E-WASTE RECYCLING BEHAVIOR

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(HONOURS)

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BY

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DECLARATION

I hereby declare that:

(1) This undergraduate FYP is the result of my own work and that due acknowledgement has been given in reference to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this FYP has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Sole contribution has been made by me in completing the FYP.

(4) The word count of this research report is 10,798 .

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LIST OF ABBREVIATIONS

Abbreviation	Full Form
TPB	Theory of Planned Behavior
HFT	Habit Formation Theory
UNU	United Nations University
ITU	International Telecommunication Union
ISWA	International Solid Waste Association
PBC	Perceived Behavioral Control
PLS-SEM	Partial Least Squares Structural Equation Modelling
AVE	Average Variance Extracted
FL	Factor Loadings
CR	Composite Reliability
HTMT	Heterotrait-Monotrait Ratio of Correlations
VIF	Variance Inflation Factor
RMSE	Root Mean Square Error
MAE	Mean Absolute Error
LM	Linear Model / Linear Regression Benchmark
CIBC	Confidence Interval Bias-Corrected
R^2	Coefficient of Determination (R-Squared)
f^2	Effect Size
G*Power	(Name of the software for sample size calculation, commonly called “G Power”)

PREFACE

Further developments of technology have resulted in the significantly rising numbers of electronic devices users. This has subsequently caused the increasing amount of e-waste produced by year. Interest has been formed in my mind to conduct a study within the e-waste field to better understand how consumers will deal with the e-waste produced by them. As the spiking trend of e-waste was produced, I was attentive to the possible implications that could be made to counter it.

By adopting to the advice of my supervisor, the scope of the study has been focused on examining the correlation between different contextual and psychological factors, and intention of e-waste recycling that further leads to the forming of actual recycling behavior. Many studies have reviewed on the impact of psychological factors with intention and actual behavior, but only limited numbers of factors are studied while some remains understudied. Therefore, the rationale of this research is to offer a more diverse view of how different intention behavior could affect the result.

I hereby hope that this study could assist in closing the gap in the field of e-waste recycling while encouraging further studies within the topic.

ABSTRACT

E-waste is one of the fastest-growing waste streams worldwide, driven by the increasing numbers of electronic devices users. The proper practice to handle the e-waste is still underperformed by most of the underdeveloped countries and further implications need to be established. Past studies on the e-waste topic have mostly conducted based on the three mains propose of the Theory of Planned Behavior (TPB), while other related psychological and contextual factors remain understudied. This research aims to provide a more diverse insight by incorporating elements from Habit Formation Theory (HFT) to further extend TPB. Variables from TPB (attitude, perceived behavioral control, and subjective norms), and HFT (perceived convenience, and habit) have been employed to examine the intention of e-waste recycling and actual recycling behavior. A survey has been designed and distributed to the targeted population of electronic devices users. Partial least square structural equation modelling (PLS-SEM) was employed to test the interrelation between five factors and the intention of e-waste recycling, and the impact of intention on the actual behavior. Outcome suggests that three of the five constructs were identified as the key indicators of intention, while intention also drives the e-waste recycling behavior. Through the PLSpredict analysis, it reveals that the research model has significant predictive power to support the observed findings. The outcome of this research provides useful insight for policymakers and related parties in developing strategies to counter the rapid rising e-waste production.

Keywords: E-waste, Psychological and Contextual Factors, Theory of Planned Behavior (TPB), Habit Formation Theory (HFT), Recycling Intention, Actual Recycling Behavior, PLS-SEM

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

The chapter gives a broad introduction to the study, beginning with research context, continuing with the knowledge gap of the study that contributes to the establishment of research's objectives and questions, and concludes with the chapter summary.

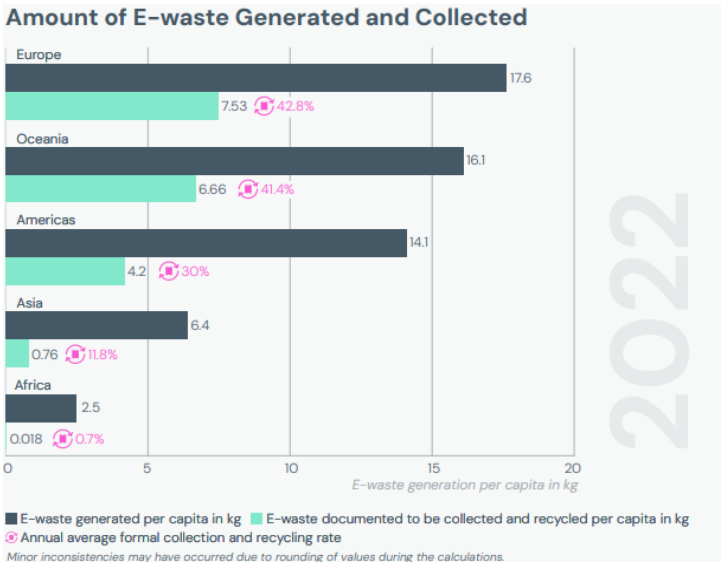
1.1 Research Background

With the spiking demand against electronic devices, production of related products also increased in response to the demand, simultaneously generating more e-waste from both the consumers and producers (Liu et al., 2023). Disposal of e-waste is an unstoppable force that continuously harms nature and human health, due to its toxic metals and acidic chemicals contains (Parvez, 2021). For the sake of reducing the e-waste numbers back, it is essential to learn the consumers behavior on disposing of e-waste. Behavior of consumers on e-waste handling is the ultimate key to execute the current issues, especially for the younger generations that stand the largest consumers portion, as they are the first impacted groups by the current development of new technologies and usage of new electronic devices (Aboelmaged. 2021). E-waste recycling is an important behavior that is impacting the whole process of disposal to either be beneficial or harmful for the environment.

In the year 2022 alone, a total e-waste of 62 million tons was recorded by Balde et al. (2024); this includes 13.8 billion kg gathered and recycled based on environmentally sound practices, 16 billion kg recycled under informal systems by upper-middle-income countries with well-developed management structures for e-waste recycling, 18 billion kg recycled in lower-middle-income countries without the utilization of developed recycling infrastructure, and 14 billion kg

thrown away as regular waste. An additional 32% increase to 82 million tons is projected by the year 2030 (Baldé et al., 2024). The actual quantity of produced e-waste could potentially be more, as not all the e-waste is recorded accordingly for developing countries, namely Africa and Latin America which do not implicate proper e-waste control systems and structures for tracking throughout the disposing process (Schneider et al., 2024; Maes & Preston-Whyte, 2022). As counter to the escalating numbers of disposing e-waste being recorded, the policymakers must take actions on understanding the behavioral intention of consumers on recycling, as the recycling process could generate environmental benefits, provide good remarket value, and decrease demand for raw materials on primary (Neves et al., 2024). A successful development of e-waste control will be essential for understanding and actively motivating the recycling behavior of the consumers as part of it, further underlying the importance of recycling behavior (Echegaray, 2017).

Figure 1.1 Amount of E-waste generated and collected globally in year 2022



Source: Baldé, C. P., Kuehr, R., Yamamoto, T., McDonald, R., D'Angelo, E., Althaf, S., ... & Wagner, M. (2024). The global e-waste monitor. *United Nations University (UNU), International Telecommunication Union (ITU) & International Solid Waste Association (ISWA), Geneva/Bonn*, 1-147.

1.2 Research Problem

Reposition of recycling behavior needs to be done, as the escalating numbers of e-

waste being generated has already been an impactful factor on both health and environment related concerns (Yadav et al., 2022; Garlapati, 2016). Most studies focused on the view of the reasoned behavior emphasizing the intention and planning (e.g. Wang et al., 2018; Kumar, 2019; Vijayan et al., 2023), excluded the view of habit roles on the behavior shaping process, which is backing evidence on e-waste recycling behavior research. As advocated by Gardner et al. (2024), intention is just one of the influences on behavior while under certain circumstances, habits may be more impactful than intention, while in other cases intention could be more impactful. For the cases of recycling behavior, it tends to fluctuate over time and across generations through research on meta-analytic and panel-based (Viscusi et al., 2023; Xia et al., 2023). Joint research on habits and intentions is vital to generate stronger foundation for understanding the recycling matter of e-waste in the changing environment.

The effectiveness of recycling behavior among consumers has remained inconsistent caused by the high volume of produced e-waste. Although consciousness on the environmental risk has been widely spread to the consumers, many consumers still choose to dispose e-waste in an irresponsible manner which is unsafe and illegal (Wang et al., 2021). Despite the growing amounts of research on e-waste management, comprehensive conceptual frameworks that analyze public intention and behavioral determination on e-waste disposal are still lacking. As highlighted by Borthakur and Govind (2018), the increasing studies from various dimensions does not contribute to eliminating the lack of literature offering a 'conceptual framework' for evaluating e-waste-related issues and anticipating potential solutions. This reveals the need for constructing theoretical models that could act as a guide for both research and policy on recycling behavior. Moreover, the psychological factors of consumer’s e-waste recycling intention and behavior are still understudied. Therefore, conducting related studies to help in stopping the growth of e-waste disposing volume remained crucial.

1.3 Research Questions and Objectives

Against research background, research questions and objectives are formulated.

1.3.1 Research Questions

Research questions are created to examine the connections between the exogenous variables (psychological and contextual factors), and the intention of e-waste recycling, that further leads to e-waste recycling behavior.

The following six are the research questions to be handled:

1. Is attitude toward e-waste recycling positively affecting e-waste recycling intention?
2. Are subjective norms of e-waste recycling positively affecting e-waste recycling intention?
3. Is perceived behavioral control of e-waste recycling positively affecting e-waste recycling intention?
4. Is perceived convenience of e-waste recycling positively affecting e-waste recycling intention?
5. Is e-waste recycling habit positively affecting e-waste recycling intention?
6. Is e-waste recycling intention positively affecting e-waste recycling behavior?

1.3.2 Research Objectives

The aim of this research is to test the interrelations linking exogenous and endogenous variables. The main aim consists of discovering how different psychological and contextual factors predict the intention, further impacting the e-waste recycling behavior.

The subsequent six are the research objectives to be achieved:

1. To discover whether there is a positive connection between attitude toward e-waste recycling and e-waste recycling intention.
2. To discover whether there is a positive connection between subjective norms of e-waste recycling and e-waste recycling intention.
3. To discover whether there is a positive connection between perceived behavioral control of e-waste recycling and e-waste recycling intention.
4. To discover whether there is a positive connection between perceived convenience of e-waste recycling and e-waste recycling intention.
5. To discover whether there is a positive connection between habit of e-waste recycling and e-waste recycling intention.
6. To discover whether there is a positive connection between e-waste recycling intention and e-waste recycling behavior.

1.4 Scope of study

According to Simon and Goes (2013), the scope of study helps in identifying the focus of a study and the establishment of boundaries in research, by defining the subject, factors, and limitations. It is a crucial component in a study, as it sets clear limitations and boundaries for research, while also ensures the study is on the right focus so the study's objectives can be attainable, and the findings are appropriate (Simon & Goes, 2013). A study often includes geographical locations in it, because knowing the setting or site helps to explain how likely the study's results can be applicable (Creswell, 2014). Specifically for this study, Malaysia has been located as the ultimate destination of conducting the research. As highlighted by Department of Environment Malaysia (n.d.), total amount of e-waste in Malaysia is forecasted to reach 24.5 million in 2025. The large amount of e-waste disposal highlights the significance of the e-waste issue, rendering this research both timely and essential.

The unit of analysis is also an important element in the scope of study, indicating the entity that is being focused on the study, which could be any individual or bodies (Babbie, 2020). Individuals as the unit of analysis is appropriate for this

study, as each person serves as a unique entity from whom data are gathered and analyzed using instruments such as surveys or interviews (Babbie, 2020). The focused unit of analysis are the individuals who own electronic devices, as they are the key entity where the data on e-waste recycling will be collected and analyzed. Besides, identifying the variables is also an important part in establishing the scope of study, as the variables refer to the key characteristics or value that is being measured (Neuman, 2013). By defining the relevant variables, it could help in determining the conceptual boundaries of the study, while also ensuring the collected data to be accurate and precise (Kumar, 2018). The key variables of this study would be electronic devices and e-waste. According to Butterfield and Szymanski (2018), electronic devices are defined as gadgets that operate with the flow of electrons in semiconductors, vacuum tubes, or circuits. Computers, mobile phones, televisions, and other devices with the use of communication and processing are all classified as electronic devices by Butterfield and Szymanski (2018). Next, as asserted by Balde et al. (2017), e-waste is the rubbish generated when electronic devices that users no longer want or need are disposed of. Improper handling of e-waste could have threat to both the environment and health due to harmful substances that are contained in electronic devices namely heavy metals like cadmium, lead, and mercury (Parvez et al., 2021).

1.5 Research significance

This research studies the connection between the different psychological and contextual factors about e-waste recycling behavior, offering view and suggestions to organizations and government in forming better strategies to overcome the high rising volume of generated e-waste. Although many recycling related studies have been done using Theory of Planned Behavior (TPB), multiple researchers have argued that by including more variables in the framework, TPB could be further enhanced (Mason et al., 2022; Cheung et al., 1999; Macey & Brown, 1983, Terry et al., 1999). Theoretically, this research helps to expand the Theory of Planned Behavior (TPB) (Ajzen, 1991) by having additional constructs

of perceived convenience and e-waste recycling habits, providing more comprehensive understanding on the topic. The additional habitual variables further refine the behavioral model, filling up the crucial gap on the matter of e-waste disposing behavior. Besides, it also provides actionable insight to the policymakers, related organizations, and educators by including the key behavioral factors of e-waste disposal (Borthakur & Govind, 2018). Thus, with the suggested action being taken, it is likely that the increasing e-waste issues could be eliminated.

1.6 Chapter Summary

Chapter 1 includes the introduction on the research topic of the interrelation between the psychological and contextual factors and the intention, and the interrelation between intention and e-waste recycling behavior. The study background states the current environment of e-waste recycling. The problem statement emphasized the gap of knowledge on the connection between psychological and contextual factors and intention, that further impact e-waste recycling behavior. Research questions and objectives were constructed as the direction of the study. Chapter 1 ended with the significance of the research into the current environment.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

The second chapter discusses the underlying theory and the framework, serving as the basis for the study. In the beginning, an explanation is given on how the underlying theory is applied to the research. Next, the endogenous variables, namely e-waste recycling behavior and intention are clarified, followed by the five exogenous variables i.e. attitude toward e-waste recycling, subjective norms of e-waste recycling, perceived behavioral control of e-waste recycling, perceived convenience, and habit of e-waste recycling. Lastly, conceptual framework is formed, while explanation is appended on the constructed hypotheses.

2.1 Underlying Theory

2.1.1 Theory of Planned Behavior (TPB)

Theory of Planned Behavior (TPB) is a prevalent structure for comprehending the immediate factors influencing conduct (Conner, 2020). As a theory that priories the study on human behavior, it interprets the interrelation between psychological and contextual factors, and human behavior. TPB is a theory that is supported by three kinds of reflection which include: the expectations of outcome caused by behavior (behavioral beliefs), the individual's expectations of social pressure on a behavior (normative beliefs), and the existence of elements that may enhance or hinder a behavior (Bosnjak et al., 2020). The key goal of TPB is to test the intention of an individual in performing a behavior, and how much effort the individual spends on performing the behavior (Du & Pan, 2021; Ajzen, 1991). Behavioral intention to perform in TPB is known as, when the intention is stronger, it is more likely that the behavior will be performed by an individual. Ajzen & Schmidt (2020) attested that indirect factors such as unexpected events

could possibly act as a prevention from having an intention.

Since TPB has been developed over decades, it has been used commonly to study the elements underlying multiple pro-environmental behaviors, which also include e-waste recycling related behavior (Yuriev et al., 2020; Echegaray & Hansstein, 2017). To enhance classical TPB implementation in some newer topic, various research has added variables to the theory, improving its analytical ability (Si et al., 2020; Ding et al., 2018).

2.1.2 Habit Formation Theory (HFT)

Habit is a fundamental phase to understand the forming of a behavior, especially in physiological and observational view that habit is an automatic and repeated action that are crucial for the surviving and learning of living creatures (James, 1890). Many studies have identified habit formation as one of the key components contributing to the behavioral change of an individual (Keller et al., 2021; Kwasnicka et al., 2019; Kwasnicka et al., 2016). The formation of habit is frequently first driven by the intentional decision of an individual on achieving specific objective (Linder et al., 2022; Wood & Rünger, 2016). For instance, an individual may often decide to recycle old or unwanted electronic devices, which over time can lead to the formation of habitual behavior. Nevertheless, habits could also be formed through the unintentional moves of an individual (Linder et al., 2022). For example, a person might leave the old or unwanted electronic devices at the nearby recycling collection point simply out of convenience, and over time, it could lead to the forming of recycling habits with repeated unintentional behavior.

Recent definitions characterize habit as the overall mechanism by which cuing these associations produces action impulses (Gardner et al., 2023; Gardner, 2015), or as an acquired cue-response connection that, upon cue exposure, automatically triggers non-conscious impulses to act (Gardner et al.,2023; Fleetwood, 2019). Although people can get into a habit with repetition of behavior, the habit could

still possibly be reverted to the old one through times and environments (Mazar et al., 2021). Guidance in this situation is crucial to maintaining habitual behavior.

2.2 Review of Variables

2.2.1 Endogenous Variable: E-waste Recycling Behavior

As attested by Koshta et al. (2022), it is crucial for stakeholders to share equal responsibility on e-waste management to form an eco-efficient economy and green society. For achieving the objective, the analyzing of individual's behavior on e-waste recycling is a must. An individual's actual and forecasted recycling behavior and intention could be used for the prediction of e-waste recycling (Vijayan et al., 2023; Aboelmaged, 2021), enabling policymakers and parties in responsible, to act on recycling engagement if needed. Thus, in-depth study on the topic is crucial to gain ultimate benefit from the outcome of environment and human beings.

Many studies have been conducted to learn the connection between e-waste recycling behavior with different psychological and contextual factors (Thurkal et al., 2023; Kumar, 2019; Wang et al., 2016). Study by Wang et al. (2016) revealed that elements including attitude towards recycling, environmental awareness, etc., have given significant impact towards e-waste recycling behavior and its intention. It is testified that strengthen on these factors could positively enhance the e-waste recycling behavior (Wang et al., 2016). Kumar (2019) confirmed that psychological factors including perceived control, individual responsibility, and subjective norm are the main driver of recycling behavior, which have a significant correlation. As examined by Thurkal (2023), there are critical elements influencing consumer intention for e-waste recycling, namely knowledge and abilities related to the behavior, habitual practices, convenience, cost, and environmental limits.

As for this study, it aims to learn e-waste recycling behavior by reviewing effect by psychological and contextual factors on it. The factors within the field have been proven that they have the ability on impacting recycling behavior significantly. This study will further review on the topic, including factors namely attitude toward e-waste recycling, subjective norms of e-waste recycling, perceived behavioral control, perceived convenience, and habit of e-waste recycling.

2.2.2 Exogenous Variable: Attitude Towards E-waste Recycling

According to Wang et al. (2019), an assessment of the acceptance or rejection of an individual's behavior is referred as attitude, encompassing emotional components (how one feels about a specific behavior) and cognitive factors (understanding). Additionally, attitude concentrates on emotions and ethical obligation of individual themselves towards an issue. Construct regarding e-waste recycling's attitude could be explained to the degree which a person perceives that their understanding of e-waste recycling will influence their readiness to participate in it (Kochan et al., 2016; Kelly et al., 2006).

Dhir et al. (2021) suggested that benefits on personal and environmental well-being could engage people to lay towards the e-waste recycling related attitudes. Through their study, they have found that the benefits are positively connected to the pro-environmental attitudes. Therefore, increasing the environmental benefits acknowledgment could be the key to enhancing recycling attitudes. Kochan et al. (2016) have pointed out that positive attitudes towards e-waste recycling do not directly influence the behavior, it could be caused by the limitation of resources and knowledge. Yadav et al. (2022) attested that constraints on the environment will act as an indirect influence reflecting one's attitude, secondarily affecting e-waste behavior shaping. Besides, attitudes towards e-waste recycling are also closely connected to the amount of recycling knowledge that the individual has, and how much the individual cares on the issues (Jabbour et al., 2023). Individuals that care less could choose to ignore the known information, which results in

negative impacts on attitudes of e-waste recycling. Individuals that agree on the e-waste recycling responsibility and involvement, will have more active recycling attitudes (Wang et al., 2016).

2.2.3 Exogenous Variable: Subjective Norms of E-waste Recycling

Subjective norms suggest that opinions, thoughts, influences, and pressures caused by an individual's social circle may be either beneficial or harmful (Ajzen, 1991). It can be categorized into injunctive norms (behavior perceived by individuals) and descriptive norms (the acknowledgement of a particular behavior by an individual), each possessing an independent prediction capacity about individual behavioral intentions (Xu et al., 2022). Subjective norms are proposed to be more impactful in collectivist cultures than the individualistic cultures (Triandis, 1996), where collectivist cultures have more acknowledgment on social pressure performing a behavior. Kumar (2019) has further elaborated that country that practices strong collectivist cultures namely China, has more intention in e-waste recycling, resulted by the high conscious of social pressures on behavior.

Studies have been conducted to test the correlation between subjective norms with the recycling behavior (Suryanto et al., 2023; Aboelmaged, 2021; Kumar, 2019). Study by Suryanto et al. (2023) has proven that subjective norms and behavior of e-waste recycling have a significant relationship through their research on 219 respondents. Kumar (2019) has examined similar results for subjective norms and e-waste recycling behavior that also has significant connection in between. However, study by Aboelmaged (2021) has tested that subjective norms have a high p-value (0.724), which does not provide enough evidence to show that it has significant influence on e-waste recycling behavior. The diversification of results can be explained by Schultz's (2014) suggestion that social norms catalyze green and sustainable behaviors "in certain circumstances, for specific actions, and for particular individuals," influenced by broader macro-level dynamics such as socioeconomic considerations that affect individual interactions with social norm stimuli.

2.2.4 Exogenous Variable: Perceived Behavioral Control of E-waste Recycling Behavior

Perceived behavioral control represents the extent to which a customer can control and execute a desired behavior. (Sultan et al., 2020; Grimmer & Miles, 2017; Kidwell & Jewell, 2003; Ajzen, 2002). Studies show that high perceived behavioral control (PBC) could result in high likeliness to conduct a behavior, while low PBC leads to low intention to behave on the behavior (Sultan et al., 2020; Kiriakidis, 2015; Ajzen, 2002). Individuals who feel to have higher perceived control are more likely to act in the best interest of environmental management (Latip, 2018). With the supporting study, Vijayan et al. (2023) conclude hypothesis of PBC having positive connection with e-waste recycling intention.

Studies by Rusell et al. (2017), Ertz et al. (2016), and Webb et al. (2013) have identified perceived behavioral control as a strong indicator for behavioral control. Kumar (2019) has also evaluated significant impact of PBC, specifically on behavioral intention of e-waste recycling. Although major studies have provided results in positive relationships, Aboelmaged (2021) examined that it is insignificant between the PBC and e-waste recycling behavior. Earlier study by Zhang et al. (2019) also tested insignificant results for behavioral control affecting household waste management. Both studies have started with a positive hypothesis supported by previous studies but end out with the opposite result. Aboelmaged (2021) explained that the unexpected result could possible being caused by the lack of awareness of public on e-waste recycling. Zhang et al. (2019) further elaborated that the potential reason for different results is possibly in connection with publics not having internalized reported challenges or abilities related to waste sorting as troublesome, which is likely to impede their behavioral objectives.

2.2.5 Exogenous Variable: Perceived Convenience of E-waste Recycling

Perceived convenience for waste management behavior is the degree of convenience that individuals anticipate while making decisions for waste management (Cheng et al., 2022; Venkatesh & Davis, 2000). E-waste recycling behavior is likely to be influenced by perceived convenience. It could be defined as the time needed and the ease of individuals to recycle e-waste (Gonul et al., 2016; Tonglet et al, 2004). Many previous works have identified that perceived convenience has strong influences towards recycling activities and proper disposal practices (Vijaya et al., 2023; Khan et al., 2019). It is to be believe that if there are more convenient access being given to the individuals, the individuals' intention on performing the e-waste recycling behavior will be enhanced (Vijayan et al., 2023; Wanger, 2011).

Studies that have been conducted within Malaysia context have shown significant relationship between e-waste recycling behavior and perceived convenience (Naqvi & Farooq, 2024; Shaharudin et al., 2023). Shaharudin (2023) has confirmed that perceived convenience directly impacts e-waste intention, but since the result is collected from small sample of 110 youth from Putrajaya, Malaysia, the result may not apply to the rest of the population. Study by Kumar (2019) has rejected the hypothesis of convenience having positive connection with e-waste recycling intention, resulting in insignificant correlation. Simamora (2021) has further confirm on the insignificant of the convenience towards e-waste recycling behavior. Simamora (2021) explained that the failure on convenience affecting behavioral intention may be resulted from the limitation of transportation, lack of the will of disposing e-waste, time restriction, and lack of knowledge to perform the e-waste recycling activities.

2.2.6 Exogenous Variable: Habit of E-waste Recycling

Habit refers to the automatic action performed by an individual, triggered by environment or repeated behavior, without the involvement of conscious goals

and intention (Robbins & Costa, 2017). Once a specific habit is being formed, recognition of the contextual cues will automatically deliver the response to the mind, and the responses will be further carried out and performed by the individual repeatedly (Wood, & Rünger, 2016). Gardner et al. (2020) explained that under certain circumstances, habit could takeover intention, directly lead to the final behavior without the need of conscious intention. For instance, when a worker repeatedly takes the same route every day, the contextual cues will be embedded in the worker's mind. In result the worker will automatically repeat the action, taking the same route even though other faster routes are made available. Studies also suggest that if an individual has a routine recycling habit, it could also enhance other forms of recycling which includes e-waste recycling (Sabbir, 2023; Welfens et al., 2016).

Few recent conducted studies have reviewed the connection between habit and e-waste recycling behavior (Vijayan et al., 2023; Sabbir et al., 2023; Aboelmaged, 2021). Study confirmed that there is a significant correlation between habit as an exogenous variable and recycling behavior as the endogenous variable (Vijayan et al., 2023). Therefore, the authors recommended that the related agencies and official bodies must educate the people in adopting recycling habits. Sabbir et al. (2023) have identified habit as the significant indirect forecaster of e-waste recycling behavior through intentions. Research by Aboelmaged (2021) has further confirmed habit as the strong predictor of behavior related to e-waste recycling. The significance of habits towards intention and behavior also applies to other study settings such as food waste (Riverso et al., 2017) and mobile healthcare application (Utomo et al., 2021).

2.2.7 Endogenous Variable: Intention of E-waste Recycling

Intention is known as the readiness of a person to perform a specific behavior (Mafabi et al., 2017). It is widely identified as a strong variable impacting behavior in behavioral theories namely Reasoned Action Approach (RAA) and Theory of Planned Behavior (TPB), serving as the immediate predictor of

behavior (Conner & Norman, 2022; Fishbein & Ajzen, 2011). Theory of Planned Behavior (TPB) explained that intention is the key determinants of one's behavior, while being influenced by three main components which include subjective norms, attitude, and perceived behavioral control (Ajzen, 1991). More recent paper by Ajzen (2020) has explained that solid intention could only be achieved with strong perceived control over behavior.

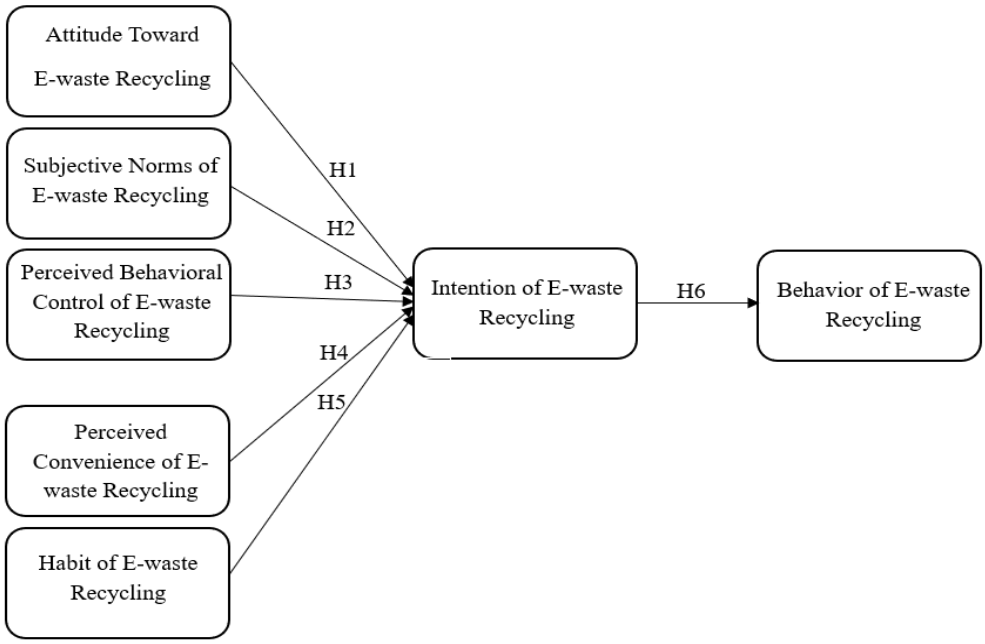
As Ajzen (1991) asserted, intention could bridge between the determinants of intention and the actual behavior. Accordingly, many studies have adopted intentions as the endogenous variable linking intention determinants to actual behavior. (Vijayan et al., 2023; Nassar et al., 2019; Echegaray & Hansstein). Under context of ICT adoption, Nassar et al. (2017) has tested valid predicting effects of behavioral intention on ICT adoption. Echegaray & Hansstein (2017) has conducted study on the e-waste recycling setting and tested similar result of intention significantly influenced by intention predictors of TPB (subjective norm, attitude, and perceived behavioral), but it failed to be predicted by additional variable such as income. Vijayan et al. (2023) have further confirmed intention is strongly impacted by intention determinants, which further forming the actual recycling behavior. Their model has given a result of 94.8% variance in intention and 85% in behavior, supporting role of intention in bridging the determinants and behaviors.

2.3 Proposed Conceptual Framework

A conceptual framework is being developed to study the interrelations between psychological and contextual factors, and the e-waste recycling intention, also the correlation between e-waste recycling behavior and intention. It includes five exogenous variables, which are subjective norms of e-waste recycling, e-waste recycling attitude, perceived behavioral control on e-waste recycling, perceived convenience of e-waste recycling, and habit of e-waste recycling. E-waste recycling intention serves as the endogenous variable for the five intention determinants, while also act as exogenous variable influencing behavior of e-

waste recycling.

Figure 2.1: Conceptual Framework of the Research



Source: Developed for this research.

As stated in figure 2.1, the conceptual framework illustrates the relationship between the five different psychological and contextual factors, and e-waste recycling intention. The framework frames the connection between e-waste recycling intention and behavior. Theory of Planned Behavior (TPB) supported the construction of the framework, while Habit Formation Theory (HFT) extended the framework with additional exogenous variables (Perceived Convenience & Habit), examining e-waste recycling behavior.

2.4 Hypotheses Development

Hypotheses that are constructed to study the relationship between the variables are as follows:

2.4.1 Attitude Toward E-waste Recycling and Intention of E-waste Recycling

Koshta et al. (2022) reviewed that positive e-waste recycling attitude could enhance the intention of people to perform recycling. They explained that the finding is because of the respondents having favorable e-waste recycling attitude, while believing the benefits of recycling. Findings by Dhir et al. (2021) suggested that individual's increased intention on e-waste recycling is likely associated with positive attitude of individual on e-waste recycling. Zhang et al. (2021) examined that recycling attitude is considered the strongest predictors for consumer's intention to take part in formal recycling activities. Their study revealed a high degree of favorability toward e-waste recycling among individuals. The results could be supported with studies by Kumar (2019) and Sahu et al. (2020), defining attitude as the evaluation of the positive or negative effect of the behavior being performed. For instance, in the case of positive attitude, outcome of strong engagement on the intention is expected, while on the opposite side, negative attitude will lead to a non-engagement of the intention (Zhang et al., 2021). Thus, following hypothesis is proposed:

H1: There is a positive relationship between Attitude toward E-waste recycling and E-waste recycling Intention.

2.4.2 Subjective norms of E-waste Recycling and Intention of E-waste Recycling

Recent study has discovered that subjective norms indicated the strongest impact on the reverse exchange intention of e-waste recycling (Sabbir et al., 2023). They asserted that influences of behavior by family members and friends could alter the intention of and individual towards the reverse exchange of e-waste recycling. Another study has also tested subjective norms having significant and positive impact on recycling intention (Haj-Salem et al., 2021). They explained that recycling intention of individuals with strong subjective norms are more likely to be affected by the public. Vijayan et al. (2023) revealed that shaping of one's

recycling behavior could be hardly influenced by subjective norms. The result is further supported by Ananno et al. (2021), asserting that individual's intention to pay for recycling is positively connected with the subjective norms. Previous studies have mentioned that more stringent subjective norm will result in increased recycling intentions (Ananno et al., 2021; Wang et al., 2018). Thus, subsequent hypothesis is established:

H2: There is positive relationship between Subjective norms of E-waste recycling and E-waste recycling Intention.

2.4.3 Perceived Behavioral Control of E-waste Recycling and Intention E-waste Recycling

Perceived behavioral control (PBC) could be defined as the individual's thought in one's ability to fulfill a specific duty, and the sense of difficulty in performing the behavior (Bhutto et al., 2023; Borthakur & Govind, 2018; Britt & Englebert, 2018; Ajzen, 1991). In waste management, PBC mostly hinges on the ease and convenience with which individuals may sort their garbage and direct it through appropriate channels for safe disposal (Ofori & Mensah., 2022; Kumar, 2019). According to Simamora et al. (2021), they asserted that PBC has positive influences on intention and behavior. They explained that as the perceived control increases, the intention of performing the task also rises, assumed they are being motivated by the task. The finding aligns with study by Chang et al. (2022), confirmed that PBC affects intention of recycling directly. The authors found that people with greater conviction in their capacity to regulate recycling behavior will have higher possibility to demonstrate an increase in intention to recycle. Recent findings by Verma et al. (2025) also attested perceived behavioral control as a strong indicator of e-waste recycling intention. They suggested that individuals with well-supported factors on their recycling abilities (ease of collection facilities & knowledge in recycling), are more engaged in recycling applications. Thus, the hypothesis is being conducted:

H3: There is positive relationship between Perceived Behavioral Control of E-waste recycling and E-waste recycling Intention.

2.4.4 Perceived Convenience of E-waste Recycling and Intention E-waste Recycling

Puzzo and Prati (2025) have discovered that the convenience on performing the recycling task (ease of collection point) positively influenced the individual's intention on performing the e-waste recycling behavior. Zhang et al. (2019) asserted that perceived convenience is a positive indicator for resident's intention in e-waste recycling. Authors have suggested that online e-waste recycling offers conveniency for the residents, it will further lead to the increase of residents' intention towards e-waste recycling. Based on Naqvi and Farooq (2024), appropriate timing, adequate storage capacity, and the placement of recycle center are critical factors influencing the perceived convenience that enhance the intention of individuals to recycle e-waste. Accordingly, it leads to the result of perceived convenience as one of the key factors that positively impacting recycling behavior in their study. Vijayan et al. (2023) also examined significant results for the ease of recycling in engaging the recycling intention, further supporting the strong influences of perceived convenience as an impactful exogenous variable. Therefore, the following hypothesis is being formulated:

H4: There is positive relationship between Perceived Convenience of E-waste recycling and E-waste recycling Intention.

2.4.5 Habit of E-waste Recycling and Intention E-waste Recycling

As highlighted by Nawaz et al. (2025), they have discovered a positive connection between habit and e-waste recycling intention. In their research, vital role of habit in influencing recycling intentions has been identified. The finding is further supported by study of Sabbir et al. (2023), which also examined positive

correlation between recycling habits and the intention to perform reverse exchange of e-waste recycling. Empirical studies being conducted on household's intention to engage in waste recycling (Liu & Yang, 2022) and electricity-saving (Wang et al., 2019) have also demonstrated positive connection between habit and respective behavioral intention. Another study further reviewed that the pro-environmental is strongly influenced by the habit (Gkargkavouzi et al., 2019). Yeow and Loo (2022) suggested the person who often donates outdated or outmoded computers will act consistently with this practice and participate in waste recycling. Aboelmaged (2021) further elaborated that habit could play the role of cognitive reminder for individuals. He suggested that habits could remind and guide individuals towards their intended behavior or action. Therefore, the subsequent hypothesis is suggested:

H5: There is positive relationship between Habit of E-waste recycling and E-waste recycling Intention.

2.4.6 E-waste Recycling Intention and E-waste Recycling Behavior

Several research have confirmed a significant impact of intention on recycling behavior of e-waste. Suryanto et al. (2023) reviewed that individuals' recycling intention significantly influences their e-waste recycling behavior. Michael et al. (2024) asserted that intention has positive connection with behavior of recycling e-waste, supported by survey evidence from 415 respondents. In research by Chengqin et al. (2024), intention has been found to have strong impact on the actual practices of recycling. Additionally, the research that have been conducted in India by Vijayan et al. (2023) have examined profound effect between e-waste recycling behavior and intention, providing evidence based on developing country's perspective. For instance, if the individual's intention is significant, the intended behavior of him or her is also more likely to be performed (Wang et al., 2023), which indicates the strong positive correlation between intention and behavior. Having a strong intention also helps to better predict the individual's behavior, which is necessary to understand why an individual performed the

behavior in the first place (Conner & Norman, 2022). Hence, the following hypothesis is being created:

H6: There is positive relationship between E-waste recycling intention and E-waste recycling behavior

2.5 Chapter Summary

Chapter 2 starts with reviewing the underpinning theories that guided this study, and the variables understudied. It then presents the proposed framework as a foundation to examine the connections between five determinants of behavioral intention and actual intention of e-waste recycling. After that, hypotheses were developed for testing in the sections that followed.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter discusses the research strategy used to achieve the stated research goal. The research design and sample strategy applied in this study are first delineated, followed by the data collection technique. Lastly, the instrument used in the study and the planned analysis method are explained.

3.1 Research Design

Good research design should be flexible so it can accommodate view on problem from different aspects, given that goal of the research is clear (Mishra & Alok, 2022). A quantitative approach is being conducted to study the correlation between the intention determinants and the actual e-waste recycling intention, which further leads to the formation of behavior on e-waste recycling. The approach helps in examines objective theories by testing the connection between variables (Creswell & Cresswell, 2018). As asserted by Johnson and Christensen (2024), quantitative researchers will formulate hypotheses and empirically test them to determine if they are supported. It is an appropriate approach for this research, since the defined variables can be quantified by measurement items, facilitating the objective examination of numerical data using statistical methods. Consequently, the correlation between the exogenous variables (five intention determinants of recycling intention), and the endogenous variables (e-waste recycling intention & e-waste recycling behavior).

Next, causal research is employed for this research to test the correlation linking contextual and psychological factors, e-waste recycling intention, and e-waste recycling behavior. It is appropriate for this study as it enables the testing of cause-and-effect connections between the variables through empirical data analysis (Clark et al., 2021; Bryman, 2016). As asserted by Decarlo (2018), causal

research, or explanatory investigation, ascertains the reasons behind the behavior of specific occurrences. Causal research advances further by establishing cause-and-effects which aim to examine how changes in one variable impact another (Remler & Ryzin, 2021). This study includes five contextual and psychological factors as the causes, while having the e-waste recycling intention as the effect. The effect on intention will further lead to the impact on recycling behavior of e-waste.

3.2 Sampling Design

3.2.1 Target Population

Denscombe (2017) suggested that studies should target population that is relevant to the topic, to avoid responses that are not appropriate to the matter. Accurate sampling could also help with better response rate, as the respondents are more relevant to the topic and more likely to give responses (Denscombe, 2017). The targeted audience should also have proper knowledge and view, so they can provide useful insights for the study (Hancock et al., 2021). This research has targeted active users and consumers of electronic devices as the main research audience. The people in the targeted population who meet the qualifying requirements are chosen as the target audience for the quantitative research. According to Lohr (2021), volunteer-based surveys are known as self-selected samples, where people choose to join the sample themselves. Statistics sometimes mislead the actual answer to a question, which makes it unsuitable for generalizing results to a broader population (Lohr, 2021). Thus, this study includes only the users who use electronic devices and those who have dealt with e-waste disposal, to ensure the statistics of the survey to be as relevant as possible.

3.2.2 Sampling Frame, Sampling Technique & Sample Size

Sampling frame is the more specific version of population, whereas it includes portion of sample units from the overall population (Rahman et al., 2022). Acharya et al., (2013) highlighted that the success of probability sampling is dependent on the sampling frame. If it is not properly constructed, the random sampling may fail in addressing the research problem. As recorded in 2024, there are approximately 5.5 billion people online with their electronic devices (International Telecommunication Union, 2024). The sampling frame of this study consists of individuals within the existing online population who are actively using electronic devices that will generate e-waste due to their device usage.

Non-probability sampling would be adopted in the sampling process of this study. According to Stratton (2021), non-probability sampling could be defined as a method which researchers will intentionally choose the relevant participants from a targeted sample, rather than allowing the population to self-select into the study. As asserted by Hair et al. (2021), power analysis offers a more dependable estimation of minimum sample size in comparison with the 10-times rule method for the minimum required sample size in PLS-SEM. The author suggested that researchers should employ the inverse square root approach, as it offers better precision and simplicity in use. According to Kline (2023), the suggested median sample size is approximately 200 with supporting reviews and studies in various fields (Kline, 2023; Shah & Goldstein, 2006; MacCallum & Austin, 2000). By using G*Power analysis tool, with five predictors, a minimum sample size of 92 is required for this study, calculated with an effect size of 0.15, an alpha value of 95%, and a probability of 0.80.

3.3 Data Collection Methods

3.3.1 Primary Data

One of the most important phases of research is data collection. It plays an important role in minimizing the potential errors that occur during the study and

ensures the overall quality of the result (Taherdoost, 2021). Thus, more effort and time should be spent on the data collection process, as it helps in gaining relevant data to avoid inaccuracy in the findings (Taherdoost, 2021; Kabir, 2016). The primary data is gathered using a questionnaire including a series of questions answered by respondents from a designated population. (Mazhar et al., 2021). According to Aithal and Aithal (2020), quantitative research in the field of social science, business management, and medical research widely adopts questionnaires as the main method to collect quantitative data from consumers, customers, and patients respectively. Moreover, a well-designed online survey may yield results that are comparable to those collected using traditional paper-based survey, while also offers benefits such as shorter data collection and distribution time, and lower cost (Regmi et al., 2016). Therefore, data will be collected using online surveys to study the interrelationship between different psychological factors, and the e-waste recycling intention, while further leads to the forming of recycling behavior on e-waste. The results collected through the questionnaire could be used for further analysis and to better understand the topic.

3.3.2 Research Instrument

An online based survey will be designed and implemented by using Google Forms as the platform. To ensure the relevance of the survey outcome, a filtering process will be implemented during distribution process to include only respondents that have experience with e-waste disposal, while excluding those who are not relevant. The survey consists of 3 separate sections. Based on the moral principles, the survey will ensure that the respondents understand the objective of research, and the risk and benefits alongside. Data privacy consent will be obtained to ensure the respondents' voluntary participation and to allow access to their provided information. Respondents will be informed on the intention of the survey and the assurance on their personal information that will be only used within the scope of study. There will be no risk associated with the responses, while the data collected will be kept confidentially. The responses will only be collected after the participants have been fully informed on the purpose of the

questionnaire. Subsequently, the respondents will start filling in the first section of the survey which is the demographic section. Questions will be asked about the age group, highest education level, gender, and income level. Demographic questions are essential in research, as they could significantly influence the research findings by revealing variations in attitudes and perception across the demographic groups (Kumar, 2018). Next, descriptive questions will be asked on electronic devices about reason to dispose, types of devices owner, numbers of devices owned, and ways of disposing. Descriptive questions could help in answering simple but important questions in a study, such as "Who, What, Why, When, Where, How, How Much" (Vetter, 2017). The last section consists of the questions established on exogenous and endogenous variables. Seven-point Likert scale is being used in this study. According to Joshi (2015), a seven-point Likert scale is more sensitive, less likely to cause forced-choice bias, and works better with how people think, which makes survey results more legitimate and reliable overall. The complete list of questions is in Appendix A.

3.3.3 Measurement of Scale

Scale of measurement is a fundamental concept used in research to categorize variables based on their level of classification and to determine the proper mathematical operations that can be applied to them (Vogt et al., 2012; Kervin, 1992). Original theory of measurement scales by Steven (1946) identified that there are four levels of measurement which include: nominal, ordinal, interval, and ratio.

3.3.3.1 Nominal Scale

According to Steven (1946), nominal measurement is the most basic level of measurement, where variables are being classified into categories that are labelled without numerical meanings. Names are commonly used for the label of categories, without specific order or numerical value (Babbie, 2020; Trochim et al., 2016). In this study, demographic questions such as education level and

gender, will be measured using nominal scale, along with the descriptive questions regarding the reason of disposing e-waste, types of electronic devices owned, and the method of disposing e-waste.

3.3.3.2 Ordinal Scale

Ordinal scale is the second level of measurement, which ranks categories in a specific order (Steven, 1946). Besides, the intervals between categories cannot be measured and assumed to be equal (Trochim et al., 2016; Gravetter et al., 2009). Demographic questions including age and income level are being measured on ordinal scale. Besides, descriptive questions regarding the numbers of electronic devices owned, along with other questions designed using seven-point Likert scale, will also be measured as ordinal data.

3.4 Proposed Data Analysis Tool

3.4.1 Partial Least Squares Structural Equation Modelling (PLS-SEM)

Partial Least Squares Structural Equation Modelling (PLS-SEM) is being used in this study to analyze the collected data by running the Smart PLS software. Smart PLS is an appropriate tool to be used for this study, because it is one of the most advanced and up-to date software for performing PLS-SEM analyses (Sarstedt et al., 2021; Sarstedt & Cheah, 2019). The software enables researchers to determine the statistical relationship between variables through the estimation of both measurement and structural models in PLS-SEM (Hair et al., 2014). Within the context of social science research, Smart PLS is widely accepted as a prevalent instrument for executing PLS-SEM, because of its advanced analytical capabilities to manage complex intricate model estimations (Sarstedt & Liu, 2024). PLS-SEM has also been chosen because it is conceptually established as a causal-predictive method that enables the testing of causal relationships and prediction (Shmueli et al., 2019). This lines up with the present research's goal to explore the

interrelations between the psychological factors and the e-waste recycling intention, in addition to the subsequent effect on the actual recycling behavior. Moreover, PLS-SEM is adept for assessing intricate models with several concurrent relationships (Hair et al., 2024), as demonstrated in the present study, which includes five direct and one indirect hypothesis. Richter et al. (2020) reviewed that the combined use of instruments enhances the understanding of complex models by testing the sufficiency logic for an outcome to occur.

To enhance the PLS-SEM analysis's validity and reliability, two essential phases are involved: measurement model evaluation and structural model assessment (Hair et al., 2022). Assessing the measurement model helps to better prove the constructs' validity by applying threshold for composite reliability (CR), factor loadings (FL), and average variance extracted (AVE). The recommended threshold values are 0.708, 0.700, and 0.5, (Hair et al., 2019). Heterotrait-monotrait (HTMT) ratio of correlations is vital for the process as it verifies the discriminant validity by measuring whether the variables are conceptually distinct from one another (Henseler et al., 2015). According to Henseler et al. (2015), HTMT value below the threshold of 0.90 is generally accepted, especially for situation where the variables are conceptually similar, indicating that the constructs are sufficiently distinct. After confirming the reliability of the measurement model, the next stage is to access the structural model by first determining the collinearity using Variance Inflation Factors (VIF). A VIF value below 5.0 indicates that the collinearity is not a threat in the structural model (Hair et al., 2019). The evaluation of structural model requires 10,000 resamples using the bootstrapping method to test the significance of path coefficient by providing confidence interval bias-corrected (CIBC), t-values, and p-values (Becker et al., 2023). In two-tailed test, t-value greater than 1.96 and p-value lower than 0.05 indicates significance inter-construct relationship at 5% level (Hair et al., 2019). While for one tailed test, t-value above 1.645 is critical for 5% significance (Hair et al., 2019).

Other indicators such as f^2, and PLS predict are being used to test the predictive power of the model, while R^2 is used to reflect the model's explanatory power. According to Hair et al. (2022), R^2 values represent the proportion of variance

explained in endogenous latent variables, and can be interpreted as substantial (0.75), moderate (0.50), or weak (0.25). f^2 are used to measure the effect size of an exogenous variable on an endogenous variable through accessing the include or exclude of predictors in R^2 (Hair et al., 2022). Cohen (1988) has set the criterion for small, medium, and large effects with F^2 values of 0.02, 0.15, 0.35 accordingly. Lastly, PLS predict was adopted to test the model's predictive power instead of the traditional Q^2 metric. As suggested by Shmueli et al. (2019), PLS predict is a more appropriate instrument to access the predictive capability of the model, as it examines both in-sample and out-of-sample for a more detailed assessment. Prediction errors such as root mean square error (RMSE) and mean absolute error (MAE) will be calculated for each endogenous variable and compared to the linear regression (LM) benchmark (Shmueli et al., 2019). As recommended by Shmueli et al. (2019), if the prediction errors are lower in the PLS-SEM model compared to the LM benchmark, it indicates that the model has an adequate predictive power.

3.5 Chapter Summary

In summary, chapter 3 discusses research and sampling design, method of collecting data, and the proposed tool for data analysis. This research employs causal analysis to examine the relationships of cause and effect between different psychological and contextual factors, and e-waste recycling intention that further impacts on the actual recycling behavior. A convenience sampling technique is being utilized in the distribution of questionnaires. The information collected from the online survey will be further analyzed through Smart PLS.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter assesses the relevant results that correspond to the research questions and hypotheses constructed. First, descriptive analysis is provided according to the demographic information gathered from the respondents through the online questionnaire, interpreted in the form of frequency and percentage. Smart PLS software was used as a statistical analysis tool to examine the mean, median, standard deviation, kurtosis and skewness of the variables apart from the inferential analysis. Further discussion was done on the reliability, validity, significance, variance inflation factors (VIF), R^2, f^2, and PLSpredict.

4.1 Descriptive Analysis

A total of 205 responses were collected in this research, surpassing the minimum requirement of 200 responses suggested by Kline (2023) and 92 responses that were calculated using the G*Power analysis tool for this study. The exceeding numbers of responses indicate that the findings are reliable and valid. Descriptive analysis outlines the demographic background of the sample and provides overview of the proposed variables. Demographic data are being illustrated in the form of frequency and percentage to give a more detailed view on the demographic background of the sample. The core tendencies and dispersion of the main variable were highlighted using the descriptive statistics like means and standard deviations, serving as the foundation for further inferential analysis.

4.1.1 The Demographic Information of Respondents

Demographic data of the respondents are collected and analyzed for better understanding of the sample's characteristics. The demographic information consists of age group, education level, gender, income level, and relevant descriptive data to better support and explain the demographic backgrounds of the sample. All the demographic information will be analyzed in the form of frequency and frequency percentage.

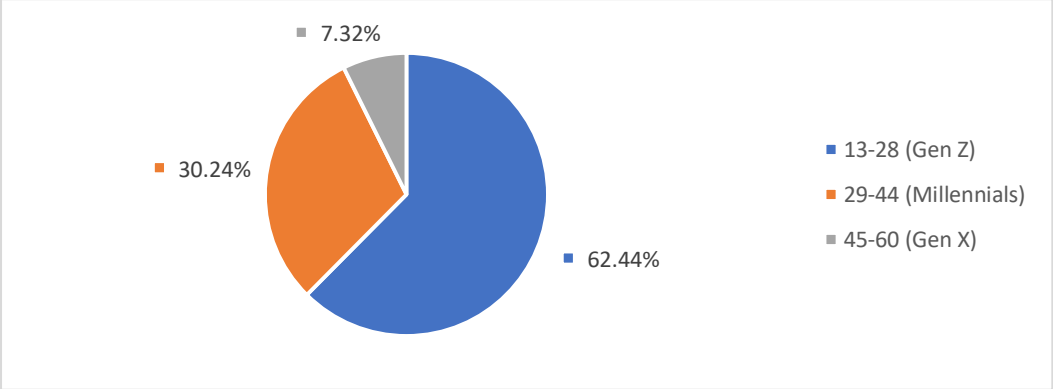
4.1.1.1 Age Group

Table 4.1: Age Group

Age Group	Frequency	Frequency percentage (%)
13-28 (Gen Z)	128	62.44
29-44 (Millennials)	62	30.24
45-60 (Gen X)	15	7.32
Grand Total	**205**	**100.00**

Source: Developed for this research

Figure 4.1: Age Group



Source: Developed for this research

Table 4.1 and figure 4.1 illustrate most respondents came from the age group of 13-28 (Gen Z), comprising 62.44% of the sample. A smaller portion of the sample falls within the age group of 29-44 (Millennials) and 45-60 (Gen X), with the percentage of 30.24% and 7.32% respectively.

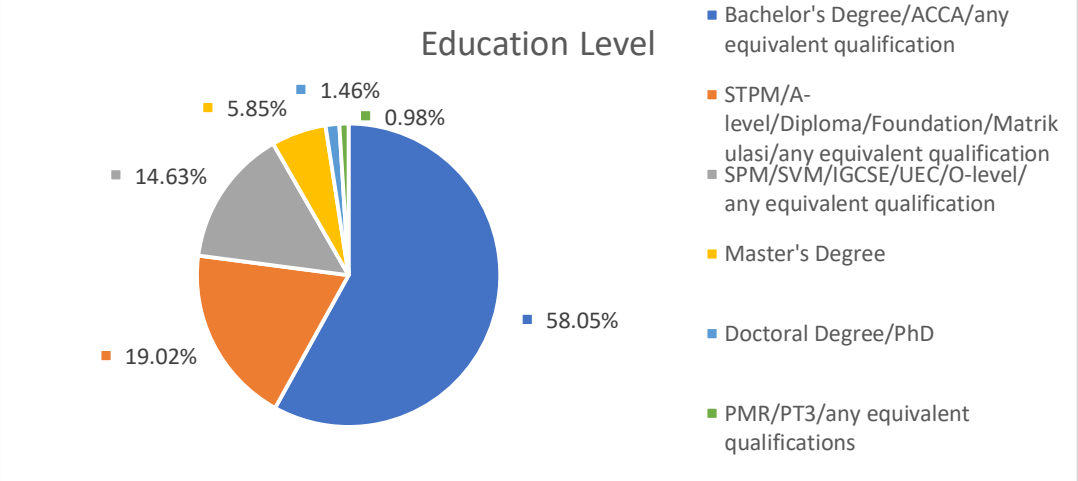
4.1.1.2 Education Level

Table 4.2: Education Level

Education Level	Frequency	Frequency Percentage (%)
Bachelor's degree/ACCA/any equivalent qualification	119	58.05
STPM/A-level/Diploma/Foundation/Matrikulasi/any equivalent qualification	39	19.02
SPM/SVM/IGCSE/UEC/O-level/ any equivalent qualification	30	14.63
Master's degree	12	5.85
Doctoral Degree/PhD	3	1.46
PMR/PT3/any equivalent qualifications	2	0.98
Grand Total	**205**	**100.00**

Source: Developed for this research

Figure 4.2: Education Level



Source: Developed for this research

Based on Table 4.2 and Figure 4.2, it shows that over half of the sample (58.05%) falls into the education level of bachelor's degree or equivalent qualification. STPM or equivalent qualification, SPM or equivalent qualification, and master's degree hold a minor portion of 19,02%, 14.63%, and 5.85% accordingly. Both doctoral degree or PhD, and PMR or equivalent comprise only small percentage of the sample with 1.46% and 0.98% correspondingly.

4.1.1.3 Gender

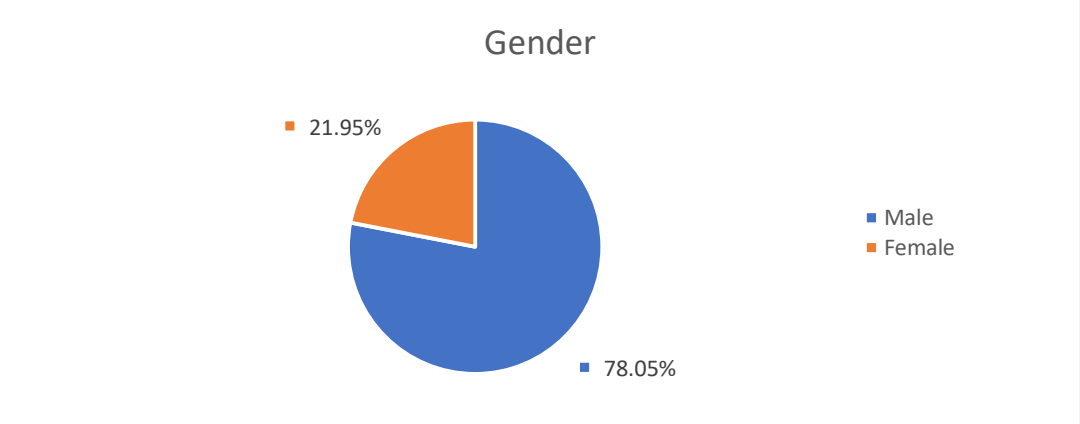
Table 4.3: Gender

Gender	Frequency	Frequency Percentage (%)
Male	160	78.05

Female	45	21.95
Grand Total	**205**	**100.00**

Source: Developed for this research

Figure 4.3: Gender



Source: Developed for this research

According to Table 4.3 and Figure 4.3, majority of the respondents are male, indicating 78.05% of the sample, while female only stands 21.95% of the portion.

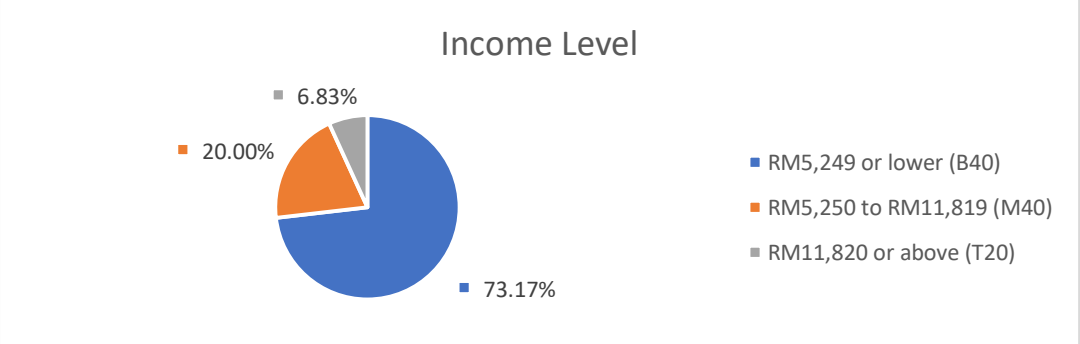
4.1.1.4 Income Level

Table 4.4: Income Level

Income Level	Frequency	Frequency Percentage (%)
RM5,249 or lower (B40)	150	73.17
RM5,250 to RM11,819 (M40)	41	20.00
RM11,820 or above (T20)	14	6.83
Grand Total	**205**	**100.00**

Source: Developed for this research

Figure 4.4: Income Level



Source: Developed for this research

Table 4.4 and Figure 4.4 indicate that most of the respondents have an income level within RM5,249 or lower (B40), while followed by RM5,250 to RM11,819 (M40) and RM11,820 or above (T20) with a smaller percentage of 20.00% and 6.83% accordingly.

4.1.2 Descriptive Statistics of Exogenous and Endogenous Variables

Table 4.5: Descriptive Statistics of Exogenous and Endogenous Variables

Name	Mean	Median	Standard deviation	Excess kurtosis	Skewness
Atd1	4.927	5	1.599	-0.225	-0.558
Atd2	5.395	6	1.529	0.245	-0.968
Atd3	5.439	6	1.572	0.367	-0.995
SN1	5.263	6	1.617	0.360	-1.027
SN2	4.673	5	1.684	-0.769	-0.371
SN3	4.590	5	1.752	-0.805	-0.387
PBC1	4.610	5	1.817	-0.797	-0.503
PBC2	4.483	5	1.839	-0.896	-0.449
PBC3	4.585	5	1.797	-0.701	-0.506
PCon1	4.332	4	1.755	-0.938	-0.178
PCon2	4.312	4	1.750	-1.018	-0.184
PCon3	4.259	4	1.810	-1.008	-0.217
H1	4.122	4	1.781	-0.870	-0.018
H2	4.088	4	1.787	-0.890	-0.087
H3	4.541	5	1.809	-0.629	-0.461
Int1	4.478	5	1.666	-0.519	-0.347
Int2	4.668	5	1.721	-0.553	-0.603
Int3	4.283	4	1.834	-0.924	-0.261
Bhv1	4.941	5	1.735	-0.544	-0.648
Bhv2	5.302	6	1.598	0.968	-1.263
Bhv3	4.288	4	1.840	-0.952	-0.217
Bhv4	4.937	5	1.751	-0.299	-0.798

Source: Developed for this research

According to the descriptive analysis in Table 4.5, it indicates that the mean value of the indicators ranges between 4.1 to 5.4 approximately, while the medians are mostly 4 or 5. The clustering value around the scale's midpoint signifies a balanced central tendency among the variables. Standard deviations range between 1.529 to 1.840, with Bhv3 (1.840) being the highest and Int3 (1.834) as

the lowest. Statistics on excess kurtosis show that most of the distributions are near normality, only few indicators such as Bhv2 (0.968) and SN1 (0.360) reflect occasional peakedness. The skewness values indicate a slight negative skew for most indicators, with Bhv2 (-1.263) and SN1 (-1.027) illustrating the strongest leftward skew.

4.2 Inferential Analyses

PLS-SEM was utilized as the analytical approach to examine the conceptual framework through a two-phase analysis. The first phase takes part in analyzing the measurement model, followed by evaluation of structural model in the subsequent phase.

4.2.1 Measurement Model Assessment

The first phase of the analysis involves the evaluation of construct's validity and reliability through the accessing of measurement model. Cronbach's alpha and composite reliability are used to examine consistency reliability, as the nature of the model's constructs were reflective. Factor loading (FL) and average variance extracted were used to evaluate the convergent validity. Discriminant validity was determined by utilizing HTMT ratio.

Table 4.6: Measurement Model

Construct	Item	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Attitude Towards E-waste	**Atd1**	0.923	0.911	0.919	0.944	0.849
	Atd2	0.913				

Recycling						
	Atd3	0.928				
Subjective Norms of E-waste Recycling	**SN1**	0.843	0.884	0.888	0.929	0.813
	SN2	0.932				
	SN3	0.928				
Perceived Behavioral Control of E-waste Recycling	**PBC1**	0.925	0.926	0.935	0.953	0.871
	PBC2	0.946				
	PBC3	0.929				
Perceived Convenience of E-waste Recycling	**PCon1**	0.948	0.935	0.936	0.958	0.884
	PCon2	0.936				
	PCon3	0.937				
Habit of E-waste Recycling	**H1**	0.963	0.944	0.945	0.964	0.900
	H2	0.963				
	H3	0.919				
Intention of E-waste Recycling	**Int1**	0.939	0.913	0.916	0.945	0.853
	Int2	0.931				
	Int3	0.901				
Behavior of E-waste Recycling	**Bhv1**	0.893	0.892	0.897	0.925	0.756
	Bhv2	0.844				
	Bhv3	0.852				
	Bhv4	0.887				

Source: Developed for this research

According to Table 4.6, the constructs' Cronbach's Alpha were all passing the threshold of 0.7 suggested by Hair et al. (2017), proving strong consistency and reliability. The values range between 0.944 and 0.884 with Habit of e-waste recycling (0.944) being the highest and subjective norms of e-waste recycling (0.844) being the lowest, indicating high reliability of the values. All the composite reliability (rho_a & rho_c) values surpassed the threshold of 0.700 recommended by Hair et al. (2019), further restate the reliability of the constructs. Range of the value is from 0.888 (subjective norms of e-waste recycling) to 0.964 (habit of e-waste recycling). Hair et al. (2019) suggested the threshold of 0.5 for the value average variance extracted (AVE), which have exceeded by all the AVE values of the constructs. Habit of e-waste recycling has the highest AVE value of 0.900 while behavior of e-waste recycling has the lowest value of 0.756. The

constructs' factor loading (FL) values have all surpassed the threshold of 0.708, illustrating strong reliability of indicators (Hair et al., 2019). Both habit of e-waste recycling and perceived convenience of e-waste recycling have shown a strong connection between their items and latent constructs, ensuring accurate and reliable measurement within the conceptual framework.

Table 4.7: Discriminant Validity: HTMT Matrix

Construct	1	2	3	4	5	6	7
1. Atd							
2. Bhv	0.742						
3. H	0.689	0.717					
4. Int	0.670	0.824	0.840				
5. PBC	0.531	0.597	0.693	0.615			
6. PCon	0.554	0.702	0.680	0.743	0.691		
7. SN	0.846	0.813	0.833	0.762	0.653	0.668	

Source: Developed for this research

Table 4.7 illustrates the discriminant validity of all the variables. The result shows that the constructs of the model are all below the threshold of 0.90 which is generally accepted (Henseler, 2019). This indicates that variables are all conceptually distinct from one another.

Table 4.8: Variance Inflation Factor (VIF)

Coefficient Path	Variance Inflation Factor (VIF)
Atd -> Int	2.411
SN -> Int	3.490
PBC -> Int	2.072
PCon -> Int	2.073
H -> Int	2.968
Int -> Bhv	1.000

Source: Developed for this research

Referring to Table 4.8, it demonstrates that all the VIF values meet the threshold of below 5.0 recommended by Hair et al. (2019). This indicates that multicollinearity is within the acceptable range, confirming strong and stable individual effects of the variables along the coefficient path and not does not pose concern for the overall model.

4.2.2 Structural Model

In the following phase, the assessment of structural model is being implemented to measure the hypothesized relationship between the latent variables. Hypothesis testing is being performed to evaluate the path coefficient significance, followed by the accessing of R^2 and the adjusted R^2 values to determine the explanatory power of the model. Subsequently, PLSpredict was utilized to test the model's predictive power.

Table 4.9: R-square & R-square Adjusted

Construct	R^2	R^2 **adjusted**
Behavior of E-waste Recycling	0.564	0.562
Intention of E-waste Recycling	0.685	0.677

Source: Developed for this research

As shown in Table 4.9, 68.5% of the variance in intention of e-waste recycling is explained by the exogenous variables, recorded R^2 value of 0.685. The adjusted R^2 value of 0.677 that poses only slight reduction after accounting for model complexity, suggested that the model's predictive accuracy is not inflated. Subsequently, the endogenous variable, behavior of e-waste recycling, has an R^2 value of 0.564, indicates that the intention of e-waste recycling and other predictors explain 56.4% of the variance. Adjusted R^2 value of 0.562 that shows minimal decrease from the R^2 value, demonstrated that overfitting of model is unlikely to be occurred when adding additional variables. As recommended by Cohen (1988) and Hair et al. (2019), R^2 value ranging from 0.50 to 0.74 is considered moderate to high, revealing the model with R^2 value within the scale could better explains substantial proportion of variance in the construct.

Table 4.10: Structural Model

Hypothesis testing	Original sample (O)	Sample means (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Decision
H1: Atd -> Int	0.117	0.115	0.065	1.783	0.037	Supported
H2: SN -> Int	0.061	0.064	0.083	0.731	0.232	Not supported
H3: PBC -> Int	-0.033	-0.027	0.075	0.445	0.328	Not supported
H4: PCon -> Int	0.298	0.297	0.089	3.358	0.000	Supported
H5: H -> Int	0.492	0.487	0.097	5.065	0.000	Supported
H6: Int -> Bhv	0.751	0.752	0.034	22.100	0.000	Supported

Source: Developed for this research

According to Table 4.10, it shows the outcomes generated by using bootstrapping procedure with 10,000 resamples, whereby four hypotheses were supported, while two were non-supported. Since H1, H4, and H5 were supported, it indicates that attitude of e-waste recycling, perceived behavioral control of e-waste recycling, and habit of e-waste recycling were all having positive relationship with intention of e-waste recycling. The supporting of H6 demonstrated that e-waste recycling intention positively affects e-waste recycling behavior. In contrast, H2 and H3 that were not supported, revealed that subjective norms of e-waste recycling and perceived convenience of e-waste recycling do not have positive correlation with intention of e-waste recycling.

Table 4.11 PLSpredict

Item	Q^2predict	PLS-SEM_RMSE	LM_RMSE	PLS-SEM - LM	Decision
Bhv1	0.429	1.316	1.296	0.020	No predictive ability
Bhv2	0.340	1.306	1.250	0.056	
Bhv3	0.479	1.334	1.321	0.013	
Bhv4	0.351	1.417	1.371	0.046	
Int1	0.587	1.076	1.054	0.022	Moderate predictive ability
Int2	0.594	1.103	1.110	-0.007	
Int3	0.487	1.319	1.398	-0.079	

Source: Developed for this research

To determine the predictive ability of the model, PLSpredict was employed. Table 4.11 listed down the prediction error, root mean square error (RMSE), which are compared between PLS-SEM and linear regression (LM) benchmark. Positive differences in all four indicators of behavior of e-waste recycling (Bhv1-Bhv4) suggested that the predictive errors in PLS-SEM are higher than LM, thus no predictive ability for the construct. In contrast, most of the intention's indicators (Int2 & Int3) have posed negative values for differences, revealing lower predictive errors in PLS-SEM model, indicating lower predictive ability

4.3 Chapter Summary

In chapter 4, exploration and inferential analyses were conducted for the study. The exploratory (descriptive) analysis summarizes the statistics on percentage and frequency percentage for the demographic characteristics and descriptive statistics of the sample. Subsequently, to access the explanatory capability of the model, examines of reliability and validity were conducted, discriminant validity between constructs was accessed, and measurement of multicollinearity has been done using variance inflation factor (VIF). Accordingly, hypothesis testing has been done to determine the significance of the proposed hypotheses. The model's predictive power was determined by utilizing PLSpredict.

CHAPTER 5: DISCUSSION, CONCLUSION & IMPLICATIONS

5.0 Introduction

This chapter discusses the results obtained in the previous chapter before proceeding with conclusion and implications. The positive connections between the variables are discussed and delineated. The implications of study are further explored, after the conclusion is drawn. The chapter ends with limitations and the recommendations for future studies.

5.1 Discussions of Major Findings

5.1.1 Attitude Toward E-waste Recycling and E-waste Recycling Intention

Research Question: Is attitude toward e-waste recycling positively affecting e-waste recycling intention?

Research Objective: To discover whether there is a positive connection between attitude toward e-waste recycling and the e-waste recycling intention.

H1: There is a positive relationship between attitude toward e-waste recycling and e-waste recycling intention.

Results: Supported

The result is supporting the hypothesis ($\beta = 0.117$, t-value = 1.783, $p < 0.05$). Beta coefficient of 0.117 indicates a positive relationship between attitude and intention of e-waste recycling. The value implies that attitude toward e-waste recycling has favorable impact on the e-waste recycling intention. Statistical significances were suggested with the p-value of 0.037 that fell below threshold of 0.05. The outcomes line up with the findings of Bhutto et al. (2023) and Aboelmaged (2021), who suggested that attitude significantly predicts the e-waste recycling intention. Thus, H1 is supported.

5.1.2 Subjective Norms of E-waste Recycling and E-waste Recycling Intention

Research Question: Are subjective norms of e-waste recycling positively affecting e-waste recycling intention?

Research Objective: To discover whether there is a positive connection between subjective norms of e-waste recycling and e-waste recycling intention.

H2: There is positive relationship between subjective norms of e-waste recycling and e-waste recycling Intention.

Results: Not supported

The outcomes fail to support this hypothesis. According to Dokoupilová et al. (2024), Gen Z have greater emphasis on individualism rather than social pressures. Since the demographic background of the sample is majorly consist of Gen Z (62.44%), it may cause insignificance of subjective norms in predicting intention. The results harmonized with findings by Afroz et al. (2020), that confirmed that subjective norms have a weak association with intention of recycling e-waste such as mobile phones. Islam et al. (2024) also reported similar outcome that subjective norms do not directly predicting intention of recycling e-waste. Therefore, H2 is rejected.

5.1.3 Perceived Behavioral Control of E-waste Recycling and E-waste Recycling Intention

Research Question: Is perceived behavioral control of e-waste recycling positively affecting e-waste recycling intention?

Research Objective: To discover whether there is a positive connection between perceived behavioral control of e-waste recycling and e-waste recycling intention.

H3: There is positive relationship between perceived behavioral control of e-waste recycling and e-waste recycling intention.

Results: Not supported

The result contradicts with the proposed hypothesis. This could result from the analyzed sample that is primary consist of lower income group, RM5,249 or lower (B40). As asserted by Amireault et al. (2008), lower income individuals are having weaker alignment with perceived behavioral control. It could be explained that B40 income group has less access to recycling facilities, which weakens their ability to perform actual intentional behavior. The outcome aligns with finding of Vijayan et al. (2023), that has reported negative correlation between perceived behavioral control and e-waste recycling intention, consistent with previous study by Zhang et al. (2018). In result, H3 is not supported.

5.1.4 Perceived Convenience of E-waste Recycling and E-waste Recycling Intention

Research Question: Is perceived convenience of e-waste recycling positively affecting e-waste recycling intention?

Research Objective: To discover whether there is a positive connection between perceived convenience of e-waste recycling and e-waste recycling intention.

H4: There is positive relationship between perceived convenience of e-waste recycling and e-waste recycling intention.

Results: Supported

The outcome confirmed the validity of this hypothesis ($\beta = 0.298$, t-value = 3.358, $p < 0.05$). Beta coefficient of 0.298 illustrates a significant positive connection between perceived convenience and intention of e-waste recycling. The p-value, 0.000, that is below the 0.05 significance level demonstrates highly statistical significance result for the association. This implies that convenience of recycling e-waste could significantly affect one's intention to recycle e-waste. Finding by Wang et al. (2021) further supported the hypothesis, suggesting that perceived convenience significantly and positively predicts the intention to participate in recycling activities.

5.1.5 Habit of E-waste Recycling and E-waste Recycling Intention

Research Question: Is habit of e-waste recycling positively affecting e-waste recycling intention?

Research Objective: To discover whether there is a positive connection between habit of e-waste recycling and e-waste recycling intention.

H5: There is positive relationship between habit of e-waste recycling and e-waste recycling intention.

Results: Supported

The result provided evidence supporting the hypothesis ($\beta = 0.492$, t-value = 5.065, $p < 0.05$). The beta coefficient value of 0.492 demonstrates a strong association, indicating that consumers will follow their habits in the forming of e-waste recycling intention. P-value of 0.000 that is far below the significance level

of 0.05, emphasizes strong statistical significance for the correlation. The result aligns with findings by Aboelmaged (2021) that confirmed positive connection between habit and e-waste recycling intention, indicating habit as a significant predictor for intention. Thus, H5 is supported.

5.1.6 E-waste Recycling Intention and E-waste Recycling Behavior

Research Question: Is e-waste recycling intention positively affecting e-waste recycling behavior?

Research Objective: To discover whether there is a positive connection between e-waste recycling intention and e-waste recycling behavior.

H6: There is positive relationship between e-waste recycling intention and e-waste recycling behavior.

Results: Supported

The result is consistent with the proposed hypothesis ($\beta = 0.751$, t-value = 22.100, $p < 0.05$). The beta coefficient of 0.751 suggested a significant relationship between e-waste recycling intention and behavior. This implies that intention is a strong indicator of the behavior. As the p-value is 0.000, statistical significance was observed, demonstrating a meaningful association between intention and behavior. The observed outcome is in line with findings of Puzzo and Prati (2024), examined robust positive connection and large effect size for intention and behavior. Hence, H6 is validated.

5.2 Implications of the Study

The research provides valuable insights into consumer's behavior regarding recycling e-waste, contributing practical implications for policymakers and organizations within the e-waste management industry. The positive association of attitude, perceived convenience, and habit with intention suggest that the related stakeholders should incorporate these factors into their development of e-waste management initiatives. Previous studies have also highlighted attitude, perceived convenience, and habit as significant predictors within e-waste management context (Vijayan et al., 2023; Aboelmaged., 2021; Simamora et al., 2021). The relevant parties should incorporate these significant psychological factors into their strategic planning to promote e-waste recycling behavior among the consumers.

Nonetheless, subjective norms and perceived behavioral control that were not significant suggest that social pressure and self-efficacy may not influence much on the actual e-waste recycling behavior. The encouragement of individuals to be comfort with normative pressure or assumption of the consumers to be capable of recycling may not drive behavioral changes towards e-waste recycling. Therefore, stakeholders should rely more on attitude, convenience, and habitual practices rather than normative beliefs and perceived control in their development and establishment of strategies. Prior study also suggested that intervention of significant psychological factors could promote behavioral changes more effectively (Xiang & Mangmeechai, 2022).

5.3 Limitation of the Study

Even though meaningful insights and implications have been identified for the research, it is still essential to observe the limitations of it. Current study only examined a limited number of variables on the intention and behavior of e-waste recycling. Although numbers of psychological and contextual factors have been proposed and tested, there are other variables such as moral norms and awareness of consequences that are not included in this study. Moreover, the research was

being conducted on cross-sectional approach, where data is gathered within a specific time frame from a population (Setia, 2016). As the behavior of consumers may change over time, the study's outcome may not be fully applicable in future context (Sedgwick, 2014). Furthermore, since the sample was only gathered from the electronic device users located in Malysia, it will limit the generalization of findings to other countries. In summary, the limitations observed do not affect the validity or significance of the outcome but instead provide groundwork for future research.

5.4 Recommendations for Future Research

Additional factors should be examined in future studies to expand the research extent, offering a more diverse view on how the psychological components could impact the intention. Additionally, longitudinal research is also suggested as it could capture changes over time through repeat observations of same subject (Caruana et al., 2015). Furthermore, research samples should be expanded to wider range of geographical backgrounds so it could offer better generalization of findings. These initiatives will contribute to future research within the scope of pro-environmental behavior.

5.5 Chapter Summary

Discussion has been done on the findings of the research to validate the correlation between different psychological factors and intention that further leads to e-waste recycling behavior. As limitations have been acknowledged, this study highlights the need of continued research to gain a deeper understanding of how various factors can enhance and shape future outcomes of e-waste recycling behavior.

References

Aboelmaged, M. (2021). E-waste recycling behavior: An integration of recycling habits into the theory of planned behavior. *Journal of Cleaner Production, 278*, 124182. https://doi.org/10.1016/j.jclepro.2020.124182

Acharya, A. S., Prakash, A., Saxena, P., & Nigam, A. (2013). Sampling: Why and how of it. *Indian Journal of Medical Specialties, 4*(2), 330–333. https://doi.org/10.7713/ijms.2013.0032

Afroz, R., Muhibbullah, M., Farhana, P., & Morshed, M. N. (2020). Analyzing the intention of the households to drop off mobile phones to the collection boxes: Empirical study in Malaysia. *Ecofeminism and Climate Change, 1*(1), 3–20. https://doi.org/10.1108/EFCC-03-2020-0004

Aithal, A., & Aithal, P. S. (2020). Development and validation of survey questionnaire & experimental data: A systematical review-based statistical approach. *International Journal of Management, Technology, and Social Sciences, 5*(2), 233–251. https://doi.org/10.47992/IJMTS.2581.6012.0114

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes, 50*(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2002). Perceived behavioral control, self-efficacy, locus of control, and the theory of planned behavior. *Journal of Applied Social Psychology, 32*(4), 665–683. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x

Ajzen, I. (2020). The theory of planned behavior: Frequently asked questions. *Human Behavior and Emerging Technologies, 2*(3), Article e195. https://doi.org/10.1002/hbe2.195

Ajzen, I., & Schmidt, P. (2020). Changing behavior using the theory of planned behavior. In M. S. Hagger, L. D. Cameron, K. Hamilton, N. Hankonen, & T. Lintunen (Eds.), *The handbook of behavior change* (pp. 17–31). Cambridge University Press. https://doi.org/10.1017/9781108677318.002

Amireault, S., Godin, G., Vohl, M. C., & Pérusse, L. (2008). Moderators of the intention–behavior and perceived behavioral control–behavior relationships for leisure-time physical activity. *International Journal of Behavioral Nutrition and Physical Activity, 5*, 7.

https://doi.org/10.1186/1479-5868-5-7

Ananno, A., Masud, M., Dabnichki, P., Mahjabeen, M., & Chowdhury, S. (2021). Survey and analysis of consumers' behavior for electronic waste management in Bangladesh. *Journal of Environmental Management, 282,* 111943. https://doi.org/10.1016/j.jenvman.2021.111943

Babbie, E. (2020). *The practice of social research* (15th ed.). Cengage Learning.

Baldé, C. P., Kuehr, R., Yamamoto, T., McDonald, R., D'Angelo, E., Althaf, S., Bel, G., Deubzer, O., Fernández-Cubillo, E., Forti, V., Gray, V., Herat, S., Honda, S., Iattoni, G., Khetriwal, D. S., Luda di Cortemiglia, V., Lobuntsova, Y., Nnorom, I., Pralat, N., & Wagner, M. (2024). *The global e-waste monitor 2024* (pp. 1–147). International Telecommunication Union (ITU) & United Nations Institute for Training and Research (UNITAR).

Bhutto, M., Rūtelionė, A., Šeinauskienė, B., & Ertz, M. (2023). Exploring factors of e-waste recycling intention: The case of generation Y. *PLOS ONE, 18*(6), e0287435. https://doi.org/10.1371/journal.pone.0287435

Borthakur, A., & Govind, M. (2018). Public understandings of e-waste and its disposal in urban India: From a review towards a conceptual framework. *Journal of Cleaner Production, 172,* 1053–1066. https://doi.org/10.1016/j.jclepro.2017.10.128

Bosnjak, M., Ajzen, I., & Schmidt, P. (2020). The theory of planned behavior: Selected recent advances and applications. *Europe's Journal of Psychology, 16*(3), 352–356. https://doi.org/10.5964/ejop.v16i3.3107

Britt, R. K., & Englebert, A. M. (2018). Behavioral determinants for vaccine acceptability among rurally located college students. *Health Psychology and Behavioral Medicine, 6*(1), 262–276. https://doi.org/10.1080/21642850.2018.1505519

Bryman, A. (2016). *Social research methods* (5th ed.). Oxford University Press.

Butterfield, A., & Szymanski, J. (2018). *A dictionary of electronics and electrical engineering* (5th ed.). Oxford University Press.

Caruana, E. J., Roman, M., Hernández-Sánchez, J., & Solli, P. (2015). Longitudinal studies. *Journal of Thoracic Disease, 7*(11), E537–E540. https://doi.org/10.3978/j.issn.2072-1439.2015.10.63

Chang, Y.-S., Yue, Z., Qureshi, M., Rasheed, M., Wu, S., & Peng, M. (2022).

Residents' waste mobile recycling planned behavior model: The role of environmental concern and risk perception. *International Journal of Emerging Markets, 18*(7), 1505–1524. https://doi.org/10.1108/IJOEM-08-2021-1215

Cheng, X., Long, R., & Yang, J. (2022). Interactive effects of two-way information and perceived convenience on waste separation behavior: Evidence from residents in eastern China. *Journal of Cleaner Production, 374*, 134032. https://doi.org/10.1016/j.jclepro.2022.134032

Chengqin, E. K., Zailani, S., Rahman, M. K., Aziz, A. A., Bhuiyan, M. A., & Gazi, M. A. I. (2024). Determinants of household behavioral intention towards reducing, reusing and recycling food waste management. *Nankai Business Review International, 15*(1), 128–152. https://doi.org/10.1108/NBRI-01-2022-0011

Cheung, S. F., Chan, D. K.-S., & Wong, Z. S.-Y. (1999). Reexamining the theory of planned behavior in understanding wastepaper recycling. *Environment and Behavior, 31*(5), 587–612. https://doi.org/10.1177/00139169921972254

Clark, T., Foster, L., Bryman, A., & Sloan, L. (2021). *Bryman's social research methods* (6th ed.). Oxford University Press.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Conner, M. (2020). Theory of planned behavior. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology* (4th ed., Vol. 1, pp. 1–18). Wiley. https://doi.org/10.1002/9781119568124.ch1

Conner, M., & Norman, P. (2022). Understanding the intention–behavior gap: The role of intention strength. *Frontiers in Psychology, 13*, 923464. https://doi.org/10.3389/fpsyg.2022.923464

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.

Denscombe, M. (2017). *The good research guide: For small-scale social research projects* (6th ed.). McGraw-Hill Education (UK).

Department of Environment Malaysia. (n.d.). *What is e-waste?* Retrieved July 24,

2025, from https://ewaste.doe.gov.my/index.php/what-is-e-waste/

Dhir, A., Koshta, N., Goyal, R. K., Sakashita, M., & Almotairi, M. (2021). Behavioral reasoning theory (BRT) perspectives on e-waste recycling and management. *Journal of Cleaner Production, 280,* 124269. https://doi.org/10.1016/j.jclepro.2020.124269

Ding, Z., Jiang, X., Liu, Z., Long, R., Xu, Z., & Cao, Q. (2018). Factors affecting low-carbon consumption behavior of urban residents: A comprehensive review. *Resources, Conservation and Recycling, 132,* 3–15. https://doi.org/10.1016/j.resconrec.2018.01.013

Dokoupilová, L., Cogiel, A., & Fero, M. (2024). Values as motivating factors for representatives of Generation Z in the Czech Republic and Slovakia within the European context. *Frontiers in Psychology, 15,* 1404354. https://doi.org/10.3389/fpsyg.2024.1404354

Du, J., & Pan, W. (2021). Examining energy saving behaviors in student dormitories using an expanded theory of planned behavior. *Habitat International, 107,* 102308. https://doi.org/10.1016/j.habitatint.2020.102308

Echegaray, F., & Hansstein, F. V. (2017). Assessing the intention–behavior gap in electronic waste recycling: The case of Brazil. *Journal of Cleaner Production, 142,* 180–190. https://doi.org/10.1016/j.jclepro.2016.05.064

Ertz, M., Karakas, F., & Sarigöllü, E. (2016). Exploring pro-environmental behaviors of consumers: An analysis of contextual factors, attitude, and behaviors. *Journal of Business Research, 69*(10), 3971–3980. https://doi.org/10.1016/j.jbusres.2016.06.010

Fishbein, M., & Ajzen, I. (2011). *Predicting and changing behavior: The reasoned action approach.* Psychology Press.

Fleetwood, S. (2019). A definition of habit for socio-economics. *Review of Social Economy, 79*(2), 131–165. https://doi.org/10.1080/00346764.2019.1630668

Gardner, B. (2015). A review and analysis of the use of 'habit' in understanding, predicting and influencing health-related behavior. *Health Psychology Review, 9*(3), 277–295. https://doi.org/10.1080/17437199.2013.876238

Gardner, B., Arden, M. A., Brown, D., Eves, F. F., Green, J., Hamilton, K., Johnston, M., Kerrison, R. S., Sheeran, P., Smith, L. E., Verplanken, B., &

Lally, P. (2023). Developing habit-based health behavior change interventions: Twenty-one questions to guide future research. *Psychology & Health, 38*(4), 518–540. https://doi.org/10.1080/08870446.2021.2003362

Gardner, B., Lally, P., & Rebar, A. L. (2020). Does habit weaken the relationship between intention and behavior? Revisiting the habit–intention interaction hypothesis. *Social and Personality Psychology Compass, 14*(8), e12553. https://doi.org/10.1111/spc3.12553

Gardner, B., Rebar, A. L., de Wit, S., & Lally, P. (2024). What is habit and how can it be used to change real-world behavior? Narrowing the theory–reality gap. *Social and Personality Psychology Compass, 18*(6), e12975. https://doi.org/10.1111/spc3.12975

Garlapati, V. K. (2016). E-waste in India and developed countries: Management, recycling, business and biotechnological initiatives. *Renewable and Sustainable Energy Reviews, 54,* 874–881. https://doi.org/10.1016/j.rser.2015.10.106

Gkargkavouzi, A., Halkos, G., & Matsiori, S. (2019). Environmental behavior in a private-sphere context: Integrating theories of planned behavior and value-belief-norm, self-identity and habit. *Resources, Conservation and Recycling, 148,* 145–156. https://doi.org/10.1016/j.resconrec.2019.01.039

Glasofer, A., & Townsend, A. (2020). Determining the level of evidence: Nonexperimental research designs. *Nursing Critical Care, 15*(1), 24–27. https://doi.org/10.1097/01.CCN.0000612856.94212.9b

Gravetter, F. J., & Forzano, L. A. B. (2009). *Research methods for the behavioral sciences* (3rd ed.). Belmont, CA: Wadsworth Cengage Learning.

Grimmer, M., & Miles, M. P. (2017). With the best of intentions: A large sample test of the intention–behavior gap in pro-environmental consumer behavior. *International Journal of Consumer Studies, 41*(1), 2–10. https://doi.org/10.1111/ijcs.12290

Guo, D., & Wang, X. (2016). Determinants of residents' e-waste recycling behavior intentions: Evidence from China. *Journal of Cleaner Production, 137,* 850–860. https://doi.org/10.1016/j.jclepro.2016.07.155

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2014). *A primer on partial least squares structural equation modeling (PLS-SEM).* SAGE

Publications.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2019). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). SAGE Publications.

Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)* (3rd ed.). SAGE Publications.

Hair, J. F., Jr., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). *Partial least squares structural equation modeling (PLS-SEM) using R: A workbook.* Springer Nature. https://doi.org/10.1007/978-3-030-80519-7

Hair, J. F., Sarstedt, M., Ringle, C. M., Sharma, P. N., & Liengaard, B. D. (2024). Going beyond the untold facts in PLS–SEM and moving forward. *European Journal of Marketing, 58*(13), 81–106. https://doi.org/10.1108/EJM-08-2023-0645

Haj-Salem, N., & Al-Hawari, M. (2021). Predictors of recycling behavior: The role of self-conscious emotions. *Journal of Social Marketing, 11*(3), 204–223. https://doi.org/10.1108/JSOCM-06-2020-0110

Hancock, D. R., Algozzine, B., & Lim, J. H. (2021). *Doing case study research: A practical guide for beginning researchers* (4th ed.). Teachers College Press.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

International Telecommunication Union. (2024). *Statistics*. ITU-D. https://www.itu.int/en/ITU-D/Statistics/pages/stat/default.aspx

Islam, M. T., Islam, M. H., & Kamal, M. A. (2024). Role of habit in household waste recycling behavior: Evidence from an emerging country. *International Journal of Sustainable Development and Planning, 19*(6), 2165–2175. https://doi.org/10.18280/ijsdp.190616

Jabbour, C. J. C., Colasante, A., D'Adamo, I., Rosa, P., & Sassanelli, C. (2023). Comprehending e-waste limited collection and recycling issues in Europe: A comparison of causes. *Journal of Cleaner Production, 427,* 139257. https://doi.org/10.1016/j.jclepro.2023.139257

James, W. (1890). Habit. In *The principles of psychology* (Vol. 1, pp. 105–127). H. Holt.

Johnson, R. B., & Christensen, L. B. (2024). *Educational research: Quantitative, qualitative, and mixed approaches* (8th ed.). Sage Publications.

Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology, 7*(4), 396–403. https://doi.org/10.9734/BJAST/2015/14975

Kabir, S. M. S. (2016). *Basic guidelines for research: An introductory approach for all disciplines* (1st ed.). Book Zone Publication.

Keller, J., Kwasnicka, D., Klaiber, P., Sichert, L., Lally, P., & Fleig, L. (2021). Habit formation following routine-based versus time-based cue planning: A randomized controlled trial. *British Journal of Health Psychology, 26*(3), 807–824. https://doi.org/10.1111/bjhp.12504

Kelly, T. C., Mason, I. G., Leiss, M. W., & Ganesh, S. (2006). University community responses to on-campus resource recycling. *Resources, Conservation and Recycling, 47*(1), 42–55. https://doi.org/10.1016/j.resconrec.2005.10.002

Kervin, J. B. (1992). *Methods for business research*. HarperCollins Publishers.

Khan, F., Ahmed, W., & Najmi, A. (2019). Understanding consumers' behavior intentions towards dealing with the plastic waste: Perspective of a developing country. *Resources, Conservation and Recycling, 142*, 49–58. https://doi.org/10.1016/j.resconrec.2018.11.020

Kidwell, B., & Jewell, R. (2003). An examination of perceived behavioral control: Internal and external influences on intention. *Psychology and Marketing, 20*(7), 625–642. https://doi.org/10.1002/mar.10089

Kiriakidis, S. (2015). Theory of planned behavior: The intention–behavior relationship and the perceived behavioral control (PBC) relationship with intention and behavior. *International Journal of Strategic Innovative Marketing, 3*(2), 40–51.

Kline, R. B. (2023). *Principles and practice of structural equation modeling* (6th

ed.). Guilford Publications.

Kochan, C. G., Pourreza, S., Tran, H., & Prybutok, V. R. (2016). Determinants and logistics of e-waste recycling. *The International Journal of Logistics Management, 27*(1), 52–70. https://doi.org/10.1108/IJLM-02-2014-0021

Kochan, C., Pourreza, S., Tran, H., & Prybutok, V. R. (2016). Determinants and logistics of e-waste recycling. *The International Journal of Logistics Management, 27*(1), 52–70. https://doi.org/10.1108/IJLM-02-2014-0021

Koshta, N., Patra, S., & Singh, S. P. (2022). Sharing economic responsibility: Assessing end user's willingness to support e-waste reverse logistics for circular economy. *Journal of Cleaner Production, 332*, 130057. https://doi.org/10.1016/j.jclepro.2021.130057

Kumar, A. (2019). Exploring young adults' e-waste recycling behavior using an extended theory of planned behavior model: A cross-cultural study. *Resources, Conservation and Recycling, 141*, 378–389. https://doi.org/10.1016/j.resconrec.2018.10.013

Kumar, R. (2018). *Research methodology: A step-by-step guide for beginners* (5th ed.). Sage Publications.

Kwasnicka, D., Dombrowski, S. U., White, M., & Sniehotta, F. (2016). Theoretical explanations for maintenance of behavior change: A systematic review of behavior theories. *Health Psychology Review, 10*(3), 277–296. https://doi.org/10.1080/17437199.2016.1151372

Kwasnicka, D., Inauen, J., Nurmi, J., Schneider, A., Short, C. E., Dekkers, T., Williams, A. J., Bierbauer, W., Haukkala, A., Picariello, F., & Naughton, F. (2019). Challenges and solutions for N-of-1 design studies in health psychology. *Health Psychology Review, 13*(2), 1–36. https://doi.org/10.1080/17437199.2018.1564627

Latip, M., Sharkawi, I., Sharifuddin, J., & Mohamed, Z. (2018). Investigating owner-manager's intention to adopt environmental management practices among food processing SMEs in Malaysia. *International Journal of Entrepreneurship and Management Practices, 1*(3), 1–11.

Linder, N., Giusti, M., Samuelsson, K., & Barthel, S. (2022). Pro-environmental habits: An underexplored research agenda in sustainability science. *Ambio, 51*(3), 546–556. https://doi.org/10.1007/s13280-021-01619-6

Liu, K., Tan, Q., Yu, J., & Wang, M. (2023). A global perspective on e-waste

recycling. *Circular Economy*, *2*(1), 100028. https://doi.org/10.1016/j.cec.2023.100028

Liu, Z., & Yang, J. Z. (2022). Predicting recycling behavior in New York State: An integrated model. *Environmental Management, 70*, 1023–1037. https://doi.org/10.1007/s00267-022-01708-6

Lohr, S. L. (2021). *Sampling: Design and analysis* (3rd ed.). Chapman and Hall/CRC.

MacCallum, R. C., & Austin, J. T. (2000). Applications of structural equation modeling in psychological research. *Annual Review of Psychology, 51*(1), 201–226. https://doi.org/10.1146/annurev.psych.51.1.201

Macey, S. M., & Brown, M. A. (1983). Residential energy conservation: The role of past experience in repetitive household behavior. *Environment and Behavior*, *15*(2), 123–141. https://doi.org/10.1177/0013916583152001

Maes, T., & Preston-Whyte, F. (2022). *E-waste it wisely: Lessons from Africa*. SN Applied Sciences, 4(3), Article 72. https://doi.org/10.1007/s42452-022-04962-9

Maier, C., Thatcher, J. B., Grover, V., & Dwivedi, Y. K. (2023). Cross-sectional research: A critical perspective, use cases, and recommendations for IS research. *International Journal of Information Management*, *70*, 102625. https://doi.org/10.1016/j.ijinfomgt.2023.102625

Mason, M. C., Pauluzzo, R., & Umar, R. M. (2022). Recycling habits and environmental responses to fast-fashion consumption: Enhancing the theory of planned behavior to predict Generation Y consumers' purchase decisions. *Waste Management*, *139*, 146–157. https://doi.org/10.1016/j.wasman.2021.12.012

Mazar, A., Tomaino, G., Carmon, Z., & Wood, W. (2021). Habits to save our habitat: Using the psychology of habits to promote sustainability. *Behavioral Science & Policy*, *7*(2), 75–89. https://doi.org/10.1177/237946152100700207

Mazhar, S. A., Anjum, R., Anwar, A. I., & Khan, A. A. (2021). Methods of data collection: A fundamental tool of research. *Journal of Integrated Community Health*, *10*, 6–10. https://doi.org/10.24321/2319.9113.202101

Michael, L. K., Hungund, S. S., & Sriram, K. V. (2024). Factors influencing the behavior in recycling of e-waste using integrated TPB and NAM model.

Cogent Business & Management, 11(1), 2295605. https://doi.org/10.1080/23311975.2023.2295605

Mishra, S. B., & Alok, S. (2022). *Handbook of research methodology*. Educreation Publishing.

Naqvi, A., & Farooq, S. (2024). Investigating the role of perceived convenience and perceived privacy risks on e-waste disposal behavior among smartphone users in Pakistan. *Journal of Hazardous, Toxic, and Radioactive Waste, 28*(2), 04023049. https://doi.org/10.1061/(ASCE)HZ.2153-5515.0000574

Nawaz, N., Shaik, S. A., Parayitam, S., Dutot, V., & Vijayakumar, G. (2025). Electronic waste recycling intention, behavior and environmental benefits: Evidence from Middle East. *Cleaner Waste Systems, 11*, 100320. https://doi.org/10.1016/j.clwas.2025.100320

Neuman, W. L. (2013). *Social research methods: Qualitative and quantitative approaches* (7th ed.). Pearson Education.

Neves, S. A., Marques, A. C., & Silva, I. P. (2024). Promoting the circular economy in the EU: How can the recycling of e-waste be increased? *Structural Change and Economic Dynamics, 70*, 192–201. https://doi.org/10.1016/j.strueco.2024.02.006

Ofori, D., & Mensah, A. O. (2022). Sustainable electronic waste management among households: A circular economy perspective from a developing economy. *Management of Environmental Quality: An International Journal, 33*(1), 64–85. https://doi.org/10.1108/MEQ-04-2021-0089

Parvez, S. M., Jahan, F., Brune, M. N., Gorman, J. F., Rahman, M. J., Carpenter, D. O., … Sly, P. D. (2021). Health consequences of exposure to e-waste: An updated systematic review. *The Lancet Planetary Health, 5*(12), e905–e920. https://doi.org/10.1016/S2542-5196(21)00263-1

Puzzo, G., & Prati, G. (2024). Psychological correlates of e-waste recycling intentions and behaviors: A meta-analysis. *Resources, Conservation and Recycling, 204*, 107462. https://doi.org/10.1016/j.resconrec.2024.107462

Puzzo, G., & Prati, G. (2025). Unraveling the influence of convenience situational factors on e-waste recycling behaviors: A goal-framing theory approach. *Sustainable Development, 33*(1), 1174–1191. https://doi.org/10.1002/sd.3164

Rahman, M., Tabash, M., Salamzadeh, A., Abduli, S., & Rahaman, M. S. (2022). Sampling techniques (probability) for quantitative social science researchers: A conceptual guideline with examples. *SEEU Review, 17*(1), 42–51. https://doi.org/10.2478/seeur-2022-0023

Regmi, P. R., Waithaka, E., Paudyal, A., Simkhada, P., & van Teijlingen, E. (2016). Guide to the design and application of online questionnaire surveys. *Nepal Journal of Epidemiology, 6*(4), 640–644. https://doi.org/10.3126/nje.v6i4.17258

Remler, D. K., & Van Ryzin, G. G. (2021). *Research methods in practice: Strategies for description and causation* (3rd ed.). Sage Publications.

Richter, N. F., Schubring, S., Hauff, S., Ringle, C. M., & Sarstedt, M. (2020). When predictors of outcomes are necessary: Guidelines for the combined use of PLS-SEM and NCA. *Industrial Management & Data Systems, 120*(12), 2243–2267. https://doi.org/10.1108/IMDS-11-2019-0638

Riverso, R., Amato, M., & La Barbera, F. (2017). The effect of food waste habit on future intention to reduce household food waste. *Quality – Access to Success, 18*, 369–375.

Robbins, T. W., & Costa, R. M. (2017). Habits. *Current Biology, 27*(22), R1200–R1206. https://doi.org/10.1016/j.cub.2017.09.060

Russell, S. V., Young, C. W., Unsworth, K. L., & Robinson, C. (2017). Bringing habits and emotions into food waste behavior. *Resources, Conservation and Recycling, 125*, 107–114. https://doi.org/10.1016/j.resconrec.2017.06.007

Sabbir, M. M., Taufique, K. M. R., & Nomi, M. (2023). Consumers' reverse exchange behavior and e-waste recycling to promote sustainable post-consumption behavior. *Asia Pacific Journal of Marketing and Logistics, 35*(10), 2484–2500. https://doi.org/10.1108/APJML-07-2022-0647

Sahu, A. K., Padhy, R. K., & Dhir, A. (2020). Envisioning the future of behavioral decision-making: A systematic literature review of behavioral reasoning theory. *Australasian Marketing Journal (AMJ), 28*(4), 145–159. https://doi.org/10.1016/j.ausmj.2020.05.001

Sarstedt, M., & Cheah, J. H. (2019). Partial least squares structural equation

modeling using SmartPLS: A software review. *Journal of Marketing Analytics*, *7*, 196–202. https://doi.org/10.1057/s41270-019-00058-3

Sarstedt, M., & Liu, Y. (2024). Advanced marketing analytics using partial least squares structural equation modeling (PLS-SEM). *Journal of Marketing Analytics*, *12*(1), 1–5. https://doi.org/10.1057/s41270-023-00279-7

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2021). Partial least squares structural equation modeling. In C. Homburg, M. Klarmann, & A. Vomberg (Eds.), *Handbook of market research* (pp. 587–632). Springer. https://doi.org/10.1007/978-3-319-57413-4_15

Sarstedt, M., Ringle, C. M., Smith, D., Reams, R., & Hair, J. F. (2014). Partial least squares structural equation modeling (PLS-SEM): A useful tool for family business researchers. *Journal of Family Business Strategy*, *5*(1), 105–115. https://doi.org/10.1016/j.jfbs.2014.01.002

Schneider, A. F., Aanestad, M., & Carvalho, T. C. (2024). Exploring barriers in the transition toward an established e-waste management system in Brazil: A multiple-case study of the formal sector. *Environment, Development and Sustainability.* Advance online publication. https://doi.org/10.1007/s10668-024-05188-y

Schultz, P. W. (2014). Strategies for promoting proenvironmental behavior: Lots of tools but few instructions. *European Psychologist, 19*(2), 107–117. https://doi.org/10.1027/1016-9040/a000163

Setia, M. S. (2016). Methodology series module 3: Cross-sectional studies. *Indian Journal of Dermatology*, *61*(3), 261–264. https://doi.org/10.4103/0019-5154.182410

Shah, R., & Goldstein, S. M. (2006). Use of structural equation modeling in operations management research: Looking back and forward. *Journal of Operations Management*, *24*(2), 148–169. https://doi.org/10.1016/j.jom.2005.05.001

Shaharudin, M. R., Said, R., Hotrawaisaya, C., Nik Abdul Rashid, N. R., & Azman Perwira, N. F. S. (2020). Linking determinants of the youth's intentions to dispose of portable e-waste with the proper disposal behavior in Malaysia. The Social Science Journal, 60(4), 680–694. https://doi.org/10.1080/03623319.2020.1753157

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing*. https://doi.org/10.1108/EJM-02-2019-0189

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: Guidelines for using PLSpredict. *European Journal of Marketing, 53*(11), 2322–2347. https://doi.org/10.1108/EJM-02-2019-0189

Si, H., Shi, J., Tang, D., Wu, G., & Lan, J. (2020). Understanding intention and behavior toward sustainable usage of bike sharing by extending the theory of planned behavior. *Resources, Conservation and Recycling, 152*, 104513. https://doi.org/10.1016/j.resconrec.2019.104513

Simamora, E. R., Farida, N., Indriani, F., & Setiawan, B. (2021). Determinants of intention of electronic waste recycling: Application of theory of planned behavior. *The Journal of Asian Finance, Economics and Business, 8*(3), 1095–1100. https://doi.org/10.13106/JAFEB.2021.VOL8.NO3.1095

Simon, M. K., & Goes, J. (2013). *Scope, limitations, and delimitations*. Seattle, WA: Dissertation Success LLC.

Stevens, S. S. (1946). On the theory of scales of measurement. *Science, 103*(2684), 677–680. https://doi.org/10.1126/science.103.2684.677

Stratton, S. J. (2021). Population research: Convenience sampling strategies. *Prehospital and Disaster Medicine, 36*(4), 373–374. https://doi.org/10.1017/S1049023X21000649

Sultan, P., Tarafder, T., Pearson, D., & Henryks, J. (2020). Intention–behavior gap and perceived behavioral control–behavior gap in theory of planned behavior: Moderating roles of communication, satisfaction and trust in organic food consumption. *Food Quality and Preference, 81*, 103838. https://doi.org/10.1016/j.foodqual.2019.103838

Suryanto, A., Nurdin, N., Andriansyah, A., Rahayu, N., & Irawati, E. (2023). Predicting supply chain management of e-waste recycling behavior using an extended theory of planned behavior model. *Uncertain Supply Chain Management, 11*(3), 1001–1008. https://doi.org/10.5267/j.uscm.2023.4.022

Taherdoost, H. (2021). Data collection methods and tools for research: A step-by-step guide to choose data collection technique for academic and business research projects. *International Journal of Academic Research in Management (IJARM), 10*(1), 10–38.

Terry, D. J., Hogg, M. A., & White, K. M. (1999). The theory of planned behavior: Self-identity, social identity and group norms. *British Journal of Social Psychology, 38*(3), 225–244. https://doi.org/10.1348/014466699164149

Thukral, S., Shree, D., & Singhal, S. (2023). Consumer behavior towards storage, disposal and recycling of e-waste: Systematic review and future research prospects. *Benchmarking: An International Journal, 30*(3), 1021–1072. https://doi.org/10.1108/BIJ-12-2021-0774

Tonglet, M., Phillips, P., & Bates, M. (2004). Determining the drivers for householder pro-environmental behavior: Waste minimisation compared to recycling. *Resources, Conservation and Recycling, 42*(1), 27–48. https://doi.org/10.1016/j.resconrec.2004.02.001

Triandis, H. C. (1996). The psychological measurement of cultural syndromes. *American Psychologist, 51*(4), 407–415. https://doi.org/10.1037/0003-066X.51.4.407

Trochim, W., Donnelly, J. P., & Arora, K. (2016). *Research methods: The essential knowledge base* (2nd ed.). Boston, MA: Cengage Learning.

Utomo, P., Kurniasari, F., & Purnamaningsih, P. (2021). The effects of performance expectancy, effort expectancy, facilitating condition, and habit on behavioral intention in using mobile healthcare application. *International Journal of Community Service & Engagement, 2*(4), 183–197. https://doi.org/10.47747/ijcse.v2i4.529

Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science, 46*(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926

Verma, S., Yadav, R., Andrade, H., & Yadav, S. (2025). Understanding household hesitancy: Analysis of e-waste recycling application adoption among Indian recyclers. *Cleaner Waste Systems, 11*, 100265. https://doi.org/10.1016/j.clwas.2025.100265

Vetter, T. R. (2017). Descriptive statistics: Reporting the answers to the five basic

questions of who, what, why, when, where, and a sixth, so what? *Anesthesia & Analgesia, 125*(5), 1797–1802. https://doi.org/10.1213/ANE.0000000000002471

Vijayan, R. V., Krishnan, M. M., Parayitam, S., Anantharaman Duraisami, S. P., & Saravanaselvan, N. R. (2023). Exploring e-waste recycling behavior intention among the households: Evidence from India. *Cleaner Materials, 7,* 100174. https://doi.org/10.1016/j.clema.2023.100174

Viscusi, W. K., Huber, J., & Bell, J. (2023). Changes in household recycling behavior: Evidence from panel data. *Ecological Economics, 208,* 107819. https://doi.org/10.1016/j.ecolecon.2023.107819

Vogt, W. P., Gardner, D. C., & Haeffele, L. M. (2012). *When to use what research design*. Guilford Press.

Wang, B., Ren, C., Dong, X., & Zhang, B. (2019). Determinants shaping willingness towards on-line recycling behavior: An empirical study of household e-waste recycling in China. *Resources, Conservation and Recycling, 143,* 218–225. https://doi.org/10.1016/j.resconrec.2019.01.005

Wang, J., Nketiah, E., Cai, X., Obuobi, B., Adu-Gyamfi, G., & Adjei, M. (2023). What establishes citizens' household intention and behavior regarding municipal solid waste separation? A case study in Jiangsu province. *Journal of Cleaner Production, 423,* 138642. https://doi.org/10.1016/j.jclepro.2023.138642

Wang, K., Qian, J., & He, S. (2021). Contested worldings of e-waste environmental justice: Nonhuman agency and e-waste scavenging in Guiyu, China. *Annals of the American Association of Geographers, 111*(7), 2165–2184. https://doi.org/10.1080/24694452.2021.1889353

Wang, Z., Guo, D., Wang, X., & Wang, H. (2021). Determinants of residents' e-waste recycling behavior intentions in China: An extended Theory of Planned Behavior perspective. *Resources, Conservation and Recycling, 168,* 105308. https://doi.org/10.1016/j.resconrec.2020.105308

Wang, Z., Guo, D., Wang, X., Zhang, B., & Wang, B. (2018). How does information publicity influence residents' behavior intentions around e-waste recycling? *Resources, Conservation and Recycling, 133,* 1–9. https://doi.org/10.1016/j.resconrec.2018.01.014

Wanger, T. C. (2011). The lithium future—resources, recycling, and the

environment. *Conservation Letters, 4*(3), 202–206. https://doi.org/10.1111/j.1755-263X.2011.00166.x

Webb, D., Soutar, G. N., Mazzarol, T., & Saldaris, P. (2013). Self-determination theory and consumer behavioral change: Evidence from a household energy-saving behavior study. *Journal of Environmental Psychology, 35,* 59–66. https://doi.org/10.1016/j.jenvp.2013.04.003

Welfens, M. J., Nordmann, J., & Seibt, A. (2016). Drivers and barriers to return and recycling of mobile phones: Case studies of communication and collection campaigns. Journal of Cleaner Production, 132, 108–121. https://doi.org/10.1016/j.jclepro.2015.11.082

Wood, W., & Rünger, D. (2016). Psychology of habit. *Annual Review of Psychology, 67,* 289–314. https://doi.org/10.1146/annurev-psych-122414-033417

Xia, Z., Gu, Y., Li, J., Xie, J., Liu, F., Wen, X., & Zhang, C. (2023). Do behavioral interventions enhance waste recycling practices? Evidence from an extended meta-analysis. *Journal of Cleaner Production, 385,* 135695. https://doi.org/10.1016/j.jclepro.2022.135695

Xiang, Y., & Mangmeechai, A. (2022). *Shaping e-waste recycling intentions through psychological motivation: An integrated study of the Theory of Planned Behavior and the Value–Belief–Norm model*. Environmental and Sustainable Production, 9(3), Article 2180. https://doi.org/10.54517/esp.v9i3.2180

Xu, Y., Du, J., Khan, M. A. S., Jin, S., Altaf, M., Anwar, F., & Sharif, I. (2022). Effects of subjective norms and environmental mechanism on green purchase behavior: An extended model of theory of planned behavior. *Frontiers in Environmental Science, 10,* 779629. https://doi.org/10.3389/fenvs.2022.779629

Yadav, R., Panda, D., & Kumar, S. (2022). Understanding the individuals' motivators and barriers of e-waste recycling: A mixed-method approach. *Journal of Environmental Management, 324,* 116303. https://doi.org/10.1016/j.jenvman.2022.116303

Yeow, P. H., & Loo, W. H. (2022). Antecedents of green computer purchase behavior among Malaysian consumers from the perspective of rational choice and moral norm factors. *Sustainable Production and Consumption,*

32, 550–561. https://doi.org/10.1016/j.spc.2022.05.015

Yuriev, A., Dahmen, M., Paillé, P., Boiral, O., & Guillaumie, L. (2020). Pro-environmental behaviors through the lens of the theory of planned behavior: A scoping review. *Resources, Conservation and Recycling*, *155*, 104660. https://doi.org/10.1016/j.resconrec.2019.104660

Zhang, B., Du, Z., Wang, B., & Wang, Z. (2019). Motivation and challenges for e-commerce in e-waste recycling under "big data" context: A perspective from household willingness in China. *Technological Forecasting and Social Change*, *144*, 436–444. https://doi.org/10.1016/j.techfore.2018.03.001

Zhang, B., Du, Z., Wang, B., et al. (2018). Motivation and challenges for e-commerce in e-waste recycling under "Big data" context: A perspective from household willingness in China. *Technological Forecasting and Social Change*, *144*, 436–444. https://doi.org/10.1016/j.techfore.2018.02.006

Zhang, B., Lai, K. H., Wang, B., & Wang, Z. (2019). From intention to action: How do personal attitudes, facilities accessibility, and government stimulus matter for household waste sorting? *Journal of Environmental Management*, *233*, 447–458. https://doi.org/10.1016/j.jenvman.2018.12.059

Zhang, L., Ran, W., Jiang, S., Wu, H., & Yuan, Z. (2021). Understanding consumers' behavior intention of recycling mobile phones through formal channels in China: The effect of privacy concern. *Resources, Environment and Sustainability*, *5*, 100027. https://doi.org/10.1016/j.resenv.2021.100027

Appendices

APPENDIX A

Questionnaire

3.0 DEMOGRAPHIC QUESTIONS

WHAT IS YOUR AGE?

[ ] 13-28 (Gen Z)

[ ] 29-44 (Millennials)

[ ] 45-60 (Gen X)

[ ] 61 and above (Boomers)

WHAT IS YOUR HIGHEST EDUCATION LEVEL?

[ ] PMR/PT3/any equivalent qualifications

[ ] SPM/SVM/IGCSE/UEC/O-level/ any equivalent qualification

[ ] STPM/A-level/Diploma/Foundation/Matrikulasi/ any equivalent qualification

[ ] Bachelor's degree/ACCA/any equivalent qualification

[ ] Master's degree

WHAT IS YOUR GENDER?

[ ] Male

[ ] Female

WHAT IS YOUR INCOME LEVEL?

[ ] RM 5,249 or lower (B40)

[ ] RM 5,250 to RM 11,819 (M40)

[ ] RM 11,820 or above (T20)

4.0 DESCRIPTIVE QUESTIONS

REASON(S) TO DISPOSE / REPLACE ELETRONIC DEVICES

[ ] Old or Outdated

[ ] Damaged or Malfunction

[ ] Bought new devices

[ ] Simply just bored with the devices

WHAT ELETRONIC DEVICE(S) DO YOU OWN?

[ ] Smartphone

[ ] Smart Watch

[ ] Power Bank

[ ] Laptop

[ ] Earphones/Headphones/Wireless Earbuds

[ ] Smart TV

[ ] Others (Please Specify)

HOW MANY ELETRONIC DEVICES DO YOU OWN IN TOTAL?

[ ] 1-5

[ ] 6-10

[ ] 11-15

[ ] 16-20

[ ] 20 and above

HOW YOU DISPOSE YOUR ELETRONIC DEVICES?

[ ] Sell it

[ ] Donate it

[ ] Recycle it

[ ] Keep it and never dispose

[ ] Throw as regular trash

[ ] Give it to friends or relatives

Construct	**Source**	**Items**
Attitudes toward e-waste recycling	Wang, Y., Wang, S., Wang, J., Wei, J., & Wang, C. (2020). An empirical study of consumers' intention to use ride-sharing services: using an extended technology acceptance model. *Transportation*, *47*, 397-415.	A1) Recycling e-waste makes me feel very satisfied A2) Recycling e-waste contributes to society A3) Recycling e-waste is everyone's responsibility
Subjective norms of e-waste recycling	Wang, Y., Wang, S., Wang, J., Wei, J., & Wang, C. (2020). An empirical study of consumers' intention to use ride-sharing services: using an extended technology acceptance model. *Transportation*, *47*, 397-415.	SN1) If my family and friends recycle e-waste, I will also do it SN2) Local media encourages me to participate in recycling e-waste SN3) Local community influences me to participate in recycling e-waste
Habits of waste recycling	Yeow, P. H., & Loo, W. H. (2018). Determinants of Consumer Behavior Regarding Reusing, Refurbishing, and Recycling Computer Waste: An Exploratory Study in Malaysia. *International Journal of Business & Information*, *13*(4).	H1) Recycling electronic waste has become a habit for me H2) Recycling electronic waste has become a common behavior to me H3) I must participate in recycling electronic waste as a habit
Behavioural	Vijayan, R. V., Krishnan, M. M., Parayitam, S.,	PBC1) I know what electronic waste can be recycled

control of e-waste recycling	Duraisami, S. P. A., & Saravanaselvan, N. R. (2023). Exploring e-waste recycling behaviour intention among the households Evidence from India. Cleaner Materials, 7, 100174.	PBC2) I know how to recycle my electronic waste PBC3) I can succeed in recycling electronic waste
Recycling Behaviour	Vijayan, R. V., Krishnan, M. M., Parayitam, S., Duraisami, S. P. A., & Saravanaselvan, N. R. (2023). Exploring e-waste recycling behaviour intention among the households Evidence from India. Cleaner Materials, 7, 100174.	RB1) I reuse electronic devices because it can significantly benefit the environment RB2) I try to use my devices like playing games, and other storage purposes RB3) I donate my electronic devices to charity Donating to others is a good way to recycle old devices.
E-waste recycling Intention	Gonul Kochan, C., Pourreza, S., Tran, H., & Prybutok, V. R. (2016). Determinants and logistics of e-waste recycling. The International Journal of Logistics Management, 27(1), 52-70.	Int1) I intend to recycle e-waste regularly Int2) I intend to drop-off e-waste at a nearby recycling station. Int3) I intend to return e-waste to the retailer or the manufacturer
Perceived convenience	Gonul Kochan, C., Pourreza, S., Tran, H., & Prybutok, V. R. (2016). Determinants and logistics of e-waste recycling. The	PC1) I have enough time to sort e-waste for recycling. PC2) I have enough time to clean up personal information on e-waste.

	International Journal of Logistics Management, 27(1), 52-70.	PC3) I have enough space to store the e-waste for recycling

APPENDIX B

Questionnaire Cover Page

E-waste Recycling Behaviour

Dear Esteemed Respondents,

This study aims to comprehensively examine the psychological and contextual factors influencing individuals' intentions and behaviours toward e-waste recycling. By integrating constructs such as attitude, subjective norms, perceived behavioural control, convenience, and habitual behaviour, the framework seeks to offer a deeper understanding of the decision-making process related to e-waste management. The findings are expected to provide valuable insights for policymakers, environmental organizations, and industry stakeholders to design more effective strategies that promote sustainable e-waste recycling practices.

There are no anticipated risks associated with responding to the questionnaire. Additionally, no personal details will be collected, and the confidentiality of all respondents will be assured. I humbly request your voluntary participation in this study. This survey will only take 15-20 minutes to complete. Your confidentiality is assured. The data collected is meant for academic purposes, and the information will be aggregated.

If you have any questions about this study at any time, please feel free to contact me.

Yours sincerely,

Teh Wai Quan (twq2003@1utar.my)

APPENDIX C

Ethical Clearance Approval Letter

UNIVERSITI TUNKU ABDUL RAHMAN DU012(A)
Wholly owned by UTAR Education Foundation Co. No. 578227-M

Re: U/SERC/78-600/2025

16 October 2025

Dr Fitriya Binti Abdul Rahim
Head, Department of International Business
Faculty of Accountancy and Management
Universiti Tunku Abdul Rahman
Jalan Sungai Long
Bandar Sungai Long
43000 Kajang, Selangor

Dear Dr Fitriya,

Ethical Approval For Research Project/Protocol

We refer to your application for ethical approval for your students' research project from Bachelor of International Business (Honours) programme enrolled in course UKMZ3016. We are pleased to inform you that the application has been approved under Expedited Review.

The details of the research projects are as follows:

No.	Research Title	Student's Name	Supervisor's Name	Approval Validity
1.	Exploring the Relationship Between AI Competency and Employment Hope Among Final-Year Undergraduates	Wong Shu Hui	Dr Low Mei Peng	16 October 2025 – 15 October 2026
2.	Examining the Knowledge Gap of Undergraduates' Awareness of the Consumer Protection Act 1999 in Relation to Influencer Marketing	Lim Jia Yu	Dr Tan Pei Meng	
3.	Examining the Drivers of AI technologies for Academic Productivity Among Higher Education Students	Esther Lee Ke Xin	Dr Low Mei Peng	
4.	E-waste Recycling Behavior	Teh Wai Quan		
5.	The Dark Side of Digital Learning: Investigating Technostress, Academic Disengagement, and Self-Perception of Academic Performance Among University Students	Weiline Chong Wei Ling		
6.	Determinants of Firm Performance Among Malaysian SMEs in Cross-Border E-Commerce	Lee Yee Heng	Dr Farah Waheeda Binti Jalaludin	
7.	The Influence of E-Commerce Live Streaming Features on Consumer Trust and Purchase Intention in Malaysia	Lai Jing Yu		
8.	The Role of Operational Efficiency in Enhancing Online Buyer Satisfaction	Liew Xin Ying	Dr Komathi a/p Munusamy	
9.	Examining the Drivers of Employee Job Performance in the Malaysian Service Industry	Chong Yen Yi	Dr Cheah Lee Fong	
10.	Understanding E-waste Recycle Practice in Malaysia through the lens of Behavioral Reasoning Theory	Tan Wei Yan	Dr Low Mei Peng	
11.	Brewing Preference: A Study on Consumer Purchase Intention Towards ZUS Coffee	Kong Carol	Dr Law Kian Aun	

Kampar Campus : Jalan Universiti, Bandar Barat, 31900 Kampar, Perak Darul Ridzuan, Malaysia
Tel: (605) 468 8888 Fax: (605) 466 1313
Sungai Long Campus : Jalan Sungai Long, Bandar Sungai Long, Cheras, 43000 Kajang, Selangor Darul Ehsan, Malaysia
Tel: (603) 9086 0288 Fax: (603) 9019 8868
Website: www.utar.edu.my

The conduct of this research is subject to the following:

(1) The participants' informed consent be obtained prior to the commencement of the research;

(2) Confidentiality of participants' personal data must be maintained; and

(3) Compliance with procedures set out in related policies of UTAR such as the UTAR Research Ethics and Code of Conduct, Code of Practice for Research Involving Humans and other related policies/guidelines.

(4) Written consent be obtained from the institution(s)/company(ies) in which the physical or/and online survey will be carried out, prior to the commencement of the research.

Should the students collect personal data of participants in their studies, please have the participants sign the attached Personal Data Protection Statement for records.

Thank you.

Yours sincerely,

Professor Dr Zuraidah Abd Manaf
Chairman
UTAR Scientific and Ethical Review Committee

c.c Dean, Faculty of Accountancy and Management
Director, Institute of Postgraduate Studies and Research

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APPENDIX D

Research Findings

Research Question	Research Objective	Hypothesis	Results
1. Is attitude toward e-waste recycling positively affecting e-waste recycling behavior?	**1.** To discover whether there is a positive connection between attitude toward e-waste recycling and e-waste recycling behavior.	**H1**: There is a positive relationship between Attitude toward E-waste recycling and E-waste recycling Intention.	**Supported**
2. Are subjective norms of e-waste recycling positively affecting e-waste recycling behavior?	**2.** To discover whether there is a positive connection between subjective norms of e-waste recycling and e-waste recycling behavior.	**H2**: There is positive relationship between Subjective norms of E-waste recycling and E-waste recycling Intention.	**Not Supported**
3. Is perceived behavioral control of e-waste recycling positively affecting e-waste recycling behavior?	**3.** To discover whether there is a positive connection between perceived behavioral control of e-waste recycling and e-waste recycling	**H3**: There is positive relationship between Perceived Behavioral Control of E-waste recycling and E-waste recycling Intention.	**Not Supported**

	behavior.		
4. Is perceived convenience of e-waste recycling positive affecting e-waste recycling behavior?	**4.** To discover whether there is a positive connection between perceived convenience of e-waste recycling and e-waste recycling behavior.	**H4**: There is positive relationship between Perceived Convenience of E-waste recycling and E-waste recycling Intention.	**Supported**
5. Is habit of e-waste recycling positively affecting e-waste recycling behavior?	**5.** To discover whether there is a positive connection between habit of e-waste recycling and e-waste recycling behavior.	**H5**: There is positive relationship between Habit of E-waste recycling and E-waste recycling Intention.	**Supported**
6. Is e-waste recycling intention positively affecting e-waste recycling behavior?	**6.** To discover whether there is a positive connection between e-waste recycling intention and e-waste recycling behavior.	**H6**: There is positive relationship between E-waste recycling intention and E-waste recycling behavior.	**Supported**