, 1995). This process is also stated by Morgado et al. (2017) as theoretical analysis. Content adequacy is crucial and essential in knowing whether the items are measuring what they are expected to measure by the investigator (DeVellis, 2016). Additionally, content validity also determines the content relevance and content representations so that the items can capture the experience of the intended target populations (McPhail, 2007). Content validity therefore includes proof of relevance, applicability and technical reliability of the content measured in the studied construct.

Content validity may be established in two ways: through expert assessment or target population judges. Expert reviewers are highly qualified individuals in their field, whereas target population judges are potential respondents to the study (DeVellis, 2016; Morgado et al., 2017). Distinct from target-population judges, investigators often employ the expert review method to evaluate the measurement items in establishing the study scale (Polit et al., 2007). The expert reviewer panel will review and evaluate each item to determine whether the items represent the studied domain. In this phase, experts will need to rate each of the items in the collection on its relevance to the proposed construct, based on their knowledge and experience in the investigated topic (Shefcik & Tsai, 2021).

It is essential that the expert evaluation be conducted by individuals who are not involved in developing the survey items (Boateng et al., 2018). Subsequently, expert reviewer judgments will be quantified using formalised scale and statistical procedures such as the content validity index (CVI) for measuring proportional agreement (Lynn, 1986) and content validity ratio (CVR) for quantifying consensus (Lawshe, 1975). Also, Cohen's coefficient kappa (k) for measuring expert or inter-rater agreement (Cohen, 1960) is used for quantifying the expert's judgement.

Several experts were contacted personally or through e-mail. However, only those who expressed interest in participating in the item validation exercise were invited. Thus, five experts participated in this study. The experts are two associate professors in the waste management field from the University of Malaya and two experts from Solid Waste and Public Cleansing Management Corporation (SWCorp) who specialise in waste management technology. Furthermore, one expert from a private waste management consultation firm who gives consultations on waste management solutions to companies to adopt safe waste treatment solutions also agreed to participate in this assessment. According to Lynn (1986), five or more experts is optimal to establish content validity assessment. However, in domains where there are a limited number of experts, a minimum of three experts should be able to perform content validity assessments. Each expert in this study has at least five years of experience in the field of waste management.

The investigator took a non-face-to-face approach by sending an e-mail to each expert with a content validation form and detailed guidelines on how to complete it. A systematic follow-up was conducted through phone calls and e-mail to collect feedback. In the content validation form, the description of each construct and the items representing the construct were clearly stated, which will help the experts during evaluations. The experts are required to review both the constructs and the items representing each construct before

providing the ratings to each item. Additionally, experts are encouraged to provide comments in the suggestion column, which will assist the investigator in improving the quality of the items. After the review is completed, experts are asked to provide individual ratings for each item using the appropriate scale such as for "Essentiality" (not necessary, useful but not essential and essential) and "Clarity" (not clear, needs some revision and clear). The expert review assessment in this study is based on the computation of CVR and CVI values.

Upon receiving the expert's assessment forms, the investigator analysed the information using CVR and CVI formula to quantify the responses (refer to **Appendix-E**). CVR has been used to measure the essentiality of an item (Yamada et al., 2010) with the score ranging between 1 and −1. The formula to calculate the CVR score is (Ne – N/2)/(N/2), where "Ne" is the number of experts indicating an item as "essential" and "N" is the total number of experts that participated (Zamanzadeh et al., 2015). Besides that, according to Zamanzadeh et al. (2015), a higher score of CVR indicates greater agreement among the panel of experts. Referring to the Lawshe table, five experts in a panel will need a minimum score of 0.99 (Lawshe, 1975). Thus, the CVR score results in this study indicate that 37 of the 82 items have a score of 1.00. The result suggests that only 37 items had a total agreement among all experts, while the remaining 45 items could not achieve minimum agreement thresholds.

Next, the investigator proceeded to calculate the CVI score. The CVI method is the most documented approach to assess the content validity in an instrument designing phase. At the item level, CVI will be computed using the Item-CVI (I-CVI) formula. According to Lynn (1986), five experts or less require an I-CVI score of 1.00 to establish agreement as content is validated by all experts. The formula to calculate I-CVI is the number of experts in agreement divided by the total number of experts who participated.

Following that, Zamanzadeh et al. (2015) suggested that I-CVI > 0.79 is considered clear; items with values between 0.70 and 0.79 indicate that the items need revision and items with values less than 0.70 are removed from the pool. Hence, the I-CVI score results in this study indicate that 52 out of 82 items have a value of 1.00. The findings suggest that only 52 items fulfilled a complete agreement on the aspect of clarity among all experts, while the remaining 30 items could not achieve complete agreement.

Therefore, based on CVR and I-CVI results, the investigator decided to retain all items that have achieved required thresholds to qualify as item establishing content validity. As a result, the total number of items achieving complete agreement among experts and establishing content validity for essentiality and clarity of items are 37 which constitute 45.1% of the total initial pool of items.

3.10.4 Pre-testing Survey Questionnaire – English Version

The investigator was encouraged to conduct a pre-testing session using the intended survey forms to ensure the survey questionnaire is meaningful. Moreover, the pre-testing procedure is to confirm that the items in the survey are relevant to the sample population before the actual survey is administered for data collection. In this way, members of the targeted population will contribute their opinions and ideas to the survey development process, allowing them to participate in the early phase of the research process. The aim of conducting a pre-test before collecting data is to determine the extent to which questions represent the studied construct and to determine how accurately respondents' responses reflect their experiences (Fowler, 1995).

According to Boateng et al. (2018), cognitive interviews are frequently used to ascertain if the questions adequately represent the study's domain and adhere to the

required standards. Other techniques besides cognitive interviews are field pre-testing under realistic conditions and focus group discussion. The cognitive interviewing approach entails distributing drafts of survey questions to targeted respondents and then asking them to verbalise the mental process involved in giving such responses (Beatty & Willis, 2007). Also, the investigator can simplify, improve or revise the question to fit the intended objectives in the cognitive interviewing process. Furthermore, cognitive interviewing also ensures that the questionnaires are free of ambiguity, have acceptable and adequate response options, are capable of identifying incorrect question order and able to identify difficult-to-answer questions (Tourangeau, 2003; Willis, 2004).

Numerous previous authors argue on the acceptable sample size for the pre-test. Among the authors are Kumar et al. (2013) who argued that the minimum sample size for pre-test should be at least 50 participants. Meanwhile, Perneger et al. (2015) suggested that a minimum sample of 30 participants should be reasonable for pre-testing sessions. Others such as Willis (2004) recommended a sample size between 5 and 15 participants whilst Roberts and Verdoorn (1964) suggested that a sample of 12 participants is sufficient to perform a pre-test. Moreover, pre-test samples should preferably be drawn from the actual target population and not from samples that are not a part of the study population (Cooper & Schindler, 2011; Kumar et al., 2013).

The investigator has employed a cognitive interview method to further improve the survey questionnaire following the expert review procedure in this study. According to Willis (1994) and Willis (2004), the pre-test participants should be samples outside the studied populations. Thus, the investigator followed Willis (2004) suggestion on sample size and randomly approached sixteen respondents from a sample outside the studied population to participate in the pre-testing process.

Each participant received a set of questionnaires containing 45 items (8 demographic items and 37 measuring construct items) which the experts had reviewed earlier. Participants were instructed to read the questions and verbalise their thoughts on their understanding. Also, during the verbalisation of thoughts, the investigator probed deeper with additional questions. Examples of questions are as follows:

a) What do you understand from the questions?
b) Do the questions reflect the studied domain?
c) Are the statements or phrases easy to understand?
d) Do you think the questions in the survey form are suitable?
e) Are the questions confusing or direct to the point?
f) Are there any suggestions to improve the questionnaire?

The outcome of the cognitive interview revealed that three items had to be dropped, and three had to be integrated with other comparable items (refer to **Appendix-G**). Most of the participants suggested that one item from each formal institution, informal institution and green disposal practice intention domain be dropped. The primary reason for dropping the items was that they were unclear and participants could not verbalise the items in the manner anticipated by the investigator. Furthermore, the participants proposed two items from the reverse vending machine and one item from the green disposal practice intention to be merged with other items with similar meanings. Apart from the above six items, the remaining items were revised based on participants' feedback. Most of the suggestions were focused on simplifying the sentences or wordings. Also, the majority of the participants stated that all the items in the survey form were straightforward and easy to understand. After the pre-testing procedure was completed, all the necessary improvements were made based on the participants' comments and 40 items (10 demographic items and 30 measuring construct items) were finalised (refer to

Appendix-C). Additionally, see **Appendix-F** for information on the source of the questions used to develop the survey questionnaire.

3.10.5 Translation of Survey Questionnaire

Back-translation is the most used approach for evaluating translation accuracy in cross-cultural social research. The translation quality is primarily measured in terms of equivalence. Besides, the back-translation method is employed to ascertain the degree of similarity between the target language and source language versions (Tyupa, 2011). The back-translation procedure involves the questionnaire being translated from English to a Non-English language and then translated back to English (Eremenco et al., 2005). Furthermore, the back-translation technique focuses on a clear and reasonable understanding of the meaning of targeted language over the source language (Tyupa, 2011).

The frequently-used back translation guideline in the psychosocial field was rooted from work published by Brislin (1970) and Brislin (1986). In both the articles, he proposed three procedures for confirming translation equivalence prior to developing the final version: forward-translation, expert panel back-translation and cognitive interview with respondents during the pre-testing phase. However, several previous authors such as Sperber (2004), Ægisdóttir et al. (2008) and Uysal-Bozkir et al. (2013) have highlighted some issues relating to the back-translation method, which investigators often overlook. Among them are a lack of language quality in the translation, a failure to explain the objectives of the source questionnaire during the translation adequately and authors failing to evaluate the meaning between the targeted and source version. However, the most serious concern was the researcher's lack of engagement in the translation process.

Based on the concerns raised above, Ozolins et al. (2020) proposed a more comprehensive technique for the back-translation method. According to Ozolins et al. (2020), scholars are encouraged to use as much as possible the following guidelines throughout the translation process:

a) Forward translators need to be briefed on the research objectives.
b) The translator or translation expert panel need to be included together with the research team from the beginning.
c) The discussions related to forward-translation and back-translation issues should be done with the investigator.
d) The back-translation does not need to be an exact literal translation to the language source.
e) The objective of back-translation is to ensure that the terminology used in the targeted language has optimal and practical equivalence to the text source.
f) The back-translation process may lead to wording for reconsideration in the source and targeted versions to achieve optimal meaning.

In essence, Ozolins et al. (2020) argued that the back-translation process should not be outsourced to a translation agency or the investigator being excluded from being involved in the translation process. It is essential that the investigator collaborates with the translator to ensure that the targeted language and the language version source have the same meaning and ability to measure the intended objective.

In this study, the investigator adopted the recommendation by Ozolins et al. (2020) when conducting the back-translation process on the current study's survey questionnaire. After the pre-testing of the English version survey questionnaire was completed, the investigator hired a professional independent translator, Ms M. Amirthamal, an Ipoh High Court interpreter, who had at least five years of experience translating documents from

English to Bahasa Malaysia. Before the forward translation process started, the translator (Translator A) was informed of the study's objectives and given two weeks to translate the survey questionnaire from the English version to Bahasa Malaysia. The investigator then hired another professional independent translator, Ms. Nor Aziah bt. Hassan, another Ipoh High Court interpreter (Translator B), who is proficient in Bahasa Malaysia and had at least five years of experience in translating documents from Bahasa Malaysia to English. Translator B was tasked with back-translating the survey questionnaire from Bahasa Malaysia to English and was given two weeks to complete the task.

After the translation procedure was completed, the back-translated survey questionnaire was compared to the original survey questionnaire. Both Translators A and B were invited to participate in the assessment of the back-translation survey questionnaire. The investigator and the panel of translators (A and B) discussed the differences between the back-translated questionnaire and source versions. The primary objective of this discussion is to reconcile the differences and ensure that the construct measuring capabilities of the survey questionnaire source are reflected in the Bahasa Malaysia version of the survey questionnaire. During the discussion, the phrasing and language structure of the Bahasa Malaysia survey questionnaire was improved. The primary goal of the discussion is to achieve the greatest possible similarity in terms of meaning, terminology confidence, the practical equivalence of the source version and the ability to measure the intended study construct. After both the panel members and the investigator had come to a total agreement, the final Bahasa Malaysia survey questionnaire was finalised and completed.

3.10.6 Pre-testing Survey Questionnaire – Bahasa Malaysia Version

As Brislin (1970) and Brislin (1986) had stated, the translated version of the survey questionnaire needs to be pre-tested with potential respondents. Following recommendations by Willis (1994) and Willis (2004), all the pre-test participants were taken from outside the studied population. The investigator had randomly contacted potential respondents and fifteen of them agreed to participate in pre-testing the translated survey questionnaire through cognitive interview sessions. Also, all the participants were native speakers of Bahasa Malaysia and were fluent in English. Subsequently, the investigator administered a set of Bahasa Malaysia survey questionnaire to each participant, each set containing 40 items (10 demographic items and 30 measuring construct items).

Participants were told to read the questions and verbalise their thought processes. During the verbalisation phase, the investigator continued to explore their thinking processes by asking additional questions (as reported in subsection 3.10.4.). Following the verbalisation process, members were provided with the questionnaire source and asked to examine if the meaning and understanding of the items in the Bahasa Malaysia survey questionnaire matched the items in the survey questionnaire source.

The outcomes of the cognitive interview revealed that a few wordings should be revised to more commonly used wordings to enable respondents to understand better. Apart from a few minor corrections, the Bahasa Malaysia survey questionnaire was straightforward and easy to comprehend. Hence, the 40 items were retained as in the questionnaire source. In addition, participants also reported that all the items measure and are related to the studied construct. As for the similarities between the Bahasa Malaysia survey questionnaire and the survey questionnaire source, participants reported that both questionnaires are highly comparable and equivalent in terms of meaning and context.

Moreover, all participants agreed that both versions of the questionnaire measure the same matters as the investigator had intended. Therefore, the Bahasa Malaysia survey questionnaire has established the necessary level of equivalence and is ready to be distributed for data collection (refer to **Appendix-D**).

3.10.7 Pilot Study

Pilot study, small sample study, pilot randomised controlled trial and feasibility study are phrases that investigators use interchangeably and frequently to refer to a trial study (Vogel & Draper-Rodi, 2017). A pilot study is a small-scale simulation of the actual research and is viewed as an essential phase in a research protocol to ensure the actual study is effectively executed (Arnold et al., 2009; Polit et al., 2007; Thabane et al., 2010; van Teijlingen & Hundley, 2002). Additionally, it enables the investigator to plan and modify the research protocol before the data collection begins (Arnold et al., 2009; Thabane et al., 2010). According to van Teijlingen and Hundley (2002), there are two types of pilot studies that are often utilised in the field of social science: small scale studies also known as feasibility studies and pre-testing studies of a specific survey instrument, also noted by Baker (1994) as a pilot study.

There are several purposes or objectives for doing a pilot study prior to conducting the actual study. In an article written by van Teijlingen and Hundley (2002), they reported various reasons why an investigator should consider doing a pilot study prior to conducting actual research. The study is suitable for planning and assessing the practical implementation of a large-scale study. The following are justifications made by van Teijlingen and Hundley (2002) for conducting a pilot study:

a) To conduct a study in order to establish the feasibility and practicality of the proposed study.
b) To identify logistical issues.
c) To determine the suitability of the research instruments.
d) To ascertain the appropriateness of the sample technique and methodology.
e) To acquire first-level knowledge through the collection of preliminary data.
f) To determine the sample size.
g) To assure the funding body that the study is feasible and worth funding.

In addition to the rationale given by van Teijlingen and Hundley (2002) for conducting a pilot study, Gudmundsdottir and Brock-Utne (2010) highlighted the importance of reliability and evaluation validity in pilot studies to improve research quality. Thus, a pilot study should be viewed as a critical component of the research design (Kim, 2010; van Teijlingen & Hundley, 2002).

There are two distinct categories of pilot study samples. Pilot studies conducted independently or externally from the actual research will not include the pilot study respondents in the actual study. In contrast, the internal pilot studies will include the sample respondents of the pilot study in the actual study (In, 2017). Investigators are often forced to include the pilot study respondents' data in the actual study since this reduces the number of participants required and shortens the duration of the investigation. Nevertheless, Arnold et al. (2009) argued that an internal pilot study is permissible only if the methodology and protocol for data collection are identical in the actual study and the pilot study. Also, it should be designed before the beginning of the actual study (In, 2017).

Numerous scholars have proposed various guidelines on choosing the sample size for pilot studies. For example, Cooper and Schindler (2011) proposed a sample size of 25–

100 respondents. Meanwhile, Isaac and Michael (1995) suggested a sample size of 10 to 30 respondents for a pilot study. However, Memon et al. (2017) suggested that a sample size of 30 respondents is sufficient if the pilot study is used to determine the internal consistency reliability measures such as Cronbach's alpha (α). Memon et al. (2017) suggestion is based on the distributional assumption of the Central Limit Theorem, which requires a minimum sample size of 30 or greater. Typically, pilot study data are used to determine the statistical reliability of the instrument's internal consistency. It measures the extent to which an instrument can be expected to produce the same result even when repeated many times (Kline, 2011; Taber, 2013). In other words, it is used to determine the degree to which questions on a unidimensional scale are connected, and it measures the same thing across all levels.

Many earlier scholars including Nunnally (1978), Cortina (1993), Raykov (2002), Terry and Kelley (2012) and Teo and Fan (2013) have criticised the use of Cronbach alpha as a reliability measure. Among the criticisms are: a) it may compromise the accuracy or validity of the interpretation if tau-equivalence and the independence of error assumptions are violated; and b) coefficient alpha is a point estimate (Ravinder & Saraswathi, 2020). Moreover, according to Ravinder and Saraswathi (2020), the McDonald Omega coefficient reliability test is a more realistic assumption than Cronbach's Alpha coefficient. Therefore, to determine the reliability of the survey questionnaire in this study, the investigator employed two methods of analysis: Cronbach's Alpha (Cronbach, 1951) and McDonald Omega coefficient (ω) (McDonald, 1999).

Following that, Kline (2011) in his book suggested that reliability coefficients above 0.90 indicate excellent reliability, values between 0.89 and 0.80 are very good, and values between 0.79 and 0.70 indicate adequate reliability. Meanwhile, any value less than 0.50

is unacceptable and indicates that the survey instrument should be revised. On the other hand, Sekaran and Bougie (2014) considered any reliability coefficient value less than 0.6 as poor reliability in their book. Also, there are other authors such as Cortina (1993), Vaske (2008), van Griethuijsen et al. (2014), DeVellis (2016) and Taber (2018) who considered coefficient values between 0.64 and 0.87 acceptable or adequate. Besides that, Yurdugül (2006) in his article considered the reliability coefficient value for McDonald's Omega and Cronbach's Alpha coefficient as equal. Hence, the reliability coefficient value range for Cronbach's Alpha and McDonald's Omega is the same. The subsequent sub-topic will explain the pilot study findings for both the English and Bahasa Malaysia versions of the survey questionnaire applied in this study.

3.10.7.1 Pilot Study 1 (English Version)

The investigator adopted recommendations made by Memon et al. (2017) to conduct a pilot study with a minimum sample size of 30 millennial respondents. In pilot study 1, the investigator used an English version of the survey questionnaire, which was distributed to respondents through an internet link generated by SoGoSurvey, an online survey platform. The investigator randomly approached 39 respondents through phone or email and only received consent from 31 respondents to participate in this pilot study. Respondents were provided with a shared online link and asked to respond within one week at their convenience.

The survey questionnaire is divided into ten sections: a) Demographics; b) Disposal Awareness; c) Formal Institutions; d) Informal Institutions; e) Reverse Vending Machine; f) Mobile Application; g) Attitudes; h) Subjective Norms; i) Perceived Behavioural Control and j) Green Disposal Intention. Each of the ten sections takes up one page, totalling a ten-page online survey form. Following the one-week period, the investigator

randomly called five respondents to solicit comments on the survey questions. Most of the respondents stated that the survey questionnaire was simple and straightforward. However, four respondents felt the survey form was too long because it required them to complete all ten pages, although the questions were straightforward and did not demand much thought. After the discussion with the respondents, the pilot study 1 data was analysed using the JASP 0.14.1 (JASP Team, 2020) software. The investigator found no missing data in pilot study 1, and hence it is ready for analysis. Below are the results of the pilot study 1 analysis.

Table 3-3: Pilot study 1 analysis results

CONSTRUCT	ITEMS	CA	McO
Disposal Awareness	Q10A	0.924	0.932
	Q11A		
	Q12A		
	Q13A		
Formal Institution	Q14FI	0.734	0.793
	Q15FI		
	Q16FI		
Informal Institution	Q17II	0.745	0.826
	Q18II		
	Q19II		
Reverse Vending Machine	Q20RV	0.733	0.785
	Q21RV		
	Q22RV		
Mobile Application	Q23MA	0.772	0.828
	Q24MA		
	Q25MA		
Attitude	Q26ATT	0.829	0.834
	Q27ATT		
	Q28ATT		
Subjective Norm	Q29SN	0.899	0.928
	Q30SN		
	Q31SN		

Table 3-3: continued

CONSTRUCT	ITEMS	CA	McO
Perceived Behavioural Control	Q32PBC	0.713	0.727
	Q33PBC		
	Q34PBC		
Green Disposal Intention	Q35GDI	0.700	0.725
	Q36GDI		
	Q37GDI		
	Q38GDI		
	Q39GDI		
	Q40GDI		

CA= Cronbach's Alpha; **McO**= McDonald's Omega

Source: Investigator

Referring to Table 3-3, all constructs achieved an acceptable range of Cronbach's Alpha and McDonald's Omega reliability coefficient values (>0.70). These findings suggest that the English version of the survey questionnaire has achieved internal consistency reliability and is ready to be used in actual data collection. Furthermore, in response to respondents' feedback, the investigator decided to divide the survey questionnaire into three sections: a) demographics; b) questionnaires on independent constructs (Disposal Awareness, Formal Institution, Informal Institution, Reverse Vending Machine, Mobile Application, Attitude, Subjective Norms and Perceived Behavioural Control); and c) questionnaires on dependent constructs (Green Disposal Intention). The decision to reduce survey questionnaire sections alleviates or minimises respondents' feelings about the lengthy survey.

3.10.7.2 Pilot Study 2 (Bahasa Malaysia Version)

Similar to pilot study 1 (refer to subsection 3.10.7.1), pilot study 2 also followed Memon et al. (2017) guideline of a minimum sample size of 30 millennial respondents. Pilot study 2 used a Bahasa Malaysia translated version of the survey questionnaire and was distributed to respondents via an internet link developed using SoGoSurvey, an online survey platform. Based on the respondents' feedbacks to the English version of the survey questionnaire, the investigator decided to divide the Bahasa Malaysia survey questionnaire into three sections: a) respondent's profile (*Profil Peserta*), b) questionnaires on independent constructs (*Kesedaran Pelupusan Sampah, Institusi Formal, Institusi Tidak Formal, Mesin* Reverse Vending*, Aplikasi Telefon Mudah Alih, Sikap, Norma Subjektif, Persepsi Kawalan Tingkah Laku*), and c) questionnaire on dependent constructs (*Niat Amalan Pulupusan Hijau*). The investigator approached 45 individuals at random through phone or email, and managed to persuade 32 respondents to participate in this pilot study. All respondents were given one week to answer the survey form.

After completing the survey questionnaire, the investigator randomly called five respondents and requested their feedback on the questionnaire. All respondents reported that the Bahasa Malaysia survey questionnaire was easy to understand, self-explanatory and very straightforward. Also, the investigator found no comments from the respondents on the length of the survey questionnaire. Following the discussion sessions with the respondents, the data from pilot study 2 went through a data cleaning process and then were assessed using the JASP 0.14.1 (JASP Team, 2020) software. The results of the pilot study 2 analysis are listed below.

Table 3-4: Pilot study 2 analysis results

CONSTRUCT	ITEMS	CA	McO
Kesedaran Pelupusan Sampah	Q10A	0.891	0.894
	Q11A		
	Q12A		
	Q13A		
Institusi Formal	Q14FI	0.814	0.824
	Q15FI		
	Q16FI		
Institusi Tidak Formal	Q17II	0.842	0.874
	Q18II		
	Q19II		
Mesin Reverse Vending	Q20RV	0.859	0.902
	Q21RV		
	Q22RV		
Aplikasi Telefon Mudah Alih	Q23MA	0.646	0.664
	Q24MA		
	Q25MA		
Sikap	Q26ATT	0.866	0.867
	Q27ATT		
	Q28ATT		
Norma Subjektif	Q29SN	0.865	0.903
	Q30SN		
	Q31SN		
Persepsi Kawalan Tingkah Laku	Q32PBC	0.889	0.893
	Q33PBC		
	Q34PBC		
Niat Amalan Pulupusan Hijau	Q35GDI	0.915	0.918
	Q36GDI		
	Q37GDI		
	Q38GDI		
	Q39GDI		
	Q40GDI		

CA= Cronbach's Alpha; **McO**= McDonald's Omega

Source: Investigator

According to Table 3-4, the reliability coefficients for Cronbach's Alpha and McDonald's Omega values for most of the constructs were within an acceptable range

(>0.8). However, only the *Aplikasi Telefon Mudah Alih* construct has a Cronbach's Alpha value of 0.646 and a McDonald's omega value of 0.664. In reference to the claims by Cortina (1993), Vaske (2008), van Griethuijsen et al. (2014), DeVellis (2016) and Taber (2018), any reliability coefficient greater than 0.64 is considered acceptable. As a result, the investigator maintained the *Aplikasi Telefon Mudah Alih* construct in this study. Therefore, the results of pilot study 2 indicate that the Bahasa Malaysia version of the survey questionnaire has achieved internal consistency reliability and is qualified to be used in the data collection for the actual study.

3.11 Data Screening

The effectiveness in performing the data screening is critical in any multivariate analysis and forms the foundation for a meaningful result from quantitative research (Lawan et al., 2011). While the data screening process may appear trivial and insignificant, it is a necessary component for multivariate analysis (Hair et al., 2010; Hair, Black, et al., 2019; Meyers et al., 2017). Even experienced investigators may be tempted to skip this part to pay more effort to perform the multivariate analysis (Hair, Black, et al., 2019). However, the accuracy and quality of an acceptable analysis are dependent on the quality of initial data screening. Neglecting this stage frequently results in low-quality output (Lawan et al., 2011).

In ensuring data quality, the primary concern is with the use of the data cleaning procedure. The goal of data cleaning (also known as data cleansing) is to eliminate data abnormalities (Meyers et al., 2017). Following the collection of data via questionnaires, several cleaning procedures will need to be carried out in order to generate a high-quality dataset (Sekaran & Bougie, 2016). According to Van den Broeck et al. (2005), data

screening involves a three-stage process that includes screening, diagnosing and editing the data.

In the screening process, abnormal or unrelated data and missing data identification are visually inspected. Diagnosing data involve identifying unengaged responses (Awang et al., 2018; Gaskin, 2021) and outliers (Hair, Babin, et al., 2018; Hair, Black, et al., 2019; Tabachnick & Fidell, 2019). Finally, editing requires the investigator to resolve missing data and outlier issues by editing the dataset.

It also includes processes such as data coding, identifying inconsistencies in answering (Hair, Babin, et al., 2018; Hair, Black, et al., 2019; Sekaran & Bougie, 2016), testing distribution assumption (Hair, Babin, et al., 2018; Hair, Black, et al., 2019) and screening for strange patterns (Van den Broeck et al., 2005). Moreover, linearity, homoscedasticity and multicollinearity (Tabachnick & Fidell, 2019) are also considered data cleaning processes.

According to Ridzuan and Wan Zainon (2019), investigators are allowed to choose their own data cleansing rules for resolving anomalies discovered in the dataset to improve its quality. Therefore, the investigator conducted data screening in this study by addressing missing data, screening for unengaged responses and removing outliers from the dataset. Each stage of data screening is explained in greater detail in the subsequent sub-topics. Besides that, the investigator decided to discuss other data screening processes such as testing distribution assumption, testing linearity assumption and multicollinearity in Chapter 4 of this thesis.

3.11.1 Missing Data

In social science studies, missing data are usually a problem, as data are typically collected through a survey instrument. Missing data exist when a respondent fails to answer one or more items intentionally or inadvertently (Hair, Black, et al., 2019; Hair, Hult, Ringle, & Sarstedt, 2017). Data analysis becomes unreliable when missing data are present. Besides that, they can also influence the properties of statistical estimators, including means, variances and percentages, resulting in a loss of strength and inaccurate conclusions (Ibrahim et al., 2005; Little & Rubin, 2002). Thus, it is essential to discuss missing data issues since the accuracy of parameter evaluations and the validity of findings strongly depend on the approaches employed to deal with missing data (Karanja et al., 2013).

According to the article authored by Rubin (1976), there are three distinct categories of missing data, which are defined based on the underlying assumptions of why the missing data occur. Missing Completely at Random (MCAR), Missing at Random (MCA) and Missing Not at Random (MNAR) are the three categories of missing data. Below are the descriptions of missing data categories by Little and Rubin (2002) and Kang (2013):

a) MCAR is a condition in which the missing data is likely unrelated to the unknown parameters or the observed data. In other words, both observed and unobserved data are missing without any specific pattern. The statistical advantage of MCAR is that in the absence of data, the analysis remains unbiased.

b) When the missing values are likely dependent on the set of observed responses but not on the specific missing values, then the missing type is considered MAR. It is categorised as MAR when the probability of missing values is the same within the data pool defined by the observed data. For example,

respondents may create a greater amount of missing value when they are in the work setting than when they are not.

c) If the missing data do not fit within the MCAR or MAR category, then the missing data are classified as MNAR. Moreover, when investigators are unsure of the reason for missing data, this condition is also classified as MNAR. For example, participants who complete an online survey form may generate more missing data if the server fails to gather data at some point, a situation that may go unnoticed by the investigator. This form of missing data refers to the values of unobserved data.

A missing value analysis (MVA) should be performed to find any systematic trend of missing data that might affect the results. Hence, MVA, as measured by Little's MCAR test might indicate the type of missingness present in a study (Buckler et al., 2007).

There is however, no consensus over the acceptable range of missingness. Several earlier writers have proposed an acceptable percentage of missing values for retaining the item in the dataset. For example, Schafer (1997) suggested a tolerance of 5% as an acceptable missing value. Bennett (2001) and Cohen et al. (2003) argued that 10% missingness is within a tolerable range. At the same time, Hertel (1976) and Hair, Hult, Ringle and Sarstedt (2017) advocated a threshold of 15% missingness in which investigators can retain the item and proceed with the appropriate treatment. Meanwhile, Peng et al. (2006) proposed a 20% threshold criterion and stated that any value above the threshold limit will result in problematic parameter estimations.

In this study, the investigator performed Little's MCAR test using the SPSS version 26.0 and discovered that no identifiable pattern existed in the missing data (chi-square = 571.115; df = 714; p = 0.998). Moreover, if the "p" value in Little's MCAR test is greater than 0.05, the missingness type is regarded to be MCAR, and the data missing in this

study's dataset will not have a bias effect. Additionally, the investigator analysed the missing data and discovered that each item had a missingness rate of less than 0.5% or 0.19% of the overall missing data in the dataset (refer to Table 3-5). Also, no missing data was discovered in the demographic items (Q1-Q9).

Following that, the investigator used statistical prediction to replace the missing data, a process known as "missing data imputation" (Ibrahim et al., 2005; Little & Rubin, 2002). Several data imputations are available in SPSS such as mean series, mean of nearby points, median of nearby points, linear interpolation and linear trend of point (Mertler & Reinhart, 2017). The investigator imputed the missing data using the median of nearby point estimation approach. Since this study uses the Likert-scale data technique, employing the median of nearby points is more meaningful than the mean of nearby points (Gaskin, 2021). A similar approach was also used by previous authors such as Guo et al. (2016), Guo et al. (2018) and Oriol et al. (2020).

Table 3-5: Missing data results

ITEMS	VALID	MISSING	
		(N)	(%)
Q10A	711	2	0.28
Q11A	711	2	0.28
Q12A	712	1	0.14
Q13A	710	3	0.42
Q14FI	712	1	0.14
Q15FI	713	0	0.00
Q16FI	713	0	0.00
Q17II	712	1	0.14
Q18II	713	0	0.00
Q19II	711	2	0.28
Q20RV	710	3	0.42
Q21RV	713	0	0.00
Q22RV	710	3	0.42

Table 3-5: continued

ITEMS	VALID	MISSING	
		(N)	(%)
Q23MA	712	1	0.14
Q24MA	712	1	0.14
Q25MA	712	1	0.14
Q26ATT	712	1	0.14
Q27ATT	712	1	0.14
Q28ATT	709	4	0.56
Q29SN	713	0	0.00
Q30SN	710	3	0.42
Q31SN	711	2	0.28
Q32PBC	711	2	0.28
Q33PBC	711	2	0.28
Q34PBC	711	2	0.28
Q35GDI	712	1	0.14
Q36GDI	712	1	0.14
Q37GDI	713	0	0.00
Q38GDI	713	0	0.00
Q39GDI	711	2	0.28
Q40GDI	712	1	0.14
TOTAL	**22,060**	**43**	**0.19**

Source: Investigator

3.11.2 Unengaged Responses

Following the examination of missing data, the investigator analysed the dataset for unengaged responses. It is a procedure that entails the examination of response patterns. In doing so, the investigators look for a pattern often referred to as unengaged responses or straight-lining (Hair, Hult, Ringle, & Sarstedt, 2017). Typically, unengaged responses occur when a respondent selects the same response throughout the questionnaire or for the majority of it. For instance, if the questionnaire utilises a 5-point Likert scale and the response pattern consists entirely of 3s (choosing the middle response), the respondent is considered disengaged when answering the survey questionnaire. According to Gaskin

(2021), unengaged responses also can be referred to as an outlier. In detecting the unengaged responses, each case's standard deviation (SD) is determined to identify the variation of individual responses. An SD score near zero suggests that there is no variation in responses, implying disengaged reactions while selecting answers (Field, 2018).

To identify unengaged responses in this study, the investigator used an SD approach to calculate the answer's variance for each case in the dataset using the Microsoft Excel application. It was found that there were two cases with SD values equal to 0.00 in the dataset, which was collected from millennial households. As a result, the two cases were eliminated from the dataset. The remaining cases had SD values greater than 1.0. A similar approach of determining unengaged responses was employed by previous authors such as Awang et al. (2018) and Ajayi and Oyedele (2018).

3.11.3 Outliers

Further diagnosis of the dataset was performed to identify outliers. Outliers can occur due to data entry errors or having an extreme (outside ranges of high or low) value (Hair, Hult, Ringle, & Sarstedt, 2017). Small datasets are more likely to be influenced by outliers than large datasets (Gaskin, 2021). Furthermore, outliers can be classified into three perspectives: univariate, bivariate, and multivariate outliers (Hair, Babin, et al., 2018). Typically, investigators will evaluate their dataset for univariate and multivariate outliers.

Univariate outliers are identified by inspecting the distribution of observations for each variable in the dataset and locating cases that fall outside the distribution's outer bounds (Hair, Babin, et al., 2018). Nevertheless, Gaskin (2021) argued that univariate outliers do not occur in Likert-scale datasets since no out-of-range value is present. Extreme responses (Likert-scale "1" or "5") are not truly an outlier case. In contrast, a multivariate

outlier is an extreme observation value formed by two or more data points (Tabachnick & Fidell, 2019). Multivariate outliers are more complex and difficult to detect since they encompass more cases (Mertler & Vannatta, 2016). A statistical approach such as the Mahalanobis distance is recommended to test for multivariate outliers (Hair, Babin, et al., 2018).

In this study, both univariate and multivariate outliers were analysed using SPSS Statistics version 26 software. The investigator used the "z" test to determine whether there was a univariate outlier in the studied dataset. Due to the larger sample size of 711 cases, an acceptable range of "z" scores is between +4.0 and –4.0 (Hair, Hult, Ringle, & Sarstedt, 2017; Mertler & Vannatta, 2016). The univariate outlier results indicated that no cases had a "z" score value of more than +4.0; however, there were 9 cases with a value of less than −4.0. As a result, 9 cases were removed from the dataset.

The investigator addressed multivariate outliers in this study using the Mahalanobis distance approach. Mahalanobis distance is a multidimensional statistical technique used to determine a case's distance in the dataset from the centroid of all cases (Field & Miles 2010). In other words, Mahalanobis distance quantifies the distance between each observation from the mean centre of all observations by assigning a single value to each observation regardless of the number of variables analysed (Hair, Babin, et al., 2018). According to Kline (2016), it is critical to identify multivariate outliers before performing SEM analysis since multivariate outliers can easily impair the fit indices. Thus, the findings of the multivariate outlier analysis indicated that 31 cases with a p-value of less than 0.001 were found. Cases with a p-value of less than 0.001 are classified as outlier cases (Tabachnick & Fidell, 2019). Therefore, 31 cases were eliminated from the dataset. A total of 40 out of 711 cases (univariate and multivariate outliers) were removed from

the dataset. Finally, the dataset with 671 clean cases (free from outliers) was ready for further analysis.

3.11.4 Data Distribution

According to the article authored by George and Mallery (2019) on data in a normal distribution, 68% of respondents' data will fall within the range of ± 1 standard deviation (SD) from the mean value, 95.5% of data will lie between ± 2 SD of the mean value, and 99.7% of the data will be grouped within ± 3 SD of the mean value. Nonparametric statistical methods such as the PLS-SEM do not require data to be normally distributed. On the other hand, CB-SEM necessitates the data to be normally distributed. Though PLS-SEM does not require data to be normally distributed, as claimed by Hair et al. (2011) and Henseler et al. (2009), nonetheless, it is crucial to check data for normality before employing the PLS-SEM method.

The normality test is required to ensure that the data does not deviate too far from the normal distribution, as highly non normal data will cause the standard errors produced via bootstrapping to be inflated significantly. Hair, Hult, Ringle and Sarstedt (2017) recommended that researchers evaluate two metrics of distributions, namely data skewness and kurtosis, in order to ascertain whether or not data are normally distributed. Skewness denotes the degree to which the data distribution of a variable is symmetrical. When the distribution of responses for a variable stretches toward the right or left end, the distribution is said to be skewed. In contrast, kurtosis assesses if the distribution is extremely peaked or too flat (Hair, Hult, Ringle, & Sarstedt, 2017).

Many scholars have established an acceptable range for skewness and kurtosis values when dealing with data distribution. For example, Hair, Hult, Ringle and Sarstedt (2017)

advocated a criterion of ±1.0 for data skewness and kurtosis. Generally, if the skewness is larger than +1.0 or lower than –1.0, then the distribution of responses is pulled toward the right or left tail of the distribution, indicating that the data is not normally distributed. Similarly, if the kurtosis value is larger than +1.0 or lower than –1.0, it indicates that the data distribution of responses is either too peaked or too flat. Meanwhile, Tabachnick and Fidell (2019) advocated that data skewness and kurtosis value should be confined between ±1.50 as the acceptable limits. Besides that, George and Mallery (2019) defined an acceptable range for normally distributed data as between ±2.0.

In this study, the investigator used SmartPLS's "data view" section to obtain information on the data kurtosis and skewness levels of each variable in the dataset, which was then utilised to conclude the data distribution pattern. Moreover, the more liberal acceptable range proposed by Tabachnick and Fidell (2019) will be used as a reference for this study. From the dataset, the investigator discovered that all the items' skewness and kurtosis scores are in the range of ±1.50 (refer to Table 3-6). Thus, both skewness and kurtosis findings indicate that the responses in this study's dataset are normally distributed.

Table 3-6: Data distribution

ITEMS	MEAN	MEDIAN	SD	KURTOSIS	SKEWNESS
Q10A	4.324	4	0.693	0.318	-0.771
Q11A	4.355	4	0.681	0.527	-0.836
Q12A	4.089	4	0.779	0.906	-0.788
Q13A	4.291	4	0.684	0.941	-0.787
Q14FI	4.293	4	0.599	1.415	-0.730
Q15FI	4.355	4	0.656	0.776	-0.809
Q16FI	4.192	4	0.624	0.713	-0.449
Q17II	4.235	4	0.496	0.810	0.238
Q18II	4.271	4	0.523	-0.456	0.201
Q19II	4.250	4	0.500	-0.301	0.375

Table 3-6: continued

ITEMS	MEAN	MEDIAN	SD	KURTOSIS	SKEWNESS
Q20RV	4.241	4	0.719	0.882	-0.851
Q21RV	4.408	4	0.537	-1.080	-0.080
Q22RV	4.365	4	0.651	1.444	-0.934
Q23MA	4.255	4	0.559	-0.410	-0.001
Q24MA	4.258	4	0.548	-0.064	-0.010
Q25MA	4.278	4	0.535	-0.111	0.050
Q26ATT	4.202	4	0.545	-0.127	0.087
Q27ATT	4.350	4	0.520	-0.529	0.093
Q28ATT	4.260	4	0.515	-0.378	0.263
Q29SN	3.957	4	0.649	0.815	-0.467
Q30SN	3.841	4	0.700	0.518	-0.522
Q31SN	3.850	4	0.684	0.592	-0.512
Q32PBC	3.998	4	0.591	0.368	-0.144
Q33PBC	4.030	4	0.586	1.360	-0.400
Q34PBC	4.147	4	0.491	0.608	0.317
Q35GDI	5.580	6	1.280	0.331	-0.871
Q36GDI	5.858	6	0.969	0.227	-0.762
Q37GDI	5.942	6	0.940	-0.321	-0.674
Q38GDI	5.673	6	1.058	0.068	-0.652
Q39GDI	6.061	6	0.878	0.360	-0.868
Q40GDI	5.742	6	1.043	-0.002	-0.714

Source: Investigator

3.12 Development of Higher-Order Construct

Higher-order constructs (HOC) are exact representations of multidimensional constructs that occur at a higher level of concept and are linked with other constructs at a similar level of concept, which completely mediates the influence of their underlying dimensions (Chin, 1998a). In general, a HOC is a term that refers to a concept that is either reflectively or formatively represented by its sub-dimensions (Becker et al., 2012). Previous scholars have suggested various methods for developing a HOC, including the

extended repeated indicator approach and the two-stage approach for specifying HOC in the PLS-SEM (Ringle et al., 2012).

The extended repeated indicator technique has been shown to provide reduced biases in the measurement model of HOC. In contrast, the two-stage method is well-known for its improved parameter recovery for paths pointing between exogenous and endogenous components in the path model (Sarstedt, Hair, et al., 2019). Furthermore, Sarstedt, Hair, et al. (2019) reported in their publication that when the sample size is sufficiently large, both extended repeated indicator and two-stage approaches often produce highly comparable findings. Also, previous studies have indicated two versions of the two-stage technique (Becker et al., 2012; Ringle et al., 2012): the embedded two-stage approach and the disjoint two-stage approach. However, Cheah et al. (2019) pointed out that the two forms of the two-stage approaches would provide comparable findings.

Thus, the investigator employed a disjoint two-stage strategy to develop a reflective-formative type-II HOC (institutional motivations and green disposal technology support) model in this study. In the disjoint two-stage method, the investigator will only focus on the lower-order components of the HOC and exclude the HOC from the studied model. To put it another way, all the lower-order components that are theoretically related will be connected to one another, and then the scores will be saved. Following that, in stage two, these scores are used as indicators for HOC (Sarstedt, Hair, et al., 2019). At the same time, reflective-formative type II refers to lower-order constructs that are measured reflectively and do not share a common cause but rather are combined to form a general concept that completely mediates the impact on endogenous variables in a formative way (Chin, 1998a).

3.13 Analytical Framework

Based on the works of previous authors, the investigator has developed an analytical framework that includes a snapshot of the analysis structure for this study (refer to Figure 3-2). This framework deals with two types of constructs: higher-order and lower-order constructs. The lower-order construct consists of eight independent variables: attitude (ATT), subjective norms (SN), perceived behavioural control (PBC), disposal awareness (DA), formal institution (FI), informal institution (II), reverse vending machine (RVM) and mobile application (MA). Aside from that, two independent higher-order constructs are produced by four sub-dimension variables. Among these are institutional motivation (IM) (formal and informal institutions), green disposal technology (GDT), RVM and MA. Meanwhile, the dependent construct in this study is the green disposal practice intention (GDI).

Furthermore, the PBC variable serves as a moderator variable to the ATT-GDI and SN-GDI relationship. PBC is also a mediator variable in this study since it mediates the association between disposal technology support and green disposal practice intention. Likewise, the ATT variable also assumes the role of mediator by mediating the association between institutional motivations and green disposal practice intention. According to this analytical framework, each pathway (the arrow) taken by an independent variable is associated with each of the hypotheses presented in subsection 1.5 of this thesis. Therefore, this analytical framework summarises the factors that may influence millennial households to practise green disposal.

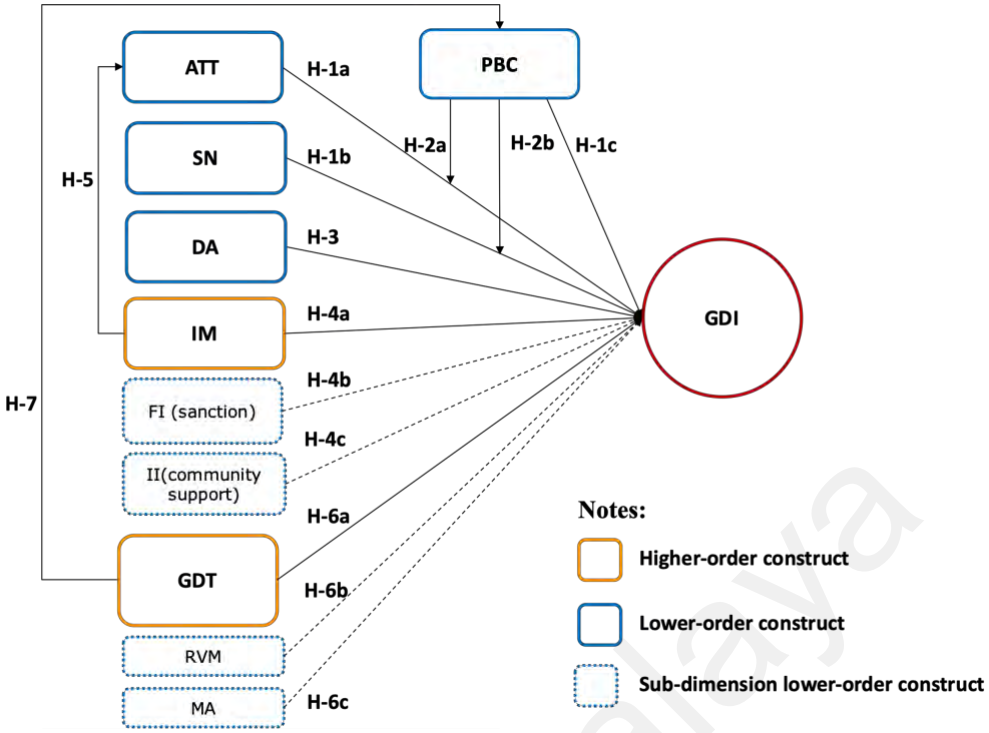

Figure 3-2: Analytical framework

Source: Investigator

3.14 Common Method Bias (CMB)

It is a common risk in studies to encounter common method bias (CMB) when data collected through a self-administered survey originates from a single source and at a single point in time (Conway & Lance, 2010; Lindell & Whitney, 2001). The term "CMB" refers to a tendency of measurement error produced by the measuring technique employed rather than the effect among latent variables (Kock, 2015). This study adds two procedural remedies to the survey questionnaire to minimise CMB risks and two statistical tests to check for CMB data contamination once the data has been collected. According to recommendations made by Podsakoff et al. (2003) and Tehseen et al. (2017), it is essential to combine several procedural remedies prior to data collection activity. One of the procedural remedies employed in this study was the methodological

separation of the measuring scale items, which was accomplished by employing 5 Likert-point scales for independent measuring items and 7 Likert-point scales for the dependent measuring items.

Another procedural method is the use of psychological remedies which provide separation of sections into categories such as the demographic section, the independent section and the dependent section, with the information given at the beginning of each part. This psychological remedy is intended to bolster respondents' confidence and understanding while completing the survey instrument. For statistical control, the investigator employed two approaches to detect CMB, which include Harman's single factor test and the full collinearity test. The findings of Harman's single-factor test show that nine factors were extracted from the factor analysis explaining 69.3% of the total variance with eigenvalues greater than one. According to Harman (1976) and Messerschmidt and Hinz (2013), any single factor variance greater than 50% is deemed to have a CMB issue. Hence, Harman's single factor results can be interpreted as CMB and is not a concern in this study because no single factor accounts for more than 50% (the largest loading factor variance was 35.14%) covariance among the measures.

Subsequently, to corroborate Harman's single factor test result, the investigator continued to perform a full collinearity test. In the full collinearity test, the investigator employed gender variable as a dummy marker and connected all constructs to the dummy marker. For each latent variable, the variance inflation factor (VIF) is calculated using SmartPLS (Ringle et al., 2015). The finding indicates that all latent variables have a VIF value of less than 3.3 (refer to Table 3-7). According to Kock and Lynn (2012) and Kock (2015), a VIF score greater than 3.3 suggests pathological collinearity and the data are contaminated with CMB. As a result, the full collinearity test findings confirm that the measured data is not contaminated by CMB. Therefore, the results of Harman's single

factor test and full collinearity test have confirmed that the measurement model is not affected by the CMB issue.

Table 3-7: Variable's CMB score

VARIABLE	ITEMS	CMB
Disposal Awareness	Q10A	1.290
	Q11A	
	Q12A	
	Q13A	
Formal Institution (Sanction)	Q14FI	1.320
	Q15FI	
	Q16FI	
Informal Institution (Community Support)	Q17II	1.550
	Q18II	
	Q19II	
Reverse Vending Machines	Q20RV	1.440
	Q21RV	
	Q22RV	
Mobile Application	Q23MA	2.143
	Q24MA	
	Q25MA	
Attitude	Q26ATT	2.490
	Q27ATT	
	Q28ATT	
Subjective Norm	Q29SN	1.365
	Q30SN	
	Q31SN	
Perceived Behavioural Control	Q32PBC	2.102
	Q33PBC	
	Q34PBC	
Green Disposal Intention	Q35GDI	1.461
	Q36GDI	
	Q37GDI	
	Q38GDI	
	Q39GDI	
	Q40GDI	

Source: Investigator

3.15 Measurement Model Assessment (Lower-order construct)

First, the researchers must distinguish between constructs that are measured reflectively and formatively before proceeding with the measurement model assessment (Hair et al., 2020; Hair, Hult, Ringle, & Sarstedt, 2017; Hair et al., 2011). The assessment of measurement model for reflective measured constructs differs from that of formative measured constructs (Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019). In this study, all the lower-order constructs are measured reflectively. As a result, the investigator followed the procedures recommended by Hair, Hult, Ringle and Sarstedt (2017) in order to conduct a measurement model evaluation on the proposed lower-order construct. Assessment of reflective measurement models includes indicator loadings, internal consistency reliability, convergent validity and discriminant validity (Hair et al., 2020; Hair, Hult, Ringle, & Sarstedt, 2017; Hair et al., 2011; Hair, Risher Jeffrey, et al., 2019). The findings of all the measurement models requiring evaluations for the lower-order constructs are presented in the following subsections.

3.15.1 Indicator Loadings

Examining indicators or item's outer loadings is the first step in assessing a reflective measurement model. According to Hair, Hult, Ringle and Sarstedt (2017), a general rule of thumb is that the standardised outer loadings for each item should be more than 0.708. This rule implies that the studied construct accounts for more than 50% of the variation in the indicator, indicating an adequate level of item reliability (Hair, Risher Jeffrey, et al., 2019).

However, researchers in the social sciences frequently report lower outer loading values of less than 0.708 (Hulland, 1999). As Hair, Hult, Ringle and Sarstedt (2017) suggested, a researcher can retain outer loadings that do not meet a minimal criterion of

more than 0.708 if the item does not raise the internal consistency value or average variance extracted from a particular construct after deletion. In any case, outer loadings of less than 0.4 should be deleted.

Most of the items in this study have an outer loading value greater than 0.708, except for four items (disposal awareness – 1 item and green disposal intention – 3 items) that have an outer loading value greater than 0.60 (refer to Table 3-8). Nevertheless, items with a loading value of above 0.60 were maintained in this study since they did not affect the internal consistency and the average variance extracted. Hence, the outer loading results in this study imply that the related indicators share common characteristics reflected by the measured construct.

3.15.2 Internal Consistency Reliability

When it comes to internal consistency, Cronbach's alpha is the most commonly used criterion. This is because it gives an approximation of reliability depending on the inter-correlations of the measured predictor variables. However, Cronbach's alpha is found to be sensitive to the number of items in a test, and it appears to overstate internal accuracy reliability. Moreover, Cronbach's alpha is based on the assumption that all indicators have equal outer loadings on the construct and are indeed equally reliable (Hair, Hult, Ringle, & Sarstedt, 2017). Due to the drawbacks of Cronbach's alpha, it is more acceptable to use an alternative mechanism of measure to compute internal consistency reliability, such as composite reliability in the PLS-SEM (Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019; Hair et al., 2012). The computation of composite reliability entails taking into consideration the outer loadings of the different indicator variables. In other words, the PLS-SEM algorithm prioritises indicators based on individual reliability (Hair, Hult, Ringle, & Sarstedt, 2017).

Generally, the composite reliability score value ranges from 0 to 1, with higher values indicating greater reliability. The range of permissible values is the same as that of Cronbach's alpha. Composite reliability scores of 0.60–0.70 are considered acceptable in exploratory studies whereas reliability values between 0.70 and 0.90 are recommended by Hair, Hult, Ringle and Sarstedt (2017) and Hair, Risher Jeffrey, et al. (2019). Also, any score less than 0.60 demonstrates a lack of internal consistency reliability, and a value of more than 0.95 is undesirable since it suggests that the indicator is measuring the same phenomena. The findings of this study confirmed that all variables scored above the necessary measurement requirement, with Cronbach's alpha and composite reliability values exceeding 0.70 (refer to Table 3-8). As a result, all variables in this study exhibited a satisfactory internal consistency. The outcomes of the internal consistency reliability indicate that the indicators used in this study measure the examined constructs accurately and reliably.

3.15.3 Convergent Validity

The degree to which a construct converges to explain the variance of its elements is referred to as convergent validity. All items that assess a specific reflective construct should have a high degree of convergence or a common high proportion of variance. The average variance extracted (AVE) is the measure used to determine whether or not a construct has established convergent validity between items on a construct. To compute the AVE, one must first square the loading of each item on a construct and then calculate the mean value (Hair, Hult, Ringle, & Sarstedt, 2017). A well-established rule of thumb is that a construct should explain a significant portion of each item's variation, typically at least 50% variance in common (Hair, Hult, Ringle, & Sarstedt, 2017; Hair et al., 2013; Hair et al., 2012). In this study, all of the proposed constructs have an AVE value that is

more than 0.50, which is considered acceptable (refer to Table 3-8). As a result, all the items in the examined constructs in this study have an established convergent validity as recommended by Hair, Hult, Ringle and Sarstedt (2017) and Hair, Risher Jeffrey, et al. (2019). The findings signify that all of the elements in the investigated construct have more than 50% variance in common.

Table 3-8: Indicator loading, internal reliability, and convergent validity results

VARIABLE	ITEMS	LOADING	CA	CR	AVE
Disposal Awareness	Q10A	0.889	0.852	0.902	0.700
	Q11A	0.900			
	Q12A	0.671			
	Q13A	0.866			
Formal Institution (Sanction)	Q14FI	0.821	0.726	0.845	0.646
	Q15FI	0.761			
	Q16FI	0.828			
Informal Institution (Community Support)	Q17II	0.867	0.894	0.934	0.825
	Q18II	0.923			
	Q19II	0.934			
Reverse Vending Machines	Q20RV	0.828	0.856	0.910	0.771
	Q21RV	0.905			
	Q22RV	0.899			
Mobile Application	Q23MA	0.914	0.906	0.941	0.841
	Q24MA	0.919			
	Q25MA	0.917			
Attitude	Q26ATT	0.809	0.848	0.907	0.765
	Q27ATT	0.893			
	Q28ATT	0.917			
Subjective Norm	Q29SN	0.887	0.882	0.927	0.808
	Q30SN	0.923			
	Q31SN	0.886			

Table 3-8: continued

VARIABLE	ITEMS	LOADING	CA	CR	AVE
Perceived Behavioural Control	Q32PBC	0.876	0.859	0.914	0.779
	Q33PBC	0.891			
	Q34PBC	0.882			
Green Disposal Intention	Q35GDI	0.627	0.832	0.877	0.546
	Q36GDI	0.826			
	Q37GDI	0.856			
	Q38GDI	0.698			
	Q39GDI	0.702			
	Q40GDI	0.697			

CA=Cronbach's Alpha; **CR**=Composite Reliability

Source: Investigator

3.15.4 Discriminant Validity

Discriminant validity is referred to as the extent to which a construct is entirely distinctive from other constructs. Achieving discriminant validity implies that a construct is unique from the other constructs in the model and it encapsulates phenomena that are not explained by the other constructs (Hair, Hult, Ringle, & Sarstedt, 2017). Authors from previous studies have commonly relied on two discriminant validity measures, including cross-loadings and the Fornell-Larcker criterion (Hair et al., 2012). Cross-loadings are frequently employed as the initial step in assessing the discriminant validity of the indicators in a construct. An indicator's outer loading on the related construct should be larger than all the corresponding cross-loadings of the construct.

Meanwhile, the Fornell-Larcker criterion is another approach that can be utilised to determine the discriminant validity of a construct. It compares the latent variable correlations to the square root of the AVE values. To be more precise, the square root of the AVE of each construct should be larger than the correlation of any other construct.

However, Henseler et al. (2015) argued that these two criteria are ineffective in disclosing a reliable discriminant validity score. In the presence of a perfect correlation between two variables, cross-loadings fail to demonstrate a lack of discriminant validity, rendering this test unreliable for empirical investigation. In fact, the Fornell-Larcker criteria also perform poorly relatively when the indicator loadings of the constructs under examination differ only a little from one another (Hair, Hult, Ringle, & Sarstedt, 2017).

In order to address this issue, researchers could use the technique of heterotrait-monotrait ratio of correlation (HTMT) to examine the discriminant validity of a construct, as recommended by Henseler et al. (2015). This measure is defined as the mean value of the item correlation across construct as a proportion of the (geometric) mean of the average correlation for the items used to measure the same construct. Based on earlier empirical findings, Henseler et al. (2015) advocated a threshold value of less than 0.90 as an acceptable score for the conceptually highly comparable constructs in the path model.

Hence, in this study, in order to assess the discriminant validity of the investigated reflective model, the investigator opted to employ the following assessment: the Fornell-Larcker and the HTMT criterion to validate construct level and cross-loadings to validate indicator level discriminant validity. Even though the Fornell-Larcker criterion is not recommended for assessing discriminant validity, the investigator nevertheless chose to use it because it is a widely reported approach that was referenced in a review by Ali et al. (2018). Furthermore, the Fornell-Lacker criterion result demonstrates that all latent constructs explain a greater proportion of variance in their own indicator than other latent constructs (refer to Table 3-9).

In comparison, the HTMT result provides a similar interpretation, revealing that all constructs have values below the threshold of 0.90, as recommended by Henseler et al. (2015) (refer to Table 3-10). The HTMT findings are consistent with the Fornell-Lacker

criterion which implies that the investigated constructs are substantially different from one another. Meanwhile, the cross-loading results suggest that all of the constructs' indicator cross-loading values are greater than the loading values of its corresponding construct indicators (refer to Table 3-11). Therefore, the findings of Fornell-Lacker, HTMT and cross-loadings in this study reveal that the constructs and their indicators have established discriminant validity. These findings signify that the investigated constructs and their indicators are independently exclusive to one another.

Table 3-9: Fornell-Larcker criterion results

	ATT	DA	FI	GDI	II	MA	PBC	RVM	SN
ATT	**0.875**								
DA	0.416	**0.837**							
FI	0.630	0.469	**0.804**						
GDI	0.503	0.364	0.380	**0.739**					
II	0.712	0.426	0.701	0.435	**0.908**				
MA	0.692	0.347	0.557	0.429	0.625	**0.917**			
PBC	0.672	0.374	0.461	0.547	0.556	0.523	**0.883**		
RVM	0.602	0.261	0.455	0.38	0.529	0.618	0.431	**0.878**	
SN	0.452	0.331	0.347	0.419	0.411	0.397	0.571	0.255	**0.899**

Source: Investigator

Table 3-10: Heterotrait-Monotrait ratio of correlations results

	ATT	DA	FI	GDI	II	MA	PBC	RVM	SN
ATT									
DA	0.481								
FI	0.798	0.592							
GDI	0.573	0.425	0.478						
II	0.818	0.487	0.873	0.495					
MA	0.786	0.394	0.683	0.484	0.693				
PBC	0.773	0.433	0.582	0.632	0.633	0.587			
RVM	0.681	0.289	0.56	0.424	0.588	0.683	0.486		
SN	0.515	0.382	0.433	0.473	0.461	0.441	0.651	0.273	

Source: Investigator

Table 3-11: Cross-loadings results

ITEMS	DA	FI	II	RVM	MA	ATT	SN	PBC	GDI
Q10A	**0.889**	0.400	0.344	0.224	0.286	0.354	0.242	0.284	0.287
Q11A	**0.900**	0.418	0.373	0.257	0.304	0.368	0.228	0.289	0.298
Q12A	**0.671**	0.293	0.270	0.144	0.238	0.242	0.355	0.299	0.270
Q13A	**0.866**	0.440	0.418	0.238	0.322	0.406	0.287	0.366	0.351
Q14FI	0.395	**0.821**	0.561	0.410	0.475	0.512	0.254	0.365	0.338
Q15FI	0.390	**0.761**	0.489	0.294	0.400	0.475	0.304	0.361	0.277
Q16FI	0.345	**0.828**	0.637	0.385	0.462	0.532	0.285	0.387	0.296
Q17II	0.414	0.699	**0.867**	0.449	0.558	0.649	0.403	0.514	0.356
Q18II	0.374	0.591	**0.923**	0.507	0.553	0.631	0.351	0.485	0.406
Q19II	0.379	0.630	**0.934**	0.484	0.593	0.663	0.370	0.518	0.420
Q20RV	0.185	0.348	0.391	**0.828**	0.442	0.428	0.155	0.322	0.253
Q21RV	0.292	0.452	0.540	**0.905**	0.625	0.615	0.291	0.444	0.417
Q22RV	0.181	0.377	0.429	**0.899**	0.521	0.502	0.191	0.341	0.290
Q23MA	0.338	0.492	0.554	0.556	**0.914**	0.597	0.360	0.460	0.381
Q24MA	0.309	0.506	0.564	0.578	**0.919**	0.629	0.379	0.452	0.358
Q25MA	0.309	0.531	0.597	0.567	**0.917**	0.672	0.354	0.519	0.434

Table 3-11: continued

ITEMS	DA	FI	II	RVM	MA	ATT	SN	PBC	GDI
Q26ATT	0.325	0.498	0.585	0.462	0.571	**0.809**	0.380	0.523	0.330
Q27ATT	0.375	0.562	0.635	0.547	0.616	**0.893**	0.356	0.540	0.431
Q28ATT	0.386	0.586	0.649	0.561	0.630	**0.917**	0.445	0.680	0.526
Q29SN	0.349	0.365	0.432	0.307	0.407	0.467	**0.887**	0.568	0.405
Q30SN	0.278	0.288	0.340	0.189	0.335	0.392	**0.923**	0.508	0.383
Q31SN	0.257	0.275	0.327	0.180	0.320	0.349	**0.886**	0.452	0.333
Q32PBC	0.338	0.392	0.464	0.372	0.446	0.560	0.551	**0.876**	0.489
Q33PBC	0.298	0.377	0.444	0.322	0.411	0.526	0.484	**0.891**	0.447
Q34PBC	0.350	0.447	0.557	0.441	0.522	0.686	0.475	**0.882**	0.506
Q35GDI	0.230	0.240	0.267	0.251	0.266	0.336	0.224	0.320	**0.627**
Q36GDI	0.353	0.357	0.396	0.328	0.385	0.461	0.428	0.524	**0.826**
Q37GDI	0.288	0.335	0.392	0.365	0.388	0.455	0.362	0.478	**0.856**
Q38GDI	0.237	0.238	0.259	0.240	0.273	0.317	0.275	0.347	**0.698**
Q39GDI	0.252	0.222	0.297	0.269	0.268	0.323	0.211	0.344	**0.702**
Q40GDI	0.229	0.259	0.283	0.201	0.290	0.297	0.301	0.355	**0.697**

Source: Investigator

3.16 Measurement Model Assessment (Higher-order construct)

In this study, all the higher-order constructs are measured formatively. As a result, the investigator employed the procedures recommended by Hair, Hult, Ringle and Sarstedt (2017) and Sarstedt, Hair, et al. (2019) in measuring formative model assessment. The evaluation of the formative measurement model entails redundancy analysis, screening for collinearity issues across formative indicators and checking the significance and relevance of formative indicator weights (Hair, Hult, Ringle, & Sarstedt, 2017; Hair et al., 2011; Hair, Risher Jeffrey, et al., 2019).

However, Professor Dr Christian M. Ringle from the Hamburg University of Technology, Germany and a co-author of the book titled “A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM)” argued that the redundancy analysis

is unwarranted for a higher-order construct that is formed by lower-order constructs (see https://forum.smartpls.com/viewtopic.php?t=15579). Furthermore, researchers may skip the redundancy test and proceed with other tests to evaluate the formative measurement model assessment since the higher-order construct is multidimensional. Hence, the next subsections will provide in-depth information on the collinearity screening and indicators' significance and relevance measurements.

3.16.1 Collinearity Assessment of Formative Measurement Models

When it comes to formative measurement models, high correlations between indicators are not necessary as opposed to reflective indicators, which are interchangeable in their fundamental structures. High correlations between formative indicators instead might be problematic from a statistical standpoint, and this phenomenon is referred to as collinearity. An elevated level of collinearity will have an influence on the outer weights of indicators and the significance of their weights (Hair, Risher Jeffrey, et al., 2019).

According to the suggestions made by Hair et al. (2012) and Hair, Risher Jeffrey, et al. (2019), researchers can conduct a collinearity evaluation for the formative model through the computation of the VIF score. A VIF value greater than five is regarded as a serious issue of collinearity among formative indicators (Becker et al., 2015; Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019). Nevertheless, according to Hair, Risher Jeffrey, et al. (2019), the recommended threshold value for VIF should be close to 3.0 or below to avoid the collinearity issue. Referring to Table 3-12, the VIF score of each formative indicator is less than the suggested 3.0 threshold value by Hair, Risher Jeffrey, et al. (2019). Therefore, all formative indicators in this study are free of collinearity issues which imply that the formative indicators in this study are not highly correlated between indicators.

3.16.2 Formative Indicator's Significance and Relevance

Another necessary criterion for assessing a formative indicator's contribution and relevance is the indicator's outer weight (Hair, Hult, Ringle, & Sarstedt, 2017). The outer weight of a formative indicator is a critical parameter in establishing whether or not it makes a significant contribution and is relevant to the formation of the studied construct (Hair et al., 2010). To establish the contribution of an indicator, researchers must employ the bootstrapping approach to ensure that the outer weights in formative construct indicators are significant and do not include zero in confidence intervals (Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019). Also, it is recommended that formative indicators should have weights greater than 0.50, according to Hair, Hult, Ringle and Sarstedt (2017) and Hair, Risher Jeffrey, et al. (2019). Nevertheless, Hair, Risher Jeffrey, et al. (2019) pointed out that researchers may decide to retain a formative indicator with a weight less than 0.50 and is statistically significant, provided the indicator has substantial support in the analysed theoretical framework for inclusion.

The significance of formative indicator weights is well established in this study. All indicators have a significance level of 0.001 except for the formal institution's indicator, which is significant at 0.01 and does not include zero in its confidence intervals (refer to Table 3-12). Furthermore, among the four indicators, there are two indicators (Formal Institution and RVM) with weight values less than 0.5. However, the investigator decided to retain formal institution and RVM indicators since these two indicators are essential to answer this study's research questions. Moreover, formal institution and RVM indicators have established their outer weights significance well in this study. Hence, the formative indicators in this study have substantially contributed to the formation of the examined construct.

Table 3-12: Higher-order measurement model assessment results

Variable	Indicators	Weight	t-Value	p - Value	Confidence Interval		VIF
					2.50%	97.50%	
Institutional Motivations	Formal Institutions	0.327	2.727**	0.006	0.092	0.556	1.965
	Informal Institutions	0.743	7.148***	0.000	0.531	0.934	1.965
Green Disposal Technology	RVM	0.421	4.311***	0.000	0.230	0.610	1.632
	Mobile Application	0.682	7.946***	0.000	0.502	0.837	1.632

**** p < 0.01**; ***** p<0.001**

Source: Investigator

3.17 Robustness Checks for Structural Model

According to recent studies, complementary approaches for evaluating the robustness of PLS-SEM results have been proposed (Hair, Sarstedt, et al., 2018; Latan, 2018). The robustness check techniques are applicable to either the measurement or structural models. Following the evaluation of the measurement model assessment, the investigator in this study proceeded to verify the robustness of the structural models. When it comes to the structural model, Sarstedt, Ringle, et al. (2019) strongly suggested that researchers give due consideration to nonlinear effects, endogeneity and heterogeneity (observed and unobserved). Several techniques have been recommended to researchers for identifying heterogeneity and endogeneity which if neglected, can result in potential problems concerning the validity of the findings (Becker et al., 2013; Hult et al., 2018).

Nonetheless, the importance of incorporating endogeneity in PLS-SEM is dependent on whether researchers are using the approach for predictive or explanatory modelling purposes, according to Hult et al. (2018). Rather than attempting to understand the

structural paths, the primary objective of this study is to predict the dependent variables. Therefore, controlling for the endogeneity effect is not recommended in this study since it may weaken the predictive ability of the model (Ebbes et al., 2005). As a result, the nonlinearity effect, observed and unobserved heterogeneity excluding endogeneity will be discussed in detail in the following subsections.

3.17.1 Nonlinear Effects

It is common for researchers to assume that the relationships between the variables under investigation are linear in nature when estimating the path models. While linear relationships often mirror the relationships seen in reality, this is not always the case (Ahrholdt et al., 2019). When the correlation between two variables is nonlinear, the extent of the effect between the two variables is determined by the magnitude of the exogenous variable's change and its value (Hair, Sarstedt, et al., 2018). In order to conduct a nonlinear assessment in PLS-SEM, researchers can examine a quadratic impact in PLS-SEM by including a quadratic term in the structural model (Hair, Ringle, et al., 2019). This quadratic term is analogous to an interaction term which constitutes the exogenous variable's interaction with itself (Rigdon et al., 2010). It is essential to note that if the interaction term's influence is significant and positive or negative, then the intensity of the exogenous variable's effect rises or decreases with the exogenous variable's higher values.

In this study, the investigator employed the approach used by Svensson et al. (2018). A quadratic interaction term was mapped in the model, and its statistical significance was tested via bootstrapping. The nonlinear effect results were calculated based on the bootstrapping setting of 5,000 sub-samples, a two-stage approach and standardised product term generation. In addition, all of the endogenous variables (GDI, PBC, and

ATT) were mapped to relevant exogenous variables to determine those variables' linearity effects. The finding indicates that all the quadratic interaction terms between the studied variables are nonsignificant, which provides evidence that there is no nonlinear influence in the investigated structural model (refer to Table 3-13), and the findings are robust. Therefore, the investigator concluded that the relationships between the variables in the proposed model are linear in effects.

Table 3-13: Linearity effect results

Quadratic Effect	Coefficient	t - Value	p - Value
ATT -> GDI	0.030	0.666	0.506
DA -> GDI	-0.039	1.373	0.170
IS -> GDI	-0.063	1.627	0.104
PBC -> GDI	-0.009	0.166	0.868
SN -> GDI	0.045	1.562	0.118
TS -> GDI	0.006	0.149	0.882
TS -> PBC	0.076	1.786	0.074
IS -> ATT	0.027	0.911	0.362

Source: Investigator

3.17.2 Observed Heterogeneity Assessment

Many studies base their conclusions on the erroneous assumption that all participants are members of a single homogeneous group. For instance, since individual behaviour is unique, pooling data through several observations are likely to provide misleading conclusions. Failure to take into account such heterogeneity might compromise the validity of PLS-SEM results and may result in inaccurate conclusions (Becker et al., 2013; Hair et al., 2012; Sarstedt & Ringle, 2010). Heterogeneity is identified when variations between two or more sets of data are associated with observable factors such as gender,

ethnicity or place of origin. Researchers can utilise these observable attributes to partition the data into distinct groups of observations, after which they perform PLS-SEM analysis on each group of observations.

Most of the time, numerical differences exist between path coefficient estimates for identifiable group models. Nevertheless, statistically speaking, are these distinctions significant? Using a multigroup analysis (MGA) approach, researchers can find the answer to this question. As such, measuring multigroup analysis improves researchers' capacity significantly to detect statistically significant variations in multiple relationships across group-specific outcomes (Picón-Berjoyo et al., 2016; Schlägel & Sarstedt, 2016). In light of this, Sarstedt, Henseler, et al. (2011) and Hair, Hult, Ringle and Sarstedt (2017) suggested two types of analyses, the permutation test and partial least squares multigroup analysis (PLS-MGA). The permutation test alternates observations across groups in a random way and re-estimates the model for each permutation (Chin & Dibbern, 2010). Calculating the variances between the group-specific path coefficients for each permutation allows one to examine whether these differences exist in the population.

Meanwhile, the PLS-MGA technique compares each bootstrap estimate of one group with all other bootstrap estimates of the same attribute in the other group. Using the PLS-MGA technique, a probability value for a one-tailed test is calculated by counting the number of occurrences in which the bootstrap estimate of the first group is greater than the bootstrap estimate of the second group. However, Hair, Hult, Ringle and Sarstedt (2017) and Cheah et al. (2020) recommended that researchers apply the PLS-MGA technique for comparing the differences in attributes between the two groups. For researchers to be able to execute MGA, it is essential that they first establish measurement invariance. A researcher can accomplish the measurement invariance analysis by employing the measurement invariance of composite model (MICOM) method in

SmartPLS. MICOM was developed by Henseler et al. (2016) and it is based on the latent variable scores that correspond with the attributes of composite modelling in PLS-SEM. Hult et al. (2008) emphasised that failure to establish measurement invariance might result in low statistical power of tests, poor accuracy of estimators and misleading findings.

In this study, the investigator followed the method outlined in Cheah et al. (2020) article on testing for observed heterogeneity using the MGA technique in SmartPLS. As recommended by Cheah et al. (2020), the investigator first and foremost divided the respondents into two groups depending on gender, with each group possessing 80% statistical power. Following that, the measurement invariance was computed using the MICOM method and it was discovered that all variables had established partial measurement invariance (refer to Table 3-14). It is stated in an article written by Cheah et al. (2020) that after partial measurement invariance is established, a researcher can proceed to MGA without achieving full measurement invariance. Hence, the investigator then continued to compute the MGA and discovered that all of the relationships between the variables in the studied structural model have no statistically significant differences between male and female respondents (refer to Table 3-15). Therefore, the investigator concluded that no evidence of observed heterogeneity was detected in this study.

Table 3-14: Measurement invariance results

VARIABLE	CONFIGURAL INVARIANCE	COEFFICIENT (β)	5% QUANTILE	PARTIAL MEASUREMENT INVARIANCE
ATT x PBC	Established	1.000	1.000	Established
ATT	Established	1.000	0.999	Established
DA	Established	0.998	0.990	Established
GDI	Established	0.999	0.997	Established
IM	Established	0.999	0.980	Established
PBC	Established	1.000	0.999	Established
SN x PBC	Established	1.000	1.000	Established
SN	Established	1.000	0.998	Established
GDT	Established	1.000	0.955	Established

Source: Investigator

Table 3-15: Multi-group analysis results

RELATIONSHIP	BETA DIFFERENCES (Male – Female)	p – Value (Male vs Female)
ATT -> GDI	0.181	0.086
SN -> GDI	-0.128	0.149
PBC -> GDI	0.136	0.191
ATT x PBC -> GDI	-0.011	0.902
SN x PBC -> GDI	0.107	0.126
DA -> GDI	-0.102	0.210
IM -> GDI	-0.080	0.491
IM -> ATT	0.049	0.236
GDT -> GDI	-0.120	0.251
GDT -> PBC	0.057	0.375

Table 3-15: continued

RELATIONSHIP	BETA DIFFERENCES (Male – Female)	p – Value (Male vs Female)
IM -> ATT -> GDI	0.142	0.076
GDT -> PBC -> GDI	0.096	0.137
FI -> GDI (Model-2)	0.018	0.860
II -> GDI (Model-2)	0.138	0.216
RVM -> GDI (Model-2)	0.140	0.084
MA -> GDI (Model-2)	0.008	0.929

Source: Investigator

3.17.3 Unobserved Heterogeneity Assessment

Unobserved heterogeneity occurs when there are existing subsets of data that could provide markedly different model estimates. If this is the case, assessing the model using the complete data set would likely yield a misleading find (Becker et al., 2013). Hence, to determine if the analysis of the complete dataset is appropriate or not, any PLS-SEM study should include a routine inspection for unobserved heterogeneity as part of the procedure (Hair et al., 2011). Sarstedt et al. (2017) established a systematic technique for identifying and addressing the unobserved heterogeneity issues by employing finite mixture partial least squares (FIMIX-PLS) to perform an unobserved heterogeneity assessment.

The FIMIX-PLS technique (Herrmann et al., 2002; Sarstedt & Ringle, 2010) has been widely accepted as the primary method for assessing unobserved heterogeneity in PLS path modelling outcomes. Researchers can determine the number of segments (if any) to be retrieved from the dataset (Hair et al., 2016; Matthews et al., 2016) using information acquired from FIMIX-PLS (Herrmann et al., 2002; Sarstedt, Becker, et al., 2011).

However, it is vital to recognise that FIMIX-PLS is limited in its ability to capture heterogeneity only in the structural model. Thus, following the systematic process developed by Sarstedt et al. (2017) for identifying and if necessary, addressing unobserved heterogeneity in PLS path models, the researchers should execute the FIMIX-PLS technique on the dataset before an examination of any analysis.

FIMIX-PLS technique is performed once the investigator determines the minimum sample size needed to estimate the maximum number of segments (Sarstedt et al., 2017). For example, the results of G*POWER assuming an effect size of 0.15 and a power level of 80% indicates that the minimum sample size needed is 109, which allows for the extraction of up to six segments. Subsequently, in line with Matthews et al. (2016) guideline, the investigator began the initial analysis by starting with a one-segment solution and applying the default parameters for the stop criterion (10^{-10}), the maximum number of iterations (5000) and the number of repetitions (10).

As a next step, the investigator reran another round of FIMIX-PLS for two to six segments, using the same parameters as in the initial analysis and saved the outcomes from the fit indices report in the SmartPLS for each run. The investigator then determined the lowest value for an optimal solution in each segment and the entropy statistic (EN) value greater than 0.5. Following that, researchers should examine the modified Akaike's information criterion with factor 3 (AIC_3) and consistent AIC (CAIC) values, which should have the same number of segments, according to Sarstedt, Becker, et al. (2011). Furthermore, Sarstedt, Becker, et al. (2011) went on to add that the modified AIC with factor 4 (AIC_4) and bayesian information criteria (BIC) work well when they are used to compute the number of segments in FIMIX-PLS.

Referring to Table 3-16, both AIC_3 and CAIC have the same number of solutions and this indicates a two-segment solution. On the other hand, AIC_4 and BIC both point to a two-segment solution. Additionally, the EN value for segment two is found to be 0.692, exceeding the minimal value of greater than 0.5. A two-segment solution also fulfils the minimum sample size requirement of 315 samples. Nevertheless, a minimum description length with factor 5 (MDL_5) indicates a two-segment solution. According to (Hair et al., 2016), researchers in general should extract more segments than the segment pointed to by MDL_5. In this study, the AIC_3, CAIC, AIC_4 and BIC all imply a two-segment solution which violates the condition of extracting more segments than that indicated by MDL_5. Moreover, selecting more than two segments is not a realistic solution since three to six segments do not fulfil the minimum sample size requirement. Therefore, the investigator concluded that the unobserved heterogeneity issue is not a concern in this study's dataset.

Table 3-16: FIMIX-PLS unobserved heterogeneity results

	NUMBER OF SEGMENTS					
	1	**2**	**3**	**4**	**5**	**6**
SEGMENT SIZE	1.00	0.47	0.133	0.063	0.044	0.064
SAMPLE SIZE	671	315	80	37	26.84	40.26
AIC	4738.506	**4217.852**	3987.928	3658.313	3499.925	3510.687
AIC_3	4751.506	**4244.852**	4028.928	3713.313	3568.925	3593.687
AIC_4	4764.506	**4271.852**	4069.928	3768.313	3637.925	3676.687
BIC	4797.12	**4339.589**	4172.788	3906.295	3811.03	3884.915
CAIC	4810.12	**4366.589**	4213.788	3961.295	3880.03	3967.915
HQ	4761.208	4265.002	4059.526	3754.359	3620.42	3655.63
MDL_5	5135.576	**5042.536**	5240.226	5338.224	5607.45	6045.826

Table 3-16: continued

	NUMBER OF SEGMENTS					
	1	**2**	**3**	**4**	**5**	**6**
LnL	-2356.253	-2081.926	-1952.964	-1774.156	-1680.963	-1672.344
EN	-	0.692	0.752	0.817	0.831	0.782
NFI	-	0.746	0.758	0.802	0.805	0.73
NEC	-	206.54	166.511	122.913	113.388	146.458

AIC= Akaike's information criterion; **AIC_3**= modified AIC with factor 3; **AIC_4**= modified AIC with factor 4; **BIC**= Bayesian information criteria; **CAIC**= consistent AIC; **HQ**= Hannan Quinn criterion; **MDL_5**= minimum description length with factor 5; **LnL**= Log Likelihood; **EN**= entropy statistic; **NFI**= non-fuzzy index; **NEC**= normalized entropy criterion

Source: Investigator

3.18 Structural Model Assessment

When the measurement model is found to be adequate in terms of accurate and valid variable measurements, the structural model is examined to evaluate the PLS-SEM findings. CB-SEM and PLS-SEM each analyse the structural model differently. In CB-SEM, the structural model is evaluated using the goodness-of-fit test. Nonetheless, in PLS-SEM, the structural model is evaluated mainly using the heuristic criterion that is defined by the model's predictive capabilities (Hair, Hult, Ringle, & Sarstedt, 2017). Hence, the structural model assessment procedure for PLS-SEM entails assessing the model's predictive capabilities, which include the coefficient of determination (R^2), the blindfolding-based cross-validated redundancy measure (Q^2), and the PLSpredict protocol using the holdout sample.

R^2 reflects the proportion of variation in endogenous constructs that is explained by all exogenous constructs associated with it. Given that the R^2 is the squared correlation of actual and predicted values, it encompasses all of the data utilised for model estimation and as such, is a good indicator of the model's predictive capacity. It also reflects a

measure of in-sample predictive power (Rigdon, 2012; Sarstedt et al., 2014). According to Hair, Hult, Ringle and Sarstedt (2017), it is difficult to specify general guidelines for acceptable R^2 values since they vary depending on the complexity of the model and the study's discipline. In general, values of 0.25, 0.50 or 0.75 for an endogenous variable can be categorised as weak, moderate or substantial respectively (Hair et al., 2011; Henseler et al., 2009). However, in relation to behavioural studies, the R^2 value of 0.20 is considered high predictive capacity (Hair, Hult, Ringle, & Sarstedt, 2017).

An alternative method of evaluating the predictive accuracy of the PLS model is to compute the Q^2, also known as Stone-Geisser's Q^2 value (Geisser, 1974; Stone, 1974). This approach is based on a blindfolding method that removes single points from a data matrix, imputes the omitted points with the mean and calculates model parameters (Rigdon, 2014; Sarstedt et al., 2014). Nevertheless, Q^2 is not a complete measure of out-of-sample prediction but rather a combination of out-of-sample prediction and in-sample explanatory power (Hair, Risher Jeffrey, et al., 2019). As a guideline, Hair, Hult, Ringle and Sarstedt (2017) indicated that Q^2 values should be greater than zero for a particular endogenous variable to reflect the structural model's predictive accuracy. In addition to that, as a rule of thumb, Q^2 values that are greater than 0, 0.25 and 0.50 denote small, medium and large predictive relevance respectively. To further assure the predictive capability of the studied model, Shmueli et al. (2016) recommended employing out-of-sample estimation which involves estimating the model on a training sample. Additionally, it is also referred to as a holdout sample when it is used to evaluate its predictive accuracy against data that is not part of the study sample. SmartPLS supports the analysis with a holdout sample via the PLSpredict protocol (Ringle et al., 2015).

The structural model analysis technique is used to determine the associations between variables by estimating a sequence of regression equations. Moreover, Hair, Risher

Jeffrey, et al. (2019) emphasised that prior to conducting a comprehensive structural assessment, it is necessary to make sure that the collinearity effect does not prejudice the regression findings. Referring to Table 3-17, the results suggest that the VIF value for all variables in this study is less than 3.3. According to Hair, Hult, Ringle and Sarstedt (2017) and Hair, Risher Jeffrey, et al. (2019), a VIF score of less than 3.3 indicates that there is no concern for multicollinearity. As a result, the variables in this study are not subject to the multicollinearity issue. Next, an R^2 analysis is conducted to determine the predictive power of the tested model, which is revealed to be 0.486. The result suggests that the model's exogenous components predict 48.6% of the endogenous variable, denoting a weak to moderate predictive accuracy (Chin, 1998b; Hair, Hult, Ringle, & Sarstedt, 2017; Hair et al., 2011; Hair, Risher Jeffrey, et al., 2019; Henseler et al., 2009). Meanwhile, the studied model's predictive relevance (Q^2) was 0.190, indicating that the model has a small to medium predictive relevance for the dependent variable under study.

To further validate the predictive capability of this study's model, the investigator employed the PLSpredict protocol with training out-of-sample estimation. Based on Table 3-18, the result reveals a medium predictive power. The results in this instance demonstrate that three indicators from PLS-SEM analysis have higher prediction errors than the linear regression model (LM). According to the guideline proposed by Shmueli et al. (2019), if the minority of indicators in the PLS-SEM analysis yields higher prediction errors (RMSE or MAE) as opposed to the LM benchmark, this implies that the model has a medium predictive ability. Thus, the out-of-sample prediction result confirms the R^2 and Q^2 findings, indicating that the analysed model has a medium or moderate predictive capability in predicting the millennials' intention to practise green disposal.

Table 3-17: Multicollinearity results

VARIABLE	VIF		
	GDI	ATT	PBC
GDI	-	-	-
ATT	3.021	-	-
SN	1.502	-	-
PBC	2.276	-	-
DA	1.346	-	-
IM	2.417	1.000	-
GDT	2.156	-	1.000
ATT x PBC	1.742	-	-
SN x PBC	1.664	-	-
FI	1.992	1.700	-
II	2.396	1.700	-
RVM	1.635	-	1.409
MA	2.036	-	1.409

Source: Investigator

Table 3-18: Manifest variables (MV) prediction summary

ENDOGENOUS INDICATORS	PLS-SEM SAMPLE		LM SAMPLE	
	RMSE	MAE	RMSE	MAE
Q36GDI	0.847	0.644*	0.853	0.639
Q37GDI	0.850*	0.643	0.848	0.644
Q38GDI	1.033	0.821	1.047	0.828
Q35GDI	1.209	0.964	1.221	0.981
Q39GDI	0.871*	0.638	0.870	0.639
Q40GDI	1.038	0.826	1.051	0.833

* Higher prediction errors value compared to LM sample

Source: Investigator

3.19 Respondent's Demographic Data

This study's demographic results show the respondents' characteristics (refer to Table 3-19). 69.9% of the respondents in this survey are female and the remaining 30.1% are male, thus showing the majority of respondents are female. As such, when there is a disproportion in data distribution on gender, the investigator was concerned that this might result in skewed outcomes toward one gender or another. For this reason, the investigator conducted an MGA test and learned that there were no statistically significant disparities between male and female respondents in terms of the relationship among variables being affected in the investigated model (refer to Table 3-15). As a result, the gender imbalance in the sample of respondents has no effect on the outcome obtained from the hypothesis analysis.

All respondents were born between 1981 and 1996, with those born in 1981 accounting for the highest proportion (11.6%). 77% of the respondents stated being married, 21.9% stated being unmarried and the remaining 1.1% being widowed, divorced or single parents. The ethnic distribution is roughly similar to the Malaysian population figures of 79.1% Malay, 11.8% Chinese, and 9.1% Indian (Department of Statistics Malaysia, 2020b). In terms of educational level, most respondents (59%) have a bachelor's degree, followed by 22.1% who have a certificate or diploma, 11.8% who have completed secondary school and 7.3% who have a postgraduate degree. The majority of this study's respondents (85.5%) work in the government sector with the remainder working in the private sector as entrepreneurs/self-employed, homemakers or students.

This survey's respondents have an equal distribution of residential locations, with 50.2% living in urban areas and 49.8% living in rural areas. When respondents were asked about their source of knowledge on related environmental issues, more than 65% reported acquiring it from newspaper or reading materials, followed by 58.4% from radio, 41.7%

from seminars or training, 38.5% from community programmes(s), 38.2% from the internet, 34% from public campaigns, 31% from family/friends/place of work and the remaining from television or banners or poster ads. Respondents of this study were also asked where they often practise green disposal. Results show that most respondents often practise green disposal at home (81.1%), followed by 61% who reported practising at the office or place of work, 33.8% practise at a shopping mall/shop/market, 19.2% when they are in a government office, 11.9% when they are at the place of worship and only 1% reported that they do not practise green disposal activities. Based on the demographic distribution of Perak's millennials, the data from the survey is believed to represent the population.

Table 3-19: Respondent's demographic characteristics

DEMOGRAPHIC ATTRIBUTE			FREQUENCY (N)	PERCENT (%)
Gender	:	- Male	202	30.1
		- Female	469	69.9
Year of birth	:	- 1981	78	11.6
		- 1982	55	8.2
		- 1983	68	10.1
		- 1984	70	10.4
		- 1985	68	10.1
		- 1986	54	8
		- 1987	49	7.3
		- 1988	39	5.8
		- 1989	29	4.3
		- 1990	39	5.8
		- 1991	26	3.9
		- 1992	31	4.6
		- 1993	22	3.3
		- 1994	16	2.4
		- 1995	13	1.9
		- 1996	14	2.1

Table 3-19: continued

DEMOGRAPHIC ATTRIBUTE			FREQUENCY (N)	PERCENT (%)
Marital status	:	- Single	147	21.9
		- Married	517	77.0
		- Widow	4	0.6
		- Divorced	1	0.1
		- Single parents	2	0.3
Ethnic/ Race	:	- Malay	531	79.1
		- Chinese	79	11.8
		- Indian	61	9.1
Level of education	:	- Secondary School	77	11.5
		- Certificate/ Diploma	148	22.1
		- Degree	396	59.0
		- Postgraduate Degree	49	7.3
		- Others	1	0.1
Occupation	:	- Government Employee (Grade 41 and above)	358	53.4
		- Government Employee (Grade 40 and below)	215	32.1
		- Private Employee (Executive and above)	44	6.6
		- Private Employee (Non-executive)	27	4.0
		- Entrepreneur/ Self-employed	9	1.3
		- Retiree	0	0
		- Housewife	7	1.0
		- Student/ Unemployed	7	1.0
		- Others	4	0.6
Residential location	:	- Urban	337	50.2
		- Rural	334	49.8
Source of knowledge	:	- Internet	256	38.2
		- Radio	392	58.4
		- Newspaper/ Reading Materials	439	65.4
		- Television	95	14.2
		- Seminar/ Training	280	41.7
		- Public Campaigns	228	34.0
		- Family/ Friends/Place of Work	208	31.0
		- Community Programme(s)	258	38.5
		- Banners/ Posters Advertisement	2	0.3
		- No Exposure	0	0

Table 3-19: continued

DEMOGRAPHIC ATTRIBUTE			FREQUENCY (N)	PERCENT (%)
Often practise	:	- Home	544	81.1
		- Office/ Place of Work	409	61.0
		- Shopping mall/ Shop/ Market	227	33.8
		- Government office	129	19.2
		- Place of worship	80	11.9
		- Not Practise	7	1.0

Source: Investigator

3.20 Summary

By the end of this chapter, the investigator has effectively described the procedures employed to acquire the appropriate data to address the research questions. However, it is important to discuss the approach utilised to collect the data because this will assure the reader that the data is valid and ready to be analysed. Also, it will serve as a reference for future investigators who wish to replicate the same approach in different settings or contexts to collect data systematically.

Furthermore, the investigator also presented the results of the measurement model, structural model assessment and respondents' demographic characteristics in this chapter. Before evaluating the studied model, the investigator examined the dataset for evidence of the CMB effect, which is accomplished through the use of two procedural remedies and two statistical tests to control the data bias. Subsequently, the investigator proceeded with the validation of the measurement models for reflective and formative measured construct, which is a pre-requisite for PLS-SEM analysis.

The reflective lower-order construct measurement model is verified by examining the indicator loadings, internal consistency reliability, convergent validity and discriminant validity. In contrast, the assessment of measurement models for formatively measured higher-order constructs includes screening for collinearity among formative indicators and determining the significance and relevance of formative indicator's weights. Following that, the nonlinear effect and observed and unobserved heterogeneity analysis are used to examine the robustness of the structural model.

Additionally, the structural model's predictive capabilities are evaluated in accordance with the guidelines of Hair, Hult, Ringle and Sarstedt (2017). After conducting the assessments mentioned above, the investigator concluded that the studied model had fulfilled all of the necessary requirements to be suitable for hypothesis testing. Nevertheless, the investigator did not present or discuss the hypothesis's findings in this chapter, as they are intended to be discussed in greater detail in the following chapters. Moreover, the hypotheses were tested using the bootstrapping function. The investigator employed 5000 bootstrap samples and applied two-tailed t-test settings for this study, in line with the recommendations by Hair, Hult, Ringle and Sarstedt (2017) in the subsequent chapters.

CHAPTER 4:

TPB PREDICTORS AND CONTROL BELIEFS AS A MODERATOR INFLUENCE ON INTENTION

4.1 Introduction

The procedures used to collect the relevant data and prepare the dataset to answer the research questions were thoroughly comprehensive in the previous chapter. In this chapter, the investigator will explain the outcomes of the hypothesis analysis. Following a review of several earlier works of literature on TPB and the millennials' behavioural traits, the investigator discovered a need to investigate further the TPB predictor's impact in predicting the millennials' pro-environmental behaviour. Furthermore, the investigator explored the argument advanced by Ajzen (2019) and La Barbera and Ajzen (2020a) that the effects of attitude and subjective norms on studied intention may be amplified when a control belief is a moderator. To predict and explain an individual's pro-environmental behaviour, TPB is a theoretical framework that is widely used (Poskus, 2015). As a result, this chapter is devoted to answering research question one and two, which was presented in subsection 1.3 of this thesis and the associated hypothesis. Hence, the subsequent subsection will discuss the probability of the TPB framework in predicting the millennials' intention to practise green disposal activities in the disposing of their municipal waste.

4.2 Empirical Results

Referring to Table 4-1, hypothesis 1a (H1a) demonstrates that ATT has a significant effect on the INT to practise green disposal, indicating that the hypothesis is supported in this study (β=0.133, t=2.787). At the same time, hypothesis 1b (H1b) reveals that SN has a significant impact on the INT to practise green disposal, which is supported in this study

(β=0.129, t=3.280). Furthermore, hypothesis 1c (H1c) examines the association between PBC and INT, with the results indicating that PBC has a significant influence on the INT to engage in green disposal activities (β=0.317, t=6.953).

Following claims made by Ajzen (2019), La Barbera and Ajzen (2020a) and Bosnjak et al. (2020), the role of PBC as a moderator is investigated via hypotheses 2a (H2a) and 2b (H2b). Thus, the findings of H2a show that the interaction terms for the moderating effect of PBC on ATT and INT to practise green disposal are negative (β=-0.081). Likewise, the outcome of H2b indicates that the moderating influence of PBC on SN and INT to practise green disposal is defined as negative interaction terms (β=-0.061). However, both H2a and H2b are significant at 0.05 and 0.01 respectively, which are supported in this study.

Table 4-1: Results of research question one and two

RELATIONSHIP		BETA (β)	t - Value	p - Value	DECISION
H1a	ATT -> GDI	0.133	2.787**	0.005	**Supported**
H1b	SN -> GDI	0.129	3.280**	0.001	**Supported**
H1c	PBC -> GDI	0.317	6.953***	0.000	**Supported**
H2a	ATT x PBC -> GDI	-0.081	3.099**	0.002	**Supported**
H2b	SN x PBC -> GDI	-0.061	2.434*	0.015	**Supported**

*Significant at $p < 0.05$; ** Significant at $p < 0.01$; *** Significant at $p < 0.001$

Source: Investigator

4.3 TPB Predictors' Influence on INT

A number of previous studies have found that millennials are environmentally conscious and responsible consumers (Jerome et al., 2014b; Williams & Page, 2011). Besides, observations have indicated that this generation responds favourably to environmentally friendly lifestyles and is considerably more inclined to engage in sustainable consumption practices than previous generations (Bathmanathan & Rajadurai, 2017). As a consequence, a research on millennials' behaviour becomes more practical since they constitute a larger working population and understanding what motivates them to participate in green initiatives will result in better environmental preservation for future generations (Sanson et al., 2018). The current study examines the adoption of green disposal practices in millennial households by employing the TPB framework.

Hence, the first objective of this study is to evaluate the predictability of TPB's predictors and the second objective is to explore the capacity of control belief in strengthening the relationship through a moderator interaction between TPB's variables in predicting the millennial households' INT to practise green disposal. Referring to the analysis findings, H1a, H1b and H1c are all positively significant in influencing the INT to engage in green disposal practices. These findings are consistent with those of previous studies, including those conducted by Karim Ghani et al. (2013), Pakpour et al. (2014), Yzer and van den Putte (2014), Hou et al. (2016), Echegaray and Hansstein (2017), Ertz et al. (2017), Oztekin et al. (2017), Hu et al. (2018), Li, Zuo, et al. (2018), Earle et al. (2019), Kumar (2019), Ramzan et al. (2020), Wang et al. (2020) and Razali et al. (2020). Furthermore, more recent studies such as those published by Shi et al. (2021), Abadi et al. (2021), Wang et al. (2021), Govindan et al. (2022), Cai et al. (2022) and Dhanabalan et al. (2023) revealed that all of the TPB predictors have a statistically significant influence on an individual's INT to participate in pro-environmental activities.

The fundamental definition of ATT is how people feel about a particular behaviour and whether they are willing to engage with the behaviour. With that, the participants in this study exhibited a positive and supportive ATT toward green disposal practices. The ATT was measured by asking respondents' perspectives on the usefulness of waste separation and the necessity and willingness to practise green disposal. As a result, the favourable ATT toward green disposal among millennial households demonstrates a potential effect on a higher engagement in waste reduction activities. ATT appears to have a modest impact on the examined INT compared to other TPB predictors. This impact is evident in the study of Wang et al. (2021), which revealed that ATT has the second-highest coefficient value among TPB predictors. In addition, Li, Zuo, et al. (2018) also found that ATT has a second greater influence on INT than other TPB predictors in a China construction waste reduction study. As such, the investigator could assume that ATT in this study is the second most influential TPB predictor in terms of affecting millennial households' INT to practise green disposal. Moreover, the positive ATT of millennial households is consistent with the assertion made by Bathmanathan and Rajadurai (2017) that millennials respond favourably to green lifestyles and are appreciative of a sustainable environment.

Subjective norms reflect the social influence of the TPB framework (Ajzen, 1991). According to the theory, an individual's INT is mainly impacted by other individuals (social pressure) whom they perceive to be influential individuals, leading them to respond to the behaviour in question (Ajzen, 1991; Ajzen & Fishbein, 1980). Based on the results, it is notable that SN has the least impact on INT when compared to ATT and PBC in this study. Although the findings indicate that SN has the least impact, it still significantly influences millennials' INT to engage in green disposal activities. Similar results were reported in studies carried out by Yzer and van den Putte (2014), Zhang et al. (2015), Ertz et al. (2017), Oztekin et al. (2017), Lizin et al. (2017) and Shi et al. (2021).

These studies revealed that SN is significant, having the lowest coefficient value in influencing respondents' INT. Moreover, a meta-analytic review by Armitage and Conner (2001) on TPB revealed that SN is the weakest construct in TPB to predict the studied INT, as evidenced by the studies mentioned above.

The SN's determinants include questions on whether their family, friends and colleagues encourage them to practise green disposal. It appears from the findings of this study that social actors have the lowest impact on millennials when it comes to assessing their INT to practise green disposal. Various reasons may contribute to the weak effect of millennials' social influences. First, it is possible that millennials' associations with the baby boomer generation (mostly their parents) and generation X (primarily their siblings, friends, and co-workers) may have a lesser influence on millennials' INT to practise green disposal. This argument is based on observations by Bathmanathan and Rajadurai (2017), which suggested that baby boomers and generation X are less involved in pro-environmental activities than millennials.

Second, reported social pressure measurements may not accurately reflect the whole range of social influencing factors, making it difficult for respondents to comprehend (Coşkun & Yetkin Özbük, 2020). In a similar context, Willis et al. (2020) observed that when researchers do not explicitly state the source of social pressure in their measurement items, participants are more likely to visualise individuals who are insignificant to the study. It is possible that the study's findings on social influences might be undermined by participants' inaccurate visualisations of the referred social actors. Hence, the investigator presumed that respondents in this study may perceive individuals other than those specified in the measurement items for SN, which results in a low influence level.

Perceived behavioural control is the third variable in TPB's framework. It refers to an individual's belief and ability to execute a particular behaviour in the presence of external

or internal constraints. Likewise, La Barbera and Ajzen (2020b) described PBC as the presence of factors that may facilitate or obstruct the function of the examined behaviour. As revealed in this study, PBC has the highest effect on INT when compared to the other TPB predictors, which is consistent with the findings of Yzer and van den Putte (2014), Arı and Yılmaz (2016), Oztekin et al. (2017), Ertz et al. (2017), Long et al. (2017), Tan et al. (2017), Hu et al. (2018), Abadi et al. (2021), Govindan et al. (2022) and Dhanabalan et al. (2023) in their studies. At large, millennials are recognised for having access to a wide range of information through the internet, as highlighted by Williams and Page (2011) and Wiedmer (2015) in their articles. In addition, convenience is another factor that often influences an individual's INT to perform a particular task, and this has been confirmed in the study published by Ramzan et al. (2020).

Thus, the investigator may speculate that millennials in this study are greatly influenced by the element of convenience and possess the necessary skills to engage in green disposal practices. Consequently, it is recommended to prioritise efforts that make green disposal more accessible and convenient, particularly for millennial households. In essence, the investigator argued that millennials' INT to practise green disposal is directly attributed to their positive ATT, social influences, capabilities, adequate skills and convenience of engaging in green disposal activities.

4.4 Impact of PBC as Moderator on ATT and SN

The exploration of H2a and H2b is carried out in response to suggestions proposed by Bosnjak et al. (2020) for further investigation, as well as arguments made by Ajzen (2019) and La Barbera and Ajzen (2020a) on PBC's function as a moderator between TPB predictors. Hence, the moderating effect results reveal that interaction between ATT x PBC (H2a) and SN x PBC (H2b) is found to be significant, with both indicating a negative

interaction term in this study. Unexpectedly, the findings of moderating interaction term for ATT x PBC contradict the findings of Hukkelberg et al. (2014), Yzer and van den Putte (2014), Kothe and Mullan (2015), La Barbera and Ajzen (2020a) (case study 1 and 3) and La Barbera and Ajzen (2021), all of which indicate a significant effect but a positive interaction term. Nevertheless, there are also a few studies such as by La Barbera and Ajzen (2020a) (in case study 2) and Earle et al. (2019) whereby in the category of riding with a high driver (RWHD), the findings demonstrate an insignificant moderator interaction of ATT x PBC. From the findings of ATT x PBC, it is possible that the difference in the sample group may have contributed to the interaction term being shifted to negative rather than positive. For example, in this study, the respondents comprised entirely of millennials, as opposed to the previous study, which was wholly a mix of generational cohorts.

Further investigation on the moderating effect of ATT x PBC was done through a simple slope analysis. As illustrated in Figure 4-1, the simple slope analysis reveals that when PBC is 1SD above the mean, the ATT is not statistically significant in predicting the INT (β=0.052, t=0.904, p=0.366). Moreover, when PBC is 1SD below the mean value (β=0.214, t=4.168, p<0.001), ATT appears to have a strong significant association in predicting the studied INT compared to 1SD which is above the mean value. As such, the investigator could argue that the millennials' ATT predominantly influences the INT to practise green disposal when the ease of performing green disposal activities is at a low level. In other words, the negative interaction term in this study could imply that when millennials' ATT is at a low level, they can be persuaded to boost their participation rate by increasing the factor of convenience and indirectly strengthening the ATT effect on INT.

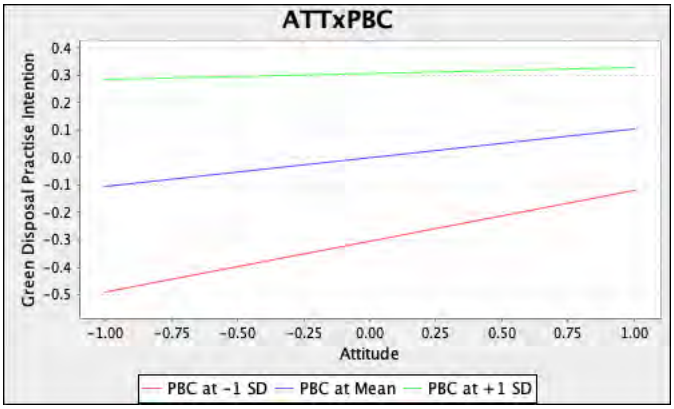

Figure 4-1: Simple slope analysis results of ATT x PBC

Source: Investigator

Meanwhile, the findings on SN x PBC support the previous studies of La Barbera and Ajzen (2020a) and in all the three case studies carried out by La Barbera and Ajzen (2021), and this indicates that SN with a negative interaction term significantly influences the INT. Furthermore, there are also contradicting findings, such as by Kothe and Mullan (2015) and Earle et al. (2019), who found no significant interaction with SN x PBC whereas Yzer and van den Putte (2014) found that there was a significant positive interaction term with SN x PBC. In general, this finding implies that when the element of convenience increases, the influence of societal pressure on millennials' INT to engage in green disposal activities decreases.

Additional investigation on the moderating effect of the SN x PBC through a simple slope analysis as exhibited in Figure 4-2 reveals that when PBC is 1 SD above the mean (β=0.068, t=1.459, p=0.145), SN association towards INT is found to have no significant impact. Nevertheless, it is statistically significant when PBC is 1SD below the mean value (β=0.190, t=4.070, $p < 0.001$). Thus, the investigator could postulate that the impact of

societal pressure on millennial households has a more substantial influence on the INT to practise green disposal when the element of convenience decreases. For example, scepticism of family members, friends and working colleagues on the practicality of performing green disposal activities can be reduced or even removed if the element of convenience is high by providing better facilities. In effect, it will enhance the influence of SN on millennials' INT to participate in green disposal activities. This finding is an echo of the previous results such as by Yzer and van den Putte (2014), La Barbera and Ajzen (2020a) and La Barbera and Ajzen (2021).

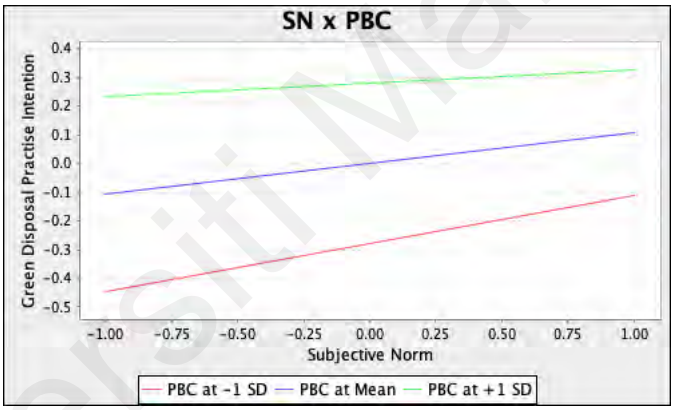

Figure 4-2: Simple slope analysis results of SN x PBC

Source: Investigator

4.5 Summary

In conclusion, the findings of this study have demonstrated that all TPB predictors are significantly associated with the millennials' intention to engage in green disposal practices. Furthermore, the findings indicate that the control element (perceived behavioural control) in TPB has the greatest influence on intention when compared to

other predictors such as attitude and subjective norms. It is evident that attributes which are used to measure perceived behavioural control such as skills, convenience and confidence are the most influential determinants in predicting millennials' intention to engage in green disposal activities. Apart from that, the findings also suggest that perceived behavioural control has a better influencing impact when interacting directly with intention than as a moderator. However, it is observed that perceived behavioural control's potential to act as a moderator in strengthening the impact of the two TPB predictors (attitude and subjective norms) is only seen to be noticeably stronger when the control element is at a low level. To put it another way, when perceived behavioural control is at a lower level, the influence of attitude and subjective norms on intention is significantly stronger than their direct association with intention.

Despite the fact that Ajzen (2002) and Fishbein and Ajzen (2010) recognised that theoretically, the increase in perceived behavioural control level should be anticipated to strengthen the attitude and subjective norms on intention through moderating effect, Yzer and van den Putte (2014) argued that the moderating influence on attitude and subjective norms has still not yet attained the status of a formal proposition. In this context, the moderating findings of this study contradict the claims made by Ajzen (2002) and Fishbein and Ajzen (2010). Thus, the investigator confirmed that all TPB's predictors are effectively able to predict the millennials' intention to practise green disposal. Also, when perceived behavioural control is at a low level, the potential of the perceived behavioural control as a moderator significantly strengthens the influence of attitude and subjective norms on intention. Therefore, H1a, H1b, H1c, H2a and H2b are all supported in this study.

CHAPTER 5:

DISPOSAL AWARENESS IMPACTS ON INTENTION

5.1 Introduction

The lack of awareness about the correct way of waste disposal is the primary cause of inappropriate and unsafe waste disposal practices. Based on a review of prior studies, the investigator determined that it is necessary to examine the influence of disposal awareness on INT which will encourage millennial households to practise green disposal. Moreover, the examination of disposal awareness and intention was motivated by the argument made by Maloney and Ward (1973) that individuals who have a considerable level of environmental awareness are more likely to engage in pro-environmental behaviour. Additionally, empirical evidence indicates that those who are concerned about the environment are more likely to participate in pro-environmental activities than those who are not. Therefore, this chapter will address research question three, which was stated in subsection 1.3 of this thesis and its hypothesis in subsection 1.5. In the following subsections, the investigator will examine the possibility of disposal awareness in influencing millennial households' behaviour to take part in green disposal activities.

5.2 Empirical Results

According to the findings of hypothesis three (refer to Table 5-1), disposal awareness (DA) has a statistically significant influence on the INT to practise green disposal (β=0.138, t=3.573). As a result, H3 is found to be supported in this study.

Table 5-1: Results of research question three

	RELATIONSHIP	BETA (β)	t - Value	p - Value	DECISION
H3	DA -> GDI	0.138	3.573***	0.000	**Supported**

*** Significant at $p < 0.001$

Source: Investigator

5.3 Influence of Disposal Awareness on INT

The third research question examines whether the effect of DA has the potential to influence millennials' pro-environmental behaviour. Inappropriate waste disposal has resulted in significant health concerns for humans and environmental degradation, all of which have been created directly or indirectly by a lack of environmental awareness (Sakawi et al., 2013). Notably, it is estimated that around 2.6 billion of the world's population do not properly dispose of their waste, as claimed by Shahzadi et al. (2018). Hence, awareness is a crucial component in improving an individual's behaviour (Williams & Gunton, 2007).

According to Mahat et al. (2019), the interconnected components of knowledge, attitudes and practices (KAP) contribute to the formation of awareness. Also, Maloney and Ward (1973) argued that people with environmental awareness are more likely to engage in pro-environmental behaviour. Moreover, Hornik et al. (1995) mentioned that environmental awareness, in comparison to other criteria such as monetary reward will result in long-term commitment and will ensure an individual's participation in pro-environment activities.

Likewise, in this study, the findings reveal a positive and statistically significant relationship between DA and the INT to practise green disposal which supports the claim made by Maloney and Ward (1973). Furthermore, the results demonstrate that the current findings are in line with previous discoveries by Wan et al. (2012), Wan et al. (2014), Gonul Kochan et al. (2016), Lizin et al. (2017), Khan et al. (2019), Nguyen and Watanabe (2019) and Meng et al. (2019). All the above-cited studies indicate that awareness significantly influences the studied INT or behaviour. Moreover, a similar previous work by Olufemi et al. (2019) that specifically addressed DA among South African university students found that there was a comparable significant influence.

However, the current study contradicts the findings of Nguyen et al. (2015), which discovered that awareness had no significant impact on studied INT. This discrepancy in outcomes can be explained by the fact that the study's sample group appears to be different. In a research done by Nguyen et al. (2015), the sample group comprised of respondents from various generations, whereas in the present study, the respondents are entirely from millennial households. In other words, millennial households are known to be knowledgeable about the environmental issue, resulting in better awareness than other generations (United States Census Bureau, 2015).

Apart from that, the findings of this study are consistent with the demographic data collected from respondents (refer to Table 3-19), indicating that all participants in this study are exposed to waste disposal or solid waste-related issues through at least one source of information. In this regard, the demographic data results could be translated as all respondents in the current study being aware of waste disposal or solid waste-related information. Also, only 1% of the respondents reported that they did not perform any form of green disposal activities. Additionally, the majority of respondents reported a

high level of awareness of the negative impact of improper waste disposal on the environment, human health and the country.

For instance, 100% of respondents reported that improper waste disposal could pollute the environment and 99.9% of the respondents are aware that such actions can be harmful to humans (90.3% are highly aware and 9.6% moderately aware). Besides, 99.7% of the respondents are aware that improper waste disposal is a problem in Malaysia (89.4% are highly aware and 10.3% moderately aware). Only a few of the respondents (less than 0.5%) acknowledge being unaware of the repercussions of improper waste disposal. Furthermore, 99.1% of those who participated in this survey are aware that recycling containers are available in public areas.

In reference to the overall findings, the investigator could speculate that millennials in this study are highly aware of the negative consequences of inappropriate waste disposal, which more likely encourage them to participate in green disposal activities. This speculation is based on claims made by MacKenzie and Scherer (2019) on millennials' greater access to knowledge as a result of technological advancements and also assertions made by Bathmanathan and Rajadurai (2017) that millennials respond positively to environmentally responsible lifestyles. Moreover, the report by United States Census Bureau (2015) also denoted that millennials are the most informed generation on environmental issues. With that being the case, the investigator believes that individuals who are aware of the negative environmental consequences of improper waste disposal will be more likely to participate in green disposal activities. Therefore, this study demonstrates that awareness about improper waste disposal significantly foresees the INT among millennial households in practising green disposal, thereby supporting H3.

5.4 Summary

The objective of research question three is to determine if the inclusion of disposal awareness will encourage millennial households to dispose of their waste in a more environmentally friendly manner such as green disposal. It is evident from the study's findings that disposal awareness significantly predicts the millennials' intention to engage in green disposal practices. This finding is in line with the argument made by Maloney and Ward (1973), which indicates that individuals with environmental awareness often engage in pro-environmental activities. Aside from that, several previous studies have established results that are comparable to those of the current study, demonstrating that awareness significantly impacts the examined intention. The findings also complement the notion advanced by Bathmanathan and Rajadurai (2017), whereby millennials are more inclined and sensitive toward protecting the environment, as seen by their preference for a green lifestyle.

Furthermore, in terms of the sources of environmental information, the findings of this study are consistent with those of Olufemi et al. (2019). It is found that reading material such as newspapers is the most frequently used medium for obtaining information about environmental issues. Consequently, the investigator assumes that newspapers are the primary source of environmental information and that millennials often read it. Hence, it is recommended that the dissemination of environmental information be expanded to include online platforms, radio and other mediums and the relevant authorities should take note of it. By doing so, it is expected that this will increase household awareness levels and as a result, indirectly persuade individuals to engage in green disposal activities. Therefore, this study confirms the findings of prior studies which found that disposal awareness significantly influences household intention, particularly among millennials.

CHAPTER 6:

INSTITUTIONAL MOTIVATIONS' INFLUENCE ON MILLENNIALS' INTENTION

6.1 Introduction

North (1990) defined an institution as one that has been established and is regulated by law. Regulations may be formal or informal, subject to their structure and operation (North, 1990; Williamson, 1998). Adomako et al. (2015) provided a more straightforward description of institutions by stating that formal institutions describe the political and economic factors whilst informal institutions explain the socio-cultural elements. In addition, the concept of institutions encompasses the structure or processes that affect behavioural patterns or social technologies (Nelson, 2008; Nelson & Sampat, 2001).

Evidence from previous scholars has found that institutions can impact how individuals interact within a given social structure. Also, several prior studies have demonstrated that institutional motivations are capable of influencing an individual's intention to engage in pro-environmental actions. As a result of prior findings on institutions, the investigator believes that it is necessary to investigate the institution's influence in terms of institutional motivations toward millennial households' intention to practise green disposal through both formal and informal institutions.

Moreover, the investigator will examine the role of attitude as a mediator in the relationship between institutional motivations and intention. Similarly, empirical evidence from past studies has established that a positive attitude significantly impacts an individual's intention to participate in pro-environmental activities. In addition, the current study also discovers that millennials' attitudes demonstrate a favourable assessment and have a statistically significant influence on their intention to adopt green disposal practices. The findings from prior studies about the significant impact of a

positive attitude and institutional motivations on a studied intention have necessitated a more in-depth investigation into whether institutional motivations indirectly affect millennial households' intention through a positive attitude.

Thus, this chapter is devoted to answering research question four and five, which is listed in subsection 1.3 of this thesis, and the hypothesis developed in response to the related research objectives. Therefore, the subsequent subsection will discuss the impact of institutional motivations via elements of sanction (formal institutions) and community support (informal institutions) on millennials' intention to raise their participation rate in green disposal activities. Besides, the investigator will explore the likelihood that institutional motivations would indirectly influence the intentions of millennials via the mediation effect of a positive attitude in this chapter.

6.2 Empirical Results

In response to research question three, the investigator suggested examining three hypotheses. Two hypotheses from the lower-order construct (H4b and H4c) are then combined to generate one higher-order construct, which is hypothesis H4a. In this study, the lower-order constructs are used to investigate the predictability of sanction and community support elements in influencing millennials' behaviour independently. However, the concern is on the higher-order construct (institutional motivations), which is intended to assess the motivations of an institution on millennials' INT to practise green disposal.

In accordance with Table 6-1, H4a suggests that institutional motivations positively influence millennial households' INT to practise green disposal (β=0.181, t=3.741). Moreover, further investigation of the sub-dimension of the institutional motivations

reveals that H4b of formal institutions (sanction) has no significant influence on millennial households' INT (β=0.043, t=0.992). Hypothesis 4b, on the other hand, indicates that informal institutions (community support) positively predict millennials' INT to participate in green disposal activities (β=0.150, t=2.847). Thus, the findings of H4a and H4c but not H4b are supported in this study.

Table 6-1: Results of research question four

RELATIONSHIP		BETA (β)	t - Value	p - Value	DECISION
H4a	IM -> GDI	0.181	3.741***	0.000	**Supported**
H4b	FI -> GDI	0.043	0.992^{NS}	0.321	**Not Supported**
H4c	II -> GDI	0.150	2.847**	0.004	**Supported**

** Significant at p < 0.01; *** Significant at p < 0.001; **NS**= Not Significant

Source: Investigator

Subsequently, the investigator examined the indirect impact of institutional motivations as hypothesised in subsection 1.5 of this thesis which is associated to research question five. A mediation analysis is evaluated to establish the indirect influence of institutional motivations on INT to participate in green disposal activities through the ATT variable. The investigator carried out the mediation analysis in accordance with the recommendations made by Ramayah et al. (2018) and Nitzl et al. (2016). As a result, according to the findings in Table 6-2, the direct association between ATT (β=0.133, t=2.787) and institutional motivations (β=0.181, t=3.741) towards INT demonstrates a statistically significant impact. In addition, the direct association between institutional motivations and ATT indicates a significant larger coefficient value (β=0.711, t=33.371),

implying a strong association between the two variables. Consequently, the mediating result demonstrates that institutional motivations have a statistically significant indirect influence on INT to practise green disposal via positive ATT (β=0.095, t=2.766).

Moreover, the R^2 analysis demonstrates that institutional motivations predict 50.6% of the ATT variable, indicating a moderate to substantial predictive accuracy (Chin, 1998b; Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019; Henseler et al., 2009). Following the recommendation of Hair, Hult, Ringle and Sarstedt (2017), the investigator determined whether the proposed mediation hypothesis is partially mediating or completely mediating in this study. According to Hair, Hult, Ringle and Sarstedt (2017), in the presence of a significant indirect impact, a variance accounting for (VAF) value of less than 0.2 holds a suggestion that there is no mediating effect. A partial mediation effect is said to occur when the VAF value is between 0.2 and 0.8, while a full mediation effect is noted when the VAF value exceeds 0.8. Aside from that, the VAF computation is required to ascertain the strength of mediation or magnitude of the mediation impact to make concluding statements regarding the mediation effect. Therefore, the findings in this study reveal that the VAF value of 0.344 (34.4%) is indicated as a complementary mediation (partial mediation effect) and is found to support H5.

Table 6-2: Results of research question five

		DIRECT EFFECT			TOTAL EFFECT		
Relationship		**Beta (β)**	**t - Value**	**p - Value**	**Beta (β)**	**t - Value**	**p - Value**
H5	IM -> GDI	0.181	3.741***	0.000	0.276	7.179***	0.000
	ATT -> GDI	0.133	2.787**	0.005	-	-	-
	IM -> ATT	0.711	33.371***	0.000	-	-	-

Table 6-2: continued

INDIRECT EFFECT							
Relationship		**Beta (β)**	**t - Value**	**p - Value**	**VAF**	**Decision**	
H5	IM -> ATT -> GDI	0.095	2.766**	0.006	34.4%	**Supported**	**Complementary mediation** (Partial mediation)

** **p<0.01**; *** **p<0.001**; **R^2** of ATT=0.506; **VAF**= Variance accounted for

Source: Investigator

6.3 Institutional Motivation's Capability in Shaping Households' Behaviour

Objective four of the current study is to examine whether institutional motivations through formal and informal institutions can shape millennial households' behaviour to engage in green disposal activities. The institutional motivation variable in this study incorporates elements of sanction from formal institutions and elements of community support from informal institutions. As North (1990) and Williamson (1998) mentioned, laws or regulations can be formal or informal, depending on their structure and execution.

This current study discovers that institutional motivations have a significant positive impact on millennials' INT to participate in green disposal activities. The findings on institutional motivations are consistent with previous studies, such as those conducted by Armijos et al. (2017), Rye et al. (2018) and Jiang et al. (2019). All the above-cited studies confirm that the collaboration between formal and informal institutions significantly influences the studied individuals' behaviour. Following these studies, the investigator could make an assumption from the present findings that institutional motivations in terms of sanctions and community support are found to be effective in encouraging millennial households to practise green disposal. The combination of both elements is

believed to shape millennials' behaviour and subsequently motivates them to practise green disposal activities.

Additionally, the investigator went on to examine the effect of an institution's motivation via the institutional dimension of both formal and informal institutions separately. It is found that the element of sanctions from formal institutions has no significant influence on millennials' INT, which is contrary to the findings of Wong et al. (2008), Amini et al. (2014), Ogiri et al. (2019), Dur and Vollaard (2019) and Zheng et al. (2020). Nevertheless, this result depicts the findings from Li, Jin, et al. (2020) which indicate that formal institution is not significant in Shanghai residents' waste separation behaviour. A possible argument may be drawn from the analysis, suggesting that the millennials in this study are unaffected by the sanctioning component of formal institutions, which could be the result of inconsistencies in policy implementation.

For instance, Act 672 (Solid Waste and Public Cleansing Management Act 2007) is a waste management policy accepted by only eight states in Malaysia. The remaining states including Perak manage their waste autonomously. Similar behaviour is also seen in a study conducted by Corbet and Gurdgiev (2017), which found that inconsistencies in policy and institutional responses discourage young voters, particularly millennials, from casting their ballots. On the other hand, the investigator found that community support from informal institutions positively influences the millennials' INT at 0.01% significance. The result is in agreement with the studies of Jimoh et al. (2012), Akpabio and Subramanian (2012), Du et al. (2016), Xiao et al. (2017) and Roberts et al. (2017).

It is discovered that community support through NGOs in promoting pro-environmental activities near areas of residence has a substantial impact on millennials' INT. In other words, millennials are more inclined to participate in green disposal activities when NGOs in their neighbourhood organise programmes that encourage such

activities. This behaviour could be because millennials, compared to previous generations are naturally connected to social networks and the community that lives around them, as reported by Bathmanathan and Rajadurai (2017) and Bednarska-Olejniczak and Olejniczak (2018). Thus, the investigator may postulate that when it comes to motivating millennial households to participate in green disposal activities, they respond favourably to the support of informal institutions than to the element of punishments associated with formal institutions.

6.4 Institutional Motivation's Indirect Effect Towards Intention Through Positive Attitude

Research question five seeks to determine if institutional motivation could indirectly impact the INT to engage in green disposal activities via a positive ATT. Prior to conducting a mediation analysis, the investigator evaluated the direct relationship between the institutional motivations on INT, ATT on INT and ATT on institutional motivations. As Rungtusanatham et al. (2014) pointed out, the transmittal mediation method focuses primarily on the indirect impact. However, the investigator is required to report all the direct impact results to determine the types of mediation. The findings of this study on the direct association between ATT and institutional motivations toward green disposal INT are significant and consistent with those of earlier studies (please refer to subsections 4.3 and 6.3 on the discussion).

Aside from that, findings on the relationship between institutional motivations and ATT are found to have a statistically significant correlation, consistent with prior research findings. For example, the study by Brown and Johnstone (2014) on environmental tax (pay-as-you-throw) demonstrated that households had more favourable ATT regarding the tax system when it was implemented. Furthermore, a study by Amini et al. (2014) on

the sanctions impact of formal institutions on household recycling INT in Kuala Lumpur found that both the penalty and reward elements had a significant impact on the households' INT to participate in recycling activities. In addition, according to the findings of a study conducted by Revilla and Salet (2018), food ritual motivations stemming from religious practices were found to have a significant influence on the ATT of households toward minimising food waste in their residence. Also, a study on the Shanghai, China government mandatory policy conducted by Li, Jin, et al. (2020) revealed that the mandatory waste separation policy had a positive and significant effect on the residents' ATT.

Following that, the effectiveness of ATT as a mediator variable was assessed, as hypothesised in this study. The institutional motivations' indirect effect toward INT to practise green disposal through a positive ATT is found to be statistically significant at 0.01. Based on the institutional motivation's indirect effect with a significant positive sign and significant direct result, this type of mediation is regarded as complementary mediation (partial mediation) effect. The findings suggest that ATT partially mediates the relationship between institutional motivations and INT, accounting for 34.4% of the relationship. Considering the indirect effect findings, the investigator could speculate that institutional motivations are able to impact millennials' INT to participate in green disposal activities through a favourable ATT toward safe disposal actions.

In other words, institutional motivations through the elements of sanctions and community support are capable of impacting millennials' ATT to have a positive impression about green disposal activities and subsequently influence their INT to practise green disposal activities. Additionally, the findings also indicate a significant total influence of institutional motivations on INT (β=0.276, $p < 0.001$), which has a greater coefficient value than the direct impact of institutional motivations on INT.

Therefore, the total influence finding implies that when the institutional motivations are combined with a favourable ATT, millennials are more likely to have a more substantial probability of engaging in green disposal activities compared to the institutional motivation's direct influence on INT.

6.5 Summary

In this chapter, the investigator has discussed the direct impact (research question four) and the indirect impact (research question five) of institutional motivations towards intention. The findings presented in this chapter demonstrate that the behaviour of millennial households could be persuaded by institutional motivations to participate in green disposal activities. Besides, it is evident that millennials respond favourably to the aspect of community support than they do to the sanctions of the formal institution. Moreover, the millennials' favourable response to community support is consistent with the assertion made by Wiedmer (2015) on the description of millennials, which implies that they are usually less independent, more inclusively community-oriented and strive for a sense of purpose in a greater context.

A similar point was highlighted by Xiao et al. (2017), who claimed that households are more responsive to community support than they are to environmental law with weak sanctions. Although formal institutions do not significantly predict millennials' intention in this study, the investigator believes that institutional motivations with the joint effort of both formal and informal institutions could significantly influence millennials' intention to engage in green disposal activities.

Meanwhile, multiple studies have indicated that the motivation of an institution has a significant impact on an individual's intention and attitude. However, the investigator

observed a scarcity of research on the indirect influence of institutional motivations on millennials' intention via a positive attitude. Hence, in this chapter, the investigator discussed the efficiency of attitude as a mediator in improving institutional motivations' influence on millennials' intentions. The study reveals an interesting finding of the attitude's ability to mediate the association between institutional motivations and intention.

According to the findings, it is apparent that institutional motivations indirectly impact the intentions of millennials to participate in green disposal activities through a positive attitude, with a complementing mediation effect of 34.4 %. Furthermore, the total effect of coefficient value of institutional motivations on intention is improved by 52.5 % of the institutional motivation's direct coefficient value. As a consequence, the findings suggest that the combined effect of institutional motivations (direct and indirect) could have a more comprehensive impact on intention when compared to the direct impact of institutional motivations.

Therefore, from the above findings, it is reasonable to argue that the elements of sanctions and community support should complement one another to encourage more millennials to participate in green disposal activities. In addition, the findings also confirm that attitude is an efficient mediator in strengthening the influence of institutional motivations on millennials' intention to engage in environmentally friendly disposal actions such as green disposal activities. Consequently, institutional motivations are seen to affect millennials' intentions indirectly, as hypothesised in this study.

CHAPTER 7:

GREEN DISPOSAL TECHNOLOGY IMPACT ON MILLENNIALS' INTENTION

7.1 Introduction

In recent times, technology has advanced at an exponential rate practically in every sector. However, waste management technology continues to develop and its potential is acknowledged. Not just in preventing waste from being disposed of in landfills, the most widely used technologies today are those that treat waste after it has been generated. When it comes to treating municipal waste, there is a wide range of approaches and some of the technologies are recognised as green technology since they apply environmentally friendly techniques.

Nevertheless, as previously stated, most green technologies in waste management focus only on treating waste. In this study, the investigator sought to explore green disposal technology in terms of minimising waste from going to landfills. As defined by Malaysia's National Green Technology Policy, green technology is a technology that minimises environmental damage, emits less greenhouse gas, conserves energy and natural resources, decreases emissions and encourages the use of renewable energy (Chien Bong et al., 2017).

Reverse vending machines and mobile applications, for example, have been identified in several studies as technologies that can assist in disposing of waste in an environmentally friendly manner by diverting the waste away from going to landfills. As a result, reverse vending machine and mobile applications technologies have been selected for this study because they adhere to the requirements outlined in the National Green Technology Policy for green disposal technology. Additionally, considering previous findings on the reverse vending machine and mobile applications, the

investigator believes it is essential to explore the effect of green disposal technology on millennial households through the use of both reverse vending machine and mobile application technologies.

After reviewing several previous works of literature on green disposal technology which primarily focuses on the reverse vending machine and mobile applications, the investigator discovered a need to study further the effect of indirect technological influence through the element of control belief on intention. Hence, the investigator will also examine the role of perceived behavioural control as a mediator in the relationship between green disposal technology (combination of reverse vending machine and mobile applications) and intention in this chapter.

Numerous previous researches have revealed that disposal technologies have the potential to affect an individual's intention to engage in pro-environmental initiatives. Moreover, empirical evidences from previous studies have confirmed that perceived behavioural control substantially influences an individual's intention to partake in pro-environmental actions. Also, the current study found that perceived behavioural control has a statistically significant impact on millennials' intention to adopt green disposal methods as their disposal practices (refer to subsection 4.2).

Thus, a more in-depth investigation of green disposal technology's indirect influences on millennials' intention through perceived behavioural control has become necessary. This proposed examination on the indirect effect of green disposal technology is the result of the evidence found from previous studies, which indicates a statistically significant direct impact of green disposal technology and perceived behavioural control on an investigated intention.

Therefore, this chapter is devoted to answering research questions six and seven, as mentioned in subsection 1.3 and the associated hypothesis listed in subsection 1.5 of this thesis. Consequently, the impact of green disposal technology via RVM and mobile applications on millennials' intention to increase their involvement in green disposal activities will be discussed in the following subsection. Furthermore, the investigator will explore the possibility of green disposal technology having an indirect influence on the intention of millennials through the mediating effect of perceived behavioural control in the subsection.

7.2 Empirical Results

Three hypotheses were proposed in response to research question six by the investigator. Two hypotheses which represent the lower-order construct were then merged to generate one higher-order construct (green disposal technology), denoted as hypothesis H6a. In this study, the lower-order constructs were employed to examine the predictability of RVM (H6b) and mobile application (H6c) technologies in terms of their influence on millennials' INT. Nevertheless, the primary focus of this study is on the higher-order construct of green disposal technology which evaluates the combined ability of RVM and mobile application technologies in influencing millennials' INT to practise green disposal activities.

Referring to Table 7-1, H6a reveals that green disposal technology significantly affects millennial households' INT to practise green disposal activities (β=0.136, t=3.431). A more in-depth analysis of the green disposal technology's sub-dimension found that RVM has been shown to positively predict millennials' INT to participate in green disposal actions (β=0.043, t=0.992). On the contrary, it is noticed that mobile applications have

no significant impact on millennial households' INT (β=0.049, t=1.225). Hence, the findings of H6a and H6b are found to be supported in this study with a significance of 0.01. Regrettably, this study finds no evidence to support the H6c result.

Table 7-1: Results of research question six

RELATIONSHIP		BETA (β)	t - Value	p - Value	DECISION
H6a	GDT -> GDI	0.136	3.431**	0.001	**Supported**
H6b	RVM -> GDI	0.114	3.223**	0.001	**Supported**
H6c	MA -> GDI	0.049	1.225^{NS}	0.220	**Not Supported**

** Significant at $p < 0.01$; **NS**= Not Significant

Source: Investigator

Following the above analysis, the investigator moved on to the mediation analysis to address the seventh research question. The PBC variable is applied to a mediation analysis to determine the indirect impact of green disposal technology on millennials' willingness to participate in green disposal practices. As was performed in Chapter 6 of this thesis, the investigator conducted the mediation analysis in compliance with the suggestions given by Ramayah et al. (2018) and Nitzl et al. (2016). Based on the results in Table 7-2, it is discovered that the direct correlation between green disposal technology (β=0.136, t=3.431) and PBC (β=0.317, t=6.953) towards INT has a statistically significant influence on millennials' INT. Furthermore, the direct association between green disposal technology and PBC reveals a statistically significant coefficient value (β=0.521, t=16.723), suggesting a strong relationship between the two variables. As a consequence, a mediation analysis is performed and the result indicates that green disposal technology

has a significant indirect impact on millennials' INT to practise green disposal via PBC (β=0.165, t=6.522).

Additionally, the R^2 assessment suggests that green disposal technology predicts 27.1% of the PBC variable, demonstrating a weak to moderate predictive accuracy (Chin, 1998b; Hair, Hult, Ringle, & Sarstedt, 2017; Hair, Risher Jeffrey, et al., 2019; Henseler et al., 2009). Subsequently, the investigator examined whether the suggested mediation hypothesis is partially or completely mediating in this study based on guidelines recommended by Hair, Hult, Ringle and Sarstedt (2017). In the presence of a significant indirect impact, Hair, Hult, Ringle and Sarstedt (2017) categorised a variance accounting for (VAF) value between 0.2 and 0.8 as a partial mediation effect, while a full mediation effect is regarded when the VAF value exceeds 0.8 and VAF value less than 0.2 is indicated as no mediation. Moreover, the VAF calculation is also necessary to determine the mediation's strength and assert the mediation effect conclusively. Therefore, the outcomes of this investigation suggest that the VAF value of 0.548 (54.8%) is indicative of complementary mediation (partial mediation effect) and thereby it supports H7.

Table 7-2: Results of research question seven

		DIRECT EFFECT			TOTAL EFFECT		
	Relationship	**Beta (β)**	**t - Value**	**p - Value**	**Beta (β)**	**t - Value**	**p - Value**
H7	GDT -> GDI	0.136	3.431**	0.001	0.301	6.837***	0.000
	PBC -> GDI	0.317	6.953***	0.000	-	-	-
	GDT -> PBC	0.521	16.723***	0.000	-	-	-

Table 7-2: continued

INDIRECT EFFECT							
Relationship		**Beta (β)**	**t - Value**	**p - Value**	**VAF**	**Decision**	
H7	GDT -> PBC -> GDI	0.165	6.522***	0.000	54.8%	**Supported**	**Complementary mediation** (Partial mediation)

** **p<0.01**; *** **p<0.001**; **R^2** of PBC=0.271; **VAF**= Variance accounted for

Source: Investigator

7.3 The Influence of Green Disposal Technology on Intention

Overcoming and mitigating the damaging environmental effects of waste in landfills have compelled policymakers and businesses to re-evaluate their policies and improve waste handling processes. Technology has made numerous breakthroughs centred on an increased production of goods with greater environmental conservation capabilities, indirectly bolstering the landfills' negative environmental effect. To encourage safe disposal, a number of private waste management businesses have developed technologies that help to moderate the efforts. These technologies include RVM and mobile application support that assist individuals in disposing of their household waste safely.

In this study, H6a is developed to examine the impact of green disposal technology on millennials' INT through the usage of RVM and mobile applications. According to the analysis results, it is discovered that green disposal technology has a statistically significant positive effect on predicting the INT to practise green disposal among millennial households. The H6a result is consistent with those of prior studies indicating that technological use in waste disposal management motivates individuals to perform safe disposal activities, such as Yerraboina et al. (2018) and Jaid Jim et al. (2019).

Furthermore, based on the study conducted by Yerraboina et al. (2018), technology (Smart Garbage Bin) has a positive impact on enhancing the monitoring process of waste disposal at the household level. Besides that, Jaid Jim et al. (2019) reported that technology use could improve the waste management system by reducing the demand for space, automating manual labour, ensuring safe waste storage and minimising environmental pollution.

Even though very little evidence can be directly linked to this study's focus on green disposal technology, the studies mentioned above could serve as proxy evidence to represent the element of technological assistance for households. Hence, the studies are assumed to reflect the variable of green disposal technology in this study. From the findings of the H6a analysis, the investigator could postulate that green disposal technology has the potential to affect the millennials' INT to dispose of waste safely. The finding also supports the study conducted by Pew Research Center (2011), which affirms that millennials are the largest generation with great technological capabilities and are able to adapt to technological advances quickly. In this instance, the use of technology that gives importance to the green concept in household waste disposal is seen to influence millennials' willingness to engage in green disposal activities.

In a more in-depth investigation of the green disposal technology sub-dimensions, the investigator discovered that RVM significantly influences millennials' INT to practise green disposal. The result of this analysis is consistent with the findings of earlier studies such as by Tiyarattanachai (2015), Pramita et al. (2019), Koushki et al. (2020), Sambhi and Dahiya (2020) and Amantayeva et al. (2021). All the above-cited studies indicate that RVM substantially influences an individual's INT to participate in pro-environmental activities. The investigator assumed that the convenience and rewards associated with RVM encourage millennials to dispose of waste by depositing it with RVM safely. This

assumption is also proven in the study conducted by Tiyarattanachai (2015), which reported that when RVM is placed next to recycle bins, recycling activity increases. Similarly, Pramita et al. (2019) indicated that respondents' willingness to recycle waste has increased as a result of the convenience provided by RVM. Likewise, Amantayeva et al. (2021) asserted that RVM provides easy access to recycling facilities thus encouraging recyclers to utilise them often.

Another aspect of green disposal technology that is examined in this study is the support of mobile applications. As shown in Table 7-1, the findings indicate that mobile application support has no significant effect on millennials' INT to engage in green disposal activities. The result of mobile application support contradicts the findings of previous studies such as by Rosa-Gallardo et al. (2018), Rakhmanov and Ibrahim (2019), Gu et al. (2019), Kang et al. (2020) and Huang et al. (2020). Based on this finding, the investigator could presume that the mobile application's support in terms of providing a guide to practise environmentally safe disposal, notifying millennials of recycling collection dates and identifying the nearest recycle collector has no effect on millennials' INT to engage in green disposal activities.

This inconsistency in the findings might be due to the fact that the sample group included in the earlier studies was composed of people from different generations whereas the sample group in this study consists solely of millennials and it is possible that the millennial group felt the services provided by mobile applications did not appeal to them. Based on the attributes (guidance, date reminder and recycler locator) used to evaluate mobile applications, it is possible that millennials may find them to be not helpful since they are known to be well-equipped with relevant knowledge about safe disposal practices (MacKenzie & Scherer, 2019). In addition, there is no scheduled recycling waste collection in Perak, contrary to the practice of some states that have adopted the Solid

Waste and Public Cleansing Management Act 2007. In this situation, the need for date reminding technology capability is not needed as there is no scheduled waste collection routine.

Apart from that, mobile application support does not give the same benefit (monetary or other types of rewards) to millennials as RVM does, which may be one of the factors contributing to the insignificant impact on millennials' INT. Consequently, it is possible that all the factors described above have led to mobile application support's negligible impact on millennials' INT as a result of rejecting the proposed H6c. However, based on the findings presented above, the investigator may conclude that when it comes to persuading millennial households to participate in green disposal activities, the adoption of RVM technology is more effective than the support of mobile applications in terms of partaking in green disposal activities.

7.4 Green Disposal Technology Indirect Effect on Intention Through PBC

The purpose of research question seven is to examine if green disposal technology could indirectly influence the INT to participate in green disposal activities through the element of PBC. Therefore, an assessment of the direct correlation between the green disposal technology on INT, PBC on INT and green disposal technology on PBC is performed prior to conducting a mediation analysis. Even so, according to Rungtusanatham et al. (2014), the primary focus of the mediation analysis based on the transmittal mediation approach will be the indirect effect only. Nevertheless, the direct impact of each relevant variable will also be reported in this section by the investigator. Besides, the results of direct impact are required to determine the types of mediation. Hence, the study's findings on the direct relationship between green disposal technology

and PBC towards green disposal INT are significant and comparable with those of previous research (please refer to subsections 4.3 and 7.3 for their discussion).

Other than that, the study also discovered a statistically significant association between green disposal technology and PBC, which agrees with earlier studies. For instance, research by Pramita et al. (2019) found that the element of convenience was a significant factor when using RVM in Bengaluru, India, which showed that respondents were encouraged to practise safe disposal. Furthermore, a study conducted by Rosa-Gallardo et al. (2018) discovered that the use of mobile applications (Sustainable WAsTe Collection-SWAT) had a significant impact on respondents' convenience levels by informing them of the availability of nearby waste containers.

On the other hand, several previous authors asserted that the usage of technology such as RVM or mobile applications had impacted respondents' control beliefs (convenience) even though PBC was not empirically tested but represented by variables with similar meaning. For example, a study undertaken in Thailand by Tiyarattanachai (2015) and a recent study conducted in Kazakhstan by Amantayeva et al. (2021) on the implementation of RVM claimed that RVM substantially increased the level of convenience of respondents to engage in pro-environmental actions. Likewise, Rakhmanov and Ibrahim (2019) in their study on mobile application support, stated that technology support had improved respondents' convenience, which indirectly enhanced their engagement in pro-environmental acts.

Subsequently, the impact of PBC as a mediator is assessed as hypothesised in this study. It is discovered that the indirect influence of green disposal technology on millennials' INT to practise green disposal activities is statistically significant at 0.001 via the element of PBC. Considering the indirect influence of green disposal technology with a significant positive sign and a significant direct result towards INT, the mediation

effect is deemed to be a complementary mediation (partial mediation). The findings imply that PBC partially mediates the relationship between green disposal technology and INT, accounting for 54.8% of the relationship. Following the indirect effect findings, the investigator could postulate that green disposal technology has the capability to influence millennials' INT to engage in green disposal activities via the aspect of PBC, as measured in terms of skills, convenience and confidence in this study.

In other words, green disposal technology that incorporates aspects of RVM and mobile application support can possibly impact millennials' control belief, which translates into an increased capability to perform safe disposal and as a result, influences their INT to engage in green disposal activities. Moreover, the analysis also demonstrates a statistically significant total influence of green disposal technology on INT (β=0.301, $p<0.001$), which has a higher coefficient value than the direct impact of green disposal technology on INT. As a consequence, the total effect finding signifies that when the green disposal technology effect is transmitted via the element of PBC, millennials are more likely to be actively participating in green disposal actions, as opposed to the direct influence of green disposal technology on INT.

Therefore, from the results of the total effect, the investigator may speculate that millennials will be strongly influenced when the adoption of disposal technology can boost and facilitate their ability to perform pro-environmental practices. Consequently, this impacts the millennials' INT to be involved in green disposal activities. Furthermore, the findings on the total effect support the claim advanced by Bathmanathan and Rajadurai (2017), whereby millennials seem to be willing to embrace environmentally responsible lifestyles that are centred on safeguarding the environment through safe disposal methods.

7.5 Summary

Several innovative solutions such as reverse vending machines and mobile application support have been developed in response to modern technological breakthroughs, and they have the potential to reduce the amount of waste that ends up in landfills. There are also studies indicating that the adoption of environmentally friendly disposal methods such as green disposal technology has a significant impact on individuals' intention and perceived behavioural control. As a result, this chapter aims to examine the potential of green disposal technology, as measured by the reverse vending machine and mobile application technology to encourage millennial households to practise green disposal activities. Besides, the investigator discovered a lack of research on the indirect impact of green disposal technology on millennials' intention through the element of perceived behavioural control. Consequently, another aim of this chapter is to demonstrate the effectiveness of perceived behavioural control as a mediator in enhancing the effects of green disposal technology on the intention of millennials, thereby achieving objectives six and seven of this thesis.

Based on the results in this chapter, it can be concluded that adopting green disposal technology impacts millennials' intention to engage in green disposal activities. The findings on green disposal technology have confirmed the statement made by Wiedmer (2015), who stated that millennials are found to be very involved and quickly adopt new technology in their life since it is an unavoidable scenario. As such, adopting green disposal technology will not be a problem for millennials.

It is also apparent that millennials are more receptive to the use of reverse vending machines than they are to the use of mobile application support. The significant impact of reverse vending machines on millennials is comparable with the assertion made by Amantayeva et al. (2021), who claimed that the monetary incentive offered by reverse

vending machines is an impactful encouragement to engage in pro-environmental activities such as recycling waste. Aside from the fact that mobile application support does not significantly predict millennials' intention in this study, green disposal technology, with the collective effort of both reverse vending machines and mobile application technology, significantly influences millennials' intention to participate in green disposal activities overall.

Moreover, informative results on perceived behavioural control's potential to mediate the relationship between green disposal technology and intention are discovered in this study. According to the results, it is evident that perceived behavioural control has a complementing mediation effect of 54.8 % in the relationship between green disposal technology and millennials' intention to partake in green disposal activities.

Furthermore, the investigator noticed that the total effect coefficient value of green disposal technology on intention has increased enormously by 121.3% of the green disposal technology's direct coefficient value, which is a significant improvement. Thus, the findings imply that the combined direct and indirect effect of green disposal technology could have a more inclusive impact on intention when compared to the direct impact of green disposal technology.

Therefore, it is plausible to conclude that reverse vending machine and mobile application support should be complementary to encourage more millennials to participate in green disposal activities. These findings are expected to contribute to the study's primary goal, which is to increase millennials' participation in green disposal activities. Also, the findings confirm that perceived behavioural control is an effective mediator in enhancing the influence of green disposal technology on millennials' intention to participate in eco-friendly disposal actions such as green disposal activities. In addition, it is reasonable to conclude that green disposal technology has a significant

indirect impact on millennials' intention via perceived behavioural control, as hypothesised in this study.

CHAPTER 8:

CONCLUSION, IMPLICATIONS AND FUTURE RESEARCH

8.1 Conclusion

This study focuses on the factors that could motivate millennial households to participate in activities that promote green disposal, which in turn increases the waste recovery rate in Malaysia. To improve the quality of the environment through safe disposal, it is essential to get an understanding of the determinants that impact the behaviour of households generally and specifically, the millennials. The need for further understanding is due to the fact that between 2005 and 2021, municipal waste in Malaysia has increased by 102.25% or an average of 6.4% each year (Malaysian Investment Development Authority, 2021). Many significant previous works of literature have discussed disposal behaviour among households, but studies on Asian millennials' disposal behaviour are relatively scarce. In particular, research on collective disposal behaviour such as green disposal (reduce, reuse, recycle and waste separation) is understudied among millennials.

Thus, this study proposes an extended theory of planned behaviour model, which includes variables such as disposal awareness, institutional motivations (formal and informal institutions) and green disposal technology (reverse vending machine and mobile application) to investigate the factors that influence millennials' intention to engage in green disposal activities in Perak, Malaysia. In addition, the investigator looks at the role of perceived behavioural control as a moderator and a mediator to strengthen millennials' intentions, and this is another aspect of the model that is explored and investigated further. Besides, the role of attitude as a mediator was also considered within the scope of this current study. Following that, the investigator analysed the model quantitatively using the SmartPLS programme. This tool is suitable to be used because the purpose of this study is designed to predict the intentions of millennials. The

subsequent paragraphs outline some of the important discoveries that have emerged from this current study (refer to Figure 8-1).

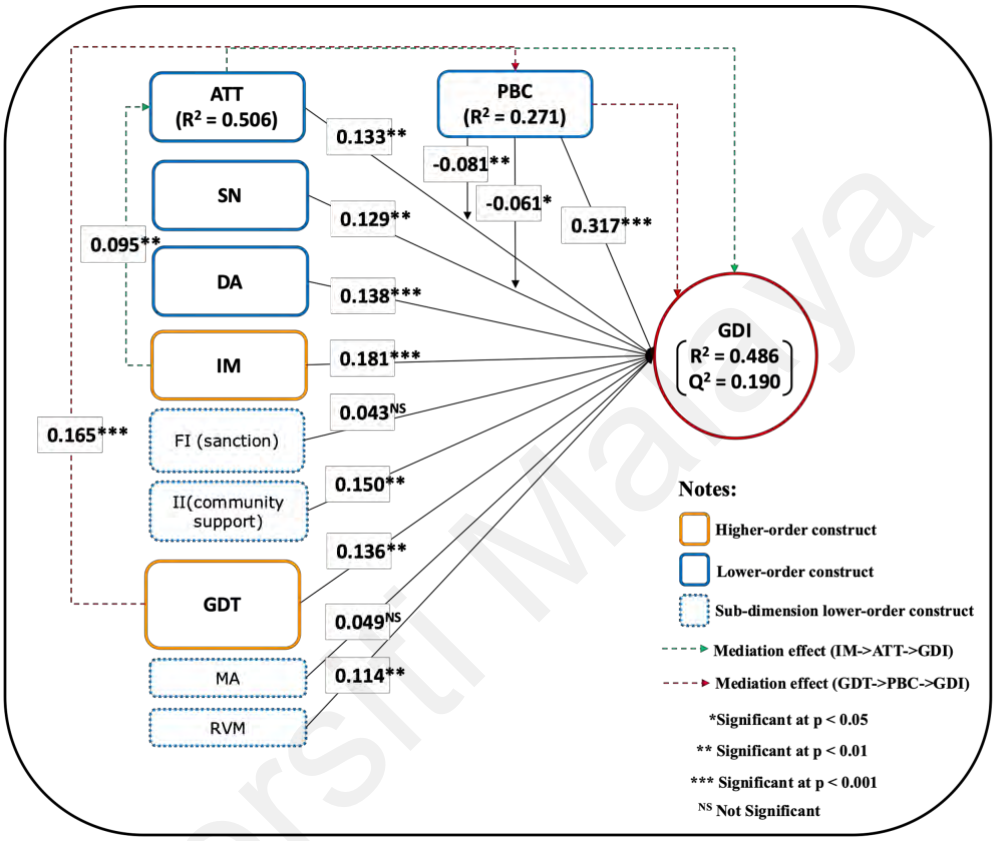

Figure 8-1: Overall findings of the investigated model

Source: Investigator

Firstly, the results of this study corroborate the hypothesised associations with the theory of planned behaviour predictors. The theory of planned behaviour predictors has a significant relationship with the intention of millennials to participate in green disposal activities. These results confirm the claim established by previous scholarly literature that

the theory of planned behaviour's framework is suitable to predict the studied pro-environmental intention. It is apparent that the criteria used to measure perceived behavioural control such as skill, convenience and confidence are the most influential factors in predicting millennials' intention. Aside from that, the results indicate that perceived behavioural control seems to have the strongest influence over all other examined predictors when interacting directly with intention as opposed to when it functions as a moderator. The findings could be interpreted as reflecting the personality of millennials which places importance on convenience and skill (represented as perceived behavioural control). This interpretation is based on the descriptions of millennial traits provided by Jorgensen (2003), Wiedmer (2015) and Bathmanathan and Rajadurai (2017).

Moreover, it is interestingly seen that the findings on perceived behavioural control's role as moderator show a significant opposite direction for both interactions (ATT x PBC and SN x PBC). Although previous findings on the interaction of ATT x PBC are mostly positive interaction terms, it could be speculated that the interaction term changes direction for ATT x PBC due to the sample population, which primarily consists of millennial households. This occurrence could be the characteristics presented by millennials compared to other generation cohorts. Also, it is discovered that the perceived behavioural control's ability to function as a moderator in enhancing the influence of attitude and subjective norms is only distinctively stronger when the control variable is at a low level. In other words, when perceived behavioural control is at a lower level, the impact of attitude and subjective norms on intention is substantially stronger than their direct correlation with intention.

Second, the study's findings indicate that disposal awareness significantly predicts the intention of millennials to engage in green disposal practices. This statistically highly

significant factor agrees with the assertion presented by Maloney and Ward (1973) which suggests that environmentally conscious individuals often participate in activities that are beneficial to the environment. Other than that, this study also reveals that reading materials such as newspapers are the most popular source of environmental information for millennials. The investigator believes that information on the repercussions of improper waste disposal should be disseminated more extensively through media such as newspapers, news portals and radio (refer to Table 3-19) to improve the effect of disposal awareness. It is evident from the findings that disposal awareness has the potential to encourage millennials to participate in activities related to environmentally friendly disposal, such as green disposal.

Third, institutional motivations are discovered to impact millennials' intention to practise green disposal at a significance level of 0.001. Further in-depth analysis in the sub-dimension of institutional motivations reveals that informal institutions (community support) are significant. In contrast, formal institutions have no significant influence on the intention of millennials. It appears that millennials respond more positively to the concept of receiving support from their communities than they do to being penalised by formal institutions. As reflected by the findings, the favourable responses to community support among millennials in this study are coherent with the notion highlighted by Wiedmer (2015), which indicates that millennials have the tendency to be more community-oriented than self-reliant. The investigator believes that institutional motivations through the collaborative approach of formal and informal institutions could significantly influence millennials' intention to encourage them to participate in green disposal activities even though formal institutions independently do not significantly predict millennials' intention in this study.

Fourth, the indirect influence of institutional motivations through a positive attitude is explored. The findings reveal that institutional motivations have a significant and indirect effect on the intention of millennials via a favourable attitude. It is discovered that attitude is capable of mediating 34.4% of the influence that institutional motivations have on the studied intention. Furthermore, it is noticeable that the total effect (indirect and direct) of institutional motivations' coefficient value on intention is enhanced by 52.5% compared to the direct coefficient value of institutional motivations. Consequently, this implies that the intervention to increase the likelihood of millennials practising green disposal is achievable when institutional motivation's indirect influence via millennials' positive attitudes is combined with institutional motivation's direct impact.

Fifth, the green disposal technology substantially impacts the intention to motivate millennials to participate in green disposal activities and is found to be significant at 0.01. The findings on green disposal technology have validated the assertion made by Wiedmer (2015), which indicated that millennials are highly engaged and embrace new technology rapidly since it is an unavoidable reality. A further and more in-depth investigation of the sub-dimension of green disposal technology has found that reverse vending machines are significant. Nevertheless, the adoption of mobile application support does not significantly impact the intentions of millennials. Therefore, it is evident that millennials are more responsive to the adoption of reverse vending machine than to mobile application support. Regardless of the fact that mobile application support does not substantially predict intention in this study, it is reasonable to make the presumption that reverse vending machine and mobile application support ought to be complementary in their endeavour to persuade millennials to take part in green disposal activities.

Finally, the impact of perceived behavioural control as a mediator in improving the indirect effects of green disposal technology on intention among millennials is explored.

It is discovered that green disposal technology indirectly impacts the intentions of millennials through the influence of perceived behavioural control. Moreover, it is revealed that perceived behavioural control is able to mediate 54.8% of the effect that green disposal technology has on intention. In addition, the total effect of green disposal technology on intention rises by 121.3% compared to its direct effect only, suggesting that the combined direct and indirect effects of green disposal technology may have a more significant influence on millennials' intention. Besides, the indirect impacts of green disposal technology are 21.3%, and this is found to be more impactful than the direct effect of green disposal technology on intention. This amplified impact denotes that the green disposal technology can increase the convenience level of millennials, hence exerting a greater effect on their intention via perceived behavioural control to adopt green disposal practices.

In essence, the findings of this study indicate that all hypothesised variables excluding formal institutions (sanction) and mobile application support are found to be significant and supported. Furthermore, six of the twelve hypotheses (excluding the insignificant hypothesis) have a highly significant effect of 0.001, which could be interpreted as factors that are extremely capable of affecting the intention of millennials to participate in green disposal activities. In influencing millennials to engage in green disposal practices, it is observed that perceived behavioural control has the largest coefficient value (0.317**), followed by the coefficient value of institutional motivation's direct effect (0.181***), disposal awareness's direct effect (0.138***) and green disposal technology's indirect effect (0.165***). Besides, the moderating influence of perceived behavioural control is shown to have significantly straightened the ATT x PBC (0.214***) and SN x PBC (0.190***) relationships when perceived behavioural control is at a low level in comparison to their direct impact on intention.

Aside from those six hypotheses, it is discovered through the mediation analysis results that the total effect coefficient value (combination of direct and indirect effect) of green disposal technology (0.301***) and institutional motivations (0.276***) also have a highly significant impact on improving green disposal practices. Accordingly, the total effect of mediation findings could be interpreted as when institutional motivations through the influence of positive attitude and green disposal technology through the influence of perceived behavioural control are perceived to have a more comprehensive impact on millennials' intention than their direct or indirect impact. Therefore, the overall findings of this study lead to the conclusion that perceived behavioural control, green disposal technology with the influence of perceived behavioural control and institutional motivations with the influence of a positive attitude can cause a change in the behaviour of millennial households to engage in green disposal activities and divert a substantial amount of recoverable waste from landfills.

8.2 Implications

The outcomes of the study have led to the suggestion of implications that will be beneficial from the theoretical viewpoints as well as to the country in general. As a result, the following subsections will discuss the implications of the thesis from two different views, which are the theoretical implication and the policy implication respectively.

8.2.1 Theoretical implication

The theory of planned behaviour is an extended form of the theory of reasoned action (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), which argues that individuals make decisions rationally. In comparison, the theory of reasoned action was developed on the

basis of the assumption that it is possible to predict the behaviour of individuals when those individuals are in total voluntary control of their actions (Ajzen & Fishbein, 1980). However, Ajzen (1991) recognised that the model has its constraint in predicting the behaviour that is examined reliably, even when the behaviour is completely within the voluntary control of the individuals. In recognition that the theory of reasoned action has been shown to have limitations (Ajzen, 1985), the perceived behavioural control is then incorporated into the model as a new predictor and consequently, the theory of reasoned action has been renamed as the theory of planned behaviour.

In general, when individuals possess a favourable attitude, supportive subjective norms and a high level of perceived behavioural control, it is reasonable to assume that they will have a stronger intention to engage in the behaviour in question. Finally, individuals are expected to act in accordance with their intentions when given the opportunity, supposing that they have considerable actual control over their actions (Bosnjak et al., 2020). Nevertheless, it is also believed that perceived behavioural control can moderate the effects of attitude and subjective norms on behavioural intentions, although this is possibly less well-known (Ajzen, 1985, 2002). This interaction was hypothesised by Ajzen (1985) and reintroduced by Ajzen (2019), who asserted that perceived behavioural control as a moderating variable can impact attitude and subjective norms, possibly enhancing the effect on intention.

Although the hypothesised moderating effects of perceived behavioural control are conceptually persuasive and theoretically founded, empirical evidence for these effects has been scarce in previous research (La Barbera & Ajzen, 2020a). Hence, in this study, the investigator had the courage to examine the interaction between ATT x PBC and SN x PBC using millennials as respondents. This decision was reached based on suggestions for further study by Bosnjak et al. (2020). It is discovered that the moderating impact for

interactions between ATT x PBC and SN x PBC is significant, with both revealing a negative interaction term in this study. Contrary to what is anticipated, the findings of the moderating interaction term for ATT x PBC contradict those of Hukkelberg et al. (2014), Yzer and van den Putte (2014), Kothe and Mullan (2015), La Barbera and Ajzen (2020a) (case study 1 and 3) and La Barbera and Ajzen (2021), all having revealed a significant effect but with a positive interaction term sign.

Based on the discovery of ATT x PBC, it is reasonable to presume that the difference in interaction term sign (a shift to negative sign rather than positive) may be contributed by the sample group. For instance, in previous studies by Hukkelberg et al. (2014), Yzer and van den Putte (2014), La Barbera and Ajzen (2020a) (case study 1) and La Barbera and Ajzen (2021), all the respondents came from various generations. In addition, the study by Kothe and Mullan (2015) encompassed first-year university students and the study by La Barbera and Ajzen (2020a) (case study 3) included students with age groups ranging from 18 to 24 as their respondents. None of the respondents who participated in either study can be classified as millennials (born between 1981 and 1996). However, in this study, the respondents comprised entirely of millennials, as opposed to the previously mentioned studies, whose respondents wholly comprised of a mix of generational cohorts.

Moreover, the findings on SN x PBC in this study complement the results of La Barbera and Ajzen (2020a) in all the three case studies and La Barbera and Ajzen (2021) demonstrate that subjective norm shows significant effects with negative interaction term sign towards the intention. Also, the findings on SN x PBC in this study contrast with the study done by Yzer and van den Putte (2014), which reported a significant positive interaction term sign. The SN x PBC result with a negative term sign may be attributed to the fact that the dependent variable of this study is considered collectivistic behaviour which is dependent on the actions of others. Similarly, it is also reflected in other

collectivistic behaviour studies, such as La Barbera and Ajzen (2020a) and La Barbera and Ajzen (2021). In contrast, the study that examines individualistic behaviour yields a positive interaction term sign, as demonstrated by Yzer and van den Putte (2014).

In conclusion, the findings from this thesis imply that a particular group sample such as the millennials may influence a change in the interaction term sign for ATT x PBC. Furthermore, the results of this study also corroborate the notion made by La Barbera and Ajzen (2020a) that collectivistic behaviour will most likely result in a negative interaction term sign for SN x PBC. In addition, although the theory expects that control belief moderates the effects of the theory of planned behaviour predictors, the notion that perceived behavioural control moderates attitude and subjective norms on examined intention has not yet attained the status of a formal proposition (Yzer & van den Putte, 2014). Thus, the investigator believes that the findings of this study will contribute to the theoretical implications.

8.2.2 Policy implication

A rigorous investigation of the factors that influence millennials' intention to engage in environmentally responsible disposal practices is carried out in this study. In this study, it is discovered that perceived behavioural control has the most substantial ability to influence the intention of millennials with a significance level of 0.001. Following that, institutional motivations, the indirect influence of green disposal technology via perceived behavioural control and disposal awareness are among the highly significant factors observed to affect millennials' intention to practise green disposal.

Due to the millennials' largest population size, the investigator had decided to focus on them for the current study. According to the Department of Statistics Malaysia

(2020b), millennials account for 26.6% of the total population of Malaysia and 23.7% of the total population of Perak. This study aims to encourage the largest population in the nation to adopt green disposal practices. Since perceived behavioural control has the most significant impact on millennials' intentions, it is recommended that the government and policymakers make an emphasis on making it easier for millennials to participate in green disposal activities by fostering an environment that is more convenient for them to do so.

Currently, there are very few facilities or programmes in Perak that promote and encourage households to engage in environmentally friendly waste disposal activities. It is essential that the government establish more facilities that can recycle waste in public places such as in government offices, shopping malls, schools and many other locations. These facilities should also be located close to residential areas or places where people tend to generate waste so that it is convenient for them to dispose of their waste.

In addition, it is expected that initiatives that encourage separation at the source and reuse by emphasising the convenience factor would motivate households to use the repurposed waste materials to a greater extent. It has been proven by prior empirical researches such as by Arı and Yılmaz (2016), Wan, Shen, and Choi (2017), Oztekin et al. (2017) and Wang et al. (2021) that the element of convenience has a substantial impact on the intention of households to engage in environmentally safe disposal practices. Thus, considering the factor of convenience, the investigator believes that there is potential for millennial households to increase their participation rate in environmentally friendly disposal practices.

Furthermore, it has been shown that institutional motivations significantly influence the intention of millennial households. This study considers two components when examining the institutional motivations: sanctions and community support. It is conceivable to motivate millennial households to participate in activities associated with

green disposal if policymakers could devise a policy that would encourage non-government organisations to become involved in programmes that promote green disposal activities. Meanwhile, formal institutions implement strict enforcement. However, it has been demonstrated that millennials have a positive response to community support and are unaffected by the aspect of formal sanctions in this study.

The findings on institutional motivations are in line with the argument made by Wiedmer (2015), who asserted that millennials are more likely to be community-oriented than self-oriented. In a similar vein, Ogiri et al. (2019) claimed that if households are aware of the possibility of being fined for not carrying out safe disposal practices, then it is likely that they will comply with carrying out these activities, thus stringent enforcement of fines is recommended. As a result, by encouraging relevant government authorities to provide incentives to non-government organisations that promote safe disposal and implementing stringent enforcement, it is possible to attract millennials to engage more in green disposal activities. Also, it is reasonable to adopt the Solid Waste and Public Cleansing Management Act 2007 (Act 672) in Perak, where sanctions and enforcement elements already exist.

Besides, the current study reveals that millennials' intentions are significantly impacted by the green disposal technology's indirect effect, which is transmitted through perceived behavioural control. The reverse vending machine and support from mobile applications are the two components that are used to measure the green disposal technology variable. Hence, it is assumed that the adoption of green disposal technology could have an impact on the convenience level for millennials, which in turn impacts the intention to practise green disposal. For instance, the utilisation of reverse vending machines is anticipated to provide an environment that makes it less of a hassle for millennials to recycle their household waste. As such, if a reverse vending machine is

installed in a location that is easily accessible by millennials, it is expected to enhance the participation rate in green disposal activities.

Moreover, the incentive that may be offered by the reverse vending machine, such as credit points that could be converted to monetary value, would undoubtedly influence the millennials' intentions. It was affirmed by Amini et al. (2014) that monetary rewards have a significant effect on the behaviour of individuals. Given the strong influence that green disposal technology has on perceived behavioural control and the perceived behavioural control's influence toward intention, this could be another option for the government and policymakers to consider when designing a suitable incentive for those implementing this system.

Finally, it is discovered that millennials' awareness of disposal practices has a highly significant influence on their intention. Aside from that, the demographic findings (refer to Table 3-19) suggest that all individuals who participated in this study had at least been exposed to information on waste disposal or challenges associated with solid waste. These results could be translated to mean that the respondents in the current study are all aware of the impact of improper waste disposal on the environment. Nevertheless, despite millennials being aware of the importance of safe disposal, the waste recovery rate in Malaysia, particularly in Perak remains relatively low.

In fact, in the effort to encourage households to engage in environmentally responsible disposal practices, the relevant authorities need to undertake effective communication campaigns that can persuade millennials to participate in green disposal activities. It is also noteworthy that reading material such as newspapers is the most preferred channel for acquiring knowledge on environmental issues. This medium of communication should be expanded to include online platforms, radio and other mediums. Through these

mediums, the ability to disseminate information about green disposal initiatives to a broader group of people will be enhanced.

Therefore, the relevant authorities and policymakers should implement suitable campaigns to raise the knowledge on institutional motivation, the use of green disposal technologies and the effects of improper waste disposal. Through these campaigns, it is hoped that millennials will be encouraged to take a more active role in green disposal activities. Moreover, it is projected that the participation rate of millennials will increase if policymakers consider the implications mentioned above when establishing a practical policy with an emphasis on convenience. Consequently, millennials will indirectly influence the next generation to engage in green disposal activities, as highlighted by Hume (2010). By virtue of the increased participation rate, it is projected that 35.2% (excluding food waste, diapers and other materials) of recoverable wastes (SWCorp, 2019) could be diverted away from Perak's landfills.

8.3 Limitations and Future Research

This study is considerably effective in predicting the factors that could influence the intention of millennial households to engage in green disposal activities. Nevertheless, the study has several limitations that should be noted for future research. First, formal institutions are assessed based on policy implications such as sanctions in this study. Given that the research location is in one of states of Malaysia that has yet to enact Act 672, future research should be done in states that have adopted Act 672 to examine the effectiveness of sanctions on millennials.

Second, in a similar context, the disposal awareness is evaluated based on samples gathered from millennials living in a state that has not yet enacted Act 672, and Act 672

is supposed to disseminate information about the effects of inappropriate disposal of municipal waste as a part of its strategic plan. The investigator proposes that future researches be conducted in states that have implemented Act 672, allowing researchers to validate the awareness level among millennials exposed to information regarding improper waste disposal.

Third, it is evident from this study that subjective norms yield the lowest coefficient value among the theory of planned behaviour predictors in this study. Since the subjective norms are measured based on close social actors (family members, friends and colleagues), the investigator suggests that future research should incorporate other social actors such as neighbours, relatives and individuals perceived as important to millennials.

Fourth, the ATT x PBC interaction result reveals an effect of significant negative interaction term sign in this study. It is assumed that this negative interaction term sign is due to the sample population of this study. As a result, future research should consider examining the interaction of ATT x PBC with other generation cohorts as a sample population.

Finally, this study examines millennials' intention rather than their actual behaviour. Thus, the investigator proposes that future research should focus on millennials' actual green disposal practices. Consequently, with the abovementioned potential future studies, the prospective researchers could bridge the gap of knowledge by understanding: 1) whether the level of disposal awareness changes with exposure to inappropriate disposal-related information; 2) whether any improvement in subjective norms is detected with the inclusion of other social actors; and 3) whether the sample population could influence the direction of perceived behavioural control moderation effect.

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