UNIVERSITI TEKNOLOGI MARA

MODELLING E-WASTE RECYCLING BEHAVIOUR AMONG THE MALAYSIAN PUBLIC IN THE SOUTHERN REGION: INTEGRATING EXTERNAL & INTERNAL PERSPECTIVES

NUR BATRISYIA BINTI NORDIN

MAS

August 2026

UNIVERSITI TEKNOLOGI MARA

MODELLING E-WASTE RECYCLING BEHAVIOUR AMONG THE MALAYSIAN PUBLIC IN THE SOUTHERN REGION: INTEGRATING EXTERNAL & INTERNAL PERSPECTIVES

NUR BATRISYIA BINTI NORDIN

Thesis submitted in fulfilment
of the requirements for the degree of
Master of Administrative Science

Faculty of Administrative Science and Policy Studies

August 2026

CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 4 May 2026 to conduct the final examination of Nur Batrisyia Binti Nordin on her Masters of Arts thesis entitled entitled "Modelling E-waste Recycling Behaviour Among the Malaysian Public in The Southern Region: Integrating External and Internal Perspectives" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The Panel of Examiners was as follows:

Nor Hafizah Mohamed Harith, PhD
Professor
Faculty of Administrative Science &
Policy Studies
Universiti Teknologi MARA
(Chairman)

Devika Krishnan, PhD
Senior Lecturer
Faculty of Administrative Science &
Policy Studies
Universiti Teknologi MARA
(Internal Examiner)

Azlan Abbas, PhD
Associate Professor
Faculty of Social Science and
Humanities
Universiti Kebangsaan Malaysia
(External Examiner)

PROF DR HJH ZURAEDA IBRAHIM
Dean
Institute of Postgraduates Studies
Universiti Teknologi MARA

Date: 14 August 2026

AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Postgraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

Name of Student	:	Nur Batrisyia Binti Nordin
Student ID. No.	:	2023405634
Programme	:	Master of Administrative Science – AM780
Faculty	:	Administrative Science and Policy Studies
Thesis Title	:	Modelling E-Waste Recycling Behaviour Among the Malaysian Public In the Southern Region: Integrating External & Internal Perspectives

Signature of Student	:	……..
Date	:	14 August 2026

ABSTRACT

Electronic waste (e-waste) comprises discarded electrical and electronic equipment such as computers, televisions, smartphones, and household appliances that have reached the end of their useful life. In Malaysia, improper e-waste disposal has become a critical environmental and public health issue due to rapid technological advancement, increasing consumption, and limited public participation in formal recycling systems. This issue is particularly pressing in the Southern Region of Malaysia (Johor, Melaka, and Negeri Sembilan), where empirical evidence on e-waste recycling behaviour remains limited. This study investigates e-waste recycling behaviour among the Malaysian public by adopting an extended Theory of Planned Behaviour (TPB) framework that incorporates both internal factors (attitude, moral obligation, time availability, and waste sorting knowledge) and external factors (policy and regulation, facility support, and subjective norm). An explanatory sequential mixed-method design was employed, consisting of a quantitative survey involving 500 respondents, followed by qualitative interviews with nine key informants to enrich and explain the survey findings. The results reveal that facility support is the most influential external factor affecting e-waste recycling behaviour, highlighting the importance of accessible and convenient recycling infrastructure. Among internal factors, waste sorting knowledge emerges as the strongest predictor, indicating that individuals' understanding of proper e-waste separation significantly influences their recycling practices. The findings contribute theoretically by extending TPB in the e-waste context and practically by informing policymakers and stakeholders on targeted strategies to improve recycling participation and sustainable e-waste management in Malaysia.

Keywords: recycling behaviour, subjective norm, time availability, waste sorting knowledge, attitude, facility support

ACKNOWLEDGEMENT

Firstly, I wish to thank Allah for giving me the opportunity to embark on my Master's Degree and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Dr. Nurul Hidayana Mohd Noor and Dr. Mahazril 'Aini Yaacob.

My appreciation goes to the respondents and interviewees who provided the facilities and assistance during sampling. Special thanks to my colleagues and friends for helping me with this project.

This thesis is dedicated to my parents for their vision and determination to educate me. This piece of victory is dedicated to both of you. I also would like to dedicate this thesis for my beloved siblings. Next, to the person who is in a better place, maktok. Maktok, Kakak have made it this far, and I know that you are proud of me. To my sky, thank you for being there, supporting me through this journey, and for not clipping my wings.

Lastly, I would like to give myself a big hug for finally keeping my words and promises. It is not easy to finally reach this moment. All the tears, breakdowns, restless days, and nights are worth it. I am proud of myself. To me, as you choose this path, you might feel it is difficult. But one fine day, the moment you look back on your life…it will all be worth it. The opportunity that you take, the things that you let go of, are all finally worth it.

TABLE OF CONTENTS

		Page
CONFIRMATION BY PANEL OF EXAMINERS		**ii**
AUTHOR'S DECLARATION		**iii**
ABSTRACT		**iv**
ACKNOWLEDGEMENT		**v**
TABLE OF CONTENTS		**vi**
LIST OF TABLES		**x**
LIST OF FIGURES		**xi**
LIST OF SYMBOLS		**xii**
LIST OF ABBREVIATIONS		**xiii**
LIST OF NOMENCLATURE		**xiv**
CHAPTER 1 INTRODUCTION		**1**
1.1	Introduction	1
1.2	Research Background	1
1.3	Problem Statement	5
1.4	Research Question	12
1.5	Research Objective	12
1.6	Scope of The Study	13
1.7	Significance of The Study	14
	1.7.1 Malaysian Government (National Solid Waste Management)	14
	1.7.2 Ministry of Natural Resources and Environmental Sustainability (NRES)	15
	1.7.3 Local Government	15
	1.7.4 Community	16
	1.7.5 Non-Governmental Organization (NGO)	16
	1.7.6 Theoretical Contribution	17
1.8	Conceptual Term and Operational Definition	17
	1.8.1 E-waste Recycling Behaviour	17
	1.8.2 External Factors	18

1.8.3 Internal Factors 20
1.9 Summary of Chapter 23

CHAPTER 2 LITERATURE REVIEW & THEORETICAL FRAMEWORK 24
2.1 Introduction 24
2.2 Waste 24
2.2.1 E-waste 25
2.2.2 E-waste Recycling Behaviour 27
2.3 E-Waste Management Across Countries 33
2.3.1 Japan 36
2.3.2 Australia 37
2.3.3 Germany 39
2.3.4 Netherlands 41
2.3.5 European Union Germany, Netherlands, etc. 42
2.3.6 Switzerland 43
2.3.7 South Korea 45
2.3.8 Singapore 46
2.3.9 China 47
2.3.10 India 49
2.3.11 Malaysia 50
2.3.12 Lesson Learned by Malaysia 55
2.4 Factors Influencing Recycling E-waste 56
2.4.1 External Factors 57
2.4.2 Internal Factors 61
2.5 Theoretical Framework 66
2.5.1 Theory of Planned Behaviour (TPB) 67
2.5.2 Conceptual Framework 72
2.6 Hypothesis Development 72
2.6.1 External Factors 72
2.6.2 Internal Factors 77
2.7 Summary of Chapter 83

CHAPTER 3 RESEARCH METHODOLOGY **85**
3.1 Introduction 85
3.2 Research Design 85
3.2.1 Quantitative Method: Survey Study 87
3.2.2 Qualitative Method: Semi-structured Interview 87
3.3 Unit of Analysis 88
3.3.1 Survey 89
3.3.2 Semi-structured Interview 89
3.4 Sample Size 90
3.4.1 Survey 90
3.4.2 Interview 92
3.5 Sampling Technique 93
3.5.1 Survey 93
3.5.2 Interview 94
3.6 Data Collection 95
3.7 Measurement 96
3.7.1 Survey 96
3.7.2 Interview 97
3.8 Data Analysis 98
3.8.1 Survey 98
3.8.2 Interview 100
3.9 Summary of Chapter 102

CHAPTER 4 FINDINGS **104**
4.1 Introduction 104
4.2 Pilot Study Results 104
4.2.1 Validity Assessment 106
4.3 Full- Scale Findings 108
4.3.1 Quantitative Study 108
4.3.2 Demographic Profile 108
4.3.3 Confirmatory Factor Analysis (CFA) 109
4.3.4 Normality Test 111
4.3.5 Validity and Reliability Tests 113
4.3.6 Discriminant Validity 114

4.3.7 Descriptive Statistic 115
4.3.8 Objective 2: To investigate the influence of attitudes, subjective norms, moral obligations, regulations, and facility support on e-waste recycling behaviour among the Malaysian public in Southern Region. 116
4.3.9 Validation through Interview Data 119
4.3.10 Syntheses of Findings 131
4.4 Summary of Chapter 132

CHAPTER 5 CONCLUSION 133
5.1 Introduction 133
5.2 Summary of Findings 133
5.2.1 The level of e-waste recycling behaviour among the Malaysian public in the Southern Region. 133
5.2.2 The influence of external factors (policy and regulation, facility support, and subjective norm) and internal factors (moral obligation, attitude, time availability, and waste sorting knowledge) on e-waste recycling behaviour among the Malaysian public in the Southern Region. 135
5.2.3 The most significant predictors of e-waste recycling behaviour among the Malaysian public in the Southern Region. 138
5.2.4 Research Recommendations/ Strategies for Improvement (Research Objective 4) 139
5.3 Research Implications 151
5.3.1 Theoretical Implication 151
5.4 Research Limitations and Suggestions for Future Research 154
5.5 Conclusion 157

REFERENCES 159

APPENDICES 204

AUTHOR'S PROFILE 237

LIST OF TABLES

Tables	Title	Page
Table 2.1	Schedule Of E-Waste Item In Malaysia	27
Table 2.2	Determinants Of E-Waste Recycling Behaviour	27
Table 2.3	E-Waste Recycling Across Best Practices Countries	34
Table 2.4	Summary Of E-Waste Policy Framework	53
Table 2.5	Malaysia National Policy On E-Waste	59
Table 2.6	Summary Of Hypothesis	83
Table 3.1	List Of Representatives	90
Table 3.2	Sample Size Distribution For Survey Study	92
Table 3.3	Table Of Measurement	97
Table 4.1	Pilot Study Reliability Test Results	106
Table 4.2	Rotated Component Matrix	107
Table 4.3	Demographic Profile (N=400)	109
Table 4.4	Normality Results	113
Table 4.5	Composite Reliability (CR), Average Variance (AVE) And Cronbach's Alpha Results	113
Table 4.6	Discriminant Validity For The Variables	115
Table 4.7	Descriptive Statistics For E-Waste Recycling Behaviour	115
Table 4.8	Assessment Of The Structural Model	117
Table 4.9	Synthesis Findings Between Quantitative And Qualitative Findings	131

LIST OF FIGURES

Figures	Title	Page
Figure 1.1	Statistics of e-waste recycling estimated until 2025 (DOE,2025)	6
Figure 1.2	E-waste collected in 2024 (The Star, 2025)	8
Figure 2.1	One of the biggest E-waste recycling centres in Australia	27
Figure 2.2	Producer Responsibility on E-waste Source (Li, 2023)	40
Figure 2.3	Retailers take back E-waste from the buyers for a new appliance	41
Figure 2.4	E-waste Facility in Malaysia	59
Figure 2.5	Framework of the TPB (Source: Adapted from Ajzen 1991)	69
Figure 2.6	Conceptual framework of the study (Adapted from Ajzen, 1. (1991)	72
Figure 3.1	Research Process (Source: Author's own work)	86
Figure 4.1	CFA Model (Source: Author's owk work)	111
Figure 4.2	Final Model of the Study Source: Author (2025)	118
Figure 5.1	Framework Strategy	146

LIST OF SYMBOLS

Symbols

α	Cronbach's Alpha (Internal Consistency Reliability Coefficient)
β	Standardised Regression (Path) Coefficient In The Structural Model
χ^2	Chi-Square Statistic (Model Fit)
χ^2/df	Chi-Square To Degrees-Of-Freedom Ratio (CMIN/DF)
df	Degrees Of Freedom
N	Total Number Of Respondents (Sample Size)
n	Number Of Respondents In A Subgroup
p	Significance (Probability) Value
r	Pearson Correlation Coefficient
M	Mean Score
SD	Standard Deviation
%	Percentage
$<$	Less Than
$\geq$	Greater Than Or Equal To

LIST OF ABBREVIATIONS

Abbreviations

TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
SN	Subjective Norm
PBC	Perceived Behavioural Control
EPR	Extended Producer Responsibility
WEEE	Waste Electrical and Electronic Equipment
EEE	Electrical and Electronic Equipment
DOE	Department of Environment
NGO	Non-Governmental Organisation
SEM	Structural Equation Modelling
CFA	Confirmatory Factor Analysis
AVE	Average Variance Extracted
CR	Composite Reliability
RMSEA	Root Mean Square Error of Approximation
CFI	Comparative Fit Index
TLI	Tucker-Lewis Index

LIST OF NOMENCLATURE

Nomenclatures

Attitude	An Individual's Overall Favourable Or Unfavourable Evaluation Of Recycling E-Waste
Subjective Norm	Perceived Social Pressure To Perform Or Not Perform E-Waste Recycling
Perceived Behavioural Control	Perceived Ease Or Difficulty Of Recycling E-Waste, Reflecting Control Beliefs
Intention	An Individual's Readiness And Willingness To Recycle E-Waste
Recycling Behaviour	The Actual Act Of Separating And Disposing Of E-Waste Through Proper Recycling Channels
E-waste	Discarded Electrical And Electronic Equipment That Has Reached The End Of Its Useful Life
Latent Variable	An Unobserved Construct Measured Indirectly Through Observed Indicators
Observed Variable	A Measured Item (Questionnaire Indicator) Representing A Latent Construct
Construct	A Theoretical Concept Measured By A Set Of Related Survey Items
Model Fit	The Degree To Which The Hypothesised Model Reproduces The Observed Data

CHAPTER 1
INTRODUCTION

1.1 Introduction

The first section discusses the problems and issues of e-waste that society must encounter in the Southern Region of Malaysia. This thesis focuses on solid waste, specifically electronic waste (e-waste). Chapter 1 presents the research background on e-waste recycling behaviour in Malaysia, followed by a problem statement that discusses the e-waste issue. Next, the research question and objective, the scope of the study, and the significance of the study will be presented and discussed. Further discussion of this study is based on the findings from the survey and interview conducted.

1.2 Research Background

Given the state of e-waste, inappropriate e-waste recycling jeopardises public health, harms the environment, and depletes natural resources, making it more challenging to achieve the Sustainable Development Goals (SDGs) set forth by the United Nations (UN) in 2015 (Nadia, 2025). Hence, the SDGs provide guidelines for managing electronic waste, given the rapid pace of technological change. SDG 12, responsible consumption and production, serves as a benchmark for the production sector, particularly by emphasizing waste reduction through prevention, reduction, reuse, and recycling. Companies such as Panasonic Malaysia have launched an e-waste campaign in collaboration with Electronic Recycling Through Heroes (ERTH). The main goal of this campaign is to promote responsible consumption to consumers.

E-waste refers to obsolete or unwanted electronic devices, typically originating from corporate and household consumers (Garcia, 2025). Examples of e-waste include discarded electronic and electrical appliances such as smartphones, ovens, printers, laptops, and washing machines. Improper e-waste recycling can have numerous adverse impacts on the environment and human health. According to Mohajan (2025), e-waste contains valuable and hazardous materials, including zinc, gold, and copper. Open burning of e-waste can cause an increased risk of cancer, damage the kidneys and liver,

and cause bone loss. (Hsu, 2024). These also pose various complications, including digestive, inhalation, and, most notably, skin-contact concerns.

Improper e-waste recycling can have significant adverse effects, and Malaysia's e-waste recycling rate remains at a concerning level. As part of the 12th Malaysia Plan (12MP) and initiatives to improve solid waste management, Malaysia has set a national recycling rate target of 40% by 2025 (Rusli, 2025). According to the Department of Environment in Malaysia, the nation will generate 24.5 million pieces of e-waste by 2025, yet only roughly 10% of the e-waste produced is recycled (Department of Environment Malaysia, 2025). This indicates that Malaysia's e-waste generation is increasing. Additionally, on 1st October 2025, an illegal e-waste centre was established in Gurun, Kedah, with an estimated value of e-waste of RM 71.8 million (Noor, 2025). This news indicates that enforcement of laws governing e-waste remains inadequate. Furthermore, another report was issued by the Royal Malaysia Police (RMP) and the Department of Environment Kedah (Zulkiffli, 2025). In the rush, numerous e-waste blocks have been found, and the estimated cost is around RM 21 million. This event is scheduled for 24 July 2025, indicating that approximately RM 90 million in e-waste was collected in Kedah alone in 2025. Effective e-waste management depends on voluntary public participation to recycle their e-waste. Research continuously demonstrates that people's willingness to engage in e-waste recycling activities is greatly increased by favorable attitudes, sufficient information, and moral responsibility (Ajzen, 1991; Kumar et al., 2023). Furthermore, actual recycling practices are heavily influenced by behavioural factors like convenience, perceived behavioural control, and accessibility to recycling facilities, especially in developing nations where formal e-waste infrastructure is still unevenly distributed (Nguyen et al., 2024; Quratul Udin et al., 2025). Social impact is also crucial since peer behaviour and subjective standards can normalize the proper disposal of e-waste and promote pro-environmental behaviour (Zhang et al., 2022). Even well-crafted laws and regulations may fall short of their goals in the absence of supportive public behaviour, underscoring the crucial role that behavioural variables play in efficient e-waste management (Borthakur & Govind, 2017; Rahman et al., 2024).

It is not a simple issue that a single party can resolve. The people and the government must work together to provide the best answer to this problem. Understanding the factors influencing Malaysia's e-waste recycling is essential to solving these problems. According to an article titled "Growing Amount of E-waste

Alarming" by The Star (2025), the Department of Environment Malaysia is expected to generate 24.5 million units of e-waste by 2025. This statistic represents an increase over the previous year, 2024, when Malaysia produced 23.8 million, and over 2023, when it produced 22.7 million.

Past studies have discovered factors that influence e-waste recycling. These factors can be categorised as external or internal. External factors are elements outside the recycling process that influence its efficiency for example, incentives, regulations, and infrastructure. Internal factors include the elements within the issues that influence the recycling process (Lidwin, 2023; Delcea, 2025). To examine e-waste recycling behaviour, many researchers have used the theory of planned behaviour (TPB) (Fulya Acikgoz, 2025; Ying Wang, 2025). Prior research has demonstrated that e-waste recycling behaviour can be influenced by elements of the expanded Theory of Planned Behaviour (TPB) (Adi Suryantoa, 2024). TPB is a theory that can be utilised to understand the relationship between subjective factors and e-waste recycling behaviour. Several environmental behaviours are evaluated within the theory of planned behaviour, including recycling, using alternative modes of transportation, reducing energy consumption, conserving water, making healthy eating choices, and making ethical investments (Michael, 2023). It is generally acknowledged as the best framework for evaluating how recycling behaviour affects outcomes.

Although past studies have examined the determinants of e-waste recycling, findings have varied. For example, Hidayana (2023) found that moral obligation does not influence e-waste recycling. In a similar vein, Mwalugeni et al. (2025) found that policy and regulation are the most influential factors. On the other hand, Puzzo and Prati (2024) conclude that psychological factors such as attitude and moral obligation do not influence e-waste recycling. Due to these inconsistencies, this study aims to examine the influence of external factors (policy and regulation, facility support, and subjective norm) and internal factors (moral obligation, attitude, time availability, and waste sorting knowledge) on e-waste recycling behaviour. Most studies do not emphasise knowledge of e-waste sorting, moral obligation, facility support, time availability, or laws and regulations.

This study employs an explanatory sequential mixed-methods design, in which the survey is conducted to achieve objectives 1, 2, and 3, and the interviews are used to achieve the final objective. This study differs slightly from previous research in that it combines surveys and interviews. Research employing a combination of methods is

preferable for a more comprehensive discussion of a particular issue. (Britt-Marie Ljungstrom, 2025). This is because mixed-methods research yields more robust conclusions than single-method research. It also enhances research by incorporating both quantitative and qualitative data, enriching the research process and providing a deeper understanding of digital exclusion.

In academia and scientific research, identifying the appropriate research gap is a crucial foundation for producing meaningful and relevant scientific work. A research gap is a knowledge void in a field that has not been thoroughly explored by prior research. Without a clear identification of the gap, research can lose direction, and its contribution will be minimal. The transition to a greener circular economy requires regulations, policies, investments, innovation, technology, and behavioural changes at all levels of society. E-waste contains hazardous substances, including lead, cadmium, mercury, arsenic, chromium, polychlorinated biphenyls, and other toxic materials. If e-waste is disposed of carelessly, it poses a danger to humans and the environment. However, previous studies, such as those by Geyer et al. (2017) and Chen and Zhang (2025), have focused on recycling plastics, oil, and household waste. In contrast, e-waste recycling is often overlooked, leading to its disregard. Most prior studies focus on only one dimension, namely internal or external factors. For example, both Islam et al. (2025) and Puzzo and Prati (2025) have focused on external dimensions of e-waste recycling. Thus, this study aims to bridge the gap left by previous studies by considering both dimensions.

Moreover, most studies employing the theory of planned behaviour (TPB) focus on recycling intentions rather than actual behaviour (e.g., Sahrum et al., 2025; Wan et al., 2024). One weakness of TPB is its assumption that stable factors, such as family and friends, drive human behaviour. In contrast, it is also shaped by internal factors, including emotions and beliefs (Liñán & Pérez-Macías, 2023). Therefore, this study suggests that internal factors, such as moral obligation, knowledge, time, and attitude, influence the action of recycling e-waste. Recycling intentions are unstable; individuals are likely to change them without taking actual action. The next gap is the lack of research conducted in the Southern region, with most studies focusing on the central region and large cities only (e.g., Yahya et al., 2025; Htet & Sahrir, 2025). Previous studies also report inconsistent findings. For example, Mohamad et al. (2022) found that attitudinal factors do not improve environmental well-being. The study found that education and campaigns can effectively promote recycling practices. Then,

Aboelmaged, (2021) found that contextual and social factors do not influence recycling activities. Subsequently, most studies in Malaysia employ only one method (e.g., Sahrum et al., 2025; Aboelmaged, 2021), resulting in a limited understanding of the community's motivations and actual experiences with recycling e-waste. Qualitative studies do not provide statistical results that can be generalized. Survey studies tend to be biased. By adopting mixed methods, we can increase the integrity of the work and strive for clarity, fairness, and accuracy in every step of the research process.

1.3 Problem Statement

Rapid technological innovation, shorter product lifespans, and rising consumer demand for electronic gadgets have contributed to the steady global increase in the production of electronic waste, or e-waste. E-waste can harm the environment and human health, including cancer, respiratory infections, and severe damage to vital organs such as the lungs (Quinto et al., 2025). Recycling e-waste requires commitment and public willingness to make it effective. According to the Global Transboundary E-waste Flow Monitor Report 2024, the expected generation of electronic waste worldwide is projected to increase to 74.7 million metric tons by 2030, with an average annual increase of 2 million metric tons (Rahman & Dusim, 2025).

The Department of the Environment's estimate of e-waste recycling through 2025 is shown in Figure 1.1. According to the data shown below, data collection began in 2016. The e-waste statistics are growing annually. The total annual increase in e-waste production is 19,000 units. The six categories of e-waste include cell phones, laptops, televisions, washing machines, refrigerators, and air conditioners. Mobile phones are the most common type of e-waste produced. This is a byproduct of technology's advancement and expansion. Next came the personal computer, as many jobs required individuals to have one. Television sets are the third category of e-waste. Most individuals watch the news on at least one television in their homes. Subsequently, air conditioners, freezers, and washing machines were introduced, as many offices use these to provide their staff with a comfortable work environment. Moreover, most of the public uses technology to expedite and simplify public tasks. According to the statistics above, it is anticipated that by 2025, e-waste generation will continue to rise, and people will need access to appropriate e-waste recycling facilities.

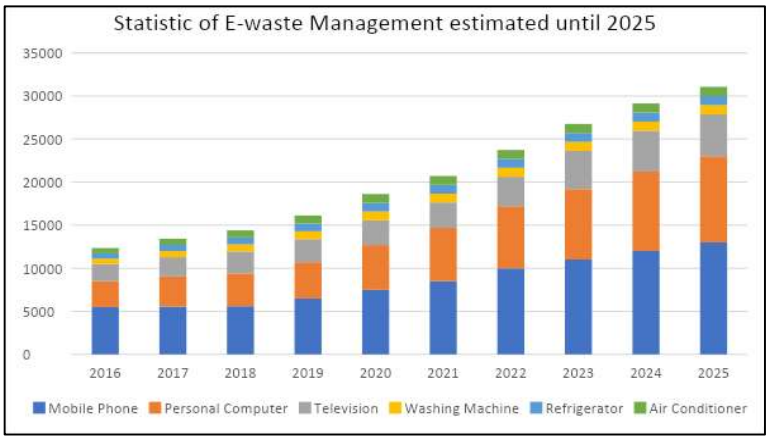


Figure 1.1 Statistics Of E-Waste Recycling Estimated Until 2025 (DOE,2025)

In Malaysia, the amount of e-waste collected in 2025 was 2657.83 metric tons, an increase of 198.32 metric tons from 2024 (Rahman & Dusim, 2025). This study has raised concerns among various stakeholders due to the increasing volume of e-waste. The level of e-waste recycling awareness remains low here (Pariatamby & Bhatti, 2024). Electronic devices such cell phones, batteries, laptops, televisions, and household appliances are thrown away with household rubbish since many Malaysians are still ignorant of the correct ways to dispose of e-waste. Lead, mercury, cadmium, and arsenic are among the dangerous materials that can contaminate soil, rivers, groundwater, and the hazardous air because of this inappropriate disposal (Nordin et al., 2025). Referring to several studies that have been conducted, it shows that low public awareness and insufficient recycling expertise continue to undermine home and community recycling involvement, particularly in urban residential areas (Yahya et al., 2025; Htet & Sahrir, 2025). Thus, initiatives to implement e-waste management programs in the Southern Region of Malaysia, such as collecting unused electrical and electronic goods, have been introduced but remain in the early stages (Sofian et al., 2023).

Despite this expansion, Malaysia continues to face serious issues with the unlawful disposal and recycling of electronic waste. According to recent reports, approximately 200 illicit e-waste recycling facilities operate nationwide, particularly in Rawang and Hulu Selangor (Mail, 2024). Additionally, the Customs Department seized 301 containers suspected of containing e-waste between March and June 2024, indicating that Malaysia has become a target for e-waste imports from other nations

(Lee, 2024). Unregulated deconstruction and open burning release hazardous elements, including lead, mercury, and cadmium, into soil and water, endangering not only public health but also ecosystems (WHO, 2024; Pradaini Nadarajan, 2023). These toxic chemicals can disperse through the air as dangerous vapours and small particles or seep into soil and groundwater. Communities in the vicinity may thus be exposed to hazardous agricultural land, poisoned water, and toxic air (Pradaini Nadarajan, 2023). Because toxins can readily penetrate the food chain and ecology, this problem becomes more serious when informal recycling operations take place close to residential areas or rivers.

Furthermore, electrical and electronic equipment, particularly computers, mobile phones, refrigerators, and air conditioners, is improperly disposed of. The main problem related to e-waste in Malaysia is the lack of awareness among Malaysians towards recycling e-waste (Marta Czajkowska, 2025). According to research Hashim et al. (2025), most Malaysians are not aware of government-run programmes or applications. They may not be as aware of one another as they should be (Rafia Afroz, 2020). Despite the increase in electrical and electronic equipment, there remain many areas for improvement in management and disposal control mechanisms (Rohit, 2025). In addition, the public needs to be aware of how to dispose of damaged electrical and electronic devices (Razip et al., 2022; Amirah et al., 2025). The community's use of electrical and electronic equipment such as smartphones, washing machines, air conditioners, and computers is increasing. Material inside the smartphones like cadmium is linked to respiratory disorders, renal damage, and weaker bones, whereas mercury exposure can impact the kidneys, lungs, and neurological system (Faradillah et al.,2025). People who participate in unofficial e-waste recycling operations are more likely to come into direct touch with hazardous chemicals and breathe in poisonous fumes, especially if they are not wearing protective gear. Although recycling education has been introduced in schools, some communities still not practicing it daily (Pariatamby & Bhatti, 2020). This is because many Malaysians have disposed of electrical and electronic equipment at will in the garbage disposal area. Therefore, this has indirectly shown negative behaviour to other users.

Figure 1.2 shows the amount of e-waste collected in 2021 by the Department of Environment which can be linked with previous discussion. Most of the e-waste collected consists of smartphones (49%) and televisions (42%). The remaining percentage consists of three per cent each for air conditioners, refrigerators, and

washing machines. The increasing number of electronic gadgets we use daily is causing an alarming trend: a rise in electronic waste (e-waste) in the future. Consumers continually upgrade their devices as technology advances, which increases sales of electronic goods. This rapid cycle is expected to significantly increase global e-waste generation. Proactively addressing this issue is essential. Sustainable practices are crucial for reducing the environmental and human health risks that come with e-waste. These practices include designing devices with longer lifespans, making recycling more accessible, and encouraging appropriate disposal techniques. Furthermore, encouraging the adoption of circular economy ideas and raising consumer awareness of the environmental effects of technology consumption will help create a more sustainable future.

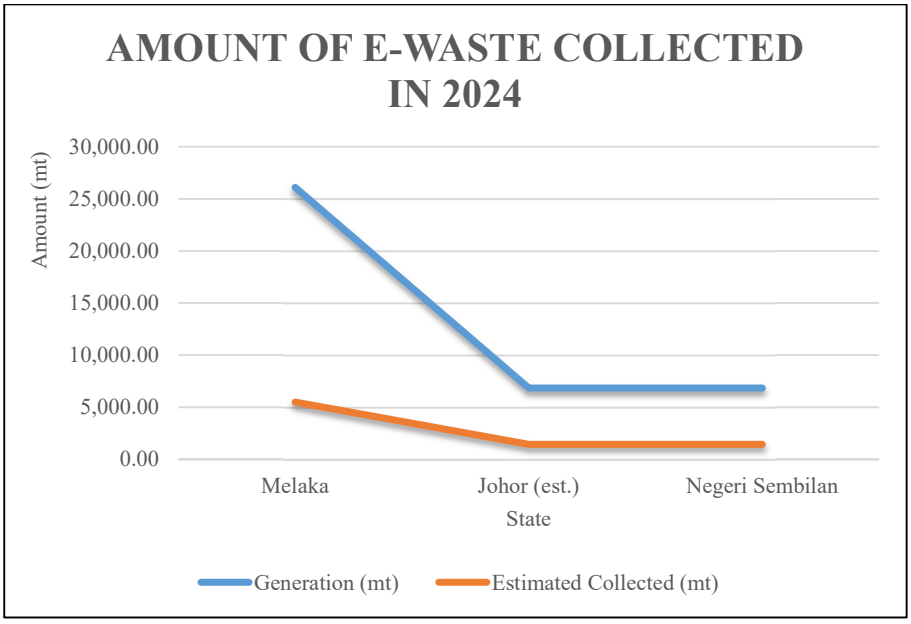


Figure 1.2: E-Waste Collected In 2024 (The Star, 2025)

In Korea and Japan, people are disciplined in separating waste, whereas this does not occur in Malaysia. Malaysia should take these two countries as an example. E-waste alone is estimated to be as tall as the iconic KLCC Tower, yet the issue is often neglected (Andeobu et al., 2021). Cooperation among parties such as experts, government agencies, and the Ministry of Education should be taken seriously to address this issue. This study examines the factors influencing e-waste recycling behaviour among the population. A study by Noor et al. (2023) found that the willingness of Malaysians to recycle depends on information, incentives, attitudes, and

even intentions to recycle. The study also found that incentives or rewards are the most important factors influencing people's intentions to recycle e-waste. A study by Sofian et al. (2023) found that 15% of consumers expect rewards if they bring their e-waste to a recycling centre. The time has come for this recycling practice to be practiced voluntarily or forcibly through enforcement (Pariatamby & Bhatti, 2020). The government needs to take drastic steps using quick and effective methods to change the mindset of Malaysians to practice recycling comprehensively. Thus, the problem of increasing e-waste quantity is not new, as it is closely related to technological changes and rapid population growth, which also contribute to this increase.

Various studies have been conducted to study the behaviour and attitude of the community towards e-waste recycling activities (Tun Ismail et al., 2025, Ahmad, 2025). One of the main factors contributing to this attitude is the inadequate e-waste facility, which has led people to become lazy to recycle e-waste as it is hard to access the facility (Chen & Ogunseitan, 2021). Malaysia has a lack of easily accessible e-waste facilities in addition to awareness and education. Public participation in appropriate e-waste disposal is discouraged by inadequate infrastructure and restricted access to recycling facilities (Chen & Ogunseitan, 2021). The issue is made worse by the incapacity to transform e-waste into reusable materials because of a lack of resources, expertise, and financial or political backing (Hafizah Abd-Mutalib, 2021; Goh & Sukri, 2025). Despite the promotion of the 3R idea (reduce, reuse, recycle), there is still a lack of practical application and poor implementation of sustainable e-waste management techniques (Rahiza, 2022). This shows that there needs to be more effective waste management and recycling systems in our country.

Furthermore, e-waste management in Malaysia still needs more adequate regulations and controls. In 2015, Malaysia focused more on environmental protection than quantity control in e-waste management. As previously announced by the Ministry of Natural Resources and Environment of Malaysia, a proper system needs to be established for managing household e-waste, as Malaysia still lacks an e-waste system (Jayaraman et al., 2019). E-waste from the manufacturing industry is only controlled according to the Environmental Quality (Scheduled Waste) Regulations 2005, from production to disposal. The absence of a structured regulation and system for managing household e-waste is a gap that requires urgent attention. Hussin et al. (2023) opined that appropriate actions and measures should be taken without comprehensive regulations related to e-waste. There needs to be more commitment from business

organizations and private companies in Malaysia to manage and report e-waste, which is one of the contributors to this issue (Technology, 2025). Furthermore, the absence and lack of e-waste recycling facilities and low participation in e-waste disposal are common issues in developing countries such as Malaysia (BERNAMA, 2025).This situation is an obstacle to moving towards sustainable e-waste management.

Although recycling instruction has been implemented in schools, it is frequently not applied consistently in day-to-day activities (Pariatamby & Bhatti, 2020). The goal of initiatives like Universiti Putra Malaysia's E-waste Program is to close the knowledge gap so that students may put what they have learned into practice. Nonetheless, a lot of people continue to inappropriately dispose of e-waste in conventional garbage disposal locations, which contaminates the environment and sets a bad example for others (Gangwar, 2019). Knowledge itself is only enough if it is put into action. For example, Universiti Putra Malaysia (UPM) has introduced an E-waste Program to combat the e-waste recycling issue (Rahiza, 2022). By participating in this program, students can apply and implement their knowledge. Some people who do not know how to decompose it throw away e-waste and other rubbish, such as food waste.

Finally, weaknesses in policy and regulation contribute to ineffective e-waste management. Malaysia has historically prioritized environmental protection over managing the volume of e-waste, and household e-waste management lacks a structured system (Jayaraman et al., 2019). While industrial e-waste is regulated under the Environmental Quality (Scheduled Waste) Regulations 2005, household e-waste is largely unmonitored. Recent legislative revisions, such as the increased fines under Section 34B of Act 127, indicate progress, but enforcement is still limited. The absence of comprehensive policies, insufficient commitment from businesses, and low public participation in recycling programs hinder the country’s efforts to move toward sustainable e-waste management (Hussin et al., 2023; Technology, 2025; BERNAMA, 2025). Under Section 34B of Act 127, illegal dumping of scheduled waste onto Malaysian land or into its waters will result in a maximum fine of RM500,000, five years’ jail, or both. The revisions made on July 7, 2024, increased penalty rates and fines, with a minimum fine of RM5,000, a maximum fine of RM10 million, and a mandatory imprisonment of up to 5 years. This action will signal to the other country that the Malaysian government takes this issue seriously. According to Datuk Ramli Mohd Tahir, managing director of KDEB Waste Management, approximately 200 illegal e-waste recycling factories have been operating in Malaysia, with dozens

reported in Rawang and Hulu Selangor (Mail, 2024). This is not a good sign for Malaysia if several steps are not being taken.

The literature reveals a research gap, as previous studies have surprisingly limited regional focus. Most existing studies focus on national trends or major urban centres (e.g., Kuala Lumpur, Penang) and provide limited empirical data on the Southern region of Malaysia (Johor, Melaka, Negeri Sembilan) (Huang et al., 2025; Rahman et al., 2025). Next is inadequate integration of qualitative and quantitative insights. While studies often use surveys or interviews, there is a lack of robust mixed methods designs that integrate both approaches to achieve a deeper understanding (Che Abdullah et al., 2025; Department of Environment Malaysia [DOE], 2025). Thirdly, behavioural drivers versus barriers are not well understood. Many studies describe e-waste behaviours but do not unpack the underlying external and internal factors namely, psychological, cultural, social, and economic drivers that influence recycling decisions. This under-representation of emotional and cultural dimensions in e-waste research in Malaysia is notable.

Most of Malaysia's current e-waste studies focus on national-level assessments or on more urbanized regions, such as Kuala Lumpur and Penang, where public awareness, infrastructure, and enforcement are relatively well developed (Creswell & Plano Clark, 2025; Kankanamge et al., 2025). Although these studies offer valuable macro-level insights, they often obscure regional differences in local governance capacity, recycling facility accessibility, and socioeconomic situations (Ivankova & Wingo, 2025). The lack of region-focused research limits the capacity to develop context-sensitive actions and policies, leading to reliance on broad conclusions that do not represent local circumstances.

Explanatory sequential mixed method designs that combine quantitative results with qualitative investigation to confirm, elucidate, and enhance comprehension are conspicuously lacking (Quratul Udin et al., 2025; Che Abdullah et al., 2025). The current literature provides only a fragmented picture of e-waste recycling behaviour in the absence of such integration. This methodological flaw undermines the empirical basis for evaluating theories and developing policies and limits the strength of the results (Hassan et al., 2025). Therefore, to produce thorough, triangulated evidence, a mixed-methods approach is required.

Additionally, Malaysian e-waste research underrepresents emotional, cultural, and social factors, such as habits, convenience orientation, trust in recycling procedures,

and community influence (DOE, 2025; Rahman et al., 2025). As a result, existing research provides little insight into why knowledge does not always translate into actual recycling behaviour. This disparity underscores the need for a theory-driven behavioural analysis, particularly one that extends well-known models, such as the Theory of Planned Behaviour, to more accurately represent decision-making processes in the real world.

While many previous studies acknowledge the gravity of the e-waste issue, they do not provide specific, practical recommendations for policymakers, municipal authorities, or commercial actors. The societal impact and policy relevance of the research are diminished when empirical findings are not clearly translated into practical methods. Stakeholders lack clear guidance on how to enhance e-waste recycling performance, as there is no evidence-based guidance on facility provision, incentive mechanisms, awareness campaigns, or regulatory adjustments. This gap highlights the need for research, particularly in regional contexts such as Southern Malaysia, that not only identifies behavioural trends but also informs policy design, enforcement strategies, and stakeholder engagement.

1.4 Research Question

Based on the issues highlighted, below are the research questions of the study:

1. What is the level of e-waste recycling behaviour among the Malaysian public in the Southern Region?
2. Do external factors (policy and regulation, facility support, and subjective norm) and internal factors (moral obligation, attitude, time availability, and waste sorting knowledge) significantly influence e-waste recycling behaviour among the Malaysian public in the Southern Region of Malaysia?
3. How to improve recycling behaviour among the Malaysian public in the Southern Region?

1.5 Research Objective

1. To examine the level of e-waste recycling behaviour among the Malaysian public in the Southern Region.
2. To investigate the influence of external factors (policy and regulation, facility support and subjective norm) and internal factors (moral obligation, attitude,

time availability and waste sorting knowledge) on e-waste recycling behaviour among the Malaysian public in the Southern Region.

3. To propose strategies for improving recycling behaviour among the Malaysian public in the Southern Region.

1.6 Scope of The Study

In conducting a survey study, the scope of this study encompasses the Malaysian public residing in the Southern Region of Malaysia, specifically Johor, Melaka, and Negeri Sembilan. These three states make up Peninsular Malaysia's southern corridor, which is strategically significant for cross-border trade (particularly between Johor and Singapore), urbanization, and industrial development. These three states are chosen based on their total population in 2025 which Johor with 4.206 million people, Melaka with 1.052 million people, and Negeri Sembilan 1.245 million people (Department of Statistics, 2025). A sample size of 500 respondents will be collected for this study. For quantitative research, the 500 respondents chosen are deemed sufficient and suitable since higher sample sizes improve the precision and dependability of statistical results (Morgan, 2008). A sample size of approximately 384 respondents is considered adequate to represent a large population at a 95% confidence level and a 5% margin of error, according to Robert V. Krejcie and Daryle W. Morgan (1970). Therefore, the use of 500 respondents, which exceeds the minimum recommended sample size, strengthens the reliability, accuracy, and generalisability of the study.

While for the semi-structured interview, it includes 9 informants, including one from the Department of Environment, one expert academician, one from a Non-Governmental Organization (NGO) which is Zero Waste Malaysia, two communities from Negeri Sembilan, two community people from Melaka, and two community people from Johor. For the qualitative approach, data collection was conducted in May 2025. To gather information, a survey was administered to participants, who were asked to respond and share their opinions on how intention affected e-waste recycling behaviour in Malaysia. The respondents answering the survey resides at Johor, Melaka and Negeri Sembilan from the age of 18 years old and above. This study aims to identify the primary factors influencing e-waste recycling behaviour, which include rules and regulations, moral obligation, attitude, subjective norm, facility support, time

availability and waste sorting knowledge on e-waste recycling among the Malaysian public.

1.7 Significance of The Study

The study's importance stems from its capacity to influence governmental decisions, raise public awareness, and encourage a shared commitment to responsible e-waste recycling behaviour. With a thorough understanding of the e-waste environment, stakeholders can collaborate to create a more equitable and sustainable future.

1.7.1 Malaysian Government (National Solid Waste Management)

In this context, e-waste recycling can help Malaysia in terms of economic benefits. E-waste contains gold, aluminium, and zinc when it is being discarded. Thus, Malaysia does not have to import raw earth material from other countries. Besides, it will also create new industries and jobs for the people (Debobrota Kumar Sarker, 2025). There will be a new sector that focuses on discarding e-waste. Besides, in terms of environmental benefits, it can reduce pollution and lower the carbon footprint. At the same time, it supports SDG 12 on responsible consumption and production (Palansamy, 2025). All in all, proper e-waste management can transform from an environmental liability into an economic resource while protecting public health and advancing sustainability goals. Thus, it also impacts to help in achieving recycling rate. This study will also support government policies.

From this, it shows that country also plays an important role in the concept of e-waste recycling. According to Mwalugeni et al. (2025), the study of economic growth in various countries highlighted the need to understand the country's economic structures and policies. Their research revealed that countries with specialized policy frameworks and investments in human capital tend to have better growth rates. This is why every country faces many challenges that help to shape its country. In this study, the country's role is to expand the context of e-waste recycling among the public to make sure that they are aware of and practice e-waste recycling. Suryawan et al. (2025), emphasize the need for country-specific research to understand how inequities and social justice concerns affect national development in their work. The findings encourage scholars and policymakers to consider both economic and social variables in

supporting inclusive growth. It also helps in achieving the recycling rate and zero-carbon nations. This study also supports the government policies. All in all, every country needs to know and put into action its efforts towards e-waste recycling, as it influences citizen behaviour.

1.7.2 Ministry of Natural Resources and Environmental Sustainability (NRES)

This study analysed the factors that influence e-waste recycling behaviour in Malaysia, which is worsening daily. The Department of Environment is the most critical factor that needs to act regarding preventing and conserving the environment. Section 127 of The Environmental Quality Act of 1974 states that any electronic device needs proper waste management as it can damage the environment if not managed correctly. These regulatory measures aim to control and monitor pollutants that can threaten the environment (Chin, Pretto, Thuppil, & Ashfold, 2025).Despite these regulations, e-waste recycling behaviour in Malaysia is still at critical level as the act's enforcement does not strictly apply. Therefore, this shows that the actions of government and policy actors are essential in the e-waste issue. They must act faster to cope with this issue by strengthening the enforcement of the current regulations so that the problem does not harm human health and the environment.

1.7.3 Local Government

Local governments play essential responsibilities in the management of e-waste. This results from the federal government giving the local government the authority to decide on some issues (MBIP, 2024). For instance, the local government covering the Iskandar Puteri region in Malaysia is called Majlis Bandaraya Iskandar Puteri (MBIP). They oversee overseeing the area's environmental management. The MBIP's Drive-to-save initiative demonstrates their unwavering commitment to managing e-waste and their use of every resource available. The local government also plays crucial role as their behaviour influences the e-waste recycling behaviour of Malaysian people. The Selangor State DOE has licensed 28 premises or e-waste recycling facilities in the state that can process e-waste in an environmentally friendly manner to produce precious metals such as gold, silver, copper, platinum, and palladium (Department of

Environment Selangor, 2024). This action is taken to ensure that e-waste is not disposed of at will, including giving it to the wrong party, throwing it into rivers and landfills, or burning it openly. As a result, this situation has an influence on the e-waste recycling behaviour among the Malaysian people. This study benefits the local government as it helps the local government have a better insight into the local community on e-waste recycling. Not only that, but this study also encourages a more effective policy implementation as it collected data that might help the policymaker to find the solution mechanism.

1.7.4 Community

This research will help create awareness and education for the community. E-waste is not being taken seriously, making it hard for the government to educate the people. Public participation is very crucial in e-waste recycling behaviour as it has a significant impact on the effectiveness of e-waste recycling behaviour in a country (Zhaohua Wang, 2018). Educating the public to help implement proper e-waste recycling is not simple. On behalf of the public, it is challenging for Malaysians to practice appropriate e-waste recycling, as many factors can influence their behaviour to sort e-waste. However, it does not mean the public can neglect their responsibilities. People can try to practice proper e-waste recycling one step at a time. Therefore, this shows significant public participation and e-waste recycling behaviour in Malaysia.

1.7.5 Non-Governmental Organization (NGO)

In this research, the NGO plays a crucial role in voicing environmental issues that need to be addressed by the government. NGO is responsible for conserving the environment as it volunteers to reduce air pollution. Greenpeace Malaysia is one of the NGO that promotes better e-waste recycling for the benefit of humans, animals and the environment. Their awareness through social media and Corporate Social Responsibility (CSR) influences the e-waste recycling behaviour of the Malaysian public. According to recent research by the World Bank 2021, shows a massive increase in the percentage of people buying smartphones compared to the 90s (Kursyiyah, 2021). Using this data, it can help NGOs to voice their opinion with the living proof of the e-

waste produced in Malaysia and influence the government to provide more facilities for e-waste recycling. Therefore, it shows that NGOs significantly impact e-waste recycling behaviour in Malaysia. Additionally, the study's findings help NGOs accomplish their objectives by offering empirical data on public recycling behaviour, which they can utilize to create more focused awareness campaigns, bolster advocacy initiatives, and work more productively with legislators to improve e-waste management infrastructure.

1.7.6 Theoretical Contribution

In this study, the research communities have played a significant role in spreading awareness through their research. Without research communities, the student will lack references, especially in e-waste recycling studies, as not many people are interested in this topic and think it is difficult. By making this study will be helpful for future students to refer to when they need a source. Some of the benefits of the output of this study for future research are that it provides a comprehensive framework which future studies can adapt and adopt to future research, and it also encourages a good comparison with other studies. Besides, the survey design may vary from the existing studies, as this study is using the AMOS SEM. In future studies, other methods might be used to improve the findings.

1.8 Conceptual Term and Operational Definition

In this section, the conceptual term and operation are defined as it is the key construct to the study. While operational definitions outline how the variable is measured, observed, or quantified in relation to the recycling practices of Malaysians in the Southern Region, conceptual words provide clarification on the theoretical meaning of each subject.

1.8.1 E-waste Recycling Behaviour

E-waste can be defined as electronic and electrical equipment that has been rejected or is not used by its owner (Khalid Mehmood Shad, 2020). Components from electronic devices are also considered e-waste. Electrical appliances such as broken

irons, medical devices, and vacuums are also listed under e-waste. The behaviours of the Malaysian public regarding the recycling of these discarded electronic items, such as sorting, segregating, and transporting them to the proper recycling channels, are referred to in this work as "e-waste behaviour" (Nordin et al.,2025). Further discussion will be discussed in the next sub-topic. For the operational definition, DOE has classified e-waste under the Environmental Quality (Scheduled Wastes) Regulations 20025. In this regulation, any e-waste, such as industrial e-waste and household equipment, is categorised under scheduled waste. E-waste can be hazardous if it is not maintained regularly and properly. Classifying the e-waste helps to have good e-waste recycling management.

According to behavioural theory, recycling e-waste is a form of pro-environmental behaviour in which people's intentions, which lead to action to recycle, which are influenced by psychological concepts like attitudes and perceived behavioural control, are translated into actual recycling behaviours (Liu & Yang, 2022). Besides, according to behavioural science, e-waste recycling behaviour reflects real pro-environmental behaviours, where people transform moral duty and environmental knowledge into practical recycling practices (Ajzen, 1991; Bamberg & Möser, 2007). This study identifies which factors have the most influence on e-waste recycling behaviour instead of focusing on the intention of the people to recycle their e-waste.

1.8.2 External Factors

External factors refer to external factors that influence or limit a person's capacity and inclination to properly recycle electronic waste. These elements function beyond individual attitudes or intentions and are usually structural, institutional, social, and environmental in nature.

1.8.2.1 Policy and Regulation

According to Dye (2020), policy is what governments decide to do or not do is known as policy. This definition emphasizes that policy encompasses both intentional inaction and actions. According to Oxford Dictionary (2025), regulation is an official rule made by a government or some other authority. Thus, the purpose of policy and

regulation is to set guidelines set by an authority to control the behaviour of the people and to maintain safety. In this study, respondents' opinions of current environmental laws, government policies, and enforcement procedures pertaining to recycling e-waste are used to gauge rules and regulations. Malaysia is using the Environmental Quality Act 1974 and Environmental Quality (Schedule Waste) Regulations 2005 regarding e-waste recycling (Malaysia, 2025). There are several policies that have been implemented, such as the National Environmental Policy (NEP) 2009, which ensures sustainable development for the country. Next, the National Green Technology Policy (NGTP) 2009, which encourages the creation and use of green technology in the fields of waste management, buildings, transportation, and energy. The recent policy, which is currently being drafted, is the National E-Waste Management Policy (Expected 2025), which focuses on the sustainable management of electronic waste. This policy is still under consideration and at the discussion level of the Ministry of Natural Resources and Environmental Sustainability (NRES) (BusinessToday, 2025).

1.8.2.2 Facility Support

Facility support for e-waste should have been provided enough for the people to practice e-waste recycling. Practising e-waste requires a time commitment, which is complicated for the generation nowadays because people are busy with their lives. At the same time, it may be possible for the older generation to retire (Alhassan, 2018). Thus, facility support should be provided to encourage people to commit fully. A good and convenient facility support should be provided to make it easy for society to practice e-waste recycling, as it can influence the intention to sort e-waste (Zhang B. L., 2019).

In this study, facility support policy refers to suitable and practical technologies offered to inspire and urge people to provide their whole devotion (Dutta, 2021). Inadequate cooperation and coordination among interested parties could result in infrastructure obstacles when implementing EWM (Chaudhary, 2018). Samsung is a corporation that offers quality e-waste facilities. At their service centre location, they provide recycling services. Customers could email the company to request that E-waste be picked up from their location (Circularity, 2023). This endeavour ought to serve as a model for other businesses seeking to offer easily accessible e-waste

facilities.

1.8.2.3 Subjective Norm

Subjective norm can be defined as an act based on what people usually do, including family, friends, and colleagues (Ziyi Zhao, 2025). It also means that normality happens, and it has become a culture that makes people feel uneasy if they do not do it. According to Pradaini Nadarajan (2023), subjective norms are views and ideals of appropriate and inappropriate behaviour in a particular situation. Identifying whether a specific issue constitutes a subjective norm is based on the positive and negative impacts of that issue on social norms. Abdullah Al-Swidi (2014) describes subjective norms because of motivation to behave in a way consistent with those referents and beliefs regarding the importance of those referents. In this thesis, the behaviour of the Malaysian public to sort e-waste can be influenced by the subjective norm, which can be a motivating factor. Further discussion on its influence on e-waste recycling behaviour can prove this issue.

In this study, subjective norm refers to the perceived benefits and drawbacks of adhering to or departing from normative behaviour when evaluating subjective norms (Nadarajan, 2023). The interaction of subjective and personal norms may influence recycling behaviour. A person's internalised views and ideals about what is appropriate and inappropriate concerning a specific behaviour like recycling e-waste are referred to as personal norms. People are more inclined to recycle e-waste if they feel strongly that recycling e-waste is a social obligation and have a solid personal norm to recycle. It shows that subjective norms can influence e-waste recycling behaviour among the Malaysian public.

1.8.3 Internal Factors

Internal factors refer to a person's motivation, intention, and choice to participate in appropriate e-waste recycling, which are influenced by psychological, cognitive, and moral factors. Rather than originating from external structures or institutional settings, these elements are inherent and stem from individual beliefs, attitudes, perceptions, and awareness.

1.8.3.1 Moral Obligation

Moral obligation is the human sense of responsibility. Every human is born with a sense of moral obligation within themselves. Conner and Armitage (1998) stated that moral obligation refers to an individual's belief about whether a particular behaviour is ethically right or wrong. As Nur Shafeera Mohamad (2022) stated in his journal, the moral obligation has a more significant influence than attitude in several aspects of e-waste recycling behaviour. The study by Nur Shafeera Mohamad (2022) proves that Malaysian society is more responsible for the 3R program, which is reused, reduced, and recycled. This shows a positive response from society and can become one factor influencing the sorting of e-waste in Malaysia. It shows that moral obligations have influenced the behaviour of the people towards e-waste recycling behaviour in Malaysia (Chad Anderson, 2025; Che Abdullah et al., 2024). People who have a moral obligation know that their actions, whether good or bad, might impact the environment. People who have moral obligation are more careful with their actions than people who do not have moral obligation.

1.8.3.2 Attitude

Ajzen (1991) defines an attitude as one's positive or negative opinions on engaging in a specific behaviour. Attitude is the response of humans towards certain situations. It is an act resulting from a particular problem and condition. Referring to studies done by Zhang (2020) stated that a person’s attitude impacts and influences e-waste recycling behaviour. Mindset is also connected with attitude as it affects one another. Attitude is also related to a person’s willingness to change. An article has proven that people’s desire to change can influence their intention to sort e-waste (Pradaini Nadarajan et al., 2023). This is because people who are willing to change will be more consistent in practicing e-waste recycling behaviour than people who do not have this attitude.

An individual's attitude describes their behaviour assessment, whether favourable or unfavourable (Ajzen I., 1991). Attitude can also have good and bad impacts on situations. People who are raised in a recycling-friendly environment, for

instance, will naturally adopt a recycling mindset. This is because attitude takes time to develop. This shows that attitude might influence e-waste recycling in the Malaysian public.

1.8.3.3 Time Availability

This study's time availability consists of idle and productive time (Encyclopedia, 2023). The time a system spends serving users' needs during a specific time frame is known as productive time. The amount of time a system is not doing valuable work in a certain period is known as idle time. In addition to awareness, public recycling intentions positively correlate with the ease of access to recycling infrastructure (Laeequddin, 2022). Ease of access is interrelated with the time availability of the people practicing e-waste in Malaysia. The above discourse indicates that time availability impacts Malaysia's e-waste recycling behaviour. This variable must also be considered when doing this investigation.

1.8.3.4 Waste Sorting Knowledge

Knowledge is crucial because it helps us make decisions, molds our understanding, and gives us the ability to effect positive changes. According to Liu (2024), knowledge is the comprehension and mastery of ideas, facts, patterns, and connections that a person has gained via ongoing study, observation, or prior experience with a particular subject. The media should be used as a platform to provide and spread knowledge on waste sorting. Programs on this issue also help spread knowledge to everyone, regardless of age.

The statement by Sonal Thukral (2022) mentions that to raise the rate at which consumers dispose of their e-waste, they must have a high degree of knowledge and awareness regarding the formal waste and recycling plan. Society in Malaysia might know the impact of improper e-waste recycling but does not know how to discard or handle it. This can be referred to in the study by Hanifah Mahat (2019), which proves that Malaysian people are not exposed to managing the electric and electronic equipment that needs to be discarded. This shows how important it is for waste sorting knowledge in e-waste recycling behaviour among the Malaysian public.

1.9 Summary of Chapter

The growing problem of electronic trash (e-waste) in Malaysia, especially in the Southern Region (Johor, Melaka, and Negeri Sembilan), is introduced in Chapter 1. Growing consumer demand, shorter product lifespans, and rapid technological innovation have all had a major impact on the rise in e-waste output. Only roughly 10% of Malaysia's e-waste is adequately recycled, despite national commitments under the 12th Malaysia Plan and alignment with SDG 12 (Responsible Consumption and Production). Weak enforcement and illegal e-waste operations make the issue worse.

The chapter emphasizes the major health and environmental hazards that incorrect e-waste disposal poses, such as exposure to lead and mercury and contamination of water and soil. Although policies such as the Environmental Quality Act 1974 and Scheduled Waste Regulations 2005 exist, household e-waste management lacks a structured system.

This study addresses research gaps by focusing on the Southern Region and integrating both internal (moral obligation, attitude, time availability, waste sorting knowledge) and external factors (policy and regulation, facility support, subjective norm) influencing actual recycling behaviour rather than intention alone. Using the Theory of Planned Behaviour (TPB) as the underlying framework, the study adopts an explanatory sequential mixed-methods design involving 500 survey respondents and 9 interview informants.

The chapter concludes by outlining the research questions, objectives, scope, significance, and key conceptual definitions, emphasizing the study’s contribution to policy improvement, community awareness, and theoretical advancement in e-waste recycling behaviour research.

CHAPTER 2
LITERATURE REVIEW & THEORETICAL FRAMEWORK

2.1 Introduction

This chapter discusses the study variables, which fall into two categories: independent variables and dependent variables. The dependent variable for this study is the Malaysian public's e-waste recycling behaviour. Furthermore, the independent variables are grouped into two, which are internal factors and external factors. External factors are rules and regulations, facility support, and subjective norm. While internal factors are moral obligation, attitude, time availability, and waste sorting knowledge.

The first part of this study discusses the research background and studies that have been done on this topic. The next part discusses the independent variable's influence on the recycling behaviour to sort e-waste. The contributing factors in this study come from aspects neglected by the people and the government. This study also consists of a conceptual framework and hypothesis studies. Besides, the hypothesis is also discussed in this chapter.

2.2 Waste

Scholars define waste as any material, substance, or item that is thrown away after usage because it is no longer beneficial to its owner. According to Abbot (1998), waste is any material that its owners deem undesirable or worthless. Similarly, waste is created when an item is eliminated because it no longer serves its intended purpose, according to Pongęcz et al. (2004). Waste is further defined by the United Nations Environment Program (UNEP) as materials or items that are disposed of, intended to be disposed of, or mandated to be disposed of in accordance with national law under the Basel Convention. Household, commercial, industrial, agricultural, and electronic activities can all produce garbage, and poor waste management can have detrimental effects on both the environment and human health.

According to Costas Velis (2025), waste should be seen as a potential resource that can be recycled, recovered, or repurposed within a circular economy system rather than just as useless material. Effective waste management is essential for environmental

sustainability and public health because growing urbanization, industrialization, and technological advancement have greatly increased the complexity and volume of waste globally, according to recent waste management research.

Municipal solid garbage, industrial waste, hazardous waste, organic waste, biomedical waste, and electronic waste (e-waste) are some of the categories into which waste can be divided. Due to the quickening pace of technological development, shorter product life cycles, and rising consumer demand for electronic gadgets, e-waste has emerged as one of the waste streams with the fastest rate of growth in the world. Waste is produced when materials no longer serve their intended purpose and are thrown away by users, according to Pongęcz et al. (2004). In the current digital era, this concept is closely associated with electronic devices that quickly become outdated or non-functional, such as laptops, cellphones, televisions, printers, and household appliances.

Globally, the volume of municipal garbage has expanded dramatically due to rapid urbanization and population development. Inadequate management of municipal solid waste has been linked to overflowing landfills, greenhouse gas emissions, and environmental damage. According to recent studies by Achillas and Vlachokostas (2025). To reduce the impact of municipal garbage, recycling and waste separation techniques are being promoted more and more.

2.2.1 E-waste

E-waste is any electrical or electronic appliance that has been discarded or is not being used. There are several categories of e-waste, which are small household equipment, lighting equipment, kitchen appliances, and medical electronic appliances (WEEE,2025). This shows that e-waste is not just produced by households but also by all sectors, like hospitals, schools, and the production sector, like factories (Oise & Konyeha, 2025).

The driving factors of e-waste are the rapid advancement of technology across all sectors. Most industries are using technology to make their work easier and to save time and money (Publication Unit JSKM, 2025). However, the rapid growth of this technology has led to an increase in e-waste produced. Besides, the increase in consumerism has also led to the rapid growth of e-waste production. The ability for the consumer to buy and own electrical and electronic devices at affordable prices has also become a major factor in these issues (BusinessToday, 2025). For example, currently,

most people will keep upgrading their smartphones at least once every 5 years. The consumer habits that might seem positive as they follow technological advancement, also affect the environment. Consumer changes their electrical and electronic appliance not because they are broken, but because of their desire. Besides, inadequate facilities for e-waste also contribute to the e-waste produced (Publication Unit JSKM, 2025).

The impact of the factors above on the environment is the release of hazardous substances. For example, smartphones or laptops contain hazardous substances like mercury and heavy metals (Bhardwaj et al., 2025). This then flows to the river and is absorbed by the soil, which then leads to water pollution. Moreover, it can lead to skin conditions, cognitive impairment, cardiovascular illness, kidney damage, respiratory problems, and an elevated risk of cancer, which can all result from exposures (The Star, 2025). Particularly at risk are those who work in informal recycling or are close to landfills (Bhardwaj et al., 2025). Workers in the cleaning sector are usually exposed to hazardous conditions. Lastly, it also affects the economic losses. E-waste contains valuable materials like gold, silver, rare earths, and copper. Improper recycling of e-waste has led to a loss of this opportunity to turn the waste into an economic opportunity.

Table 2.1 below shows the list of e-waste items that are being listed by the Department of Environment (DOE). Most of the items listed are the common items that can be found in every household. Furthermore, in Malaysia, e-waste is regulated as Scheduled Waste (SW110) under the Environmental Quality (Scheduled Wastes) Regulations 20025.

Table 2.1
Schedule of E-waste Item in Malaysia

E-waste Items	Examples
Washing Machine/Dryer	Household washing machines and clothes dryers
Refrigerator/Freezer	Refrigerators, chillers, and freezers
Television	CRT, LCD, LED, and plasma televisions
Computer/Laptop	Desktop computers, laptops, monitors, tablets, and accessories
Mobile Phone/Smartphone	Mobile phones and smartphones
Air Conditioner	Residential and commercial air conditioning units

Source: Department of Environment (2025)

Overall, the Department of Environment Malaysia's Scheduled Waste Code SW110 classification of e-waste items offers a clear regulatory framework for identifying and managing end-of-life electrical and electronic equipment, guaranteeing that such waste is handled through appropriate and ecologically sound recycling channels. It will be discussed in the next sections.

2.2.2 E-waste Recycling Behaviour

Several studies have been conducted on e-waste recycling behaviour, which give more insight into this issue. The studies were conducted between 2020 and 2025 in several countries, including Malaysia. Below is the summarisation of the determinants of e-waste recycling behaviour.

Table 2.2
Determinants of E-Waste Recycling Behaviour

No.	Year	Authors	Country/Sample	Findings
1	2020	Yana et al. (2020)	Malaysia	E-waste behaviours influence by subjective norm and attitude
2	2022	Mohamad, N. S., et al. (2022)	Malaysia	Moral obligation is the strongest predicator on e-waste recycling
3	2024	Michael, L. K.	Developing	Policy intervention as the

		(2024)	countries	strongest predictors
4	2024	Traverso, M., et al. (2024)	Ghana and Nigeria	E-waste sector vulnerabilities implications and policy intervention as the strongest predictors
5	2025	Nawaz, N., et al. (2025)	Bahrain	Determinants of e-waste are attitude, norms, perceived control, convenience and awareness
6	2022	Mohamad, N. S., Thoo, A. C., & Huam, H. T. (2022)	Malaysia (Consumers)	Attitude, perceived behavioural control, moral obligation, and convenience significantly influence intention; intention predicts actual recycling behaviour.
7	2024	Wan Yusoff, W. Z., Ahmad, N., & Esman, F. (2024)	Malaysia (TVET Staff)	Attitude and subjective norms significantly influence intention; environmental knowledge is not significant.
8	2024	Saphores, J. D. M., Nixon, H., Ogunseitan, O. A., & Shapiro, A. A. (2024)	Multi-country	Saphores, J. D. M., Nixon, H., Ogunseitan, O. A., & Shapiro, A. A. (2024)
9	2025	Htet, N. N., & Sahrir, S.	Malaysia (Residents)	All TPB constructs significantly influence intention; intention positively predicts recycling behaviour.
9	2025	Hasbullah, N. N., Muthusamy, G., Naseri, R. N. N., & Yahya, W. K. (2025)	Malaysia (Retail Consumers)	Ergonomic bin design and social influence significantly increase recycling intention.
10	2025	Nordin, N. B., Mohd Noor, N. H., & Yaacob, M. ’Aini. (2025)	Malaysia (Public)	Moral obligation and facility support are strong predictors of e-waste recycling behaviour.
11	2025	Omar, M., Samsudin, N., Ahmad Shukri, F.	Malaysia	Highlights joint influence of social and behavioural factors on recycling practices.

		N., & Syed Abdullah, S. S. (2025)		
12	2023	Borthakur, A., & Govind, M. (2023)	Developing Countries	Personal norms and awareness significantly affect recycling intention.
13	2024	Saphores, J. D. M., Ogunseitan, O. A., & Shapiro, A. A.	Global	Habit formation combined with accessible recycling systems sustains recycling behaviour.
14	2025	Trinh, D. D. & Sakurai (2025)	Vietnam and Japan	Regulation is the strongest determinants for e-waste recycling while other factors like moral obligation and subjective norm also have significant influence on it.

Source: Author (2025)

Based on the study conducted by Mohamad et al. (2022), the study used the Theory of Planned Behaviour to have a thorough and clear picture of the consumer's behaviour towards waste recycling. Several determinants are being discussed in this study, like convenience, perceived behavioural control, subjective norms, and moral obligations. Moral obligation is the self-accountability towards certain issues and the way they act towards the issues (Nordin et al., 2025). It influences people's decision-making. According to Goh and Sukri (2024), showed that across Penang communities, moral obligation was a strong predictor of awareness and desire to manage electronic trash properly. Thus, findings from the studies show that the strongest predictor is moral obligations.

Michael (2024) used an integrated Theory of Planned Behaviour (TPB) and Norm Activation Model (NAM) method to investigate the psychological and contextual factors influencing e-waste recycling behaviour. The findings from the study highlighted policy intervention in pro-recycling behaviour. Besides, studies by Veerappan et. al (2025), Tun Ismail (2025) also found that policy intervention needs to work together with infrastructure to be more efficient. Michael (2024) concluded that to increase e-waste recycling participation in poor countries, policy interventions must address both practical obstacles and moral motives.

A social analysis of the e-waste recycling industries in Ghana and Nigeria was carried out by Travero et al. (2024), with an emphasis on the social, health, and labor circumstances influencing recycling activities. This study combines the vulnerabilities and the socio-economic risks relationship with the informal e-waste recycling. It reveals that the weak enforcement and regulation of e-waste cause occupational hazards and toxic exposure in recycling activities. Besides, a study by X. Zhang (2025), reveals that policy intervention can reduce the barriers towards e-waste recycling.

Nawaz et al. (2025) in their study also examined the determinants of e-waste recycling intention and behaviour in Bahrain. The results indicated that the attitude of the people and awareness of e-waste recycling are the strongest predictors of e-waste recycling. He also highlighted in his study that the policy framework to improve recycling includes infrastructure and lots of educational campaigns. Mohd Akhir Ahmad, Razak, and Iteng (2025) in their study also indicate that awareness programs can improve the industrial-level compliance and environmental performance. However, awareness should be supported with accessible infrastructure, policy, and regulation.

Trinh and Sakurai (2025) conducted a survey with over 2400 students across Vietnam and Japan. From the survey that has been conducted, it has resulted in regulation and policy as the strongest predictors of recycling behaviour. As discussed before, policy and regulation alone are not enough. It needs to work together with accessible infrastructure, and the moral obligation of the people is also important (Mohd Akhir Ahmad et al., 2025). The results of this research show that effective and sustainable e-waste treatment in Malaysia and elsewhere needs an integrated strategy that combines moral responsibility, public awareness, and supportive regulations (Goh & Sukri, 2024; Goh & Sukri, 2025; Mohd Akhir Ahmad et al., 2025).

Behaviour can be defined as what an individual does or says. Humans behave differently due to several influences, such as religion, age, and society (Bosnjak et al., 2020). Everyone has positive behaviour, and some have negative behaviour. This behaviour is easily explained as all human actions that can be observed, measured, and evaluated, and any action done directly or indirectly, consciously or subconsciously (Maulana et al., 2024). Behaviour is the physical manifestation of any attitude based on specific values (Bosnjak et al., 2020). An individual behaves according to his/her self-perception and circumstances. The environment influences the behaviour of people regarding e-waste recycling.

Everyone plays a vital role in managing e-waste. Everyone can play a role in reducing the amount of e-waste sent to landfills while also reducing pollution. According to Noor et al. (2023), among the challenges faced inefficient e-waste management are the need for more enforcement regarding e-waste disposal, insufficient recycling infrastructure, and less environmentally friendly disposal methods that could affect the e-waste recycling behaviour. Noor et al. (2023) stated that Malaysia still needs an effective e-waste management system. Therefore, the community needs help with e-waste recycling in a planned concept.

Furthermore, the community's knowledge and awareness regarding e-waste management is still low, and they need to know the correct method for disposing of e-waste (Pariatamby & Bhatti, 2020). Sofian et al. (2023) explained that awareness of e-waste management can help create an environmentally friendly management system. In Ningbo, China, most respondents know about e-waste management in terms of recycling, and 64% of respondents know about the separation of recyclable waste (Aslam et al., 2020). This can be seen when the community disposes of electrical and electronic waste by separating it into labelled recycling bins. The scenario abroad does not occur in Malaysia, as the people still lack knowledge of e-waste recycling (Pariatamby & Bhatti, 2020). A study by Hamzah et al. (2020) also showed that the knowledge and awareness among the public in Negeri Sembilan about e-waste were satisfactory. However, the researchers found that most respondents needed to learn the correct ways to dispose of e-waste. This statement is also supported by Mohamad et al. (2021), who argue that consumers are not aware of the correct way to dispose of e-waste, even though local authorities have implemented a solid waste separation program by the regulations of the Solid Waste Management and Public Cleansing Act 2007 (Act 672).

E-waste can be recycled through two approaches. First is formal recycling. Electronics must be separated, sorted, and categorized according to their contents before cleaning. The e-waste is then shredded by a machine so that further separation can be carried out using advanced separation technology. Companies that do this work must comply with health and safety regulations and use pollution control technologies that reduce health and environmental hazards (Pariatamby & Bhatti, 2020). Next is informal recycling. In these informal recycling centres, employees extract valuable materials by melting devices with mercury and acid and opening devices by hand to extract other valuable materials. These workers often do not wear protective equipment

and are unaware of the dangers of the materials they are handling. To prevent these health and environmental hazards, avoid opening, cleaning, repairing, or reselling used electronic devices yourself (Pariatamby & Bhatti, 2020). Package them according to type or category and let professionals handle them. For those living in the Klang Valley, there are several locations for e-waste recycling. This includes UrbanR Recycle+, SOLS Tech, Taiwan Buddhist Tzu-Chi Foundation Malaysia, T-Pot Group, and others. Penang residents can contact Ellusion: Recycle E-Waste via their Facebook page. For residents outside the Klang Valley, the Department of Environment (DOE) has listed e-waste collection locations by state from Perlis to Johor Bahru.

Most of the studies discuss the recycling behaviour of e-waste recycling (Qiao Sun, 2024; Puzzo, 2024; Qiao Sun, 2024; Merve Aydın, 2024). In the past few years, there has been a growing focus on examining the behaviour of residents regarding e-waste recycling. Studies have shown that certain factors, such as attitude and knowledge, influence recycling behaviour (Rusydina Idris, 2024). The main problems associated with e-waste recycling behaviour include insufficient recycling and disposal facilities (Cao et al., 2018). It is essential to implement regulations that tackle e-waste recycling. Researchers commonly assert that the recycling behaviour can forecast later participation in recycling activities (Zhang et al., 2019). A study stated that the elements that affect consumers' behaviour towards e-waste recycling, such as value alignment, concern for the environment, and willingness to adopt change (Dhir, 2021). Regrettably, current studies have not addressed the reasons behind residents' failure to act on their intentions and behaviour regarding e-waste recycling or how to encourage the transformation of intentions into actual behaviours effectively.

Scholars have investigated the factors influencing behaviours related to e-waste through well-established frameworks, including the theory of planned behaviour (TPB), technology acceptance model (TAM), elaboration likelihood model (ELM), innovation diffusion theory (IDT), and social cognition theory (SCT) (Ravi et al., 2023). Most studies have used the Theory of Planned Behaviour (TPB) because the theory discusses a person's characteristics. Moreover, individuals who possess a strong awareness of environmental issues are more inclined to value the ecological features of products over any other qualities when making purchasing decisions. Applying the Theory of Planned Behaviour (TPB) proves to be highly beneficial in this situation, as many previous studies have utilized TPB to investigate consumer attitudes toward eco-friendly products more broadly (Niloy, 2023; Kumar, 2021; Varah, 2021). The Theory of

Planned Behaviour (TPB) is commonly acknowledged as the most effective model for forecasting people's intentions and behaviour.

E-waste recycling is closely related to the Sustainable Development Goals (SDG). Based on goal number 12 of the United Nations Sustainable Development Goals (UN SDGs), promoting responsible consumption and production can be accomplished by motivating consumers to recycle and minimize toxic waste (Nation, 2024). This goal can be achieved if the user supply chain is responsible for their usage. Besides, technology users are critical in effective e-waste recycling behaviour (Ismail, 2020). The existence of the SDG has helped the country implement and practice a better e-waste recycling environment, which has resulted in people's behaviour towards e-waste recycling. This is because the SDG is used as the target that needs to be achieved by the country. Even other studies (Bhat, 2023; Nurdeng, 2024) have stated that SDG has helped the country practise e-waste recycling, resulting in a better understanding of e-waste.

All in all, there are previous studies that have discussed e-waste recycling behaviour. This study has adapted and adopted some of the studies to help in discussing the matter. Referring to the previous studies, it helps to propose a stronger and more significant research. Some previous studies only discussed people's intentions towards e-waste recycling and not their behaviour towards e-waste recycling (Pradaini Nadarajan, 2023). In this study, people's behaviour towards e-waste recycling is the highlighted point. A comprehensive literature review is conducted utilizing content analysis to synthesize the results of previous studies and establish a unified framework of understanding in the relevant field of study.

2.3 E-Waste Management Across Countries

Some countries are used as a benchmark for e-waste recycling in this study, like Japan, Australia, Germany, Netherlands, European Union, Switzerland, South Korea, Singapore, China, and India. According to several studies that have been made (Chung Duc Tran, 2025; Laeeq Razzak Janjua, 2025), these countries practice a good e-waste recycling concept. These countries are considered good and excellent in practicing e-waste because the facilities and regulations that they have towards e-waste recycling are very impressive. Further discussion will be discussed in the next section.

Table 2.3
E-waste recycling across Best Practices Countries

No	Country	Facilities	Regulation	Reward	Policy
1	Japan	Association for Electric Home Appliances Recycling Ticket Centre (A EHA)	Home Appliance Recycling Act (Act No. 97 of 1998) Small Home Appliance Recycling Act (Act No. 57 of August 10, 2012) Promotion of Effective Utilization of Resources (Act No. 48 of April 26, 1991)	Eco-Point	Basic Environment Plan
2	Australia	National Television and Recycling Scheme (NTRS)	The Australian National Waste Policy SERI 2 Scheme	No Reward	E-waste to landfill ban
3	Germany	Electronic Waste Recycling System	Electrical and Electronic Equipment Act (ElektroG)		National Circular Economy Strategy (NKWS)
4	Netherlands	WEEELABEX-compliant treatment facility	Dutch Waste Electrical and Electronic Equipment (WEEE) Management Regulations	Waste Collection Point	Dutch E-waste Policy Intervention
5	European Union (e.g. Germany, Netherlands)	Nationwide collection points; advanced recycling facilities	WEEE Directive; Extended Producer Responsibility (EPR)	Mandatory producers take-back; strict collection and recycling targets; strong	

				enforcement	
6	Switzerland		Advance Recycling Fee (ARF); EPR	Retailers take-back; municipal drop-off centres	
7	South Korea	Continuous education campaigns	Free household collection; smart recycling systems	No reward	EPR Act; Resource Circulation Policy
8	Singapore	Producer-led collection points; centralized recyclers	Mandatory EPR for electrical and electronic waste	No reward	Resource Sustainability Act; EPR
9	China	Formal recycling parks; licensed recyclers		No reward	Circular Economy Law; EPR pilots
10	India	Authorized collection centers; dismantling units	Training and licensing of informal collectors; expanding formal sector	No reward	E-Waste Management Rules; EPR

2.3.1 Japan

Japan is among the nations that are generous and dedicated to managing e-waste. Despite being the wealthiest nation in the world, they continue to make every effort to preserve the environment (Urata, 2021). As a result, Japan has led to good behaviour in e-waste recycling in Japanese society. The facilities are known as the Association for Electric Home Appliances Recycling Ticket Centre (AEHA). In addition to planning and carrying out research and policy, AEHA strives to ensure the safety of these constantly changing home appliances essential to our daily lives. It also works to improve after-sales service and product liability. It is predicated on thoroughly comprehending the typical challenges with home appliances, including those directly related to environmental concerns like disposing of discarded appliances and conserving energy and resources (AEHA, 2024).

Besides focusing on the facilities, Japan is also strengthening and introducing regulations to help with e-waste recycling behaviour (Hotta Y, 2024). Three recent statutes in Japan have addressed the management of e-waste. The first is the Home Appliance Recycling Act (Act No. 97 of 1998), enacted in 1998 and went into effect in 2001. It is also known as the Recycling of Specified Kinds of Home Appliances Act. Second, the recent Tiny Home Appliance Recycling Act covers tiny WEEE, Act No. 57 of August 10, 2012. Ultimately, personal computers are governed under the Act on the Promotion of Effective Utilisation of Resources (Act No. 48 of April 26, 1991) as a part of a voluntary producer take-back and recycling programme (Portugaise, 2023). As the fastest-growing residential waste stream in the world, electrical and electronic devices are the reason why Japan concentrates on those three acts. They consistently exceed expectations. In addition, most of the materials used in electrical and electronic equipment are non-renewable and can harm the environment and human health.

Furthermore, Japan has also classified appliances based on how they are utilised. This is to facilitate the recycling of e-waste. Moreover, producers and manufacturers must recycle their products according to existing regulations (Masahisa, 2024). Fujitsu is one of the Japanese companies that has demonstrated a solid commitment to recycling e-waste. Their company is focused on technology. Furthermore, Fujitsu is a top business in the ICT sector. Additionally, Fujitsu has expanded its operations into nations including Malaysia, Hawaii, and California. Due to its extensive global presence, Fujitsu complies with all e-waste regulations in the

countries where its factories are situated (Fujitsu, 2024). For instance, since the California Electronic Waste Recycling Act of 2003 (often referred to as SB20) was introduced in 2005, it has been implemented. Retailers who sell specific electronic items in California are now required by law to charge recycling fees to customers at the time of purchase.

Besides, Japan also has a Basic Environment Plan. The purpose of this plan is to reduce the waste generation, including the electrical and electronic appliances, by recycling them (MOE, 2025). Not only that, but Japan also plans to increase its accessibility to e-waste infrastructure. The Japanese government also encourages its producers to make a product that can be recycled, and they are responsible for the product until the end of it. This policy goal is also to fight global warming and biodiversity conservation. It focuses on environmental conservation by either users or producers. Japan is known for its discipline on their daily life, so it is very good that this policy is being invented.

All in all, the action taken by the government of Japan, by providing facilities like AEHA influenced people's behaviour in recycling e-waste. Not just society, but even the private sector is also giving a total commitment to e-waste recycling. It shows that e-waste recycling behaviour is influenced by the actions that the government takes to tackle this issue.

2.3.2 Australia

Australia, along with Japan, is one of the nations that recycles e-waste worldwide. According to a statement (Commission, 2024), information and communication technology (ICT) and electronics are two industries with the most resources and the highest potential for circularity. Australia is a leading country in ICT and is committed to e-waste practices. Among the well-known global corporations are Acer, Apple, and DELL. The most significant technological company in the world is one of those major corporations. Figure 2.1 shows that Australia is very committed to manage and recycle its e-waste by spending more on the e-waste system.



Figure 2.1 One of the biggest E-waste recycling centres in Australia

The Australian government created the National Waste Policy 2019 to address the growing e-waste problem in Australia because of technological advancements. The Department of Climate Change, Energy, the Environment, and Water's Minister's waste priority list revealed that e-waste is one of Australia's priority waste streams, which has been acknowledged recently (DCCEEW, 2024). Practically speaking, the National Trash Policy 2019 offers a framework for coordinated, national action on resource recovery, recycling, and trash management through 2030.

Additionally, the Australian government plans to create a product stewardship program with regulatory regulations for solar photovoltaic (PV) systems and minor electrical and electronic equipment (Government, 2024). This system aims to decrease the amount of waste in landfills; particularly hazardous elements present in electronic waste. In addition, they seek to maximize the safe, ecologically responsible, and scientific recovery and reuse of precious materials. They have also conferred with industry stakeholders, regulators, recyclers, peak bodies, state and territory governments, and industry associations to create this public consultation paper.

Furthermore, Australia is also implementing the SERI R2 Scheme. Seri stands for Sustainable Electronics Recycling International. It is a certification standard for retailers or any recycling centres to collect and recycle e-waste. The Asia-Pacific countries, like Australia and New Zealand, take part in this scheme (JASANZ, 2025). To properly reuse, repair, refurbish, and recycle electronics and electronic trash, it is important to prioritize data security, worker health and safety, environmental preservation, and responsible material recovery. Any recyclers that have obtained the

certification will be audited to make sure that they follow the global standards of e-waste (Bennett, 2025).

A study also found that if Australia's e-waste is managed sensibly, environmental problems like global warming may be decreased by 70.5% (Islam M. T.-R., 2023). The Australian Government also provides facilities for e-waste recycling through the National Television and Recycling Scheme (NTRS). Through free recycling services for the community, the program keeps millions of outdated or damaged TVs and laptops out of the trash. Businesses that need to recycle more considerable quantities can even take advantage of some complimentary services. This plan is also the outcome of collaboration among all parties involved, including the business sector. This is because commercial companies like TechCollect, Ecocycle Pty Ltd, and Ecycle Solutions provide recycling programs for the public (You, 2024).

Moreover, Australia also has an e-waste policy that is being implemented in its country, which is called the E-waste to Landfill Ban (Western, 2025). This policy is being implemented as Australia's e-waste is rapidly growing, and it has caused a large pile of garbage. However, this policy highlights the responsibility of the producer for their product. Households are not legally obligated but are encouraged to recycle their e-waste efficiently. This ban is supporting the Waste Avoidance and Resource Recovery Strategy 2030 that aims Australia towards a circular economy and at the same time balancing environmental and health risks (Wa, 2025).

In a nutshell, facilities provided by the government of Australia, known as NTRS, are very efficient and need to be taken as an example by other countries. The discussion above shows that facilities provided by the government for e-waste can influence e-waste recycling behaviour among people.

2.3.3 Germany

Germany now has the second-largest volume of electronic waste. The Germans have proposed Waste Electrical and Electronic Equipment as a signpost to address this problem and to assist in managing the e-waste generated in their nation (Zealuk, 2024). Figure 2.2 is referred to. The figure illustrates the producer's responsibility for e-waste throughout the End-of-Life (EOL) stage. In Germany, producers or retailers are responsible for a product from production through EoL.

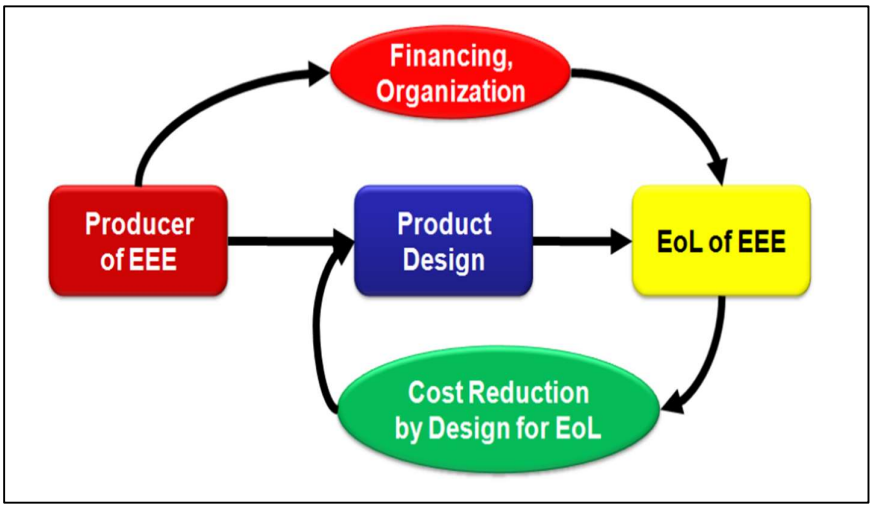


Figure 2.2 Producer Responsibility on E-waste Source (Li, 2023)

Germany's laws governing the sale, reclamation, and recycling of electrical and electronic equipment are set out in the recently enacted Electrical and Electronic Equipment Act [ElektroG] (Donnerberg, 2024). More than ever, producers, importers, and, in some cases, resellers are accountable for the goods they place on the market for their whole lives. The "Waste of Electrical and Electronic Equipment" (WEEE) must be retrieved and disposed of at their own expense. Since night storage heaters are found in most German homes, they are the product of choice under this rule. The night storage heaters are being highlighted because they contain asbestos. Diseases such as asbestosis, mesothelioma, and lung cancer can result from asbestos exposure. Asbestos exposure may raise your risk of developing digestive system cancers, such as colon cancer (Health, 2024).

Furthermore, Germany is implementing the National Waste Prevention Program (NWPP) as a commitment towards e-waste recycling (Europe, 2023). The goal of this policy is to reduce e-waste generation and improve its management. This policy not only focuses on the disposal of e-waste but also on its valuation. Under this policy, the government outlines potential prevention approaches, such as recycling e-waste, awareness campaigns, and product development, to ensure that products are designed for easy recycling (BMUV, 2023; Umweltbundesamt, 2024). The focused parties in this policy are the industry, households, and stakeholders. Thus, this policy remains in use and is updated annually.

It provides valuable insight into the discussion of e-waste recycling in Germany. The discussion above shows that cooperation among NGOs, the private sector, and the government is crucial, as it influences people's e-waste recycling behaviour.

2.3.4 Netherlands



Figure 2.3 Retailers take back E-waste from the buyers for a new appliance

Figure 2.3 is referred to. The figure above illustrates one of the Dutch Waste Electrical and Electronic Equipment (WEEE) initiatives aimed at managing and controlling e-waste by placing the responsibility for recycling on retailers. The Dutch Waste Electrical and Electronic Equipment (WEEE) Management Regulations are now in effect in the Netherlands (De Waal, 2023). By preventing and enhancing WEEE waste management, reducing resource use, and increasing resource efficiency, it seeks to safeguard human health, the environment, and sustainable development. Article 4 of this law stipulates that all manufacturers must take the necessary steps to guarantee that eco-design specifications that facilitate WEEE treatment and reuse are applied. The Human Environment and Transport Inspectorate (ILT) monitors compliance with these regulations by online retailers (Eva, 2024).

The government of the Netherlands operates a WEEELABEX-compliant treatment facility for managing electronic waste. Every piece of electrical and electronic equipment will complete its life cycle at a treatment facility that complies with WEEELABEX regulations. To benefit the environment, they will manage the garbage as safely as possible (C.P. Baldé, 2020). As a result, the current registration of WEEE

collection data in the NWR is based solely on WEEE. It is handled in line with WEEELABEX, as WEEELABEX certification has been required by law since July 2015. The legal requirement for WEEELABEX certification has increased openness in the WEEE management chain, as seen by the rise in WEEE collection.

The Netherlands is implementing the Dutch E-waste Intervention for e-waste recycling. The purpose of this regulation is to ensure proper management of e-waste. This national e-waste act serves as a prevention plan that embeds e-waste as a priority within the circular economy agenda (Weee Nederland, 2025). One provision of the policy is that retailers must accept old appliances at no cost when customers purchase new appliances from online stores. In addition, devices must be transferred to approved processors after being collected separately, rather than combined with ordinary waste (Ilgemann et al., 2025). The Human Environment and Transport Inspectorate (ILT) oversee compliance by retailers and online retailers with take-back obligations. This indicates that the Netherlands is highly committed to e-waste recycling.

In conclusion, the Netherlands has one of the best e-waste practices. It can serve as a good example for other countries that wish to practice e-waste recycling. E-waste recycling is not the responsibility of producers alone, but also of households, importers, and the government.

2.3.5 European Union Germany, Netherlands, etc.

The Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU), which aims to prevent the generation of e-waste and promote its separate collection, reuse, recycling, and recovery, serves as the legal and policy foundation for the European Union's approach to e-waste recycling (European Commission, 2025). According to this concept, electrical and electronic equipment (EEE) that turns into waste is referred to as WEEE, and member states must put in place systems that guarantee e-waste is collected separately and treated using environmentally sound procedures rather than being thrown away as general waste.

The directive requires manufacturers and distributors to register, report sales volumes, organize or finance the collection and recycling of WEEE, including offering free take-back services to customers, and establishes specific goals and targets for collection and recycling based on the quantity of equipment placed on the market (Your Europe, 2025). By recovering valuable secondary raw materials from e-waste and

reducing dependence on virgin resources, this framework complements the EU's broader circular-economy goal, thereby improving resource efficiency and promoting sustainable production and consumption patterns across member states.

E-waste recycling systems are further enhanced in countries such as Sweden and Germany through deposit-return programs, public awareness campaigns, and stringent reporting requirements. As a result, these nations have higher collection and recycling rates than the worldwide average (European Environment Agency, 2025). As a global standard for sustainable e-waste management, the EU's e-waste recycling concept shows an organized, legally binding, and consumer-inclusive system that combines resource recovery, producer accountability, and environmental protection.

According to prior empirical research, the EU's strategy has increased public participation in e-waste recycling through robust legislative enforcement, clear consumer education, and readily accessible infrastructure. Research from Germany, Sweden, and the Netherlands, for example, shows that households are more likely to recycle e-waste when collection points are conveniently located and when retailers are required to accept old devices in exchange for new ones (Wang et al., 2024; Parajuly et al., 2024).

Additionally, recent studies indicate that the EU's incorporation of e-waste recycling into its circular economy strategy has enabled the recovery of valuable materials such as copper, gold, and rare-earth elements, thereby reducing environmental pollution risks and reliance on virgin raw materials (Huang et al., 2025). Together, these results show that the EU model not only controls the disposal of e-waste but also actively influences recycling practices by combining consumer-friendly procedures, economic responsibility, and legal obligations.

Thus, this indicates that the European Union is highly committed to e-waste recycling, and numerous efforts have been made to achieve this target. Some efforts, such as the take-back policy, are exciting because they motivate people to recycle more. This is because people tend to repeat an action when a reward is provided.

2.3.6 Switzerland

Switzerland is committed to ensuring that its electronic waste is recycled correctly. The Environmental Protection Act currently in use has been revised numerous times (Swiss Federal Office for the Environment [FOEN], 2025). It is to

ensure that the act is effective and efficient for the people and the country. Stakeholder cooperation in ensuring the efficiency of the policy and act is crucial. Swico Recycling is one of the systems used in Switzerland (Swico Recycling System, 2025). It is a take-back e-waste policy designed to ensure proper management of e-waste. Surprisingly, this system has been used since 1994 and continues to be revised periodically.

By reducing barriers to convenience and increasing public participation, the EU's structured regulatory framework consistently improves formal e-waste recycling rates (Baldé et al., 2024; Cucchiella et al., 2024). Research demonstrates that e-waste recycling is transformed from voluntary behaviour into a socially accepted practice when mandated take-back programs, public awareness efforts, and stringent enforcement are combined. Even among individuals with modest environmental attitudes, studies based on behavioural theory suggest that institutional support increases perceived behavioural control, which, in turn, increases actual recycling behaviour (Wang et al., 2024).

Switzerland, which runs one of the oldest and most effective e-waste recycling systems in the world under the Ordinance on the Return, Taking Back and Disposal of Electrical and Electronic Equipment (ORDEE), offers a similar but more developed concept. Switzerland imposes an Advanced Recycling Fee (ARF) on the purchase price of electronic devices, in contrast to many EU member states. This guarantees funding for collection and environmentally responsible recycling regardless of customer motivation at the disposal stage. According to earlier research, Switzerland routinely achieves extremely high e-waste collection rates. This is primarily because of the system's long-term public trust, statewide coverage of collection stations, and clarity of responsibility (Widmer et al., 2024; Zeng et al., 2025).

In summary, Switzerland's extended producer responsibility (EPR) system, characterized by mandatory take-back requirements, advance recycling contributions, and stringent environmental treatment standards, is well established and highly successful. Switzerland has consistently achieved high collection and recycling rates while ensuring environmentally sound disposal practices, owing to the integration of law enforcement with reputable producer responsibility organizations such as Swico and SENS eRecycling. To reconcile national practices with international environmental agreements, recent policy developments also indicate a deliberate trend toward reuse, circular-economy principles, and tighter controls on transboundary e-waste movements. Switzerland's strategy provides a useful policy model for other nations,

particularly developing ones, seeking to enhance institutional capacity, increase public participation, and improve the overall effectiveness of e-waste recycling systems, as noted in earlier research.

2.3.7 South Korea

To manage electronic waste, South Korea has established a comprehensive legislative framework that promotes recycling, resource circulation, and extended producer responsibility (EPR). The Act on Resource Circulation of Electrical and Electronic Equipment and Vehicles (EEEV Act), which was created to improve resource recovery and lessen environmental burdens from discarded electrical and electronic equipment (EEE) through methodical collection, treatment, and recycling processes, serves as the fundamental legal framework (Global PCCS, 2024). To internalize environmental costs within product life cycles, this act requires manufacturers and importers to collect, transport, and recycle waste EEE. This includes meeting recycling targets and making sure that recovered materials enter resource-circulation streams rather than landfills.

Extended producer responsibility (EPR), which requires manufacturers to meet specific recycling and recovery requirements for electrical and electronic devices, is incorporated into South Korea's model (Samsung Electronics, 2025). To align South Korea with frameworks such as the EU WEEE and RoHS directives and to improve recyclability and safety, the Ministry of Environment has proposed revisions that would extend the scope of mandatory collection and recycling from approximately 50 designated products, such as refrigerators and washing machines, to nearly all electrical and electronic equipment.

To promote high performance in recycling outcomes and resource recovery, operational mechanisms under the EEEV Act include specific reuse and recycling standards, such as minimum reuse/recycling rates, for example, 70–80% by weight for many categories, and safe treatment procedures like separating refrigerants and valuable metals (Bonafide Research, 2025). Furthermore, the longer-term goals of South Korea's Resource Circulation Plan (2018–2027) include raising per-capita recycling levels toward benchmarks observed in other developed economies and integrating circular economy concepts across product life cycles, from eco-design to end-of-life treatment (Bald´e et al., 2024).

Practical initiatives that go beyond legislation include collaborations between public organizations like the Korea Environment Corporation and private businesses to advance recycling campaigns and enhance resource circulation systems, as well as government-sponsored collection networks and mutual aid associations that enable shared collection infrastructure (Korea Environment Corporation, 2024; Ministry of Environment, 2023). To address new electronic devices not yet fully covered by current regulations, South Korea must also expand its e-waste management systems in response to public calls and governmental pressure. This reflects the country's ongoing efforts to keep pace with technological change and evolving consumer habits.

Taken as a whole, these rules and practices indicate that South Korea is moving toward a sustainable e-waste governance model that prioritizes hazardous chemical management, producer accountability, performance criteria for reuse and recycling, and broader circular-economy goals.

2.3.8 Singapore

The Resource Sustainability Act (RSA), which designates e-waste as a priority waste stream alongside food and packaging waste under the national Zero Waste Masterplan, provides the foundation for Singapore's e-waste management strategy. To ensure that e-waste is collected and processed in a manner that safeguards the environment and public health, the RSA requires a regulated e-waste management system that distributes responsibilities among key parties (Ministry of Sustainability and the Environment, 2025; National Environment Agency, 2025). This framework defines "e-waste" broadly to encompass big appliances, batteries, lighting products, and information and communications technology (ICT) equipment. All these items must be handled by licensed systems rather than being disposed of as ordinary waste.

The Extended Producer Responsibility (EPR) program, introduced in July 2021 and managed by the National Environment Agency (NEA) under the RSA, is a key component of Singapore's system. Under the EPR method, manufacturers that supply Singapore's market with regulated electrical and electronic items are responsible for end-of-life collection and treatment. To put this into practice, NEA has designated ALBA E-Waste Smart Recycling Pte Ltd as the Producer Responsibility Scheme (PRS) Operator. This person will be responsible for establishing e-waste collection locations throughout the island, including doorstep pickups, scheduled collection drives, and

public e-waste bins, and for sending the collected waste to certified recyclers for appropriate treatment and material recovery. (ALBA E-Waste Singapore, 2025; National Environment Agency, 2025).

Singapore has significantly increased access to recycling since the implementation of the regulated e-waste system. Since 2021, the EPR program has collected and recycled more than 34,000 tons of e-waste, demonstrating a growing commitment from producers and consumers to use official recycling channels (The Straits Times, 2025). By the first half of 2026, every Community Center (CC) will have installed e-waste bins, thereby increase the number of collection locations and improve public accessibility as part of ongoing efforts to enhance convenience. The goal of these developments is to increase the visibility of e-waste recycling and to integrate it into routine waste disposal practices.

Notwithstanding these encouraging advancements, Singapore's e-waste management system continues to evolve in response to rising e-waste volumes and emerging technologies. To promote appropriate disposal and recycling practices, the NEA and its partners are expanding infrastructure and raising public awareness. Furthermore, it will be essential to continuously refine data tracking and recycling targets to align Singapore's practices with the objectives of the circular economy and international resource recovery standards. Future cycles of policy implementation are likely to center on increased enforcement of producer duties and ongoing innovation in recycling technologies.

2.3.9 China

Through sectoral recycling targets, extended producer responsibility (EPR) systems, circular-economy regulations, and national guidelines, China has been strengthening its regulatory framework and practical solutions to manage the growing problem of electronic waste (e-waste). The State Council released "Guidelines to Establish a Waste Recycling System" in February 2024 to create a comprehensive national recycling system that covers all waste streams, including e-waste, by 2025 and a well-organized, efficient, and regulated system by 2030, guaranteeing that waste resources are fully utilized and support China's green transformation objectives.

The Circular Economy Promotion Law and the Solid Waste Pollution Prevention and Control Law, which together offer legal support for source reduction,

reuse, and recycling of waste electrical and electronic products, are two important components of China's strategy. In addition to pushing manufacturers to implement EPR systems that hold them accountable for the end-of-life management of their goods, including funding treatment and recycling infrastructure, these regulations place a strong emphasis on the collection, processing, resource recovery, and ecologically appropriate disposal of e-waste.

To strengthen official recycling channels and corporate involvement in e-waste management, pilot programs such as the Target Responsibility System for Waste Appliance Collection were introduced in 2022 to engage major domestic appliance manufacturers in the collection and recycling of discarded household appliances (Deng et al., 2024; Government of China, 2024). To increase the recycling rate of end-of-life products (such as TVs, refrigerators, and washing machines), Beijing and several ministries have issued joint recommendations to develop recycling model cities, support online collection platforms, and foster collaboration between producers and retailers.

Ambitious national targets are reflected in specific policy goals. By 2025, China intends to recycle at least 50% of its e-waste and to increase the recycled content in new electronic products to 20% (Li et al., 2023). These goals place domestic recycling initiatives within larger agendas for resource efficiency and sustainable development. Regulations, such as draft standards such as "Regulations for the Recycling of Waste Electrical and Electronic Products," which define responsibilities across the e-waste value chain and clarify technical and operational requirements for recyclers, are being developed to support national efforts.

To reduce hazardous and informal processing and promote the growth of domestic recycling companies, China has also implemented import restrictions on solid waste, including a near-complete ban on waste imports in recent years. When combined, these programs and policies demonstrate how China is moving toward a formalized, regulated, and enhanced e-waste management system that aligns industry participation, public-sector goals, legal requirements, and the development of recycling infrastructure to turn waste into resources that can be recovered within circular-economy frameworks.

2.3.10 India

India is one of the few nations in South Asia with a formalized legal framework for e-waste management, which has gradually been strengthened to address the rapidly increasing volume of electronic waste. The E-Waste (Management) Rules, 2022, which superseded the previous 2016 regulations and went into effect on April 1, 2023, provided the fundamental regulatory framework (Zhou & Shih, 2024). By adding annual collection and recycling targets, requiring producers to ensure that e-waste is collected, disassembled, and recycled in an environmentally sound manner through registered recyclers, and incorporating key stakeholders into the formal system to enhance transparency and accountability, these updated regulations significantly strengthen the role of Extended Producer Responsibility (EPR).

The 2022 Rules now include 106 types of electrical and electronic equipment (EEE), broadening the regulatory scope to include items such as laboratory instruments, medical devices, solar modules, and other electronics that are discarded as waste (Forti, 2024). The EPR regime requires producers to register with the Central Pollution Control Board (CPCB), meet phase-by-phase recycling targets (such as 60% by 2025), produce EPR certificates linked to the amounts of recovered materials (such as iron, copper, gold, and aluminum), and continue to report on e-waste management activities.

The regulations now include environmental compensation measures to bolster enforcement. If producers fail to fulfill their responsibilities, they may incur financial penalties, depending on the costs of collecting, transporting, and recycling any deficiencies (Kumar et al., 2024). The revised framework further expands the scope of compliance requirements for large enterprises, banks, and government agencies, which must direct e-waste to authorized recyclers rather than unofficial handlers.

Recent initiatives seek to close this gap by formalizing integration and providing support to informal workers through capacity-building, training, and incentives, acknowledging the scope and informal character of e-waste management in India, where the informal sector still processes the majority of electronic waste. To increase collection efficiency and worker safety, this strategy focuses on safer e-waste practices and aims to integrate informal actors into the formal recycling system.

Through cooperative initiatives such as the five-year national circular electronics economy effort launched with the United Nations Development Program (UNDP) and the Global Environment Facility (GEF), India is advancing the goals of

the circular economy. The goals of this program are to build institutional capacity, enforce e-waste regulations, strengthen sustainable e-waste management, and expand resource recovery infrastructure. Initiatives such as citywide e-waste collection drives (e.g., the Brihanmumbai Municipal Corporation in Mumbai) and the construction of e-waste processing parks (e.g., the proposed zero-waste facility in Delhi) are examples of state and local implementation efforts that supplement federal regulations.

Despite these policy advancements, problems persist: a significant portion of India's e-waste is still handled informally, with limited formal processing capacity and poor public awareness relative to the volume of generation. These gaps are intended to be addressed by recent advances in traceability and accountability, as well as by regulatory enforcement, but improving infrastructure and stakeholder compliance remains a crucial ongoing endeavor.

2.3.11 Malaysia

Malaysia currently uses the Environmental Quality (Scheduled Wastes) Regulations 2005 (SW110), administered by the Department of Environment (DOE), to manage electronic waste (e-waste). In addition, DOE uses e-SWIS to monitor industrial waste. The industry needs to continually update its e-waste information on the website (Palansamy, 2025). Besides, the Solid Waste & Public Cleansing Management Act 2007 (Act 672) was enacted by all southern regions, which are Johor, Melaka, and Negeri Sembilan, and Separation at Source (SAS) was put into effect under SWCorp on September 1, 2015, with a phased reminder before enforcement began in June 2016. Households must separate recyclables, including electronic waste (e-waste), into specified categories. Noncompliance will result in increasing fines (RM50–RM500 for landed households; RM100–RM500 for high-rise buildings).

The Malaysian government has been addressing electronic waste, including by drafting policies and promoting recycling initiatives (Noor et al., 2023). However, government support and initiatives might not be as extensive as in other countries. These countries have robust government initiatives to promote e-waste recycling, including legislation, funding, awareness campaigns (Shaharudin et al., 2020), and collaboration with industry stakeholders. Government support and initiatives are crucial to e-waste recycling, as they influence people's behaviour. The amount of e-waste produced worldwide is rising by 20–40 million tons per year, and because of the

significant quantities of valuable metals it contains, recycling has enormous potential (Panda et al., 2020). The burden of the rising demand for metals in many industrial applications can be mitigated by raising awareness, thereby encouraging e-waste recycling behaviour among the public.

The states of Johor, Melaka, and Negeri Sembilan, all of which have explicit e-waste policies and actively participate in the national e-waste management framework, constitute the Southern Region of Peninsular Malaysia, the subject of this study. Since September 2015, the Separation at Source (SAS) policy has been implemented in these states in accordance with the Solid Waste and Public Cleansing Management Act 2007 (Act 672). According to SWCorp (2024), this rule requires households to sort recyclables, including specific electronic waste, prior to disposal. Furthermore, the Environmental Quality (Scheduled Wastes) Regulations 2005, which classify e-waste as Scheduled Waste SW110 and guarantee that it is handled in compliance with national environmental safety standards, place all three states under the jurisdiction of the Department of Environment (DOE) (DOE, 2024). To curb illicit processing, Johor has taken a significant step further by imposing a ban on the importation of e-waste and strengthening supervision (Malay Mail, 2025). Additionally, KITARecycle, a mobile-based recycling initiative, was launched by SWM Environment, the concessionaire responsible for waste management in these states, to encourage families to dispose of recyclables, including e-waste, properly (SWM Environment, 2024). This integrated policy approach demonstrates the region's dedication to organized and sustainable e-waste management.

Compared with those of Malaysia, the e-waste recycling programs in Japan, Australia, the Netherlands, and Germany exhibit notable differences in regulations, infrastructure, public awareness, and government initiatives (El-Gawhari et al., 2024; Andeobu et al., 2023; Mohd Noor et al., 2023). Compared to Japan, they held an Association for Electric Home Appliances Recycling Ticket Center (AEHA) program. Other telecommunications companies, such as Maxis and Senheng, also provide collection centres for individuals who wish to recycle broken or unused electrical appliances and smartphones (Maxis, 2024; Senheng, 2024).

Overall, Malaysia is participating in the e-waste recycling program. The drive-thru recycling e-waste program is one of the efforts made by the Department of Environment (Department of Environment, 2024). It encourages people to recycle e-

waste despite their busy schedules by allowing them to drop off their e-waste via the drive-thru process.

The infrastructure for e-waste recycling in Malaysia might be less developed than in the other countries listed. However, there have been efforts to establish recycling facilities and improve infrastructure (Gaur et al., 2023). These countries, Japan, Australia, the Netherlands, and Germany, have advanced e-waste recycling infrastructure, including collection centres, recycling facilities, and advanced technologies for processing different types of electronic waste (Governance and Assurance - Cenviro, 2024). Some of the government's infrastructure and accommodations to support e-waste recycling include the provision of collection centres and drop-off points, such as those operated by SW Corporation (Rau et al., 2000; SwCorp, 2024). Operates e-waste collection centres nationwide where consumers can drop off their old electronics.

Public awareness of e-waste recycling behaviour may vary in Malaysia, but efforts are needed to educate the population on the importance of recycling electronic products. There is generally higher public awareness about e-waste recycling in these countries, driven by educational campaigns, environmental initiatives, and government support. Public knowledge is the primary factor influencing the Malaysian public's e-waste recycling behaviour (Dhir et al., 2020; Thukral et al., 2022). According to a review of prior research, academics now have significantly greater awareness of environmental protection. Consequently, over the past ten years, much research has examined e-waste (Awasthi & Li, 2018; Vuppaladadiyam et al., 2024), focusing on the intentions and behaviours of people regarding e-waste recycling.

A robust regulatory framework established collection and recycling facilities, and ongoing public awareness initiatives support Malaysia’s infrastructure for e-waste recycling behaviour. Continuous improvement and adaptation to new challenges are essential to ensure the sustainable management of e-waste in the country. Companies such as Samsung and Panasonic have established take-back programs, establishing collection points for their products (Samsung Malaysia, 2023). Moreover, Malaysia can learn from Japan, which promotes Eco-point to encourage recycling of e-waste (Eco-point, 2019). This program is highly effective because it provides the public with information on energy-efficient home appliances. According to data from June 2011, the percentage of green home appliances with four or more stars on the unified eco-label had increased relative to the total quantity shipped.

Table 2.4 provides a comprehensive summary of the e-waste policy frameworks implemented in Johor, Melaka, and Negeri Sembilan, all located in southern Malaysia. The Solid Waste and Public Cleansing Management Act 2007 (Act 672), which formally requires the application of the Separation at Source (SAS) policy, has been enthusiastically embraced by these states. Because the implementation began in September 2015, residents must separate recyclable materials, including electronic waste, prior to disposal (SWCorp, 2024). A federal stakeholder in charge of managing waste management services in these states, SWM Environment Sdn. Bhd. is responsible for enforcing and managing the SAS policy (SWM Environment, 2024).

Table 2.4
Summary of E-waste policy framework

State	Relevant E-Waste Policy / Program	Details
Johor	1. Solid Waste & Public Cleansing Management Act 2007 (Act 672) 2. DOE Scheduled Waste Regulation (SW110) 3. EPR Pilot	• Mandatory Separation at Source (SAS) since Sept 2015 • Managed by SWM Environment • Ban on e-waste imports since 2024 • Supports KITARecycle program
Melaka	1. Act 672 2. DOE E-Waste Management System 3. EPR Framework	• SAS implemented in 2015 • Participates in national e-waste pilot projects • Household e-waste collection through authorized centers and mobile units
Negeri Sembilan	1. Act 672 2. DOE Scheduled Waste Regulation 3. SWM & KITARecycle Program	• SAS is active and enforced • Concessionaire: SWM Environment • E-waste collected through drop-off bins, campaigns, and the KITARecycle app

(Source: Author's own work)

The DOE's Scheduled Waste Regulation (SW110), which designates e-waste as scheduled hazardous waste and establishes guidelines for safe processing and disposal, is one of the regulatory measures that Johor has implemented to support the SAS project (DOE, 2024). Johor is also at the forefront of the federal government's efforts to enforce regulations, particularly through the 2024 ban on the import of e-waste, which aims to

reduce unlicensed processing facilities and illicit recycling operations (Malay Mail, 2025). Additionally, Johor is one of the trial states for the Extended Producer Responsibility (EPR) program, which requires manufacturers and producers to collect electrical and electronic devices that have reached the end of their useful lives (DOE, 2024). The state also supports the KITARecycle program, an innovative app-based initiative by SWM Environment that rewards users with points for recycling items, including e-waste, that can be redeemed for cash or prizes (SWM Environment, 2024).

Similar policy structures exist in Melaka. Since 2015, the state has carried out the SAS program in accordance with Act 672, and it actively takes part in the nationwide e-waste pilot projects led by the Department of Environment (DOE, 2024). With assistance from private recyclers, local governments, and non-governmental organizations, these programs include the creation of an integrated e-waste management system that addresses the collection, transportation, treatment, and ultimate disposal of e-waste (DOE, 2024). Melaka is also in favor of the EPR Framework's implementation, which is consistent with DOE's plan to divide up the duties among producers, consumers, and regulators. In order to increase accessibility and community involvement, e-waste is collected through public recycling campaigns, planned mobile collection services, and authorized collection centers (SWM Environment, 2024).

E-waste produced in the state is disposed of safely and legally thanks to Negeri Sembilan's full adoption of the SAS program under Act 672 and adherence to the DOE's Scheduled Waste Regulation (DOE, 2024). Additionally, the state collaborates with SWM Environment to implement the KITARecycle program, which has grown into a significant forum for public engagement in recycling. Drop-off bins, planned campaigns, and smartphone apps that monitor and incentivize recycling behaviour are among the strategies this program employs to encourage residents to recycle e-waste (SWM Environment, 2024). These efforts demonstrate a shared objective of promoting a circular economy and strengthening compliance with Malaysia's e-waste management laws.

In conclusion, the southern part of Malaysia, namely Johor, Melaka, and Negeri Sembilan, has shown a commendable commitment to environmentally friendly waste management by implementing organized and legally supported e-waste policies. These states have established a strong basis for responsible e-waste management through the implementation of the Solid Waste and Public Cleansing Act 2007 (Act 672), supported

by the National E-Waste Management System and the Department of the Environment's Scheduled Waste Regulation. A progressive strategy that incorporates producers and consumers into the recycling ecosystem is further demonstrated by the adoption of Extended Producer Responsibility (EPR) and the incorporation of public participation programs, such as the KITARecycle program. Although there remain issues with infrastructure, awareness, and compliance, the advancements in Johor, Melaka, and Negeri Sembilan can serve as a template for other areas. To ensure that Malaysia not only efficiently manages its e-waste but also sets the standard for sustainable environmental governance in the region, enforcement must be strengthened, public education expanded, and successful programs scaled up nationally.

2.3.12 Lesson Learned by Malaysia

Malaysia can learn from the European Union, Japan, and South Korea by strengthening the implementation and enforcement of EPR. While Malaysia has regulations under the Environmental Quality Act and the Scheduled Waste Regulations, clearer producer obligations, measurable collection targets, and transparent reporting mechanisms are needed. Adopting mandatory take-back schemes and holding producers financially accountable would reduce dependence on government-led enforcement and improve system efficiency. This shows that the government is not the only stakeholder responsible for e-waste recycling; all stakeholders are responsible.

Best practices from Switzerland and Japan highlight the importance of convenient collection systems. Malaysia could expand the nationwide network of collection points through partnerships with retailers, local authorities, and community centres, particularly in residential areas. Making e-waste disposal convenient and visible would likely increase public participation, particularly among households that currently store unused electronics. Most people do not recycle their e-waste because they lack access to infrastructure and facilities for its disposal. The infrastructure and facilities influenced people’s behaviour regarding waste recycling.

Lessons from China and India show that informal collectors can be integrated rather than excluded. Empirical data demonstrate that integrating informal collectors through formalized processes such as licensing, registration, and skill development has significantly reduced ecologically hazardous activities while increasing collecting efficiency (World Bank, 2023; UNEP, 2024). In Malaysia, informal e-waste handlers

play a role in collection but often operate outside regulatory oversight. This legal gap reduces material traceability across the recycling chain and undermines environmental and occupational safety norms (OECD, 2024). Therefore, formalizing the informal sector through targeted incentives, technical training, and enforcement-linked licensing could improve data transparency, increase environmental compliance, and match Malaysia's e-waste management system with the goals of the circular economy (Kumar et al., 2024; Abdul Rahman et al., 2025).

Countries such as South Korea and Singapore demonstrate that continuous public education is essential. Malaysia can intensify awareness campaigns through schools, universities, social media, and local communities to improve understanding of environmental and health risks associated with improper e-waste disposal. Clear guidance on where and how to dispose of e-waste would help bridge the gap between awareness and actual recycling behaviour.

Malaysia could adopt market-based instruments, such as deposit–refund schemes, reward-based recycling programs, or advance recycling fees, drawing on practices in Japan and Switzerland. Incentives can motivate households and small businesses to return e-waste through formal channels rather than informal or illegal disposal routes.

From countries such as Germany and the Netherlands, Malaysia can learn the value of robust data systems. Establishing a centralized e-waste database to track the generation, collection, recycling, and export of e-waste would enhance transparency and enforcement. Reliable data would also support evidence-based policymaking and evaluation of national e-waste strategies.

2.4 Factors Influencing Recycling E-waste

Several factors influence e-waste recycling behaviour, which can be divided into two categories: external and internal. The internal domain comprises moral obligation, attitude, and time availability. The external dimension comprises policy and regulation, waste-sorting knowledge, facility support, and subjective norm.

External factors are those that originate outside of individuals. For example, Malaysia uses the Environmental Quality Act 1974 as an external regulatory instrument to control industrial activities and human activities. Internal factors are forces within the organization or among its people. For example, people’s attitude towards recycling.

Internal factors are difficult to change because they can be altered only if the person wants to.

2.4.1 External Factors

2.4.1.1 Policy and Regulation

In Malaysia, regulations are crucial in shaping e-waste recycling practices. Rules and regulations are formal directives or guidelines established by an authority, organization, or governing body to govern conduct, actions, or procedures within a particular context or domain (Dictionary, 2024). They are designed to ensure order, safety, fairness, or compliance with established standards or objectives. For example, in the legal context, government agencies may issue regulations governing various aspects of public life, such as environmental protection, workplace safety, and consumer rights (Herrera et al., 2020; Vighnesh et al., 2024). These rules often carry the force of law and may be enforced through penalties or other legal mechanisms.

One of the policies being implemented in Malaysia is the National Green Technology Policy, introduced in 2009 under the Ministry of Energy, Green Technology and Water (KeTTHA). This policy acknowledges that economic expansion must be balanced with social welfare and environmental preservation, and that green technology may play a significant role in achieving this balance. This policy highlights four main areas: energy, environment, economy, and society. Those four items must work together to achieve the goal of reducing and recycling e-waste. The policy should ideally encourage the reuse and refurbishment of electrical and electronic equipment, which is behaviourally relevant to the production and disposal of e-waste, thereby enhancing resource efficiency and supporting circular economic approaches (Shahril, 2021). Key instruments under this policy include the Green Investment Tax Allowance (GITA) and the Green Technology Financing Scheme (GTFS). For the recognition, MyHIJAU is one of the achievements (Hijau, 2025). Public procurement and green labeling components may affect consumer and firm behaviour in the area. For example, if public agencies only purchase devices with green certification or mandate recycling or take-back, this may have an impact.

Here is how regulations affect e-waste recycling behaviour in Malaysia, particularly within the legislative and policy frameworks. Malaysia has been developing legislation and policy frameworks for e-waste recycling (Yahya et al.,

2022). While the country may not have as comprehensive regulations as some nations, the introduction of policies such as the Environmental Quality (Scheduled Wastes) Regulations 2005 has provided a foundation for managing e-waste. Section 34b of the Scheduled Waste Act addresses the management of scheduled waste, including licensing, import/export, and sanctions for violations. Malaysia cannot import or export e-waste to or from other countries.

Efforts are underway to address this gap by developing new regulations and amending existing ones. Thus, the penalties for imported e-waste have increased to 10 million. Penalties are being amended as part of a government initiative that takes e-waste seriously. This is because government legislation influences people's behaviour toward e-waste recycling. For example, when there is punishment for violations of the e-waste law, people will take e-waste recycling more seriously. There is a nation that compensates its citizens for their contributions to e-waste recycling. For instance, in China, the government provides subsidies to producers of electronics and electrical equipment if they choose to handle product collection and disposal in-house or contract the work to third parties (Asia, 2021). They must, however, adhere to strict environmental regulations set by the government. It is suitable for the government and for the manufacturers. This influenced people's e-waste recycling behaviour.

In summary, rules and regulations represent the codified directives or guidelines established by an authoritative body to govern behaviour, activities, or processes within a specific context. They are critical in ensuring compliance with legal requirements, promoting accountability, and maintaining order within society or regulated industries.

Table 2.5
Malaysia National Policy on E-waste

Policy: National Cleanliness Policy
Regulation:
1. Environmental Quality Act 1974 (Act 127)
2. Environmental Quality (Scheduled Wastes) Regulations 2005
3. Basel Convention
4. Solid Waste and Public Cleansing Management Act 2007

Source: Author (2025)

2.4.1.2 Facility Support

Apart from external factors such as policy and regulation, knowledge of waste sorting and facility support are also external factors influencing e-waste recycling behaviour among people in Southern Region Malaysia. Malaysia has several e-waste facilities that handle the collection, recycling, and disposal of electronic waste. Figure 2.4 shows the e-waste facility in Malaysia. The Department of Environment (DOE) licenses and regulates these facilities to ensure environmentally sound e-waste recycling. Kualiti Alam Sdn Bhd provides comprehensive hazardous waste management services, including the collection, transportation, treatment, and disposal of electronic waste (Governance and Assurance - Cenviro, 2024). They employ state-of-the-art technology to ensure the safe and efficient processing of electronic waste. Another facility is Southeast Asia Recycling Technologies (S.E.A.R.T.). Specialises in the recycling of electronic and electrical waste. They dismantle, sort, and process various types of electronic waste to recover valuable materials such as metals and plastics (Latimer, 2023).

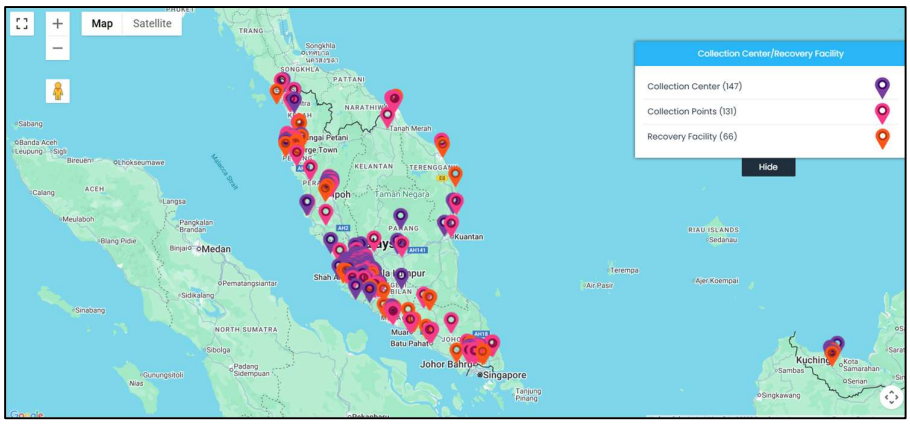


Figure 2.4 E-waste Facility in Malaysia

Malaysia has implemented regulations to manage e-waste through licensed facilities. The Department of Environment (DOE) has authorized 35 companies to treat/manage e-waste and established 121 collection centres nationwide (Business Today, 2024). These measures aim to ensure that e-waste is processed in an environmentally friendly manner. Numerous e-waste collection programs have been organized to increase public participation in e-waste recycling. For instance, in 2022 alone, various e-waste collection events occurred across multiple states, including Perlis, Sabah, Kedah, and Negeri Sembilan (Department of Environment, 2024). These programs often collaborate with local schools, businesses, and community groups to enhance outreach and effectiveness. Companies like ERTH (Electronic Recycling Through Heroes) provide free pickup services for e-waste, offering financial incentives to public and businesses to encourage recycling (Khaw & Khaw, 2023; Hussin et al., 2023). ERTH categorises collected devices based on their condition and routes them to appropriate recycling channels. The Malaysian government has recognised this private sector initiative and supports the overall e-waste recycling infrastructure.

In summary, while Malaysia has made significant strides in e-waste recycling behaviour through regulatory support and innovative private-sector solutions, ongoing efforts are needed to address public awareness and illegal recycling activities to enhance the effectiveness of these initiatives.

2.4.1.3 Subjective Norm

Apart from external factors: policy and regulation, waste sorting knowledge, and facility support, subjective norm is another factor that influencing e-waste recycling behaviour of people in Southern Region of Malaysia. In social psychology, scholars define subjective norms as the perceived social pressure or influence to perform or not perform a particular behaviour. (Duong, 2021). It reflects an individual's perception of whether essential others (such as family, friends, or colleagues) approve or disapprove of the behaviour and whether they think the individual should or should not engage in it. This concept is a critical component of the Theory of Planned Behaviour (TPB) proposed by Icek Ajzen (1991). According to TPB, subjective norms, attitudes toward the behaviour, and perceived behavioural control influence an individual's behaviour to engage in a behaviour, predicting actual behaviour.

According to a study, subjective norms are one crucial factor influencing recycling behaviour (Kumar, 2019; Nordin. Et. al, 2025). For example, Korea introduced Extended Producer Responsibility (EPR) in 2003 to control the amount of electric and electronic waste produced (Jihwan Park, 2020). Electric and electronic manufacturers, importers, and sellers are required by the EPR system in South Korea to fulfil their total obligations to collect and recycle. They can do this independently or by joining a Producer Responsibility Organisation (PRO), in this case, the Korea Electronics Recycling Cooperative (KERC). As a condition of membership, one must pay "allotted charges" to the KERC, and money is then given to the Waste of Electrical and Electronic (WEEE) transporters and recyclers as "support funds" (Jihwan Park, 2020). Companies like LG also use this system to control the amount of e-waste produced (LG, 2023).

2.4.2 Internal Factors

Numerous earlier studies have looked at internal elements that explain pro-environmental and e-waste recycling behaviour, including environmental knowledge, attitudes, moral obligation, and personal norms. Even so, there is still a dearth of empirical research on internal issues, especially when it comes to the general public's e-waste recycling habits in developing nations like Malaysia. There is a knowledge vacuum about how internal psychological elements affect people's willingness and actual engagement in e-waste recycling activities because most of the current research tends to focus on technological, infrastructural, or policy-related aspects.

2.4.2.1 Moral Obligation

Apart from external factors: policy and regulation, waste sorting knowledge, facility support, and subjective norm, moral obligation is another factor under internal factors. "Moral obligation" refers to a sense of duty or responsibility to act according to ethical principles or values, even without legal or formal requirements. It pertains to the internalized sense of right and wrong that guides individuals to consider the consequences of their actions on others and society.

One prominent definition of moral obligation comes from Immanuel Kant (1989), a German philosopher who emphasized the importance of moral duty in his ethical theory. Kant argued that moral obligations are grounded in rationality and the categorical imperative, which states that individuals should act so that their actions can be universalized without contradiction. In other words, one should act according to principles that could apply universally to all rational beings. As stated by Ajzen (2002) and Rahayu and Day (2015), moral obligation is the ethical principle that holds that guilt is a moral duty each person has when performing a task. Cleanliness is a necessary condition for moral discipline and spiritual purity, according to Imam Al-Ghazali. He maintained that excellent character and spiritual faith are reflected in outward purity.

> *"Inner purification from sins and external cleanliness from dirt constitute purity."*

Thus, it shows that moral obligation influences the state of cleanliness of society.

Awareness of the environmental impact of e-waste and the potential hazards can heighten a sense of moral obligation (Naz et al., 2020). Studies have shown that individuals more aware of these issues will likely feel an ethical duty which is also their behaviour to recycle e-waste. In 2019, a comprehensive survey by Tan et al. highlighted the importance of educational campaigns in fostering a sense of moral obligation towards e-waste recycling in Malaysia. The campaign "Go Green with E-Waste" was launched in several Malaysian cities, emphasising the environmental hazards of improper e-waste disposal and the ethical duty to recycle (Tan, 2019). The campaign included workshops, school programs, and media advertisements, significantly increasing public awareness and recycling rates.

In 2021, the Malaysian government implemented the "Eco-Schools Program," targeting young students to cultivate a sense of moral responsibility towards the environment (Lee, 2021). The program included activities like e-waste collection drives and environmental clubs. Studies by Wong (2022), showed that students participating in these programs developed a strong moral obligation to recycle and influenced their families and communities to do the same. The "Community Recycling Initiative" launched in Kuala Lumpur focused on building community responsibility and moral duty towards e-waste recycling. Community leaders were trained to conduct awareness sessions and organise recycling events. A study by Lim et al. (2020) reported that these

initiatives significantly increased e-waste recycling behaviour rates in participating communities due to the strong sense of moral obligation fostered through social norms and community engagement (Teo, 2021).

Moral obligation significantly influences e-waste recycling behaviours in Malaysia. Through educational campaigns, religious teachings, school programs, community initiatives, and supportive policies, individuals are motivated to recycle their e-waste as part of their ethical duty towards environmental conservation. These efforts have proven effective in enhancing e-waste recycling behaviour rates, showcasing the critical role of moral obligation in sustainable practices.

2.4.2.2 Attitude

Apart from internal factors: moral obligation, attitude is another factor that influencing e-waste recycling behaviour of people in Southern Region Malaysia. One influential definition of attitude comes from psychologists Gordon Allport, a pioneering figure in personality psychology, and his co-author Philip Vernon: "An attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objects and situations with which it is related." Attitude is a theoretical construct that represents assessments of sentiments toward the attitude object that are favourable, negative, or neutral (Al-Qadasi et al., 2024), and it also is the degree to which an individual regards behaviour as positive or undesirable (Puzzo & Prati, 2024).

Research indicates that a favourable attitude towards e-waste recycling positively impacts individuals' recycling behaviours (Xiang & Mangmeechai, 2023). For example, the Theory of Planned Behaviour (TPB) has been widely applied to understand e-waste recycling behaviours, highlighting that attitudes strongly predict recycling behaviours. Studies have shown that individuals who view e-waste recycling favourably are likelier to engage in such behaviour (Bhutto et al., 2023; Nguyen et al., 2018). In Malaysia, several factors influence attitudes towards e-waste recycling behaviour. Educational campaigns and awareness programs have significantly improved public knowledge and attitudes towards the environmental benefits of e-waste recycling (Landrigan et al., 2018). However, despite high levels of awareness, translating positive attitudes into actual recycling behaviour remains challenging. Many residents still find recycling methods unclear and perceive the process as inconvenient.

Further, demographic factors such as education level and environmental awareness play a crucial role. Individuals with higher education levels tend to have better attitudes towards e-waste recycling and are more likely to engage in proper e-waste disposal practices (Sajid & Zakkariya, 2022). Social influence, including family and community norms, also significantly shapes attitudes and behaviours towards e-waste recycling (Landrigan et al., 2018). Enhancing e-waste recycling in Malaysia must address the gap between positive attitudes and actual recycling practices (Arslan et al., 2024). This involves increasing awareness and making recycling more accessible and convenient for residents. Implementing effective regulations and providing adequate facilities can help translate positive attitudes into sustainable recycling behaviours (Neves et al., 2024).

In summary, while positive attitudes towards e-waste recycling are prevalent in Malaysia, converting these attitudes into consistent recycling practices requires addressing practical barriers and enhancing the overall ease and accessibility of recycling programs.

2.4.2.3 Time availability

Apart from internal factors: moral obligation and attitude, time availability is another factor that influencing e-waste recycling behaviour of people living in Southern Region Malaysia. People live in a significantly developed era with technological advancements like gadgets, smartphones, and laptops everywhere. They spend most of their time using smartphones and having their world while using gadgets. Managing electronic waste is a significant concern for societies worldwide, as it is crucial for environmental conservation in combating climate change and for economic reasons by considering waste as valuable tradable commodities (Nikou, 2023; Islam, 2019).

Time availability influences other elements like knowledge and awareness. This is because when adequate awareness and knowledge and awareness have been given to people, people need to provide their time to practice it (Sankar, 2023). Some people who did not practice e-waste recycling use time availability as an excuse. This is not something that should be happening. Many Malaysians, particularly in cities, lead hectic lives juggling work, family, and social responsibilities. For people with hectic schedules, finding time to shift, transport, and properly dispose of e-waste may appear inconvenient (Lau, 2024).

Recycling e-waste generally demands work, such as collecting old devices, locating appropriate disposal facilities, and ensuring that materials are correctly segregated. These actions may appear inconvenient to those who lack sufficient time or energy. A study by Sónia et al. (2024) shows that, if e-waste recycling facilities are not readily available, Malaysians may be less likely to recycle. The time and effort required to go to proper e-waste disposal locations may discourage participation, particularly if the recycling process is perceived as inconvenient.

In conclusion, facilities provided for e-waste recycling influenced people's behaviour. It is very crucial to have easy access to e-waste facilities for people to practice it. The government needs to consider providing more accessible e-waste facilities.

2.4.2.4 Waste Sorting Knowledge

In addition to policy and regulation, knowledge of waste sorting is another external factor. The world benefits from innovation. On the other hand, an innovation's quick development may have unintended environmental effects. For instance, it will increase the production of e-waste. A study claimed that an innovation affecting consumption patterns created a use barrier (Ma, 2019). Nevertheless, no prior research has examined the relationship between resistance to recycling e-waste and the barrier posed by perceived inconvenience. The annoyance caused by a lack of knowledge about e-waste recycling and the inconvenient location of e-waste collection centres is measured as a use barrier in this study (Zakkariya, 2022).

Moreover, knowledge of waste sorting has become a barrier to e-waste management. Knowledge is essential. Lack of knowledge has led to lots of problems, such as pollution. According to a study, the knowledge barriers are consumer awareness, environmental awareness, technical innovation, and understanding of reverse logistics, which are the main areas of concern (Imnatila Pongen, 2023; Zakkariya, 2022). People's awareness of e-waste recycling and its impact can make a massive difference. For example, in previous days, people often discarded electrical and electronic waste alongside household waste, which has led to environmental issues such as soil pollution and health problems (Hoang, 2022). However, the knowledge barrier is often linked to financial constraints, as substantial funding is required to implement it. According to a published study, economic obstacles and knowledge

barriers are interconnected (Imnatila Pongen, 2023). Unrecognized knowledge distortion may lead to inaccurate risk assessments and responses. Some people may also base their assessments of dangers and coping mechanisms on distorted information, resulting in distorted knowledge and skewed risk perceptions or reactions (Jaeger, 2021). This indicates that the knowledge barrier has become a contributing factor.

Some campaigns have also been on e-waste recycling, for example, the Household E-waste Collection Campaigns. The Department of Environment (DOE) has actively promoted public awareness of electronic waste through this campaign. The list of registered e-waste collection centres is also available on the DOE website, which facilitates e-waste recycling. Moreover, MyEwaste initiatives have also been launched for this campaign. Users can locate registered e-waste collection centres and information on e-waste in this digital tool. The most common annual campaign undertaken by the Government of Malaysia is *Hari Alam Sekitar Negara.* Based on an interview with a DOE employee, the employee noted that during Hari Alam Sekitar Negara, they typically collect a higher volume of e-waste than on regular days. This is because, on this day, people typically bring all their electronic waste for disposal.

In conclusion, knowledge of waste sorting influences people's e-waste recycling behaviour. The root cause of people not practising e-waste recycling is a lack of awareness and knowledge about how to recycle it. Easier work for them is by dumping it with other solid waste. This situation will not occur if sufficient knowledge and awareness are provided to the public on how to manage their e-waste.

2.5 Theoretical Framework

The theoretical framework supporting the investigation is explained in this section. The study is based on the Theory of Planned Behaviour (TPB), which holds that three main factors influence human behaviour: perceived behavioural control, subjective norms, and attitude toward the behaviour. Other constructs, including moral obligation, facility assistance, policy and regulation, time availability, and trash sorting knowledge, are incorporated to enhance TPB's explanatory power in the context of e-waste recycling. This framework guides the study of e-waste recycling practices among Malaysians in the southern region and forms the basis for developing the research model and hypotheses.

2.5.1 Theory of Planned Behaviour (TPB)

Icek Ajzen, a social psychologist, developed the Theory of Planned Behaviour (TPB) as an extension of his earlier Theory of Reasoned Action (TRA), which he and Martin Fishbein developed in the late 1970s. In his 1985 book "From Intentions to Actions", Ajzen established the idea of perceived behavioural control to address instances where individuals wish to act but confront barriers, thus boosting TRA's predictive power. This innovation culminated in Ajzen's seminal 1991 paper, "The Theory of Planned Behaviour", which articulated the three core determinants of behavioural intention like attitude, subjective norm, and perceived behavioural control and demonstrated that intentions, when combined with perceived control, significantly predict actual behaviour. The perceived control construct, based on Bandura's self-efficacy theory, enhances the model by taking into consideration people's confidence in their capacity to accomplish certain behaviours. Since its introduction, TPB has received widespread empirical support spanning thousands of studies and continues to evolve through refinements to belief-based measurement scales, the identification of intention-behaviour gaps, and the exploration of moderators like implementation intentions and moral obligation.

Subjective norms, attitude, and perceived behavioural control are factors that can impact the behaviour to engage in e-waste recycling behaviour, which in turn affects actual e-waste recycling behaviour within the framework of the Theory of Planned Behaviour (TPB) (Ajzen & Madden, 1986; La Barbera & Ajzen, 2021). The theory of planned behaviour is the theory of reasoned action that emphasises that attitude and subjective norms are the two aspects that determine a person's behaviour to engage in each conduct (Fishbein, 1975). This theory has been used in many studies, and some arguments exist. However, some studies use these theories to add a new explanatory factor to provide a more thorough explanation of the behavioural purpose. Besides, the theory of planned behaviour is also used to provide a more thorough explanation of behavioural intention; recent researchers expanded the planned behaviour model by adding a new explanatory variable (Vinnell, 2021).

Furthermore, it asserts that a person's behaviours, which are often the result of three key factors: (1) attitudes towards the behaviour, (2) subjective norm, and (3) perceived behavioural control, greatly influence human behaviour (Ajzen, 1991). Individual perceptions of the social expectations connected to activities are subjective

norms (Van Tonder et al., 2023). Subjective norms have been shown to influence people's intentions and behaviours related to recycling e-waste (Ajzen, 1991). According to Ajzen's (1991) research, people are more likely to carry out specific activities if they believe their social environment supports and endorses them. Individual perceptions of the social expectations connected to activities are subjective norms (Van Tonderetal,2023). Subjective norms have been shown to influence people's intentions and behaviours related to recycling e-waste (Ajzen, 1991). According to Ajzen's (1991) research, people are more likely to carry out specific activities if they believe their social environment supports and endorses them. Ajzen (1991) discovered that people's attitudes affect how they recycle their e-waste. It was highlighted by Ajzen (1991) that people who have a good attitude toward e-waste recycling tend to recycle it more successfully. Perceived Behavioural Control (PBC), one of the extended TPB constructs, can lead to people behaviour towards e-waste recycling by offering inspiration, motivation, and positive reinforcement (Koshta et al., 2022).

These three elements have influenced people's actions towards an issue, for example, recycling e-waste. People’s habit of recycling can impact the e-waste produced by the public. Besides, financial incentives should be involved to make it a habit for people to recycle e-waste (Md. Mahiuddin Sabbir, 2022). Furthermore, a theory of planned behaviour method study on Malaysians' attitudes towards e-waste recycling has been conducted (Kianpour, 2021). When combined with awareness, the theory of planned behaviour variables (attitude towards behaviour, subjective norm, and perceived behavioural control) has a favourable impact on people's behaviours to recycle e-waste (Echegaray, 2017).

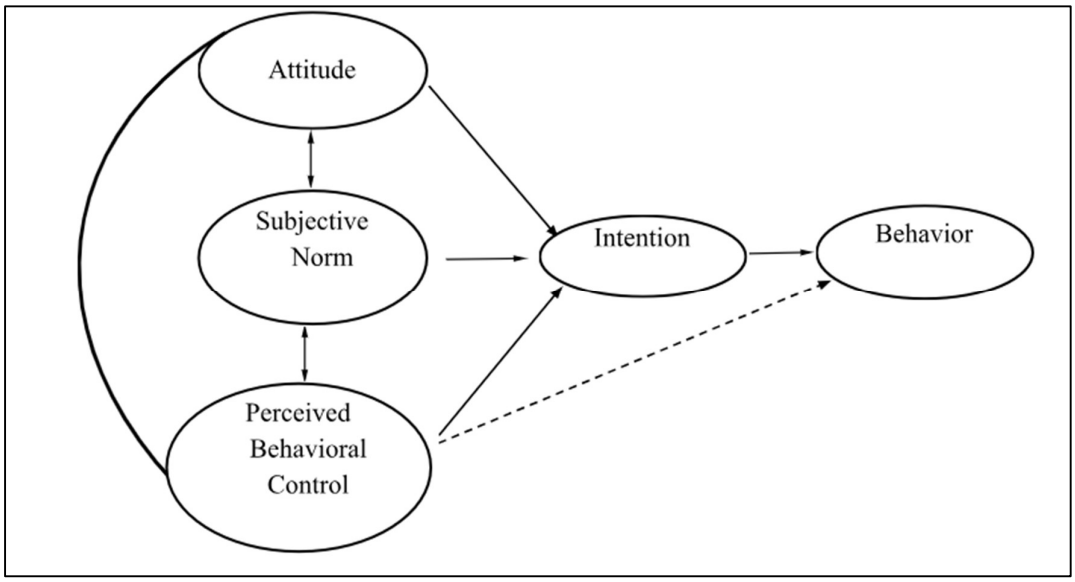


Figure 2.5 Framework of the TPB (Source: Adapted from Ajzen 1991)

Some previous research has successfully utilised the TPB to show the impact of TPB predictors on behavioural changes (Nguyen, 2023). For example, Djafarova and Foots' (2022) research findings show that young consumers' awareness and desire towards ethical and environmental issues significantly influence ethical consumption. Similarly, the results of Rotimi et al. (2023) show positive relationships between all the TPB factors on garment recycling. Conversely, some research results show the difference or gap between favourable attitudes and actual practice. Tiwari et al. (2023) and Sujood et al. (2023) have discovered that perceived behavioural control did not influence intention and behaviour. The gap revealed that not all predictors always translate into action. The expert also revealed that the TPB model was not considered suitable for explaining behaviour since it only focuses on limited variables and ignores other important variables such as feeling or emotion. Thus, it is necessary for this study to extend the TPB utilisation and to address the gap that occurs in this theory. Research in the future is expected to expand and enrich the discussion about the TPB. Like previous studies (Annamdevula et al., 2023; Sann et al., 2023), our current study aims to extend the TPB by examining the intervening influences of environmental value on the relationships between pro-environmental attitude, ecological knowledge, subjective norm, price incentive, perceived behavioural control, and young consumer sustainable fashion consumption.

According to a study, nudging is another technique covered by planned behaviour (Parajuly, 2020). The subtle manipulation of people's behaviour in a particular direction while maintaining their freedom of choice is known as nudging (Sunstein, 2018). For instance, you may motivate people using financial incentives and social media to encourage e-waste recycling. A study that has been conducted may be found on the effectiveness of this strategy (Parajuly, 2020). Additionally, research has indicated that behaviour and attitude significantly impact environmental studies (Khan, 2019). This proves that the planned behaviour theory can substantially influence e-waste recycling.

A subsequent study in China found that individuals prefer buying more environmentally friendly electrical appliances that conserve energy (Hua, 2019). Furthermore, it is linked to the recently introduced green environment. In a green environment, businesses should consider the efficiency of their use of resources and other environmental initiatives that benefit society as a whole and individual citizens (Sang-Binge Tsai, 2018). Therefore, by identifying the key elements influencing motivation to recycle e-waste, governments and policymakers can target specific characteristics that may enhance willingness to do so. A study that has been done also proves that TPB has been extensively used to study energy-saving, travel, recycling, and environmentally friendly behaviours (Yuriev, 2020).

The theory of planned behaviour is interconnected with the factors influencing e-waste recycling among Malaysian public (Bosnjak M, 2020). Subsequent research, however, has shown that behavioural purpose does not always translate into an act since both the intended action and the behaviour are influenced by external factors (Yu Xiang, 2024). Utilising opportunities or resources that impact people's ability to control action is frequently necessary for the final execution of numerous behaviours. The act's performance may be hampered if the abovementioned non-motivational elements are unmet (David, 2018). In the end, a person can only act effectively if he has access to a specific number of resources or opportunities, feels that the action is beneficial, has the support of significant individuals, and wants to act. The theory of Planned Behaviour provides a theoretical foundation for research on recycling behaviour. It accurately predicts other behaviours in domestic and international studies, such as purchasing and public participation in decision-making (Yu Xiang, 2024).

Besides, this study employed TPB theory on the attitude of people towards e-waste recycling behaviour. Not only that, but this study also employed subjective norm.

To improve the prediction of pro-environmental behaviour, researchers have added to the original TPB model other factors like moral obligation, waste sorting knowledge, facility support, policy and regulation, and time availability (Chen & Tung, 2010; Wan et al., 2014; Zhang et al., 2020). The traditional TPB constructs of attitude, subjective norms, and perceived behavioural control can be supplemented by variables like waste sorting knowledge, facility support, moral obligation, policy & regulation, and time availability as additional predictors of intention (and behaviour). Given the notable impact of these factors in previous Malaysian studies, it is predicted that in the Southern Region of Malaysia, subjective norms and policy & regulation will be among the best indicators of intention to recycle e-waste.

To sum up, planned behaviour impacts the behaviour to recycle e-waste. Most research studies have also demonstrated the influence of the idea of planned behaviour. This indicates that planned behaviour must also be considered a potential influence on further e-waste research.

2.5.2 Conceptual Framework

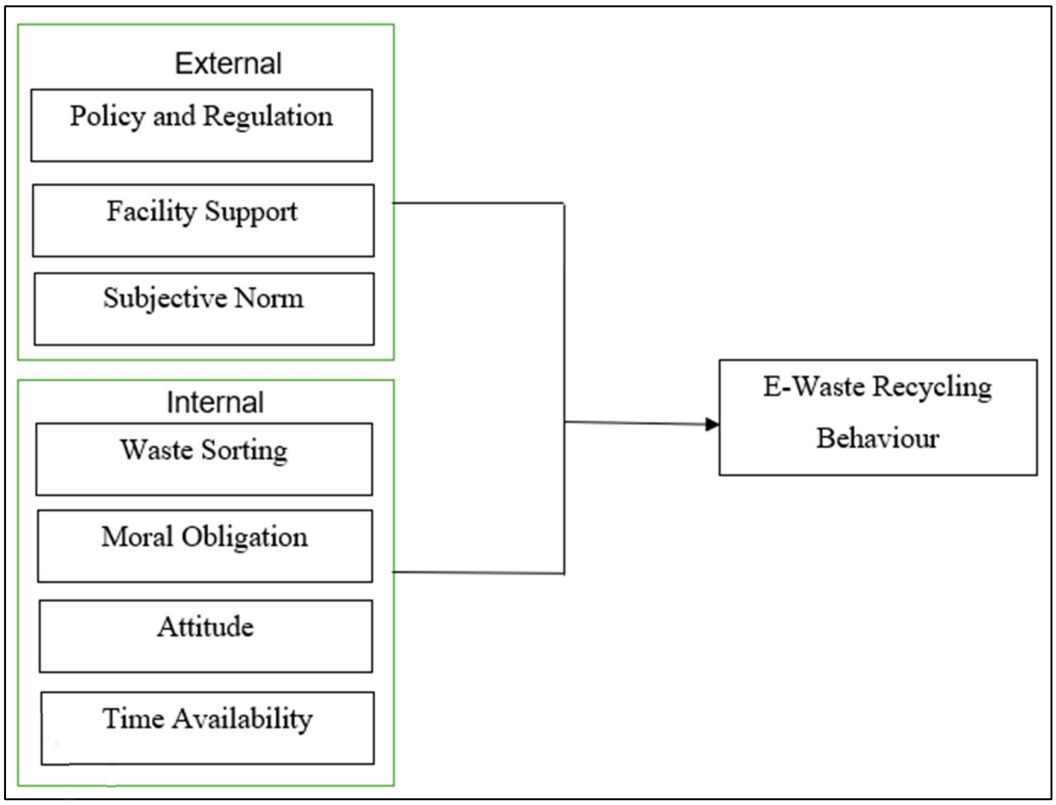


Figure 2.6 Conceptual framework of the study (Adapted from Ajzen, 1. (1991)

2.6 Hypothesis Development

This section provides the development of hypotheses based on the Theory of Planned Behaviour (TPB) and extended constructs relevant to e-waste recycling behaviour. The hypotheses are developed to investigate the connections between attitudes, moral obligations, subjective norms, facility support, rules, and recycling behaviour among people in Malaysia's Southern Region, drawing on previous research and theoretical underpinnings.

2.6.1 External Factors

Numerous prior studies have examined external factors to explain e-waste recycling behaviour, such as the availability of recycling facilities, accessibility of collection places, convenience, economic incentives, social influence, and government support. However, the research that is currently available places very little attention on

external factors, especially when it comes to how contextual and structural factors influence actual recycling behaviour as opposed to just intention. Research on external factors influencing e-waste recycling in Malaysia is still rare and dispersed, with little consideration for regional variations and the efficiency of current infrastructure and support networks in promoting public involvement.

2.6.1.1 The Relationship between Policy and Regulation and E-waste Recycling behaviour among the Malaysian public in the Southern Region

Past research, such as Yunus et al. (2025), Bird et al. (2022), Kyriakopoulos (2021), Mulakkal et al. (2021), Ahmad et al. (2025), and Rene et al. (2021), has established that environmental law and policy are necessary enablers for e-waste recycling and administration. Law, including e-waste administration, plays an elementary role in maintaining order, justice, and equilibrium in a country (Dias et al., 2022; Noor & Nordin, 2023). The magnitude of law covers several aspects of community life, from securing citizens' rights to controlling the social and economic order. Besides, a proper guideline or well-designed regulation helps people to recycle the e-waste easier. Regulation that will influence the subjective norms, which same as the Theory of Planned Behaviour framework (Suin, 2024).

Environmental policy refers to the approaches and programs that governments and institutions apply to direct environmental issues (Dada et al., 2025). Its main point is to guarantee that human activities are conducted in an environmentally friendly manner, reducing damage, and upholding a more stable relationship between economic progress and environmental preservation (Yunus et al., 2025). To guarantee conformity with its objectives, this type of policy is maintained by a legal and regulatory frame. Policies and laws play a significant role in shaping human behaviour, as they encourage people to take responsibility for managing e-waste (Rahmanda et al., 2023). This is because policies and laws have instituted standards, rewards, and penalties for those who commit offenses associated with e-waste (Quinto et al., 2025). Law plays a fundamental role in the life of society, serving as the backbone that delivers a legal basis, protects rights and interests, and maintains social order (Nordin et al., 2025). A notable example of European environmental action is the stimulation of renewable energy, where the European Union has placed a strong emphasis on reducing its dependence on fossil fuels and stopping climate change. Policies have also been applied

to protect biodiversity and alleviate environmental risks (Global E-waste Statistics Partnership, 2025). A key aspect of European environmental policy is the well-known principle "The polluter pays", enshrined in Article 191 of the Treaty on the Functioning of the European Union. This principle stipulates that polluters must bear the costs associated with the environmental damage they cause. In European countries, e-waste recovery facilities pay lower prices for e-waste that does not contain high concentrations of valuable metals and even impose penalties for low-value materials (Narbón Perpiñá & Prior, 2025). This means that they only select e-waste that contains high concentrations of valuable metals and low plastic and resin content, which allows them to offer high prices for the material. As a result, initial processing takes place in "filter" countries, where low-value and polluting materials are discarded before containers of high-quality materials are sent to Europe for further processing (Narbón Perpiñá & Prior, 2025). Thus, the hypothesis is developed as follows:

Ho1: Policy and regulation significantly influence e-waste recycling behaviour among Malaysian public in Southern Region

Ha1: Policy and regulation do not significantly influence e-waste recycling behaviour among the Malaysian public in Southern Region

2.6.1.2 The Relationship between Facility Support and E-waste Recycling Behaviour Malaysian public in Southern Region

Sufficient and conveniently located facilities would make it easier for people to sort their waste. Sorting waste wouldn't be helpful if facilities weren't available or accessible (Rakhmawati, 2023). For instance, if individuals had sorted their public waste but there was no facility (such as a waste bank or recycling centre) that handled sorted waste, they would probably stop doing so. Lack of facilities was one of the most significant barriers to environmental behaviour. A study has investigated 682 establishments that produce food waste, including industries, supermarkets, food courts, cafeterias, and universities and colleges. Their investigation showed that the behaviour to separate food waste is positively impacted by facility availability (Ng, 2021; Kutty et al., 2024).

Based on the TPB model, one of the primary predictors of behaviour is perceived behavioural control, defined as an individual's belief in their capacity to carry out specific behaviours (Sari, 2021; Nordin et al., 2025). According to a study, building

a financially sustainable waste management system depends heavily on the facility's location (Yadav, 2018). When suitable and readily available facilities are provided, people can be encouraged to recycle their electronic waste.

The profusion of facilities nearby inhibits individuals from wasting a lot of time and money and removes barriers to e-waste recycling action. Elgarahy et al.'s (2024) study also found that the design and condition of facilities impact e-waste recycling behaviour. For example, a user-friendly and modern recycling centre can induce e-waste recycling behaviour. The drive-thru recycling centre is a user-friendly initiative that makes it easier for the community to separate their recyclable waste, while also reassuring people to adopt recycling practices that contribute to increasing the national recycling rate by 40% by 2025 (Faradillah et al., 2025). The Sepang Municipal Council (MPSepang), in cooperation with KDEB Waste Management, has established an Automatic Drive-Through Recycling Center (ADTReC) at the Cyberjaya Recycling Center (PKSC). The ADTReC at PKSC is the first to work in the state of Selangor, operating fully solar technology. To persuade community involvement in recycling activities, ADTRec provides facilities for the community to implement recycling practices by using reward or incentive methods. It operates on the concept of 'Do It Yourself' every day using a digital platform, and Trash4Cash is responsible for managing and handling user information, as well as making payments to ADTRec users (KDEB Waste Management, 2024). Thus, this hypothesis has been developed as follows:

Ho2: Facility support significantly influences e-waste recycling behaviour among the Malaysian public in Southern Region.

Ha2: Facility support does not significantly influence e-waste recycling behaviour among the Malaysian public in Southern Region

2.6.1.3 The Relationship between Subjective Norm and E-waste Recycling Behaviour Malaysian public in Southern Region

Subjective norms refer to the attitudes, notions, demands, and influences that come from one's social circle and can be either favourable or unfavourable (Ajzen I., 1991). Norms can define and create guidelines for society, and members of that society can adhere to these implicit norms to carry out specific behaviours (Masud, 2021). Subjective norms are social pressures experienced, whether engaging in a behaviour or

not and might be characterised as usual (David, 2020; Amir et al., 2025). This shows how three approaches to social pressure might impact persons with social anxiety: a norm can be evaluated from other people's normative expectations to an individual's motivation to meet their expectations (Irawan, 2020).

Subjective norm (SN): a term used to describe how societal expectations or pressure affect a person's decision to participate in a particular conduct. According to earlier research (Dakduk et al., 2018; Goh et al., 2025), students' views of the expectations of others, including classmates, who push them to embrace blended learning, may be linked to social norms (SN). Students are more likely to adopt blended learning when they see their peers doing so (Dakduk et al., 2018; Valtonen et al., 2022; Goh et al., 2025). Subjective norms highlight the extent to which people's will be involved in their actions.

When people conduct (or do not conduct) a specific behaviour, they are subject to societal pressures known as subjective norms. Family, friends, public personalities, and the surroundings could all be sources of this pressure (Bhutto M. Y., 2023). Subjective norms are subjective norms to which individuals, society, or close relationships approve or disapprove of a particular behaviour (Bhutto M. Y., 2021). The discussion on the definition of subjective norms shows that people's behaviour and attitudes, which are considered subjective norms, can influence e-waste recycling in the Malaysian public.

Past studies found that when an individual sees family members and friends transfer e-waste to a recycling centre, they are more likely to do the same (Kutty et al., 2024). In other words, they will mimic the actions of the community around them (Nawaz et al., 2025). For example, when the community considers that recycling is significant in curbing environmental pollution and that e-waste, especially materials that are difficult to decompose, thrown away carelessly, can pollute the soil and water, as well as endanger the lives of flora and fauna, it will create a norm for recycling (Nordin et al., 2025). Japan is known as one of the most beautiful and cleanest countries in the world. To continue the cleanliness and beauty of their country, efforts are made at all levels of society and have been ongoing for a long time. For example, Japanese society is renowned for its high level of self-discipline in environmental management, which is attributed to the Shinto religious beliefs that have been prevalent in Japan since the early 8th century (Prasetyo & Wicaksono, 2021). Awareness of implementing recycling practices among Japanese society began in the post-war period. At that time,

waste was produced in large quantities due to rapid economic development and an increasing population. In Japan, the culture is more community-oriented than individualistic, and they do not litter everywhere to take care of the environment, which is a common courtesy (Molony, 2020). Thus, this hypothesis has been stipulated:

Ho3: Subjective norms significantly influence e-waste recycling behaviour among Malaysian public in Southern Region.

Ha3: Subjective norms do not significantly influence e-waste recycling behaviour among Malaysian public in Southern Region

2.6.2 Internal Factors

2.6.2.1 The Relationship between Moral Obligation and E-waste Recycling Behaviour Malaysian public in Southern Region

Moral norms are internalised ideas of duty to act in a way that advances society or abstains from doing things that impede it (H., 1977). Moral obligation can also be defined as a paradigm that stresses how moral obligations that originate within might predict whether people will engage in pro-environmental behaviours like recycling (Lidwin Kenneth Michael, 2024). Empirical solid evidence from Indonesian cities demonstrates a substantial impact of moral norms on waste sorting intention and behaviour (Setiawan B., 2021; Che Abdullah et al., 2025).

In this study, moral obligation refers to the ethical duty that people, organisations, and communities must reduce the adverse effects of managing and disposing of electronic equipment on the environment and society (Nation, 2024). This entails implementing procedures that lessen the production of e-waste, encourage ethical recycling, and safeguard the welfare of the environment and marginalised people impacted by inappropriate e-waste disposal (Md Shah Newaz, 2023). The moral requirement of stakeholders to responsibly manage electronic waste through sustainable approaches, minimising environmental degradation, and enhancing social well-being is known as the "e-waste moral obligation (Ofori, 2021; Huang et al., 2025). This entails implementing policies that promote ethical and sustainable production methods and responsible consumption and disposal.

Environmental sustainability expects a shift in attitudes, thinking, and views of nature, as well as a transformation in lifestyle, which inevitably implies debates of a

metaphysical, moral, and legal nature (Goh & Sukri, 2024). Syed Muhammad Naquib al-Attas elucidated that the secular view of nature, which separates the relationship between nature and God and frees nature from cosmic meaning, is the reason why humans are becoming careless in their actions towards nature (Hidayatullah & Arif, 2020). Religion serves as a source of moral values that provide support for human behaviour, thereby confirming the existence of morality and good morals. Islam is a religion that places great emphasis on environmental awareness and sustainable living. Many verses of the Qur'an and Hadith explain, recommend, and even oblige every human to maintain the survival of their own life and the lives of other creatures on earth, even in the most critical situations (Harris, 2022). Goh and Sukri (2025) found that most respondents expressed a high level of concern about environmental problems and believed that the government should play a significant role in protecting the environment. The results of their study also found that most respondents reported feeling angry and disappointed when thinking about the way industries pollute the environment. Environmental concern requires us to be aware of the lifestyle that has a negative impact on the environment and try to change our attitudes to adopt new ones that aim to maintain and promote a high-quality environment (Islam et al., 2025). Thus, this hypothesis has been stipulated:

Ho4: Moral obligation significantly influences e-waste recycling behaviour among the Malaysian public in the Southern Region

Ha4: Moral obligation does not significantly influence e-waste recycling behaviour among Malaysian public in Southern Region

2.6.2.2 The Relationship between Attitude and E-waste Recycling Behaviour Malaysian public in Southern Region

The first factor that relates to perception and cognition about the result is attitude. The degree to which respondents assess their behaviour about a particular outcome explains their attitude towards recycling (Sabbir, 2022; Zhao et al., 2025). The intention to carry out a specific activity will likely rise in response to a favourable review, such as "recycling is sensible/responsible/pleasant." In contrast, a negative evaluation will eventually result in poorer intent and actions (Kumar, 2019; Hossain et al., 2025). The most crucial element influencing mobile phone recycling behaviour was behavioural control, whereas moral norms and attitude were found to be significant

(Dhir, 2021). People in certain developing situations are aware of recycling but not inclined to do so (Koshta, 2022). Information security is the primary cause, followed by incentive and convenience. This leads to increased storage at home and, eventually, a broken recycling system. Thus, establishing public confidence by protecting individuals' private information would be essential to developing an effective smartphone recycling program (Md Shah Newaz, 2023).

An individual's behaviour informs their perceptions, which are made up of both personal and ingrained beliefs. The study results also indicate that a person's positive attitude towards a particular behaviour and the perceived repercussions of the behaviour both increase the person's desire to engage in the behaviour (Gultom, 2020; Yahya et al., 2025). Not only that, a study by Nguyen (2019) indicates that one of the main factors influencing Vietnamese people's behaviour towards e-waste recycling for official collections is their attitude towards recycling. A study by Rahimah et al. (2020) has demonstrated that consumers' attitudes towards the environment and their social responsibilities are strengthened by materialism. As environmentalism is widely acknowledged as a noble ideal in society, the authors contend that materialistic consumers regard environmental issues as a chance to enhance their perceptions of themselves. Furthermore, individuals don't want to be seen as wasteful shoppers whose addiction to material possessions steadily harms the environment, especially considering the growing popularity of pro-environmental initiatives.

Goh and Sukri (2025) define environmental attitudes as the tendency to consistently respond favourably or unfavourably towards the environment. Environmental attitudes play an important role in influencing and motivating human behaviour towards the environment. Yahya and Tengku Hamzah (2025) found that individuals who have positive thoughts about the environment influence their level of participation in e-waste recycling actions. Studies by Zhao et al. (2025) also found that individuals with limited knowledge of the concept of sustainable development are less prepared to manage sustainable development activities such as e-waste management. According to Thompson and Barton (1994), a gradual shift in attitude and behaviour from anthropocentric to ecocentric is necessary among the community to minimize environmental destruction. This ecocentric attitude will subsequently change the lifestyle of the community in ensuring that the responsibility for preserving the environment can be shared together for the sake of future generations (Nordin et al., 2025). Thus, this hypothesis has been stipulated:

Ho5: Attitudes have a significant influence towards e-waste recycling behaviour among the Malaysian public in Southern Region

Ha5: Attitudes have no considerable influence towards e-waste recycling behaviour among Malaysian public in Southern Region

2.6.2.3 The Relationship between Time Availability and E-waste Recycling Behaviour Malaysian public in Southern Region

Advanced technology in e-waste recycling can be provided to save time for people to practice e-waste recycling. People nowadays are too busy with their careers and personal lives. Hence, it has been proven that time availability is also essential in e-waste recycling. Based on studies have been done it shown that the older generation and retirees are the only groups that commit fully to e-waste recycling, as they do not have much activity to do compared to the young generation that has a career and working lifestyle (Alhassan, 2018; Liu et al., 2023; Abha et al., 2025). To encourage people to practice e-waste recycling, introducing advanced facilities for e-waste that can make people work easier and save time is also an efficient alternative.

An article by Kuehr (2020) stated that the impact of COVID-19, which has led to people working from home and online learning, has increased the amount of future e-waste. As a result, sales of electronic equipment and gadgets such as laptops, tablets, and smartphones have increased (Xi et al., 2025). This shows that time availability also influences the e-waste recycling behaviour. Recycling e-waste is time-consuming because individuals must visit a recycling centre to separate the waste. For those with schedules that allow it or who live far from a recycling centre, this makes them reluctant to recycle e-waste (Nordin et al., 2025). For example, residents of rural areas find it difficult to send their e-waste because most recycling centres are located in urban and suburban areas. This leads to the growth of illegal e-waste recycling centres. Given numerous responsibilities and a tight schedule, time is highly valued, whereas recycling is regarded as trivial. Therefore, they prefer to dispose of e-waste directly into the trash. This has been demonstrated by Puzzo and Prati (2024), who found that individuals with a positive attitude toward recycling but lacking the time to do so are less likely to engage in recycling behaviour. Nordin et al. (2025) found that this time constraint can be mitigated by increasing the number of recycling centres and placing e-waste bins in residential and public areas. Thus, this hypothesis has been proposed as follows:

Ho6: Time availability significantly influences e-waste recycling behaviour among Malaysian public in Southern Region

Ha6: Time availability does not significantly influence e-waste recycling behaviour among Malaysian public in Southern Region

2.6.2.4 The Relationship between Waste Sorting Knowledge and E-waste Recycling Behaviour Malaysian public in Southern Region

Knowledge is essential for a country. Most of the solutions to the issues that arise are by providing knowledge to the people. The same goes for the e-waste recycling issue. To address the issue of the increasing volume of e-waste and to profit from it, many countries have passed e-waste legislation (Hanifah Mahat, 2019; Yang et al., 2024). In this study, knowledge policy refers to people who can learn from various sources, including previous experience, verbal persuasion, and witnessed learning (Chen, 2022). The annual rise in e-waste problems is partly a result of some people's ignorance. Environmental issues are being caused by their ignorance of e-waste (Thi Thu Nguyen, 2019; Akter & Hossain, 2025). Lack of knowledge is the leading cause of ignorance (Cram, 2021). According to Wang et al. (2023), people may be discouraged from participating in a particular behaviour if they are unaware of it. This shows the importance of knowledge policy for the society. Experts emphasise that the key to controlling e-waste is education. Additionally, education on e-waste ought to be provided to all members of the organisation, not just the stakeholders, after it has been planned (Thukral, 2023). The government must provide enough and adequate knowledge to the people through awareness programs, social activities, and mass media. It should also give people enough understanding of e-waste (Arain, 2019).

According to research conducted in Putrajaya, Malaysia, most consumers know the risks of incorrect e-waste recycling (Hanifah Mahat, 2019; Gaur et al., 2025). Though their practice and understanding of e-waste recycling are still poor, Malaysians have moderate knowledge about e-waste. Azlan (2021) also stated that the lack of understanding regarding the proper disposal of e-waste is the cause of low awareness of e-waste recycling.

Studies have found that individuals who are aware of the negative effects of e-waste, its contents, and how to manage it are more likely to recycle e-waste (Ahmad et al., 2025). This knowledge is acquired through reading, learning, and personal

experience. The importance of environmental education needs to be recognized because it is related to various aspects of the human self (Wan Yusoff et al., 2024). Education plays a crucial role in addressing the issue of e-waste by raising public awareness through various channels. Among the most significant initiatives are organizing awareness programs, promoting innovation and research, and collaborating with the industry to develop recycling programs. Additionally, parents play a crucial role in educating their children about e-waste. At home, parents can set a good example by managing e-waste correctly and encouraging children to participate in recycling activities (Zhang et al., 2025). Additionally, community activities and programs can also serve as effective platforms for fostering awareness about e-waste. Encouraging the generation to participate in e-waste collection campaigns, interactive games that educate about recycling, or creative competitions using e-waste materials can make the exposure process more engaging and effective for them (Amanda et al., 2024). Furthermore, practical knowledge, such as the location of e-waste collection centres, proper disposal procedures, and the accessibility of incentives or recycling programs, also improves the prospect of recycling behaviour (Sulaiman et al., 2025). Even if a person has high environmental awareness, a deprivation of practical information can be a block to actual action. Thus, education, whether formal or informal, is one of the most effective instruments in fostering a spirit of love and appreciation for the environment (Ezanee et al., 2025). Thus, this hypothesis has been stipulated:

Ho7: Waste sorting knowledge significantly influences e-waste recycling behaviour among the Malaysian public in Southern Region

Ha7: Waste sorting knowledge does not significantly influence e-waste recycling behaviour among the Malaysian public in the Southern Region

Table 2.6
Summary of Hypothesis

	Hypothesis Statement
Policy and Regulation	Ho1: Policy and regulation significantly influence e-waste recycling behaviour among the Malaysian public in the Southern Region
	Ha1: Policy and regulation do not significantly influence e-waste recycling behaviour among the Malaysian public in the Southern Region
Facility Support	Ho2: Facility support has a significant influence on e-waste recycling behaviour among the Malaysian public in the Southern Region
	Ha2: Facility support has no significant influence on e-waste recycling behaviour among the Malaysian public in the Southern Region
Subjective Norm	Ho3: Subjective norms have a significant influence on e-waste recycling behaviour among the Malaysian public in the Southern Region.
	Ha3: Subjective norms have no significant influence on e-waste recycling behaviour among Malaysian public in Southern Region
Moral Obligation	Ho4: Moral obligation significantly influences e-waste recycling behaviour among the Malaysian public in Southern Region
	Ha4: Moral obligation does not significantly influence e-waste recycling behaviour among Malaysian public in Southern Region
Attitude	Ho5: Attitude significantly influences e-waste recycling behaviour among Malaysian public in Southern Region
	Ha5: Attitude does not significantly influence e-waste recycling behaviour among Malaysian public in Southern Region
Time Availability	Ho6: Time availability significantly influences e-waste recycling behaviour among Malaysian public in Southern Region
	Ha6: Time availability does not significantly influence e-waste recycling behaviour among the Malaysian public in the Southern Region
Waste Sorting Knowledge	Ho7: Waste sorting knowledge significantly influences e-waste recycling behaviour among the Malaysian public in Southern Region
	Ha7: Waste sorting knowledge does not significantly influence e-waste recycling behaviour among Malaysian public in Southern Region

2.7 Summary of Chapter

The study's theoretical and conceptual underpinnings are established in Chapter 2, which also examines the body of research on recycling practices for electronic trash, or "e-waste." It starts off by going over the sharp rise in e-waste production brought on by advances in technology, shorter product lifespans, and increased consumer demand, all of which pose major threats to human health and the environment if not effectively managed. The chapter focuses on the Malaysian setting, namely the difficulties in

managing domestic e-waste despite laws and government programs. Effective recycling techniques are nevertheless hampered by behavioural and infrastructure constraints, and public participation is still low. The study is based on Icek Ajzen's Theory of Planned Behaviour, which explains how attitude, subjective standards, and perceived behavioural control affect behaviour.

The chapter builds on this approach by classifying determinants of e-waste recycling into external factors such as facility availability, policy support, and societal impact and internal factors such as knowledge, moral obligation, attitude, and personal responsibility components. The literature analysis highlights the necessity to incorporate both internal and external causes and points out a study shortage in studies that concentrate on actual recycling behaviour, particularly within Malaysia's Southern Region. All things considered, Chapter 2 defends the study's conceptual framework and encourages the formulation of hypotheses to investigate the variables affecting the recycling behaviour of e-waste.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

This chapter begins by introducing the study's research design. This study employed an explanatory sequential mixed-methods design, in which survey data collection and semi-structured interviews were conducted sequentially the sample, sampling technique, measurement, and data analysis. Stated otherwise, the research technique provides a comprehensive understanding of the study's methodology. This chapter also discusses one data collection method to prove the study being conducted.

3.2 Research Design

This study employed an explanatory sequential mixed method. It comprises two phases: quantitative data collection and analysis, followed by qualitative data collection and analysis. This design's primary goal is to use qualitative data to further interpret, explain, or expand on the quantitative phase's findings. This method is beneficial when preliminary numerical data reveals surprising patterns or require a more thorough understanding of underlying causes. According to Creswell and Plano Clark (2018), the explanatory sequential design starts with the collection of quantitative data to test theories or hypotheses. Next, qualitative data is collected to help contextualize or explain the quantitative results. By combining the advantages of both quantitative and qualitative methods, this approach enables researchers to gain a more thorough understanding of complex phenomena (Ivankova, Creswell, & Stick, 2006).

The research philosophy of this study is pragmatism. As defined by Peirce, C. S. (1878), pragmatism is a technique for revealing meaning through real-world implications. According to it, an idea's significance is determined by the consequences it yields in practice. The study's conceptual approach demonstrates openness in discussing this issue, which helps to gain deeper insight into e-waste recycling behaviour.

Quantitative methods are used to identify the internal and external factors while qualitative to explain how and why the factors influence e-waste behaviour. It works

particularly well when a researcher wants to focus on quantitative results but still needs detailed, descriptive information to interpret those results. Additionally, the design's sequential structure guarantees that the qualitative phase is directly informed by the quantitative findings, establishing a logical progression between phases (Creswell & Plano Clark, 2018). To produce robust and comprehensive research results, the explanatory sequential mixed method is increasingly used in behavioural, educational, and social science research.

Research objectives (RO1) and (RO2) are addressed through a quantitative study. Interviews were conducted to validate the quantitative findings, and RO3 is addressed through the synthesis of both approaches. The quantitative data were disseminated to the Malaysian public, and qualitative data were collected through interviews with individuals from various agencies with experience in e-waste recycling. Moreover, for the public, individuals are selected based on their household roles, which will be discussed in the next subtopic. The quantitative and qualitative studies were conducted sequentially. The purpose of combining quantitative and qualitative methods is to provide rich insights into e-waste recycling behaviour. For example, quantitative studies help to find 'what' influences the e-waste recycling behaviour. In contrast, qualitative studies are used to see 'why' those factors of e-waste influence the recycling behaviour of the people.

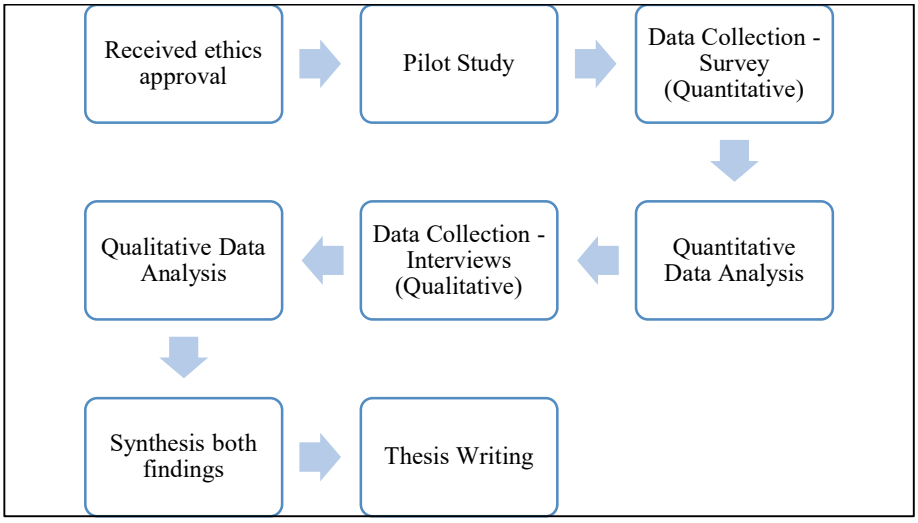


Figure 3.1 Research Process (Source: Author's own work)

3.2.1 Quantitative Method: Survey Study

The research design serves as the study's structure, encompassing all components used in the study. A cross-sectional design was employed, combining quantitative (questionnaire) and qualitative (interview) methods to achieve the goal. This study employs a multi-response methodology to track variables (Thomas, 2022). The quantitative technique, implemented through an online survey, enables more detailed data collection, including objective measurements and numerical analyses, by creating survey questionnaires. We have employed it in this study for our research survey.

3.2.2 Qualitative Method: Semi-structured Interview

Additionally, this study employed an interview with nine respondents. Laken (2025) ssaturation is achieved when additional interviews no longer contribute new perspectives, themes, or interpretations to the study. Similarly, Guest, Bunce, and Johnson (2006) argued that data saturation in qualitative research can often be achieved within a relatively small number of interviews when participants share similar experiences related to the phenomenon under investigation. In this research, theoretical saturation was attained when recurring patterns regarding recycling behaviour, facility support, waste sorting knowledge, and public attitudes consistently emerged across the interview sessions. Therefore, the selection of nine informants was considered sufficient to generate meaningful and comprehensive qualitative findings.

Semi-structured interviews were used in the study because e-waste recycling behaviour is a multifaceted issue influenced by individual experiences, societal factors, infrastructure accessibility, awareness, and behavioural incentives. Semi-structured interviews were thought to be the best approach since they allow respondents to freely share their thoughts and experiences while also allowing the researcher to stay true to the study's goals. Semi-structured interviews are especially useful for examining participants' experiences, perceptions, and viewpoints on a given topic, according to Wakelin, McAra-Couper, and Fleming (2024). In a similar vein, Do Carmo et al. (2024) contended that because respondents are free to expound on their experiences and viewpoints, semi-structured interviews allow researchers to get rich and detailed qualitative data. This flexibility was important in the present study because the

researcher sought to critically explore the factors influencing e-waste recycling behaviour beyond the limitations of structured survey responses.

Additionally, semi-structured interviews were chosen over fully organized interviews because the latter may hinder the formation of fresh ideas and constrain respondents to planned answers. However, unstructured interviews might lead to participant inconsistencies and complicate data comparison. As a result, the semi-structured approach offered a harmony between adaptability and methodical investigation. Semi-structured interviews are frequently employed in qualitative research, according to Junnier (2024), since they give researchers a greater insight of participants' worldviews, attitudes, and behaviours as well as insider perspectives. Using exploratory questions like "how," "why," and "what factors," the researcher was able to go deeper into the responses, which was crucial in identifying the underlying obstacles, driving forces, and difficulties related to e-waste recycling procedures.

To reduce social pressure, conformity bias, and outside influences that can compromise the veracity of participants' answers, the interviews were also done one-on-one rather than in groups. Respondents were able to talk more candidly and openly about their recycling experiences, attitudes toward the environment, and personal struggles during one-on-one interviews. Participants' accessibility and convenience were enhanced by the option of doing interviews in person or virtually, which improved participation and the effectiveness of data collection (Wakelin et al., 2024). As a result, the semi-structured interview method was crucial in producing in-depth, situation-specific, and behaviour-focused insights that reinforced this study's explanatory sequential mixed-method design.

3.3 Unit of Analysis

The unit of analysis, which refers to the primary entity being examined to respond to the research questions, is explained in this section. Individuals above 18 years old, particularly members of the Malaysian public in the Southern Region, serve as the unit of analysis in this study, as the primary objective is to investigate how they recycle e-waste and the factors that influence this behaviour.

3.3.1 Survey

According to Kumar (2018), the unit of analysis refers to the source from which researchers collect data to explore theoretical frameworks, with theory development closely tied to the analysis of these data. In this study, the unit of analysis is Malaysian citizens residing in the southern region of the country. The focus is on examining the key factors influencing e-waste recycling behaviour, including policy and regulation, moral obligation, personal attitudes, knowledge of waste sorting, facility support, and time availability. To ensure relevance and reliability, respondents must be Malaysian nationals aged 18 and above. Furthermore, they must come from the Southern Region of Malaysia, which includes Johor, Melaka, and Negeri Sembilan.

3.3.2 Semi-structured Interview

As for the qualitative study, interviews were conducted among the eight informants: one from the Department of Environment Johor (DOE), one from a Non-Governmental Organization (NGO), which is Zero Waste Malaysia, one academician from Universiti Teknologi Malaysia (UTM), two community members from Negeri Sembilan, two from Melaka, and two from Johor. The respondents are selected based on their extensive experience in managing e-waste recycling. Some respondents, such as lecturers at UTM, have more than 5 years of academic experience and have conducted research on e-waste. Furthermore, respondents from Zero Waste Malaysia and the Department of the Environment have conducted several activities and field studies on e-waste recycling. Moreover, public respondents who have been selected to spend most of their time at home, use electronic devices in their daily lives, and have resided in the southern area for more than 5 years. Their opinions and responses on e-waste recycling were helpful, as they enabled the study to identify factors from the public's perspective. They have first-hand knowledge, which allows the study. Additionally, they provide valuable insights into e-waste recycling behaviour, including gaps, potential improvements, and the factors that influence it. The list of representatives is as follows:

Table 3.1
List of Representatives

Informant	Representative
Respondent 1	Department of Environment (Johor)
Respondent 2	Non-Governmental Organization (NGO), Zero Waste Malaysia
Respondent 3	Universiti Teknologi Malaysia (UTM) Lecturer
Respondent 4	Community people from Negeri Sembilan
Respondent 5	Community from Negeri Sembilan
Respondent 6	Community from Johor
Respondent 7	Community from Johor
Respondent 8	Community from Melaka
Respondent 9	Community from Melaka

3.4 Sample Size

This section explains the sample size calculation for the study's quantitative and qualitative phases. To ensure that the population in the Southern Region was representative, the necessary sample size for the quantitative phase was determined using Krejcie and Morgan's (1970) sampling table. According to the data saturation principle, proposed by Guest, Bunce, and Johnson (2006) and Fusch and Ness (2015), the sample size for the qualitative phase was determined by conducting interviews until no new themes or insights emerged.

3.4.1 Survey

Krejcie and Morgan (1970) state that the sample size table can be used to determine the appropriate sample size for a given population. For populations of 10,000 or more, approximately 370 to 384 respondents are sufficient at the 95% confidence level. According to Krejcie and Morgan (1970), the minimum sample size for the study is 384. However, in this study, 500 samples were collected, and the final sample size is 400. To ensure proper representation and to gather thorough data from survey respondents and interview informants, this study uses a mixed sampling strategy that combines probability and non-probability sampling techniques.

A mixed sample strategy was employed in this study to guarantee that the data gathered were appropriate for both the quantitative and qualitative stages of the investigation. The study's explanatory sequential mixed-method design necessitated a

sampling strategy that could accommodate both follow-up interviews and a large-scale survey. The study was able to increase representativeness while maintaining practicality in terms of accessibility, cost, and time by mixing various sample techniques. This strategy made it possible for the results to more precisely represent the recycling habits of people living in Malaysia's southern area.

Additionally, this study employs cluster sampling, with the sample divided into three regions: Melaka, Negeri Sembilan, and Johor. Due to the population's geographic dispersion throughout Malaysia's Southern Region, cluster sampling is used in this study. The researcher can better organize data collection while guaranteeing geographical representation by grouping the population into clusters according to states (Johor, Melaka, and Negeri Sembilan) and choosing these clusters at random. When a list of naturally occurring groups such as states or districts is accessible, but a comprehensive list of individuals is difficult to obtain, cluster sampling is especially appropriate (Creswell & Creswell, 2023). Compared to simple random sampling across the entire region, this method also reduces logistical, financial, and time constraints (Sekaran & Bougie, 2020). Furthermore, the selection of Johor, Melaka, and Negeri Sembilan is justified based on population statistics reported by the Department of Statistics Malaysia, which identifies these states as major population centers within the Southern Region of Malaysia. According to the Department of Statistics Malaysia (2024), Johor recorded approximately 4.1 million residents, Negeri Sembilan about 1.2 million residents, and Melaka approximately 1.0 million residents. The inclusion of these three states therefore enables the researcher to obtain a broader representation of public perceptions and e-waste recycling behaviour within the Southern Region while ensuring that the findings remain manageable and feasible within the scope of the study.

In Melaka, the central districts under focus are Alor Gajah and Ayer Keroh. In Negeri Sembilan, the focus is on Seremban and Port Dickson. Lastly, for Johor, the focused districts are Johor Bahru and Pasir Gudang. Next, to determine the sample size for each district, quota sampling is used. By using quota sampling, each chosen state is represented proportionately based on its population size or predefined percentage. To better reflect regional differences, the researcher can use this strategy to manipulate the sample distribution: Johor (40% of 500 = 200), Melaka (30% of 500 = 150), and Negeri Sembilan (30% of 500 = 150). The total sample size is 500 when precise subgroup representation is crucial for comparison and when individual-level probability sampling is not feasible, quota sampling is suitable.

Table 3.2
Sample Size Distribution for Survey Study

State	District	Sample Size
Johor (n=200)	Johor Bahru	60
	Kulai	60
	Batu Pahat	80
Melaka (n=150)	Ayer Keroh	80
	Jasin	70
Negeri Sembilan (n=150)	Seremban	70
	Port Dickson	80

3.4.2 Interview

According to Creswell & Plano Clark (2018), the purpose of mixed methods research is to provide in-depth insights that supplement quantitative findings, which is why the qualitative sample is frequently limited. The sample size was determined based on data saturation. When there were no new themes or information surface from the data gathering, data saturation has occurred (Guest, Bunce, & Johnson, 2006; Fusch & Ness, 2015). Additionally, Guest et al. (2006) showed that saturation frequently occurs within the first six to twelve interviews, suggesting that eight individuals may be sufficient to elicit key topics.

Sample size refers to the portion of the population that is deliberately selected to ensure sufficient data for drawing definitive conclusions (Rahman MM, 2022). In this study, nine respondents were chosen to fulfil the sample size for the interview: one from DOE, one from a Non-Governmental Organization (NGO), which is Zero Waste Malaysia, one academician from Universiti Teknologi Malaysia, two public person from Melaka, two communities from Johor, and two communities from Negeri Sembilan. Similarly, Kumar (2021) defined sample size as the "aggregate count of individuals within the sample," which effectively captures the number of participants or observations in a study. The process of determining an appropriate sample size requires careful consideration of several factors, including the research methodology selected, analytical methods used, the complexity of the variables or models, logistical and temporal constraints, response rates, advisory input, previous sample sizes from similar studies, and the data analysis software used (JF Hair, 2014). Considering

qualitative interviews emphasize in-depth information over extensive number representation, the choice of nine respondents is deemed adequate. Braun and Clarke (2022) state that the goal of qualitative research is to gather rich, in-depth, and significant insights from participants who have relevant experience or knowledge about the study question. To ensure a variety of viewpoints on e-waste recycling practices in Malaysia's Southern Region, the study's respondents were specifically chosen from a variety of backgrounds, including government agencies, non-governmental organizations, academic institutions, and local communities. The researcher can obtain a wide range of perspectives regarding awareness, obstacles, and methods for enhancing e-waste recycling behaviour because of the diversity of participants.

Additionally, smaller interview samples are enough when the study focuses on certain concerns and when data saturation is reached, according to modern qualitative research researchers. According to Hennink and Kaiser (2022), thematic saturation frequently happens in a comparatively limited number of interviews, especially when participants discuss experiences connected to a specific research topic. The point at which more interviews yield no new themes, concepts, or insights is known as data saturation. Because the purpose of the interviews is to get in-depth information rather than statistical generalization, the study's usage of nine respondents is deemed sufficient Furthermore, Guest et al. (2020) pointed out that when the data gathered consistently addresses the research aims, qualitative studies with homogeneous or focused participant groups can produce significant findings with less than twelve interviews. Therefore, the chosen sample size is sufficient to offer deep qualitative insights while staying within the constraints of the study's time and resources.

3.5 Sampling Technique

3.5.1 Survey

This adopts an explanatory sequential mixed sampling approach. For the first phase, the sampling technique employed is multi-stage sampling: the population is separated into geographic groups, and a subset of clusters, namely Negeri Sembilan, Johor, and Melaka, is randomly selected. Quota sampling is used to determine the required sample size for each region: Johor (40% of 500 = 200), Melaka (30% of 500 = 150), and Negeri Sembilan (30% of 500 = 150), for a total sample of 500. In the third

step, convenience sampling is employed: respondents are recruited via online outreach and intercept surveys at public locations such as malls or parks. Convenience sampling is a non-probability sampling method in which units are selected for inclusion because they are the most accessible to the researcher (Turner, 2020). Researchers contend that depth, relevance, and practicality are prioritized in non-probability qualitative designs, particularly when the study aims to comprehend behaviours, perceptions, or experiences within a particular context (Creswell & Poth, 2018; Etikan et al., 2016). Convenience sampling enabled the researcher to effectively recruit participants with sufficient knowledge and firsthand experience relevant to the study's goals, facilitating the collection of pertinent, contextually grounded data. This may involve collecting data from individuals who are present at a given location at a specific time (Turner, 2020).

3.5.2 Interview

This study used purposive sampling to select key informants for the interview study. Purposive sampling is a judgmental, non-probability sampling technique in which researchers deliberately choose participants based on specific characteristics or qualities. The primary goal of purposive sampling is to focus on population characteristics of interest that best enable the researcher to answer their research questions. Its advantage is that it can provide rich, detailed data for the study. The interviews are conducted in around 30 to 40 minutes to get people's opinions and feedback on e-waste recycling in Malaysia. As this will be crucial for assessing the data shortly, ensuring that the survey's respondents can understand it is vital. The criteria for informants are people residing in the Southern Region of Malaysia aged 18 years and above.

The researchers interviewed the respondents from three different areas of expertise: Department of Environment (DOE), one from Non-Governmental Organization (NGO) which is Zero Waste Malaysia, one academician from Universiti Teknologi Malaysia (UTM), two community from Johor, two community from Negeri Sembilan, and two community from Melaka. The Department of Environment is being interviewed because it has numerous initiatives to promote e-waste recycling among the Malaysian public. According to Palinkas et al. (2015), having informants with broad knowledge of the study is crucial, as it helps ensure credible data. Guest (2017), also stated that a quantitative study requires not only participants but also in-depth

knowledge from informants with experience in the topic. One respondent is from an NGO because it serves as the people's voice, bringing concerns about e-waste recycling to the forefront. This is to enable continued support for and practice of e-waste recycling. One respondent is an academic from UTM and an expert in e-waste, which supports the study being conducted. Next, one respondent is from the e-waste recycling centre, as they are the closest parties to e-waste processing. The last respondents are two communities. Communities are selected because they face the daily challenges of recycling electronic waste. Their point of view is critical because it influences the outcome.

3.6 Data Collection

Convenience sampling was used to recruit respondents for the quantitative component; individuals from the public in Malaysia's Southern Region were selected based on their availability and willingness to participate. In survey-based and exploratory research, convenience sampling is frequently employed when the goal is to collect data effectively within realistic time, cost, and access constraints, especially when probability sampling is impractical (Etikan et al., 2016; Creswell & Creswell, 2018). To increase response rates among the target demographic, the survey questionnaire was primarily distributed online via digital platforms, including social media and messaging apps. Where possible, it was also distributed in person (Saunders et al., 2019). For the survey data collection, responses are recorded on a Likert scale. Respondents are required to answer all the questions in the survey. The survey comprises eight sections: Part A presents a demographic profile; Part B contains questions on the dependent variable; and Parts C-I present questions on independent variables.

For the qualitative component, semi-structured interviews are being conducted. Semi-structured interviews were used for the qualitative component to obtain detailed information that survey data alone could not adequately convey. Convenience-based and purposeful criteria were used to choose informants, focusing on those with pertinent expertise or experience in e-waste recycling procedures. This strategy is well-suited to qualitative research, where selecting individuals with extensive information is more important than achieving statistical representativeness (Creswell & Poth, 2018; Patton, 2015). The informants were asked questions and could respond based on their

understanding and experiences. Semi-structured interviews provide a more flexible environment in which informants can share their deeper thoughts on the topics. The interviews are conducted for 30 to 40 minutes, either face-to-face or online.

3.7 Measurement

This section offers a thorough explanation of how the study's independent variables, attitude, moral obligation, subjective norm, regulation, and facility support, and dependent variable e-waste recycling behaviour were measured. Measured on a five-point Likert scale, each construct was analyzed using items modified from extended environmental behaviour research and the Theory of Planned Behaviour.

3.7.1 Survey

The research items were altered from the studies by Aboelmaged (2021) for evaluating attitude, facility support, waste sorting knowledge, moral obligation, and time availability, and Rakhmawati et al. (2023) for gauging subjective norms, policy, and regulation, and Darby and Obara (2005) for measuring e-waste recycling. The Likert Scale was used as the measurement scale for all dimensions across all variables. Table 3.3 shows the items used to measure each variable. The purpose of this study is to measure e-waste recycling, which is influenced by several external and internal factors, including: 1) policy and regulation, 2) facility support, 3) subjective norm, 4) moral obligation, 5) attitude, 6) time availability, and 7) waste sorting knowledge. All variables are measured following the study by Quratul Udin et al. (2021). The Likert Scale was used as the measurement scale for all dimensions across all variables. On a 5-point Likert scale, respondents' levels of agreement or disagreement with propositions are measured (Sekaran, 2003). The Likert Scale, which goes from 1 (strongly disagree) to 5 (strongly agree), is used to evaluate each variable. For the dependent variable, there are three questions on E-waste Recycling Behaviour for which respondents must rate their behaviour using the provided scales. Next, external factors begin with policy and regulation, followed by moral obligation, attitude, and waste-sorting knowledge. Having addressed external factors, respondents should proceed to internal factors: facility support, time availability, and subjective norm. The measurement details are as follows:

Table 3.3
Table of Measurement

Variable	Question
E-waste Recycling Behaviour	1. I sent my e-waste to a recycling center in the last 12 months. 2. I separated my old electronic devices for recycling purposes before discarding them 3. I used the e-waste collection service provided by the local authority
External Factors	
Policy and Regulation	1. Environmental monitoring encourages me to sort e-waste 2. Environmental regulations encourage me to sort waste. 3. Government policies encourage me to sort waste 4. Government promotions help me understand the importance of waste sorting
Facility Support	1. In my area, there are adequate bins to sort out waste. 2. My area has an adequate facility to collect sorted waste. 3. Sorted-waste collection in my area is appropriately managed. 4. There are sufficient resources to collect sorted waste in my area.
Subjective Norm	1. I want to spend my time sorting waste. 2. People who are important to me think that sorting waste is a good activity. 3. People who are vital to me sort them. 4. People vital to me think that I should sort my waste.
Internal Factors	
Waste Sorting Knowledge	1. I know the types/categories of waste. 2. I know how to sort waste. 3. I know where to send my waste. 4. I am familiar with waste-sorting guidelines.
Moral Obligation	1. Sorting waste is in line with my pro- environment principles 2. I am willing to put extra effort into properly disposing of my e-waste 3. I would feel guilty if I did not recycle my e-waste correctly 4. I feel a personal solid obligation to dispose of my e-waste properly
Attitude	1. E-waste recycling makes me feel delighted. 2. E-waste recycling contributes to society. 3. E-waste recycling is everyone's responsibility. 4. E-waste recycling is beneficial.
Time Availability	1. Sorting is wasting time. 2. I have minimal time to sort waste. 3. I want to spend my time sorting waste.

3.7.2 Interview

The interview questions have gone through protocol consultation with an expert. 9 interviewees have been selected; they have experience in e-waste recycling. An interview session for research involves gathering information directly from individuals or groups by asking them questions in a structured, semi-structured, or unstructured format. The interview questions were created using the findings from the quantitative

survey because this study employed an explanatory sequential mixed-method design. In this design, statistical data are explained and given a better understanding through the use of the qualitative phase. Following an analysis of the survey data from 500 participants, a few significant factors, including facility support, waste sorting knowledge, and subjective norm, were found to influence e-waste recycling behaviour. The interview protocol was developed based on these important findings.

This methodology was chosen because it enabled participants to elaborate on their responses while also providing standardized input through the questionnaires. Notably, the 'think aloud' qualitative component was beneficial for this study because it allowed participants to verbalize their reasoning, provide context when selecting questionnaire responses, and highlight potential sustainability/scalability factors they considered important but that were not included in the questionnaires. According to Creswell and Plano Clark (2011), it is important to choose individuals with experience in a "phenomenon of interest". These interview questions are being reviewed by Dr. Shawal Hussain, a senior lecturer at UiTM Seremban 3, in the Faculty of Administrative Science and Policy Studies. For example, the following are the questions that will be asked by the respondents:

1. Can you introduce yourself?
2. Are you familiar with the concept of e-waste?
3. From your point of view, what are the factors that influence e-waste recycling?
4. Which one do you think is the most significant predictor of e-waste recycling among the Malaysian public?
5. Could you provide any recommendations to improve e-waste recycling in Malaysia?

3.8 Data Analysis

3.8.1 Survey

The data analysis technique used in this research is an explanatory sequential mixed-methods study. To explain the statistical findings, this study used an explanatory sequential mixed-methods approach, in which quantitative data were collected and analyzed first, followed by qualitative interviews. Creswell et al, (2018) define explanatory sequential design as gathering quantitative data in the first phase and qualitative data in the second to provide more detail on preliminary findings. This

method is consistent with their definition. Similarly, Creswell (2023) emphasized that this approach prioritizes quantitative data while enhancing understanding through qualitative insights. To address research objective one, descriptive statistics are used to examine the frequency and percentage of the collected data.

Next, to address the second research objective, an analysis of the correlation and multiple Regression/Structural Equation Modelling (SEM) is conducted. The purpose of analyzing this data is to find the relationship between the independent variables and the dependent variable. Structural Equation Modelling (SEM) is a second-generation multivariate analysis technique that enables researchers to test relationships among complex variables and obtain a comprehensive model. In SEM, there are two models: the measurement model (i.e., confirmatory factor analysis) and the structural model. Before structural model analysis, a model can be considered good if empirical data conceptually and theoretically support the model. The goodness-of-fit test is used for path analysis, which uses the following measurements (Hair et al., 2010):

1. Goodness-of-fit Index (GFI) (≥ 0.90)
2. Tucker-Lewis Index (TLI) (≥ 0.90)
3. Comparative Fit Index (CFI) (≥ 0.90)
4. Normed Fit Index (NFI) (≥ 0.90)
5. Root Mean Square Error of Approximation (RMSEA) (<0.08)
6. Chi-Square/degree of freedom ratio ($\chi 2$/pdf) (<5.0)

This study further assessed convergent and discriminant validity. Convergent validity refers to the extent to which a test designed to assess a particular construct correlates with other tests that measure the same construct. According to Hair et al. (2010), convergent validity is established when composite reliability (CR) and average variance extracted (AVE) exceed 0.70 and 0.50, respectively. Furthermore, the Fornell-Larcker (1981) criterion and cross-loading examination were used to assess discriminant validity. Discriminant validity is established when the square root of AVE is greater than the correlation, and the correlation value between the constructs is more than 0.50 and below 0.85 (Fornell & Larcker, 1981). The discriminant validity assessment ensures that the constructs have the most robust relationships with their indicators (Hair et al., 2010). Structural model analysis was used to test the mediation effect in the final step.

For the third research objective, which is to identify the most significant predictors of e-waste recycling behaviour among the Malaysian public in the Southern Region, a multiple regression analysis is done. The purpose of Multiple Regression Analysis is to identify which independent variable has the most decisive influence on e-waste recycling behaviour.

3.8.2 Interview

The data analysis technique used to answer research objective number three, which was to propose a strategy for improving recycling behaviour among the Malaysian public in the Southern Region, was thematic analysis. According to Bryman (2016), thematic analysis presents data in greater detail and addresses a variety of topics through interpretations. Thematic analysis is a qualitative method used to identify, analyse, and interpret patterns of meaning (themes) within qualitative data. According to Alhojailan (2012), thematic analysis accurately identifies relationships between concepts and compares these concepts with similar facts. This study employs a concurrent mixed-methods explanatory sequential design.

The first step in thematic analysis is to collect data from semi-structured interviews with eight respondents across three agencies. Thematic analysis is "a method for identifying, analyzing, and reporting patterns (themes) within data," according to Braun and Clarke (2006). Key themes explaining the underlying factors influencing e-waste recycling behaviour among Malaysians in the Southern Region were identified through the investigation.

Before the interview session, the respondents will be provided with the transcript of the questions that will be asked. It is intended to help them identify the topics they want to discuss during the interview. From the interview data, researchers can assess the Malaysian public's willingness to recycle e-waste. A written analysis will be made based on the interview.

The qualitative portion of this study was conducted with careful attention to several ethical issues. Respondents were made aware of the goals of the study, the purpose of the research, and the intended use of the results prior to data collection. All interviewees gave their informed agreement prior to the semi-structured interviews, and participation was completely optional. To maintain openness and give them time to

comfortably prepare for the conversation, the interview questions were also sent to the respondents beforehand.

Anonymity and confidentiality were strictly upheld during the whole research process. Codes (such as A1, A2, and A3) were used in place of actual names to conceal the identity of the eight respondents from the three agencies. The final report did not include any information that might be used to identify the participants or their organizations. For academic purposes, only the researcher had access to the safely archived interview recordings and transcripts.

Additionally, participants were told that they could leave the research at any time without facing any adverse effects. If answering a question made them uncomfortable, they were free to refuse. This reduced any possible psychological or professional danger and guaranteed that the interview procedure respected the autonomy of the participants.

Lastly, honesty and integrity were maintained throughout the reporting and data analysis processes. In order to accurately and impartially portray the opinions of the participants, thematic analysis was carried out. Based on the themes found in the interview data, the conclusions were presented honestly. In addition to safeguarding the rights and welfare of each participant, these ethical procedures guarantee that the study conforms with academic research norms.

3.9 Summary of Chapter

The methodological approach used to accomplish the goals of this study on e-waste recycling practices among Malaysians in the Southern Region was described in Chapter 3. An overview of the research design was provided at the beginning of the chapter, followed by thorough explanations of the unit of analysis, sample size calculation, sampling strategies, data collection methods, measurement tools, and data analysis methods.

The pragmatist research philosophy underpinned this study's explanatory sequential mixed-methods design. A quantitative survey phase and a qualitative interview phase were the two consecutive stages of the methodology. This design's main goal was first to use quantitative analysis to identify key characteristics that influence e-waste recycling behaviour, and then to use qualitative insights to validate and explain these findings. While the qualitative phase supported and enhanced the interpretation of results, the quantitative phase addressed Research Objectives 1, 2, and 3.

Individuals, primarily Malaysian citizens living in the Southern Region, which includes Johor, Melaka, and Negeri Sembilan, served as the unit of analysis for both phases. Key informants from government agencies, non-governmental organizations, academic institutions, and local communities were selected for the qualitative component to provide knowledgeable perspectives based on their involvement in and experience with e-waste recycling.

Regarding sample size, the quantitative survey used Krejcie and Morgan's (1970) sampling table, yielding a final acceptable sample of 400 respondents from the 500 questionnaires initially distributed. Nine interviewers comprised the qualitative sample, and its sufficiency was supported by the data saturation principle, which holds that no new topics emerged from further interviews.

To ensure regional representation and effective data collection, the survey study employed a multistage sampling strategy that included cluster, quota, and convenience sampling. Purposive sampling was used to select informants with relevant knowledge and experience in recycling e-waste for the interview phase. This guaranteed the gathering of extensive, reliable, and contextually relevant qualitative data.

Semi-structured interviews were used for the qualitative phase of data collection, while a structured questionnaire with a five-point Likert scale was used for

the quantitative phase. The survey instrument assessed e-waste recycling behaviour and the factors influencing it, including facility assistance, policy and regulation, moral obligation, attitude, subjective norm, knowledge of trash sorting, and time availability. To guarantee validity and reliability, measurement items were modified from well-established research. To enhance content validity and ensure consistency with the study's objectives, the interview methodology was reviewed by a specialist.

Thematic analysis was systematically applied to interview data in the qualitative phase. Themes were identified to explain the underlying behavioural, institutional, and contextual factors influencing e-waste recycling, using the paradigm proposed by Braun and Clarke (2006). To develop comprehensive and practical plans to enhance e-waste recycling practices among Malaysians in the Southern Region, the qualitative and quantitative findings were synthesized.

All things considered, Chapter 3 laid a strong, systematic basis for the investigation, guaranteeing validity, accuracy, and depth in tackling the research goals using a comprehensive mixed-methods methodology.

CHAPTER 4
FINDINGS

4.1 Introduction

This chapter presents findings from an online survey with 400 responses and semi-structured interviews with 9 participants across the Southern Region of Malaysia. Thematic analysis was applied, yielding several key themes that explain e-waste recycling behaviour. There are four objectives in this study:

1. To examine the level of e-waste recycling behaviour among the Malaysian public in the Southern Region.
2. To investigate the influence of external factors (policy and regulation, facility support, and subjective norm) and internal factors (moral obligation, attitude, time availability, and waste sorting knowledge) on e-waste recycling behaviour among the Malaysian public in the Southern Region.
3. To identify the most significant predictors of e-waste recycling behaviour among the Malaysian public in the Southern Region.
4. To propose a strategy for improving recycling behaviour among the Malaysian public in the Southern Region.

4.2 Pilot Study Results

Reliability tests have been conducted on the collected data points. A widely used rule of thumb in social science research is to allocate approximately 10% of the total sample size (Hertzog, 2008). Isaac and Michael (1995), who recommend selecting 10% to 30% of the planned sample for initial testing, lend credence to this. The rule of thumb was applied to this test, which used 10% of the collected data. Gigerenzer et al. (1999) stated that Rules of thumb are simplifications or heuristics that provide good enough solutions to problems without requiring extensive computation. The total sample for this pilot is 50. A reliability test for every variable has been conducted. To ensure that the items used to measure a construct consistently reflect the same underlying construct, a reliability test is performed to evaluate the internal consistency and stability of the measurement instrument. Stated differently, dependability is the extent to which a set of questions or items yields consistent responses when administered repeatedly under

comparable conditions (Hair et al., 2010). According to George and Mallery (2003), while an alpha above 0.7 is considered “acceptable,” values above 0.6 may still be deemed adequate, particularly for exploratory research.

Table 4.1 shows that all Cronbach’s Alpha values for the independent variables exceed 0.6, indicating that all variables are reliable. With Cronbach’s Alpha of 0.800, attitude was one of the internal components that demonstrated strong reliability, indicating that the items consistently measured respondents' attitudes toward recycling e-waste. With a higher reliability coefficient of 0.888, the subjective norm demonstrated significant internal consistency in assessing the influence of perceived societal expectations on recycling behaviour. Time availability received an acceptable grade of 0.767, indicating the reliability of the items in determining respondents' perceptions of the time required to engage in recycling activities. With a value of 0.863, moral obligation also demonstrated excellent internal consistency, indicating that respondents consistently recognized their ethical duty to manage e-waste.

Policy and regulation yielded a reliability rating of 0.840 for external factors, indicating strong consistency among items assessing the impact of environmental legislation and enforcement. With a high dependability score of 0.915, facility support demonstrated exceptional consistency in the criteria used to evaluate the sufficiency and accessibility of recycling infrastructure. Similarly, respondents consistently demonstrated proper techniques for sorting and managing e-waste, as evidenced by a trash-sorting knowledge score of 0.912, indicating high internal consistency. Overall, the high Cronbach's Alpha values for each construct confirm the instrument's internal reliability and support the subsequent data analysis.

Table 4.1
Pilot Study Reliability Test Results

Variables		Cronbach's Alpha	Total Items for Each Variable
External Factors	Policy and regulation	0.840	4
	Facility support	0.915	4
	Subjective norm	0.888	4
Internal Factors	Waste sorting knowledge	0.912	4
	Moral obligation	0.863	4
	Attitude	0.800	4
	Time availability	0.767	3

4.2.1 Validity Assessment

Table 4.2 presents the Rotated Component Matrix, which identifies the underlying factor structure of the research constructs and assesses whether the items load smoothly onto their corresponding components, the goals of this analysis. According to Kaiser (1974), KMO values over 0.60 are considered acceptable for factor analysis. Table 4.2 shows that the KMO value is 0.922, which is regarded as satisfactory. The rotated matrix helps with "assessing whether items load on the correct theoretical constructs," which is essential to validity (Hair et al., 2019). According to Hair et al. (2019), a loading of 0.60 or greater is appropriate for exploratory research with sample sizes of 100-150. Additionally, they stress that things should have few cross-loadings and a significant burden on a single factor. Component 1 represents Subjective norm. All the items in Subjective Norm show consistency as their values are from (07.87-0.857). It has good internal consistency. Next, for Component 2, the dependent variable is E-waste Recycling behaviour. The item loading for the Dependent Variable also shows consistency with the item loading from (0.744-0.762). Component 3 represents Facility Support. For item loading is all above 0.6 (0.715-0.814), which shows a strong convergence. Component 4 represents Policy and Regulation. Strong support for the construct is confirmed by loadings ranging from 0.631 to 0.770. This indicates acceptable factors alignment. Component 5 represents Waste Sorting Knowledge. The items loading range from 0.709 to 0.799, indicating

strong support for the construction. Thus, it shows that Waste Sorting Knowledge effectively influences e-waste recycling behaviour. Component 6 represents Attitude; item loadings range from 0.678 to 0.789, indicating strong loadings and consistent measurement. Component 7 represents Moral Obligation. Item loading is from 0.678 to 0.710. All items are acceptable and above the cutoff, indicating that Moral Obligation influences e-waste recycling behaviour. Lastly, Component 8 represents Time Availability. All the items (0.701-0.756) are above the cut-off value, which shows a strong influence on e-waste recycling behaviour. In conclusion, the Rotated Component Matrix matches the conceptual model.

Table 4.2
Rotated Component Matrix

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.922
Bartlett's Test of Sphericity	Approx. Chi-Square	1790.008
	df	210
	Sig.	.000

Rotated Component Matrix

	Component							
	1	2	3	4	5	6	7	8
DV 1		0.744						
DV2		0.801						
DV 3		0.762						
PR 1				0.631				
PR 2				0.690				
PR 3				0.770				
PR 4								
FS 1			0.715					
FS 2			0.728					
FS 3			0.669					
FS 4			0.814					
SN 1	0.787							
SN 2	0.819							
SN 3	0.824							
SN 4	0.857							
WSK 1					0.709			
WSK 2					0.720			
WSK 3					0.678			
WSK 4					0.799			
MO 1							0.678	
MO 2							0.710	
MO 3							0.690	
MO 4							0.700	
ATT 1						0.747		
ATT 2						0.789		
ATT 3						0.690		
ATT 4						0.678		
TA 1								0.701
TA 2								0.756
TA 3								0.724

4.3 Full- Scale Findings

The full-scale study results are presented in this section, beginning with quantitative findings on the extent of e-waste recycling behaviour, the impact of independent variables, and the identification of the most critical components. The qualitative results, which provide a more in-depth understanding of the data, are presented below. The section concludes by synthesizing the two lines of investigation to provide a comprehensive understanding of how Malaysians in the Southern Region recycle e-waste.

4.3.1 Quantitative Study

For the survey, 500 responses have been collected. The survey comprises the respondent's demographic profile, dependent variable questions, and independent variable questions, covering Parts A through I.

4.3.2 Demographic Profile

A response rate of 80%, which is high for behavioural research, was achieved from distributing 500 questionnaires; 400 were returned and included in the analysis (Fincham, 2008). According to Table 4.3, most respondents are female (293; 73.3%), whereas the remainder are male (107; 26.8%). For age 18-20 years old are 50 (12.5%), 21-25 years old are 88 (22%), 26-30 years old are 88 respondents (22%), for age 31-35 years old are 36 respondents (9%), for 41-45 years old there are 45 respondents (11.25%) and lastly for age 46 years old and above are 116 respondents (29%). By income group, most respondents (245; 61.3%) were from the Low-Income group, followed by Middle Income (126; 31.5%) and High Income (29; 7.3%). Furthermore, at the state level, most respondents are from Johor (50%), Melaka (20%), and Negeri Sembilan (30%). Most respondents (108, 27%) held undergraduate degrees. This is followed by Foundation, Postgraduate, and Sijil Tinggi Pelajaran Malaysia (STPM), with 10 respondents each (2.5%). In terms of residence, many respondents (43.5%) were from metropolitan areas, followed by semi-urban areas (147, 36.8%) and the rural regions (79, 19.8%). Lastly, with respect to occupation, 39.25% of respondents are from the private sector, followed by students (28.25%), public servants (3%), and others (29.5%).

Table 4.3
Demographic profile (n=400)

No.	Profile		Frequency (n)	Percentage (%)
1	Gender	Female	293	73.3
		Male	107	26.8
2	Age	18-20	50	12.5
		21-25	88	22
		26-30	65	16.25
		31-35	36	9
		41-45	45	11.25
		46 years and above	116	29
3	Income Group	Low Income (< RM 5250) (B40)	245	61.3
		Middle Income (RM 5250 – RM 11,819) (M40)	126	31.5
		High Income (> RM 11,820) (T20)	29	7.3
4	State	Johor	200	50
		Melaka	80	20
		Negeri Sembilan	120	30
		SPM	5	1.3
		STPM	10	2.5
5	Level of Education	Foundation	10	2.5
		Undergraduate	108	27
		Post-graduate	10	2.5
6	Living Area	Rural	79	19.8
		Semi-urban	147	36.8
		Urban	174	43.5
		Public servant	12	3
7	Occupation	Private sector	157	39.25
		Self employed	130	32.5
		Student	113	28.25

Source: Author (2025)

4.3.3 Confirmatory Factor Analysis (CFA)

To ensure that the observed data accurately reflects the theoretical model, it is crucial to assess the measurement model's overall fit before proceeding to structural model analysis. The model fit indices indicate the extent to which the proposed model matches the observed data. Hu and Bentler's (1999) guidelines state that in confirmatory factor analysis (CFA), a Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) should exceed 0.95, while the Root Mean Square Error of Approximation (RMSEA) should be less than 0.06 to indicate excellent model-data fit. Although these criteria are widely accepted, some researchers argue that CFI/TLI ≥ 0.90 and RMSEA ≤ 0.08 may still indicate adequate fit in specific settings. The GFI measures the proportion of variance in the observed data explained by the model. Values greater than 0.90 are considered acceptable, and values above 0.95 indicate an excellent model fit (Hair et al., 2019; Kline, 2015). The CMIN (chi-square statistic) tests the difference between the observed and expected covariance matrices. However, it is susceptible to sample

size. Therefore, researchers often use the CMIN/DF ratio (Chi-square divided by degrees of freedom) as a more reliable indicator of model fit.

A CMIN/DF value between 1.0 and 3.0 is generally considered indicative of a good fit, while values up to 5.0 may still be acceptable depending on the model complexity and sample size (Byrne, 2010; Hair et al., 2010). The degrees of freedom (DF) are not fixed; they must be positive and are used to calculate the CMIN/DF ratio. According to Hair et al. (2019), a good model fit is indicated by a Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI) greater than 0.90, Root Mean Square Error of Approximation (RMSEA) below 0.08, and Standardized Root Mean Square Residual (SRMR) below 0.08. Additionally, the Chi-square/df (CMIN/DF) ratio should ideally be less than 3 to demonstrate acceptable model fit (Kline, 2016; Hu & Bentler, 1999). The goodness of fit indices is produced as follows: 1) CFI=0.939, 2) GFI=0.900, 3) NFI= 0.900, 4) TLI= 0.928, 5) RMSEA =0.066, and 6) CMIN/DF= 2.106. Figure 4.1 reveals the CFA model.

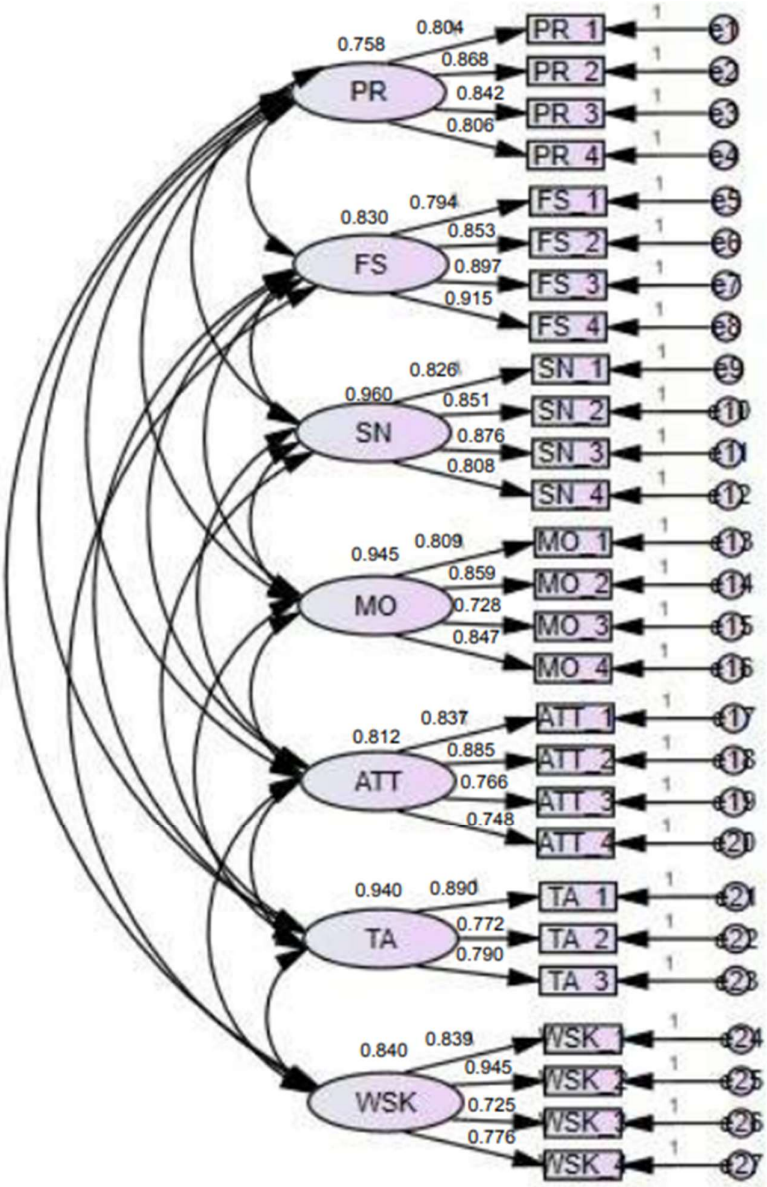


Figure 4.1 CFA Model (Source: Author's owk work)

4.3.4 Normality Test

Mean scores above 3.5 on a 5-point Likert scale are often regarded as indicating a high degree of agreement or positive behavioural intent, 3.0 is considered neutral, and scores below 2.5 are considered as disagreement (Boone & Boone, 2012; Nemoto & Beglar, 2014). In behavioural and social science studies, SD values typically range from 0 to 1.5, with 0.5 to 1.0 considered typical and appropriate (Boone & Boone, 2012;

Field, 2018; Hair et al., 2019). This implies a moderate degree of response variability, indicating that responses were not unduly uniform but relatively consistent (Gravetter & Wallnau, 2014).

According to these findings, respondents appeared to have a positive attitude toward recycling. Table 4.4 shows a positive trend across all variables, particularly external factors: Policy and Regulation (Mean=4.0288, SD=0.831), Waste Sorting Knowledge (Mean=4.163, SD=0.527), Facility Support (Mean=4.316, SD=0.539), and Subjective Norm (Mean=4.163, SD=0.527). For internal factors, Moral Obligation (Mean=4.000, SD=0.859), Attitude (Mean=3.847, SD=0.747), and Time Availability (Mean=4.255, SD=0.986). It has been concluded that all standard deviations in this study fall within the acceptable range and are reliable.

The normality of the data was assessed using skewness and kurtosis. Based on the guidelines by Hair et al. (2010), values within the range of ±2 are considered acceptable to indicate approximate normal distribution. Kurtosis scores in the range of -7 to +7 suggest that the data distribution is suitable for use in structural equation modeling, as it does not substantially deviate from normality. In this study, all variables recorded skewness values between -0.821 and 0.537, and kurtosis values between -0.476 and 0.975. These results suggest that the data are approximately normally distributed and thus appropriate for further parametric analyses, including Structural Equation Modeling (SEM) using AMOS.

Table 4.4
Normality Results

Variable	Mean	SD	Skewness	Kurtosis	Cronbach's Alpha
E-Waste Recycling Behaviour	3.805	0.795	-0.479	-0.476	0.600
External Factor					
Policy and Regulation	3.793	0.755	-0.286	0.068	0.898
Waste Sorting Knowledge	3.677	0.850	-0.262	-0.181	0.903
Facility Support	3.265	0.996	-0.289	-0.328	0.930
Subjective Norm	3.718	0.765	-0.401	0.975	0.906
Internal Factor					
Moral Obligation	4.165	0.711	-0.821	0.635	0.892
Attitude	3.677	0.850	-0.262	-0.181	0.896
Time Availability	2.592	0.849	1.011	0.903	0.699

4.3.5 Validity and Reliability Tests

The Fornell-Larcker criterion (1981) is commonly used to assess the degree of shared variance between latent variables in a model. According to Fornell and Larcker (1981), this method measures the difference between two similar constructs within a model. This indicates that the square root of the AVE on the diagonal should exceed the correlation between the off-diagonal variables. The results in Table 4.5 indicate sufficient discriminant validity, where the square root of the AVE (diagonal) is higher than the correlation (of diagonal) for all reflective constructs.

Table 4.5
Composite Reliability (CR), Average Variance (AVE) and Cronbach's Alpha Results

Variable	Items	Item Loadings	AVE	CR
E-waste Recycling Behaviour	DV 1	0.778		
	DV2	0.776	0.576	0.803
	DV 3	0.791		
Policy and Regulation	PR 1	0.804	0.690	0.899

	PR 2	0.868		
	PR 3	0.842		
	PR 4	0.806		
	FS 1	0.794		
Facility Support	FS 2	0.853	0.923	0.750
	FS 3	0.897		
	FS 4	0.915		
	SN 1	0.826		
Subjective Norm	SN 2	0.851	0.706	0.906
	SN 3	0.876		
	SN 4	0.808		
	WSK 1	0.839		
Waste Sorting Knowledge	WSK 2	0.945	0.894	0.681
	WSK 3	0.725		
	WSK 4	0.776		
Moral Obligation	MO 1	0.809	0.660	0.886
	MO 2	0.859		
	MO 3	0.728		
	MO 4	0.847		
Attitude	ATT 1	0.837		
	ATT 2	0.885	0.884	0.658
	ATT 3	0.766		
	ATT 4	0.748		
Time Availability	TA 1	0.890		
	TA 2	0.772	0.670	0.858
	TA 3	0.790		

Source: Authors' calculations

4.3.6 Discriminant Validity

The Fornell-Larcker criterion (1981) is commonly used to assess the degree of shared variance between latent variables in a model. According to Fornell and Larcker (1981), this method measures the difference between two similar constructs within a model. This indicates that the square root of the AVE on the diagonal should exceed the correlation between the off-diagonal variables. The results in Table 4.6 indicate sufficient discriminant validity, where the square root of the AVE (diagonal) is higher than the correlation (of diagonal) for all reflective constructs.

Table 4.6
Discriminant Validity for the Variables

No.	Variable	1	2	3	4	5	6	7	8
1	Policy and Regulation	0.758							
2	Facility Support	0.450	0.830						
3	Subjective Norm	0.529	0.376	0.960					
4	Waste Sorting Knowledge	0.370	0.429	0.409	0.840				
5	Moral Obligation	0.600	0.570	0.536	0.527	0.945			
6	Attitude	0.458	0.690	0.389	0.579	0.440	0.812		
7	Time Availability	0.511	0.511	0.511	0.430	0.527	0.591	0.940	
8	E-waste Recycling Behaviour	0.650	0.567	0.590	0.620	0.680	0.700	0.610	0.818

Source: Authors' calculations

4.3.7 Descriptive Statistic

The mean score classification proposed by Sekaran and Bougie (2016) and Pallant (2020) was used to interpret the descriptive statistics. High scores fell between 3.67 and 5.00, moderate scores fell between 2.34 and 3.66, and low scores fell between 1.00 and 2.33. This guideline helps situate respondents' perceptions of the measured constructs in context. Table 4.7 shows the findings on the e-waste recycling behaviour. Based on the result, we can find that the level of respondent behaviour to donate e-waste is at a medium level (mean: 3.090, SD: 1.181), while the level of respondent behaviour to resell e-waste is at a medium level (mean: 3.000, SD: 1.100) and for the third level of respondent behaviour to store e-waste at a high level (mean:3.720, SD:1.035). Besides, the overall mean for the dependent variable is also at a medium level (mean: 3.045, SD: 0.9926). This indicates that there is a positive influence on e-waste recycling behaviour.

Table 4.7
Descriptive Statistics for E-waste Recycling Behaviour

Items	Mean	SD	Min	Max	Interpretation
1.I sent my e-waste to a recycling centre in the last 12 month.	3.090	1.181	1	5	Medium

2.I separated my old electronic devices for recycling purposes before discarding them	3.000	1.100	1	5	Medium
3. I used the e-waste collection service provided by the local authority.	3.720	1.035	1	5	High
4.E-Waste Recycling Behaviour	3.0450	0.99264	1	5	Medium

4.3.8 Objective 2: To investigate the influence of attitudes, subjective norms, moral obligations, regulations, and facility support on e-waste recycling behaviour among the Malaysian public in Southern Region.

The second objective for this study is to investigate the influence of attitudes, subjective norms, moral obligations, regulations, and facility support on e-waste recycling behaviour among the Malaysian public in the Southern Region. Based on the findings in Table 4.8, the structural model revealed external factors, specifically policy and regulation ($\beta = 0.586$, $p < 0.001$), facility support ($\beta = 0.667$, $p < 0.001$), and subjective norm ($\beta = 0.467$, $p < 0.001$), had a significant positive impact on e-waste recycling behaviour. These results align with prior studies, which emphasize the importance of environmental policies, infrastructure, and public knowledge in enhancing recycling practices (Borthakur & Govind, 2017; Zhang et al., 2011). The significant influence of these factors supports hypotheses H1, H2, and H3, reinforcing the idea that structural and regulatory measures are key drivers of recycling behaviour in the southern region of Malaysia.

In contrast, internal factors, including waste sorting knowledge ($\beta = 0.522$, $p > 0.001$), moral obligation ($\beta = 0.428$, $p > 0.001$), attitude ($\beta = 0.645$, $p > 0.001$), and time availability ($\beta = 0.316$, $p > 0.001$), did not demonstrate statistically significant relationships with e-waste recycling behaviour. While these constructs are commonly associated with pro-environmental actions (Wan et al., 2014; Khan et al., 2019), their lack of significance in this context suggests that individual motivations alone may not be sufficient to influence recycling behaviour. Thus, it shows that the internal factors,

which are attitude, subjective norm, time availability, and moral obligation, are rejected as there is no significant relationship with e-waste recycling behaviour. For the external factor, facility support has the highest β (0.667), whereas for the internal factor, attitude has the highest β (0.645).

This implies that relying solely on internal psychological drivers may be less effective than implementing top-down interventions, such as robust legislation, policy enforcement, and public infrastructure development. Nevertheless, previous literature highlights that internal factors like knowledge, social norms, and moral responsibility may still play mediating or moderating roles within broader behavioural frameworks (Ajzen, 1991; Nguyen et al., 2018), warranting further exploration in future studies. This implies that relying on internal factors such as attitude, subjective norm, time availability, and moral obligation alone may be less effective than top-down interventions through legislation. However, prior research suggests that knowledge, social influences, and ethical standards frequently mediate or moderate environmental behaviour (Ajzen, 1991; Nguyen et al., 2018), warranting further investigation. Lastly, for external factors, facility support (β = 0.667) is considered strong, whereas for internal factors, attitude (β = 0.645) is considered strong.

Table 4.8
Assessment of the Structural Model

Path			β	S.E.	C.R.	*p- value*
Standardized						
Direct Effects						
External Factor						
Policy and Regulation	→	E-waste Recycling Behaviour	0.586	0.080	7.33	***
Facility Support	→	E-waste Recycling Behaviour	0.667	0.085	7.85	***
Subjective Norm	→	E-waste Recycling Behaviour	0.467	0.075	6.23	***
Internal Factor						
Waste Sorting Knowledge	→	E-waste Recycling Behaviour	0.522	0.078	6.69	***
Moral Obligation	→	E-waste Recycling Behaviour	0.428	0.070	6.11	***
Attitude	→	E-waste Recycling Behaviour	0.645	0.082	7.87	***
Time Availability	→	E-waste Recycling Behaviour	0.316	0.065	4.86	***

Note: ***Paths are significant at the 1% level ($p < 0.01$).

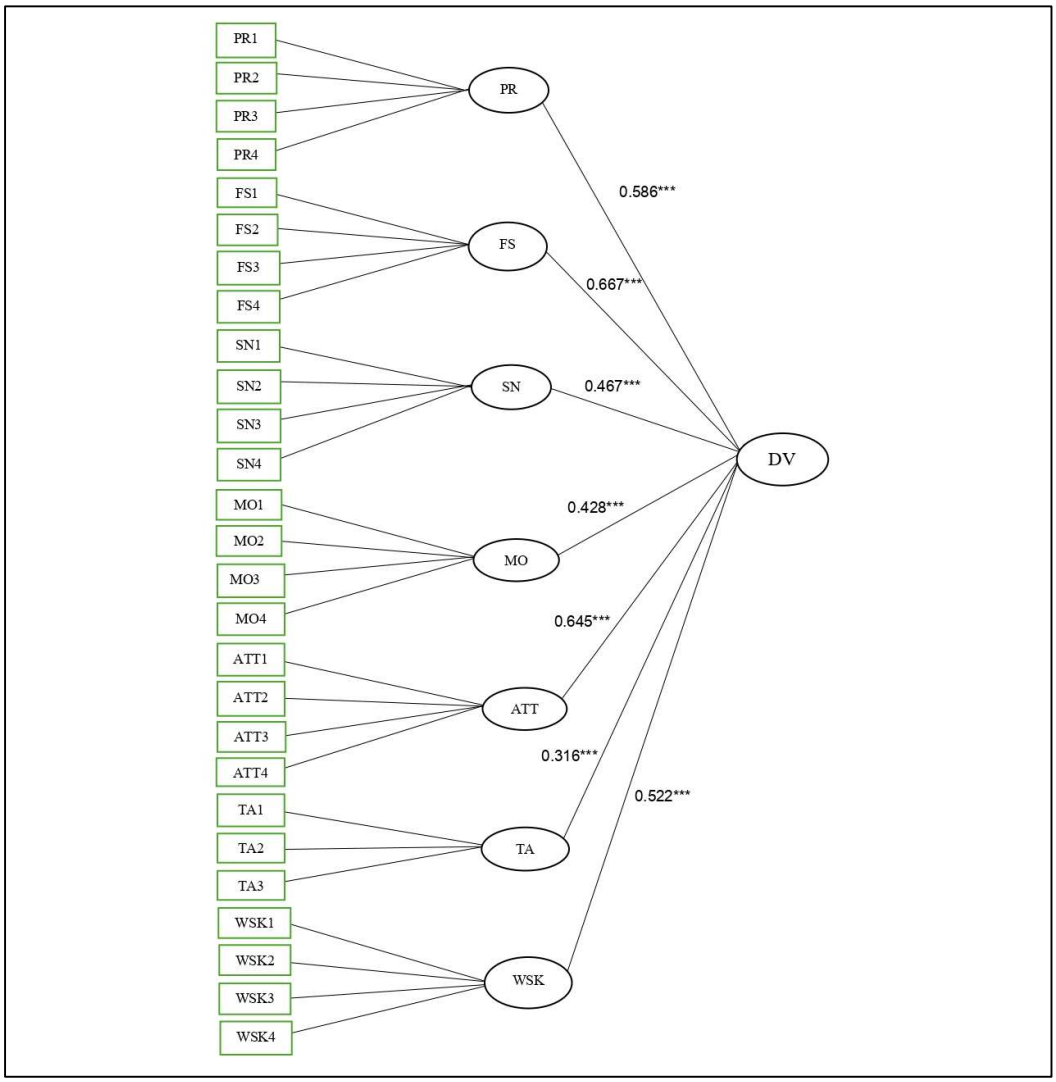


Figure 4.2 Final Model of the Study Source: Author (2025)

4.3.9 Validation through Interview Data

4.3.9.1 Assessment of E-Waste Recycling Behaviour Level (Research Objective 1)

The eight informants' opinions on e-waste are discussed in this section. This is consistent with findings on the level of e-waste recycling behaviour, which show that the majority of Malaysians store e-waste rather than donate or resell it and are not actively recycling it. This is substantially supported by qualitative interviews, which also explain why these behaviours take place. Verbatim quotes are as follows:

> *"I am searching for the facilities to recycle my e-waste. I have searched for the facilities them on several occasions but ultimately decided to collect and store them at home. As we know, improper e-waste recycling can bring danger to the environment." (A4)*

> *"For me, I will store my electronic waste at home. I find it quite difficult to dispose of the e-waste. I even searched for e-waste facilities near my house but was unable to find any. Instead of throwing it along with other waste, I store it at home" (A9)*

These quotations clearly indicate that people store e-waste at home because they are unsure where to send it, which explains why quantitative data show the highest storage rates. Thus, it is consistent with the quantitative result indicating a high level of e-waste storage (M = 3.720).

Next, the quantitative survey indicates that donating e-waste is at a moderate level (M = 3.090). This statement is supported by qualitative surveys conducted among the informants. The verbatim quotes are as follows:

> *"There are facilities for e-waste recycling, just that the place is quite far to go. For example, if the amount of e-waste I intend to recycle is small, it is not worthwhile. I need to collect more e-waste so that the travel effort to find the e-waste facilities is worth the travel" (A3)*

> *"Some schools invited us to come and make an awareness program. However, for the public, knowledge and awareness must be acquired independently. It means that they need to make their own effort to gain the knowledge and awareness on e-waste." (A8)*

This aligns with the survey's medium score, demonstrating that despite being aware, the likelihood of donating e-waste is reduced by the absence of convenient facilities. People often store their e-waste at home rather than donate it due to practical difficulties. Respondents demonstrate a respectable degree of awareness of the importance of donating or appropriately managing e-waste, but their behaviour does not fully reflect this understanding. This is mainly because the public cannot readily access current e-waste facilities. Many people are unaware of the location of the nearest collection center, and some must travel considerable distances to reach an appropriate disposal site. Consequently, the difficulty deters them even when they wish to contribute e-waste. As a result, their actual behaviour remains moderate, consistent with the survey results.

Thirdly, the survey results indicate that reselling e-waste is at a medium level (M = 3.00). The verbatim quotes are as follows:

> *"Maybe for some students, they do not have the value of the e-waste as they lack knowledge of it. For example, inside e-waste, there is gold, which is valuable. It is either that they lack knowledge or just that they are ignorant of it" (A3)*

Other informants also shared that:

> *The Malaysian community has less awareness of waste segregation. They are not taught how to recycle e-waste. They do not have the idea that they can resell the e-waste as no one has ever done that" (A2)*

The discussion above demonstrates that consumers are unaware of the economic and environmental benefits of recycling e-waste. They are less inclined to act if they are unaware that e-waste contains valuable parts or can be resold. As explained by informant A2, this indicates that the public is neither exposed to nor aware of appropriate e-waste handling practices. People lack confidence in handling or reselling e-waste when they do not understand the proper procedures.

The following discussion is on the overall medium-level behaviour. The overall mean (M = 3.045) shows a medium level of e-waste recycling behaviour. Verbatim is as follows:

> *"There are many factors that influence the community attitude. One of them is a lack of efficient facilities. When the system is not efficient, people find it difficult to recycle their e-waste. The easiest solution is by throwing*

the e-waste along with other waste" (A2)

"I think the public should be exposed to more awareness programs on e-waste. I do not know where to dispose of e-waste. No one has even taught me how to recycle and where to recycle the e-waste." (A5)

The results of the interviews corroborate this by demonstrating that, despite people's general willingness to recycle, system-related obstacles, including poor management, a lack of suitable facilities, and inadequate information, restrict their actions. Informant 5 stated that she "does not know where to dispose of e-waste," whereas Informant 2 clarified that "one of the factors is the lack of an effective management system." Recycling frequently rests on individual willingness, according to Informant 3, who stated that "the real challenge is ourselves, whether we want to do it or not." Taken as a whole, these findings indicate that although the public is prepared, the current system does not adequately encourage regular recycling behaviour, resulting in a moderate level of e-waste recycling.

Lastly, it shows a positive influence on e-waste recycling behaviour. The interview indicates a strong willingness, particularly among youth, to use the facilities if they are improved. The verbatim is as follows:

"I think the attitude and infrastructure are the most influential factors. For example, if there are sufficient facilities to recycle e-waste, people will send it for recycling. The thing is, in Malaysia, we lack facilities and infrastructure for e-waste." (A4)

"In my opinion, if people are given enough awareness, young people will be more concerned and feel responsible for recycling the e-waste. Currently, the lack of knowledge and awareness has contributed to this issue. Government and public sector should work together on this issue" (A5)

Thus, the interview findings indicate that people intend to recycle e-waste; however, internal and external factors have become barriers to their action.

4.3.9.2 External Factors Influencing E-Waste Recycling Behaviour (Research Objectives 2)

a) Public and Private Responsibilities on E-waste Recycling Behaviour

E-waste recycling is not the exclusive responsibility of any group. However, it is the responsibility of all people to recycle electronic waste. Some respondents also stated that the government and the private sector should collaborate to address the e-waste recycling problem, which has become a national issue year by year. Extended Producer Responsibility (EPR) frameworks are the approach that can be used. This method holds producers accountable for the end-of-life management of their goods, urging them to offer take-back programs, repair services, and incentives for proper disposal. Retailers, on the other hand, serve as convenient points of contact for customers and can help bridge the gap between them and recycling services. Informants' remarks are as follows:

> *"Right now, I do not see much involvement from the private side. It is always the government trying to educate people, but the brands and shops should also play a role. They have the resources. For example, Samsung can collect e-waste produced by users and recycle it. Not only can it reduce e-waste produced, but it can also produce money from the e-waste produced." (A9)*

> *"If the government and companies can do campaigns together, more people will notice. Sometimes, when only the government talks, people ignore it. But if it comes from both sides, it feels more serious. Some people also refuse to recycle e-waste because they do not know who will collect the e-waste, and lastly, they take an easy step, which is throw it along with other waste" (A7)*

Licensed recyclers play an essential role in the official management of e-waste by ensuring that discarded electronic devices are disassembled, cleaned, and safely and environmentally responsibly recycled. However, many recyclers in Malaysia, particularly in the southern region, face operational, financial, and technical challenges that limit their capacity to manage the increasing volume of e-waste effectively. Strengthening their competence is critical to ensuring the long-term viability and scalability of the national e-waste recycling framework. Most licensed recyclers still use manual or outdated processing methods that are inefficient, time-consuming, and difficult to use. The government should provide financial incentives to licensed recyclers to purchase a modern machine that saves time and is easy to use. For example,

they can buy automated sorting, shredding, and metal-recovery systems to increase efficiency and reduce hazards to workers and the environment.

Additionally, a training program on safe handling and dismantling is essential for personnel. This is because human skill and knowledge remain very important, even in this era of technology. The government agencies like DOE and the National Institute for Occupational Safety and Health (NIOSH) should give training to those people by providing a national certification program for e-waste workers to ensure competency. Another reason it is challenging to achieve the e-waste recycling objectives is the bureaucratic process of obtaining industrial-sector licenses. The licensing process should be streamlined to facilitate permit application and renewal and to ensure compliance with fundamental technical and environmental criteria. By increasing the number of certified recyclers, Malaysia can create healthy competition, expand regional access to recycling services, and reduce the dependence on unregulated practices. Verbatim area as below:

> *"Building the capacity of licensed e-waste recyclers is essential for the long-term sustainability of Malaysia's formal recycling system. Support in the form of equipment grants, training, and simplified licensing processes will empower recyclers to operate safely, efficiently, and in compliance with environmental standards. These efforts are crucial to preventing illegal disposal and ensuring that e-waste is managed in a responsible, scalable manner."(A6)*

> *"We need more proper recyclers, not the roadside ones who just take old TVs and burn parts to get the copper. The authorities should make it easier for genuine recyclers to get certified and grow their operations."(A1)*

Licensed recyclers play a critical role in ensuring that e-waste is handled safely, legally, and environmentally responsibly. Unlike informal recyclers, certified facilities must adhere to standard handling practices, use appropriate equipment, and comply with environmental regulations. However, the study found that the capacity of licensed recyclers remains limited due to insufficient resources, outdated technology, and a cumbersome licensing process. Respondents emphasized the need for additional government support, including financial aid, training programs, and simplified

licensing requirements, to enable recyclers to operate more efficiently and safely. By building the capacity of licensed recyclers, Malaysia can strengthen its formal e-waste management system, reduce reliance on informal and hazardous practices, and move closer to achieving a sustainable circular economy.

In conclusion, building capacity among recyclers will help the government manage the e-waste recycling issue in Malaysia. However, the application process should be accessible to recreational players. This will attract more recycling players to apply for a license.

b) E-waste Facility Influence on E-waste Recycling Behaviour

A well-developed e-waste infrastructure typically comprises designated collection centers, transportation systems, permitted recycling or dismantling facilities, and monitoring systems to ensure that e-waste is processed safely and in an environmentally responsible manner. This infrastructure also requires supportive legislation, public-private collaboration, and public awareness. In countries with robust e-waste systems, clear regulations and procedures enable producers, merchants, local governments, and consumers to participate in an organized recycling chain. Six of the nine respondents agreed that a good infrastructure influenced people's behaviour on recycling e-waste. Some people refuse to recycle e-waste because they find it difficult to locate facilities and infrastructure for its disposal. The verbatim quotes are as follows:

> *"I have never seen any specific bins or centres for e-waste around my area. We have recycling for bottles and paper, but for electronics, there is nothing. It appears not to be a priority. I think that it is one of the reasons that people in Malaysia are not too concerned about e-waste recycling. Sometimes, the facilities are there, but people do not practice it." (A8)*

> *"There should be more visible, permanent locations where people can drop their e-waste. The government needs to work with the local councils to make it easier for the public. The location should be easily accessible and near the housing area. In my housing area, the e-waste facilities are 5km away, which makes it harder to recycle the e-waste." (A6)*

> *"I do not know any nearby e-waste facilities. Moreover, I do not know how to recycle e-waste because none of my close friends or family members*

recycle it. I find it hard to keep consistent recycling it when there are inadequate facilities and when people around you are not practicing it" (A1)

A successful e-waste recycling system relies heavily on adequate infrastructure and easily accessible collection stations. Infrastructure refers to the physical facilities, logistics, and support systems that allow electronic trash to be collected, stored, transported, and processed. Even the best-intentioned awareness programs and legislation may fail to create substantial results in the absence of adequate infrastructure. A significant hurdle found in this study is the scarcity and visibility of e-waste collection locations, particularly in residential areas. Many informants reported not knowing where to take their old electronic devices, which leads to inappropriate disposal, such as dumping e-waste into conventional garbage cans or storing it indefinitely at home. Accessible collection points should be strategically located, such as near supermarkets, schools, and residential areas. Moreover, it also needs to be promoted on social media platforms such as Instagram.

Moreover, to make it convenient for the people, it must be convenient for the people. The government should establish permanent drop-off centres for the recycling of electronic waste. For example, in Johor, drop-off points for e-waste recycling at Majlis Bandaraya Iskandar Puteri (MBIP) operate once a month. However, it is inconvenient for the public, as there is a specific time for recycling e-waste, and the process is not permanent. The verbatim quotes from the interview that have been conducted can be referred to:

"One of the biggest problems is that there are not enough collection centres. We hear about only one or two places in the entire district, and even then, we do not know the exact location or whether they are still operating. I think the government or local authorities should provide more permanent and visible drop-off points, especially in residential areas or public places like shopping malls, schools, or mosques."(A2)

"Sometimes I have old electronics like a broken TV or an unused printer, but I do not know where to send them. If there were a fixed collection centre nearby, I would definitely send it there. But when it's far or unclear, people discard it with normal waste. I think every neighbourhood should have at least one dedicated e-waste bin or a mobile collection truck that comes on a schedule."(A3)

Overall, storage facilities, vehicles, and appropriate handling equipment are part of the infrastructure that ensures safe and efficient operations. Without these, there is a risk of improper handling, which could lead to hazardous exposure and unlawful dumping. The government should consider these essential recommendations to achieve the target.

c) Enforcement Policy and Regulation on E-waste

Effective e-waste management requires comprehensive policies that clearly define the roles of all stakeholders, including government agencies, producers, retailers, and the public. Strong policy frameworks provide the legal foundation for regulating the collection, transportation, recycling, and disposal of electronic waste, while promoting environmental protection and resource recovery. Although legislation, such as the Environmental Quality (Scheduled Wastes) Regulations 2005, exists in Malaysia, enforcement and public awareness of e-waste remain low, particularly among consumers. Based on the interview conducted, 4 of 9 respondents agreed that the e-waste policy plays a significant role in e-waste recycling. From their perspective, only people can control their behaviour through policy and regulation. The verbatim is as follows:

> *"Honestly, I do not know if there is even a proper law for e-waste. If there is, it is not reaching the public. We are not told what is allowed or what is not, so people throw their old stuff like normal rubbish. I think if people are aware of the law, they would not do that. The problem now is that people do not know the existence of the law and its functionality." (A2)*

> *"There is policy and regulation on this matter. However, some people are unaware and do not receive information about it. Perhaps using social media to raise awareness of this issue is insufficient. The government may enforce the existing law using the mass media, as everyone is using social media nowadays. (A1)*

> "The enforcement of e-waste laws is not merely a regulatory function but a foundational element in ensuring environmental sustainability, public health protection, and economic accountability. Weak enforcement undermines policy effectiveness, allowing irresponsible disposal to persist unchecked."

(A7)

> "There needs to be a clear policy. Many people are unaware that e-waste is hazardous to human health. Some people do not even know the agencies that are responsible for e-waste recycling." (A8)

In Malaysia, the Environmental Quality Act 1974 is used, which falls under the Schedule Waste Regulations 20025. The agency that is responsible for this law is the Department of Environment (DOE). In 2023, DOE announced progress toward gazetting a specific regulation for household e-waste, which is expected to be implemented soon. However, all the rules and laws that have been made will not be achieved if implementation is not under the control of the responsible authorities. In addition to DOE, the responsible agencies, such as the Solid Waste Management and Public Cleansing Corporation (SWCorp) and the Ministry of Natural Resources and Environmental Sustainability (MESTECC), need to work in concert on this matter. The purpose of those agencies is to ensure compliance and accountability among practitioners of e-waste recycling. Furthermore, when authorities oversee this matter, it will foster public trust and participation. The participation of private agencies such as Alam Flora will provide support and encouragement to people in practicing waste recycling. When clear agencies and regulations for e-waste recycling are in place, people will be more responsible for their e-waste. Empowering local governments is an essential technique for improving the enforcement of e-waste recycling legislation. Decentralizing enforcement obligations enables municipalities and local governments to play a more active role in managing and monitoring e-waste activities within their jurisdictions. This decentralized approach assures better responsiveness to community needs, faster enforcement, and more efficient recycling operations. To implement this, local councils should be provided with training and capacity-building programs to ensure officers and staff understand the regulatory framework, the environmental risks of improper disposal, and effective e-waste management practices. Adequate financing is also required to enable municipalities to establish infrastructure, such as collection stations, surveillance systems, and logistics for transporting e-waste to approved facilities.

Furthermore, local enforcement authorities should be authorized to impose fines or penalties on individuals and enterprises that violate e-waste disposal legislation. This would deter unlawful dumping and increase grassroots compliance. Furthermore, local

governments should be encouraged to implement frequent community-based e-waste collection programs under adequate legal supervision. These programs can enhance public participation while ensuring that collected e-waste is appropriately processed and transported in accordance with national regulations. Empowering local governments not only reduces the enforcement burden on federal agencies such as the Department of Environment (DOE) but also strengthens community trust, improves compliance, and encourages sustainable recycling practices at the local level.

4.3.9.3 Internal Factors Influecing E-Waste Recycling Behaviour

This section presents the quantitative analysis of internal factors influencing the recycling behaviour of e-waste among Malaysians in the Southern Region.

a) Attitude Influence on E-Waste Recycling Behaviour

Individual perceptions and values about the environment often shape their willingness to adopt sustainable practices, such as safe disposal of electronic waste. Every action people take reflects their valuation of the environment. Of the eight respondents, five stated that they know their attitudes affect the statistics on e-waste generated in Malaysia. People lack a sense of responsibility for e-waste recycling and fail to recognize that their irresponsible environmental practices harm the environment. A person who prioritizes sustainability will be more aggressive in seeking proper disposal outlets for gadgets, even if it is less convenient. On the other hand, those unconcerned about the environment may overlook the importance of recycling or dispose of e-waste improperly out of habit or convenience. Environmental behaviour theories, such as the Theory of Planned Behaviour, reinforce this association, stating that an individual's attitude toward a behaviour strongly predicts whether they will engage in that behaviour. The verbatim is as follows:

> *"Honestly, I do feel guilty when I throw away my old electronics. I know it is harmful to the environment, especially if the chemicals leak. But sometimes I do not know what else to do with them. I do think that it is wrong to act that way, but the e-waste facilities are also hard to find." (A2)*

"Everyone has a role. It is not just the government or the companies. If I purchase the product, I should also be responsible for its disposal. That is how I see it. However, some people do not have this attitude. They use the easiest and fastest solution to handle e-waste, which is throw it along with other waste." (A6)

"Honestly, I have e-waste in my household. However, I am too busy to find the nearest e-waste facility. Additionally, access to e-waste facilities is difficult. Not only that, most of my friends and family members either kept their e-waste or threw it with other domestic waste. I think the attitude of people towards e-waste recycling sometimes gets influenced by its environment" (A5)

b) Awareness Influence on E-Waste Recycling Behaviour

Based on interviews, 5 of 9 informants agreed that knowledge of e-waste is the understanding and information a person has gained about a given subject through education, experience, or exposure. Awareness is the extent to which people understand the existence, importance, and potential repercussions of e-waste, including its environmental and health effects. Thus, knowledge and awareness play an important role in influencing people's e-waste recycling behaviour. From this study, awareness and knowledge of e-waste are very crucial. Unexpectedly, seven out of eight respondents stated that the central issue in e-waste recycling is a lack of awareness of what is included under e-waste. The verbatim is as follows:

"Honestly, I do not really know what counts as e-waste. I dispose of old cables and phones with the rest of the waste because I never learned the proper way to handle them. No one has ever explained it clearly. Not in school, not in the media. I suggest the government propose additional e-waste programs, such as talks on e-waste. People's lack of awareness of e-waste has led to improper e-waste management. Local government can also collaborate with the private sector to conduct a more interactive program on e-waste that can attract people to take part in it" (A5)

"I think the problem is that not enough people are educated about e-waste. They might hear the term but do not understand what it really means or why it's dangerous. If you ask the public, most will not know that batteries and broken gadgets require different recycling processes. Lack of awareness,

either in school or society, has become a factor that leads to these issues"(A3)

"Some of my family and friends are not aware of what e-waste is. This underscores the critical importance of awareness of e-waste. Thus, they dispose of e-waste, such as broken ovens, phones, and other household appliances, in the domestic waste bin. I think if society gets more awareness on this matter, they will practice it efficiently" (A4)

Public awareness and education efforts play an essential part in shaping ethical e-waste recycling behaviour. One of the most significant impediments to safe electronic waste disposal is a lack of information. Many people are unaware of the environmental and health risks associated with improper disposal, or do not know where or how to recycle old electronics. To address this, strategic awareness programs should be established for key segments of the population, including households, students, working people, and seniors. These efforts should educate the public on the necessity of e-waste recycling, its benefits, the risks of informal disposal methods (such as burning or dumping), and the proper disposal channels. Campaigns should not be one-time events. They should be ongoing and long-term initiatives. E-waste issues can be integrated into national education curricula, community activities, and local council outreach programs to ensure long-term awareness and engagement. Collaboration with influencers, NGOs, and the commercial sector can also help to spread awareness. Furthermore, awareness campaigns should be backed by easy access to information, such as clear signage at recycling facilities, smartphone apps to identify e-waste bins, or hotlines for public inquiries.

"Raising awareness through continuous, inclusive, and targeted campaigns is essential to encourage responsible e-waste recycling behaviour. Education not only informs the public but also empowers individuals to make environmentally conscious decisions, thereby supporting the effectiveness of policy and enforcement efforts."(A1)

"Awareness should not just be during campaigns or one-off events. It should be continuous and visible. For example, the 3R campaign has strong awareness. The responsible agencies go from school to school to give awareness to the students on this issue."(A4)

Campaigns are a tool for influencing mindset and behaviour, especially in communities where discarding broken electronics is considered normal. Regular exposure through media, schools, and community programs can help people understand the importance of recycling. Additionally, it helps foster environmental responsibility and establish a new habit of properly separating and disposing of e-waste. Without awareness, people are unlikely to participate in recycling initiatives, even when facilities are available. Effective campaigns can be tailored to target different segments of the population, such as urban, rural, young, and elderly, to ensure no group is left behind in understanding and accessing e-waste solutions.

In conclusion, awareness and campaigns are vital to e-waste recycling, as they directly influence people's knowledge, attitudes, and behaviours. This was clearly reflected in the interview findings, where many respondents recommended increasing campaigns due to widespread lack of understanding and low participation in proper disposal practices.

4.3.10 Syntheses of Findings

Table 4.9
Synthesis Findings between Quantitative and Qualitative Findings

Findings of Survey Study/Quantitative Data	Findings from the Interview Study/Qualitative Data
The level of e-waste recycling behaviour is at a medium level.	6 out of nine informants believe that the e-waste recycling behaviour is at a medium level among Malaysians in Southern regions
All external factors show a significant influence on e-waste recycling behaviour. The most external factor with the highest beta is facility support.	2) During the interview, the informants mentioned external factors like policy and regulation, and facilities towards e-waste recycling behaviour.
All internal factors show significant influence on e-waste recycling behaviour. The internal factor with the highest beta is attitude.	3) In the interview, the informants mentioned that the internal factors that influence e-waste recycling behaviour are the waste sorting knowledge and attitude.

Source: Authors (2025)

4.4 Summary of Chapter

This study concludes that among the identified factors, policy and regulation, waste sorting knowledge, and facility support emerged as significant predictors of e-waste recycling behaviour in the Southern Region of Malaysia, underscoring the crucial role of structural and institutional support over individual disposition Besides, for the qualitative analysis it shows that most of the respondent agreed that external factors like waste sorting knowledge, facilities support and policy and regulation influence the people's behaviour towards e-waste recycling behaviour in Southern Region Malaysia. The interview also confirmed that awareness is a critical factor in addressing e-waste issues.

Based on the first objective, most responses indicate a moderate level of e-waste recycling among the public in Southern Region Malaysia. Additionally, SEM analysis shows that facility support, moral obligation, attitude, and subjective norms significantly improve e-waste recycling behaviour. Lastly, the fourth objective proved that according to the findings, a comprehensive strategy to improve e-waste recycling should concentrate on three main areas which are enhancing environmental ethics and moral education through community engagement, media campaigns, and school programs to increase moral obligation, improving facility support by integrating e-waste disposal in municipal waste systems, expanding e-waste drop-off points, and providing mobile collection services; and also improving public policy communication, where current regulations are actively promoted, made simpler, and made more accessible to the general public. To align infrastructure development with awareness efforts, cooperation among the government, local governments, and private recyclers is crucial. In accordance with the Theory of Planned Behaviour (Ajzen, 1991), the strategy should also leverage social influence by enlisting the support of influential individuals and community leaders to establish constructive recycling norms.

Additionally, quantitative and qualitative studies have shown that internal factors (attitude) and external factors (knowledge and awareness) influence the recycling behaviour of the community living in the Southern Region of Malaysia. Based on the collected data, the government can play its role by providing extensive knowledge and awareness about e-waste.

CHAPTER 5
CONCLUSION

5.1 Introduction

This chapter connects the research aims and questions presented in previous chapters to the findings from the quantitative and qualitative phases of this study. The study's specific objectives are to assess the extent of e-waste recycling behaviour among Malaysians in the Southern Region and to examine how attitudes, moral obligations, subjective norms, laws, and facility support influence that behaviour. In addition to outlining the study's shortcomings and offering suggestions for further research, the chapter discusses the findings' theoretical and practical implications. This mixed-method study's integration of both data types provides a thorough insight into the recycling practices of e-waste in Malaysia's southern region.

5.2 Summary of Findings

The findings indicate that the overall level of e-waste recycling behaviour among the Malaysian public in the Southern Region is moderate. Although there is awareness of the importance of recycling e-waste, many individuals still do not practice it consistently. This observation supports the findings of Pariatamby and Bhatti (2020), who highlighted a similar gap between awareness and actual behavioural engagement. This behaviour gap suggests that awareness alone is insufficient to drive consistent recycling, as other external and internal factors can impede such efforts.

5.2.1 The level of e-waste recycling behaviour among the Malaysian public in the Southern Region.

The previous findings in Chapter 4 indicate a moderate level of e-waste recycling behaviour among the Malaysian public in Southern Region. People are aware of e-waste recycling however; they lack knowledge of the methods for recycling e-waste.

This interpretation is supported by recent research from Malaysia (Goh & Sukri, 2025). Even when awareness is there, research shows that knowledge gaps are a significant obstacle to successful e-waste recycling. According to a Malaysian study Nordin et al., 2025), for instance, many household members store outdated electronics at home or dispose of them with other debris instead of properly recycling them due to a lack of information about appropriate disposal techniques. This is because most Malaysians are unaware of the proper protocols and resources for recycling electronic waste.

Recycling habits are significantly influenced by community understanding and attitudes, according to another recent study conducted in Malaysia (Zia, 2024). Despite awareness, there remains a lack of practical knowledge and disposal skills, which leads to moderate rather than high recycling behaviour. Karya Ilham Research in Northwest Malaysia also shows that, despite high awareness levels, home recycling behaviour is constrained by inadequate practical expertise (Goh & Sukri, 2025). Findings from interviews show that informant A1, A7, A8, and A9 agreed that community understanding and attitudes does have influence on e-waste recycling behaviour.

The results align with the Theory of Planned Behaviour, which explains how attitudes, subjective standards, and perceived behavioural control affect behaviour. Many participants in this study showed favorable attitudes about recycling, but they also expressed challenges with properly disposing of e-waste because of inconvenience and inadequate infrastructure. Similar results were observed by Hassan et al. (2024), who discovered that public participation in environmental programs is greatly decreased when recycling facilities are not easily accessible. However, the current study discovered that awareness alone was insufficient to guarantee consistent action, in contrast to research done in more developed nations where awareness strongly predicts recycling behaviour. One possible explanation for this difference is the uneven development of formal e-waste management systems in Malaysia, particularly in semi-urban and rural areas where recycling facilities and collection campaigns remain limited. Consequently, informal disposal practices continue to be widely practiced despite growing environmental awareness. The study therefore contributes to environmental behaviour literature by demonstrating that recycling participation is shaped by both psychological motivation and structural conditions.

In conclusion, although Malaysians in the Southern Region and nationwide recognize the importance of recycling e-waste, they lack the specific knowledge and

practical understanding required to recycle it efficiently. The fact that recycling behaviour remains moderate rather than high can be explained by the disconnect between awareness and action.

5.2.2 The influence of external factors (policy and regulation, facility support, and subjective norm) and internal factors (moral obligation, attitude, time availability, and waste sorting knowledge) on e-waste recycling behaviour among the Malaysian public in the Southern Region.

The study also found that some dependent variables, like policy and regulation, facility support, and subjective norm, have a substantial impact on e-waste recycling behaviour. Among these, attitude, moral obligation, perceived social support, and subjective norm were identified as significant determinants. Individuals with a positive attitude toward environmental conservation were more likely to recycle. This finding is consistent with the Theory of Planned Behaviour (Ajzen, 1991), which holds that a person's attitude directly influences their intention and conduct. Similarly, moral obligation was a significant element, with many respondents claiming that recycling e-waste is a community responsibility. This outcome is consistent with the thoughts of Nur Shafeera Mohamad (2022), who noted that a strong sense of moral duty can be more helpful than attitude alone in promoting sustainable conduct.

Policy and regulation have the most significant impact on recycling behaviour, according to the statistical analysis ($\beta = 0.586$, $p < 0.001$). This result supports the findings of Borthakur and Govind (2017), who contend that vigorous policy enforcement increases public compliance with environmental regulations. This is supported by qualitative responses, in which participants stated that behavioural triggers are clear and that regulations are enforced. Nonetheless, a communication and implementation gap is indicated by the general lack of public awareness regarding current policies.

Consistent with the Theory of Planned Behaviour (Ajzen, 1991), which posits that knowledgeable individuals are more likely to act responsibly, knowledge was a significant predictor ($\beta = 0.193$, $p < 0.001$). Consistent with Nguyen et al.'s (2018) findings that knowledge mediates environmental intentions and actions, interviewees acknowledged that they were unclear about what qualifies as e-waste. Therefore, legal frameworks and education initiatives must be given equal priority.

Another critical factor was facility support ($\beta = 0.067$, $p < 0.001$), consistent with Zhang et al.'s (2011) findings that infrastructure access is crucial for encouraging recycling behaviour. Respondents emphasized the lack of permanent or visible e-waste collection locations, suggesting that, despite awareness, physical accessibility remains a significant obstacle. Facility support was regarded as one of the most important determinants. Many respondents to the survey and interviews expressed concern about the absence of accessible, convenient, and conspicuous e-waste recycling locations. For example, interviewees A5, A6, and A8 stressed that, even when people want to recycle, insufficient infrastructure discourages them from doing so. This study confirms the arguments of Borthakur and Govind (2022) and Zhang et al. (2021), who similarly identified infrastructure inadequacies as major hurdles to effective e-waste recycling in underdeveloped countries.

This study found no significant direct effects, despite earlier research (Wan et al., 2014; Khan et al., 2019) identifying moral obligation and attitude as substantial influences. Contextual variations in public awareness and priorities could be the cause of this. Qualitative findings showed that although people experience guilt, these internal values do not adequately guide their behaviour. This is probably because there are no workable solutions or enforcement mechanisms in place.

Time availability ($\beta = 0.216$, $p > 0.001$) and subjective norm ($\beta = 0.167$, $p > 0.001$) also had no discernible effects on behaviour. This runs counter to parts of the Theory of Planned Behaviour, which holds that social pressure and time constraints may not lead to action in situations with inadequate environmental infrastructure and policy. This is corroborated by qualitative responses, in which some participants reported difficulty finding drop-off locations and noted the absence of social pressure to recycle.

Moreover, interviews with informants indicate that A6 and A1 agreed that external factors, such as facility support, policies, and regulations, and internal factors, such as knowledge of waste sorting for e-waste recycling, influence e-waste recycling behaviour. The respondents identified two primary factors influencing e-waste recycling behaviour. First, there are few easily accessible, nearby e-waste collection facilities because current drop-off locations are often far from residential areas, which makes recycling difficult. Second, public awareness and education on e-waste are insufficient; many people lack understanding of what e-waste is, its environmental risks, and the need for proper recycling of items such as batteries and damaged

electronic devices. Thus, this finding indicates that facility support (an external factor) and waste-sorting knowledge (an internal factor) influence e-waste recycling behaviour.

Subjective norms were also found to influence behaviour. Individuals are likely to be influenced by the expectations and behaviours of those around them, including family, friends, and community leaders. This finding is consistent with the TPB framework, in which subjective norms are among the primary constructs influencing behaviour (Mrozik et al., 2021). In Malaysia, particularly in communal societies, social expectations can shape individual behaviour, reinforcing or discouraging practices such as recycling (Ingrassia et al., 2023).

This is align with the findings from the interviews that have been conducted which mention that informants A2, A3, A4 and A5 think that their decision to recycle electronic garbage was influenced by the social influence of those in their immediate vicinity. According to Informant A2, family members' support raised awareness and encouraged appropriate disposal of unwanted electronics. In a similar vein, Informant A3 claimed that seeing neighbors and coworkers actively engage in recycling initiatives inspired them to follow suit. Informant A3 further underlined that exposure to community advertising and friend reminders reinforced the intention to transfer e-waste to approved collection locations. The Theory of Planned Behaviour's idea of subjective norm, which describes how people are impacted by perceived social pressure from significant referent groups, is reflected in these answers (Ajzen, 1991). People are more likely to follow the rules when recycling behaviour is encouraged and expected in their social circle. The consensus among Informants A1, A2, and A3 shows that peer pressure, family support, and societal acceptance serve as motivating elements in determining the intention and actual behaviour of recycling e-waste. Thus, the qualitative results confirm that, in the context of southern Malaysia, e-waste recycling practices are significantly influenced by subjective norms.

This study was strengthened by an explanatory sequential mixed-methods design, which provided a more thorough understanding of the statistical results. The interviews helped identify why some variables had less impact than others, even though the survey measured the influence of different predictors. For instance, although moral obligation had low predictive power, interview data indicated that this was not due to indifference but to a lack of supportive systems that would enable respondents to act on their values.

5.2.3 The most significant predictors of e-waste recycling behaviour among the Malaysian public in the Southern Region.

The most significant predictor of e-waste recycling behaviour among all the variables examined was facility support. This highlights an important realization, even with adequate understanding and good intentions, achieving meaningful behavioural change is challenging without the requisite infrastructure (Hagelüken & Goldmann, 2022). This result indicates that the primary factors driving proper e-waste disposal are the availability, accessibility, and convenience of recycling facilities.

It shows how a complex interplay of environmental knowledge, accessibility to recycling facilities, social influence, and institutional assistance affects the recycling behaviour of e-waste among Malaysians in the Southern Region. Respondents' attitudes toward environmental sustainability were usually good, but their actual recycling behaviours were inconsistent. This result corroborates other research that suggested an attitude-behaviour gap prevents environmental concern from always translating into sustainable behaviour (Nguyen et al., 2024; Kumar & Shah, 2025). Therefore, the current study builds on previous research by demonstrating that behavioural intention may deteriorate when people encounter real-world obstacles such restricted access to official collection facilities, insufficient knowledge about disposal protocols, and low trust in recycling systems. This suggests that e-waste recycling behaviour is not determined solely by personal motivation but is also shaped by external structural conditions.

Moreover, it emphasizes the urgent need for more accessible, navigable, and widely advertised recycling facilities in the Southern Region and beyond. More than 2,400 employees now have easier access to e-waste recycling through BASF Malaysia's 2024 partnership with ERTH, which also includes alternatives for sending devices from home (Recycling, 2024). According to Mohamad, Thoo, and Huam (2022), Malaysians' propensity to recycle electronic devices is significantly increased by logistical convenience and the visibility of collection stations. Similarly, Yahya and Hamzah (2025) found that the availability of buy-back programs and drop-off locations directly increases recycling participation, particularly in urbanized regions such as Melaka City and Johor Bahru.

Interviews conducted indicate that, even when awareness is present, the interview document consistently identifies inadequate facilities, ambiguous locations,

and system inconvenience as the primary obstacles preventing individuals from recycling e-waste. Informant A5 stated in the interview that some people are unsure where to dispose of electronic waste. This shows that access to e-waste facilities has become a barrier to e-waste recycling behaviour among the public. Moreover, informant A2, from an NGO, noted that the lack of an effective e-waste recycling system indicates weaknesses in the system.

The study's emphasis on facility support underscores the importance of developing accessible recycling infrastructure, including mobile collection units, fixed collection centers, and connections to existing municipal waste systems, to encourage public participation. This strengthens the claim by Shaharuddin et al. (2024) that structural convenience influences Malaysian recycling behaviour more than motivational factors.

5.2.4 Research Recommendations/ Strategies for Improvement (Research Objective 4)

The qualitative data also highlighted several practical suggestions for improving e-waste recycling behaviour. Respondents recommended increasing public education through schools and universities, strengthening enforcement of existing regulations, and leveraging local councils and social media platforms to promote recycling programs. Some participants also suggested providing incentives or rewards to encourage public participation, echoing findings from previous studies, including those by Noor et al. (2023) and Sofian et al. (2023). Increasing public education is the most critical strategy to be implemented. Campaigns and programs on e-waste recycling will be highly beneficial, providing knowledge not only of educational institutions but also to the nearby community. Distributing brochures on e-waste and providing free vouchers will increase awareness and understanding of e-waste.

5.2.4.1 Stronger Enforcement of Laws and Policies

In terms of regulation, government agencies strictly enforce it. This is because they act as agents to implement what the government has aligned for the public (Abd Rauf et al., 2023). For example, e-waste is currently listed under the Schedule Waste

Regulation 1973, which requires an appropriate recycling process. However, there are no clear guidelines on the implications of noncompliance with the regulations. Proper e-waste regulations should be introduced to provide clear guidelines for the public. Not only that, but heavier action also needs to be taken towards those who disobey and break the rules.

Earlier in 2025, the Department of Environment (DOE) and Royal Malaysia Police (PDRM) initiated "Op Hazard," a national operation aimed at illicit e-waste plants. As a result, 246 people were arrested and assets valued at RM2.86 billion from unregistered e-waste activities were seized, proving the ability of law enforcement to upend major criminal organizations (Mail, 2025). Furthermore, Malaysian authorities have enforced compliance with both national law and the Basel Convention by intercepting hundreds of containers of illegally imported e-waste at ports and ordering their return (New Straits Times, 2024). By making unlawful e-waste activities economically unappealing, the EQA 1974 changes that tighten penalties allowing fines of up to RM10 million and imprisonment for significant offences further improve deterrence. These actual instances demonstrate that to prevent illicit e-waste practices, safeguard public health, and guarantee sustainable e-waste management in Malaysia, persistent, coordinated, and strict enforcement is necessary.

Effective e-waste management in Malaysia is nevertheless hampered by several issues, despite continuous enforcement efforts. One significant issue is the continued existence of illicit e-waste enterprises, which frequently resurface following enforcement efforts because of their large earnings and comparatively low operating expenses as compared to facilities that comply (Mail, 2026). Continuous monitoring is challenging because illegal operators often take advantage of regulatory loopholes by operating in distant and non-industrial regions or making fraudulent reports at ports to evade discovery.

The frequency and scope of inspections are also constrained by enforcement agencies' lack of personnel, technical know-how, and resources, especially when it comes to numerous entrance points and inland processing facilities. Implementing regulations is made more difficult by a lack of cooperation between the various governmental levels and variations in the severity of enforcement between states. Furthermore, the persistence of unlicensed and unofficial collectors who contribute to the collecting of e-waste presents concerns to the environment and public safety because they do not adhere to pollution control regulations (DOE Malaysia, 2024).

These difficulties show that, to effectively combat illicit e-waste activities in Malaysia, greater regulations and punishments are required, but so are ongoing enforcement, enhanced interagency coordination, and capacity building.

Thus, this shows that stronger enforcement of laws and policies does help to restructure back the effectiveness of e-waste recycling in Malaysia. With the existing act, a small change can be made, and the enforcement of all the government agencies might help to overcome the e-waste recycling issues in Malaysia.

5.2.4.2 Provision of Accessible Recycling Facilities

To promote appropriate e-waste disposal and lower the risks connected with improper electronic waste dumping in Malaysia, accessible recycling facilities are crucial. To help divert hazardous waste from landfills and unofficial disposal sites, the Department of Environment (DOE Malaysia) has set up a network of registered e-waste collection centers where the public can bring items like cell phones, computers, televisions, refrigerators, and other household electronics for environmentally sound recycling.

Moreover, local councils should provide recycling and waste disposal facilities (Ya'acob et al., 2023). The space should be accessible to people. For example, the public can dispose of their e-waste at the local council recycling facility without limit and can access it at any time. This initiative will encourage people to recycle their e-waste. Moreover, it will strengthen the public's connection with the local council, which may benefit the future. Recycling initiatives can be promoted via social media to attract participants (Faradillah et al., 2025). The use of social media is also critical to raise public awareness and knowledge.

As part of the RE:Cycle campaign, tech companies like Urban Republic and Switch now accept used electronics at their locations in the Klang Valley, Johor, and Penang. They frequently offer vouchers in exchange for recyclables and collaborate with recycling experts to guarantee correct processing (The Star, 2025). By collaborating with Pos Malaysia to use postal outlets across the country as drop-off locations, ERTH (Electronic Recycling Through Heroes) has further enhanced accessibility, making it easier for Peninsular Malaysians to participate in e-waste recycling. This includes free transportation to authorized recycling facilities and even payment for items collected.

Other community-oriented programs such as IPC Recycling and Buy Back Centre and Karun Hijau accept e-waste and offer pick-up services or incentives like Green Points redeemable for vouchers, lowering barriers for households and promoting active engagement in circular economy practices (InvestKL, 2025; Malay Mail, 2025). Malaysia's e-waste management system intends to make recycling more convenient and appealing by offering a range of accessible facilities and incentives, from official DOE centers to retail and postal partnerships. This will increase participation and decrease unsafe or unlawful disposal methods.

Despite initiatives to increase the number of easily accessible e-waste recycling facilities in Malaysia, several obstacles still restrict their efficacy and public acceptance. The unequal distribution of recycling facilities, which are still mostly found in urban and economically developed areas like the Klang Valley, Johor Bahru, and Penang, is a major problem that leaves rural and semi-urban communities with little to no convenient access to appropriate e-waste disposal options. Because households may be reluctant to drive great distances to authorized collection places, this geographical imbalance deters participation. Furthermore, low public awareness and knowledge gaps continue to be a significant obstacle; many customers don't know the locations of official e-waste collection facilities or erroneously think that small electronic goods can be disposed of with regular household rubbish.

Thus, it shows that accessible facilities do help to overcome the issue on e-waste recycling in Malaysia. This is because, other than knowledge, the facilities provided also should be enough and adequate for people to recycle their e-waste.

5.2.4.3 Economic Incentives and Rewards

By making environmentally conscious conduct financially appealing, financial incentives and rewards play a critical role in encouraging people and companies to engage in appropriate e-waste disposal and recycling in Malaysia. The voucher and rebate programs provided by retail-led initiatives, which provide customers store credits or discounts in return for bringing in used electronics, are one actual example. To lower the perceived cost of disposal and promote recurring recycling behaviours, electronics retailers taking part in the RE:Cycle campaign, for example, give customers vouchers that can be redeemed against new purchases when they turn over items like phones, laptops, or small appliances for recycling (Ahmad, 2025).

Moreover, the e-waste take-back policy will also help address this issue. A regulatory strategy known as an "e-waste take-back policy" mandates that producers or manufacturers of electronic goods return their products when their useful lives are nearing the end (OECD, 2024; Forti et al., 2024). Producers must gather, recycle, or properly dispose of their own products rather than leaving it up to consumers. This lessens environmental damage and closes the loop on product life cycles. Extended Producer Responsibility (EPR) frameworks, which aim to increase recycling rates and reduce inappropriate disposal of electronic waste, often include take-back mechanisms (Wan Yusoff et al., 2024).

Another noteworthy example is the postal-based incentive model put into place through collaborations like that between ERTH (Electronic Recycling Through Heroes) and Pos Malaysia, where citizens of Malaysia can send electronic waste through Post Office locations and receive cash rewards or credit points after it is successfully processed by certified recyclers. This effectively transforms recycling from a chore into a value-earning activity (Maxis, 2024; InvestKL, 2025). The impact of economic incentives is further demonstrated by business and corporate initiatives. For example, telecommunications and technology companies like Maxis and Celcom have extended their e-waste initiatives to include rebates and trade-in discounts for customers who upgrade devices through official channels and recycle old units, lowering barriers to sustainable consumption while channeling more e-waste into formal recycling streams (Maxis, 2024).

Even while financial incentives and awards are available, several obstacles prevent them from effectively encouraging the recycling of e-waste in Malaysia. One significant problem is that residents in rural or semi-urban areas have fewer opportunity to engage in incentive programs because many voucher or rebate schemes are centered in urban areas (DOE Malaysia, 2024). Furthermore, the impact of these programs is diminished by poor public knowledge; some customers do not know how to engage in reward-based collection campaigns or where to redeem coupons (Malay Mail, 2025). While informal collectors frequently provide simpler, door-to-door collection with instant cash compensation, some programs require pre-registration, specific drop-off locations, or adherence to strict item categories, which discourages participation due to their complexity and inconvenience (Ahmad, 2025).

Furthermore, despite the existence of legitimate programs, the informal e-waste sector continues to draw participation through direct financial incentives, diverting e-

waste away from licensed facilities (InvestKL, 2025). To enhance recycling rates in Malaysia, these obstacles show that while financial incentives are significant motivators, their efficacy requires on expanded geographic coverage, streamlined participation procedures, and integration with current informal collection activities.

Thus, this shows that economic incentives and rewards are very essential in e-waste recycling issue. This is because people will get motivated to do things when there is something they get in exchange. With this, people will be excited and motivated to recycle more.

5.2.4.4 Strengthening Social Norms and Community Influence

Since it uses peer pressure and collective expectations to normalize ecologically responsible behaviour, strengthening social norms and community influence is a potent technique for increasing e-waste recycling behaviours in Malaysia. Instead of viewing recycling as an optional activity, people are more likely to regularly participate when sustainable disposal is seen as the "right thing to do" in a community.

Moreover, it is essential to cultivate a culture of e-waste recycling within society. A recycling culture comprises common beliefs, customs, and routines that motivate people to dispose of electronic waste in an environmentally friendly manner regularly. Policies, infrastructure, and take-back programs are crucial, but cultural acceptability and internalization of recycling habits are necessary for long-term behaviour change. According to recent studies (Goh & Sukri, 2024; Forti et al., 2024), e-waste recycling behaviour is strongly influenced by social norms, moral obligations, and habitual behaviours that develop over time through repeated exposure, education, and community involvement. Regardless of external enforcement, people are more likely to recycle when it becomes a social norm than when it is an infrequent activity (OECD, 2024).

Community-driven projects like neighborhood Kitar Semula (Recycling) Days have been successful in changing norms in a few Malaysian towns through group activities and public pledges; residents are more likely to recycle as a social behaviour rather than an individual task if they witness neighbors bringing old electronics to shared collection points (DOE Malaysia, 2024). Campaigns involving peer ambassadors and competitions for the highest e-waste collection rates at universities like Universiti Sains Malaysia (USM) and Universiti Teknologi Malaysia (UTM) have

increased participation by framing recycling as a source of pride and community identity (The Star, 2025). Schools and universities also have an impact. These actual cases show that people are more likely to absorb responsible disposal as a social norm when recycling is integrated into communal activities and backed by obvious societal approbation, resulting in long-lasting behaviour change that goes beyond individual incentives alone.

Social media should be utilized wisely for e-waste recycling. Recently, most people have been using social media to obtain updates on current events. According to recent studies (Goh & Sukri, 2024; Forti et al., 2024), social media significantly promotes pro-environmental behaviour by fostering behavioural imitation and reinforcing social norms. The knowledge gaps identified in this study are addressed by platforms such as Facebook, Instagram, and TikTok, which are particularly effective at providing brief, visually appealing content that describes practical recycling techniques (Htet & Sahrir, 2025). Social media contributes to the transformation of recycling from an infrequent act into socially acceptable behaviour by normalizing e-waste recycling content online. Using hashtags and online calls to action to increase participation and awareness among Malaysians, companies like Maxis have used LinkedIn and other social media platforms to promote e-waste recycling campaigns and engage a wide audience (Maxis, 2024).

Despite the advantages of using social media, community influence, and social norms to encourage e-waste recycling, several obstacles restrict its efficacy in Malaysia. Participation in community-led recycling drives or university campaigns frequently rely on local interest, volunteer availability, and social cohesiveness, leaving rural or less organized areas underrepresented. This is one of the main problems with unequal engagement among communities (DOE Malaysia, 2024). The reach of social media campaigns is also impacted by low public awareness and digital literacy; not all demographics are equally exposed to online messaging, and older or less tech-savvy people may miss out on online initiatives like Maxis' LinkedIn e-waste campaigns (Maxis, 2025; Malay Mail, 2025). Despite seeing peers or online messaging, people may not absorb recycling as a social norm due to behavioural inertia and regular patterns, especially if accessibility or convenience are inadequate (Ahmad, 2025). Furthermore, in spite of community or social media initiatives, misalignment with informal recycling practices might undercut official campaigns because informal

collectors continue to offer instant financial incentives, diverting e-waste from licensed programs (InvestKL, 2025).

In conclusion, encouraging e-waste recycling in Malaysia requires bolstering societal norms and community influence. People are encouraged to see responsible disposal as a shared expectation when recycling is integrated into neighborhood networks, local communities, and educational institutions (DOE Malaysia, 2024; The Star, 2025). Particularly among younger people, social media increases awareness and normalizes sustainable behaviour (Maxis, 2025; Malay Mail, 2025). These tactics can successfully promote a socially reinforced and long-lasting e-waste recycling culture when paired with inclusive involvement and alignment with unofficial recycling practices.

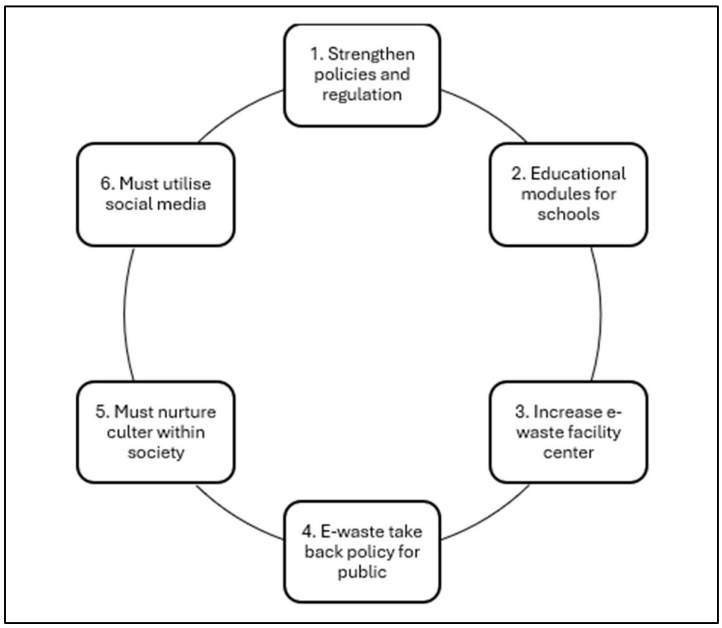


Figure 5.1 Framework Strategy

5.2.4.5 Multi-stakeholder Collaboration

Multiple players, including government agencies, private firms, non-governmental organizations (NGOs), and academic institutions, must work closely together to improve recycling behaviour among Malaysians. Multi-stakeholder collaborations aid in filling up the gaps in public participation, infrastructure, and awareness that are frequently impossible for one player to handle alone. Government

policy frameworks, for instance, can offer incentives, rules, and national goals, such as Malaysia's goal of achieving a 40% national recycling rate. However, these initiatives are more successful when combined with other sectors' efforts. Therefore, collaborative platforms that unite communities, NGOs, and the public and corporate sectors can foster a more encouraging atmosphere for behavioural change (KPKT, 2023).

The study also emphasizes how crucial institutional and governmental assistance is in influencing recycling behaviour that is sustainable. According to respondents, their willingness to recycle e-waste appropriately was diminished by uneven enforcement, few advertising campaigns, and a lack of incentives. This result is consistent with earlier studies (Lee & Chen, 2025; Rahman et al., 2024) that found that when governments provide clear legislation, convenient facilities, and ongoing educational campaigns, public engagement in environmental programs rises. The current findings are consistent with previous research, which may be explained by the increasing awareness that public confidence in waste management systems and the efficacy of policies have a significant impact on environmental behaviour. In the Malaysian context, the findings suggest that existing e-waste management efforts may still require stronger coordination between local authorities, educational institutions, non-governmental organisations, and recycling industries to improve public engagement and long-term behavioural change.

Besides, through corporate social responsibility (CSR) efforts and sustainability programs, the private sector, which includes telecommunications corporations like Maxis and Celcom, has a considerable capacity to influence public behaviour. Private companies can use their sizable audiences and resources to boost awareness and involvement in recycling initiatives when they collaborate with governmental and community organizations. By increasing awareness and offering easily accessible services or incentives, the participation of private firms and non-governmental organizations can strengthen public commitment to recycling, according to research on environmental campaigns (ScienceDirect study on recycling behaviour).

Additionally, NGOs are essential in addressing gaps that may not be adequately addressed by the government and business sector alone. Local environmental non-governmental organizations frequently possess robust community networks and enjoy public confidence, which facilitates the dissemination of information and encourages citizens to embrace recycling habits. Recycling techniques become more relevant and attainable at the local level because to their grassroots initiatives, which include

workshops, community clean-ups, and educational outreach. Furthermore, NGOs can co-design programs that are both technically solid and culturally relevant when they work with businesses and academic institutions.

Universities are in a unique position to encourage recycling behaviour change through community involvement initiatives, research, and innovation. Higher education institutions like Universiti Teknologi Malaysia and Universiti Tun Hussein Onn Malaysia have created and spearheaded recycling programs that engage locals, students, and business partners. One example of how academic leadership may convert research and instruction into quantifiable community benefits is UTM's community-based e-waste recycling initiative, which involved schools, public libraries, and licensed recyclers in the collection and recycling of electronic waste. In a similar vein, UTHM's collaboration with SWM Environment organized more than 30 ongoing recycling activities that included students and the public in waste segregation, environmental education, and proactive stewardship.

Lastly, formalizing these partnerships and expanding effective models require government backing. Malaysia can institutionalize common objectives and coordinate resources by forming national councils or frameworks with members from the public and business sectors, academia, and non-governmental organizations. Formal multi-stakeholder organizations like this facilitate the construction of recycling infrastructure, help coordinate efforts toward national recycling targets, and guarantee that communication campaigns are consistent across sectors. When combined, these programs can foster a recycling culture where people are encouraged to modify their behaviour for long-term environmental sustainability because they feel informed, supported, and supported.

5.2.4.6 Use of Digital Technology and Innovation

Digital technology and innovation integration is becoming more widely acknowledged as a crucial tactic to improve recycling efficiency and participation in Malaysia. Recent scholarly research highlights the importance that digital platforms and mobile applications play in streamlining recycling operations and increasing public accessibility and engagement. For example, by utilizing the widespread use of smartphones in Malaysia, the "Re: Think" mobile app seeks to link people with recycling organizations and expedite sustainable waste management procedures,

promoting more positive recycling behaviour. This digital strategy is particularly pertinent to southern urban areas where smartphones are widely used and mobile technology is ingrained in daily life (Ismail, Azizan, & Mohamed, 2025).

Apart from mobile applications, specifically created recycling apps like the KITARecycle app have been demonstrated to have a positive impact on users' understanding of waste separation and their adoption of the 3R (Reduce, Reuse, Recycle) principles. With financial incentives linked to proper garbage sorting, research conducted at Malaysian educational institutions revealed that the app not only improved users' knowledge of what items might be recycled but also had an impact on their attitudes and actual recycling behaviour. This implies that behavioural incentives coupled with digital innovation can strengthen students' and employees' positive recycling practices; this model could be modified for larger community initiatives in the southern region.

In addition to mobile applications, more comprehensive digital tools like QR code systems, real-time data tracking, and digital dashboards provide better monitoring and feedback loops between waste management authorities and homeowners, which enhances recycling infrastructure. Digital technology improves operational efficiencies and help users make educated decisions about properly sorting and disposing of waste, according to a 2024 literature analysis on digitalization in waste recycling. These solutions have the potential to decrease misunderstandings regarding recycling procedures and boost public trust in waste management systems by offering prompt feedback and more precise instructions. This is crucial for maintaining long-term behavioural change.

Furthermore, new research from 2025 shows how cutting-edge digital technologies like artificial intelligence (AI) also influence recycling behaviour. According to a study on AI-driven interventions, by offering individualized information and educational opportunities, AI raises consumer awareness and favorably affects e-waste recycling behaviour. This implies that by making the process more user-friendly and responsive to user needs, innovation beyond simple apps, such as AI-enabled awareness campaigns or intelligent sorting aid, could further encourage the Malaysian public to practice recycling.

5.2.4.7 Public Education and Awareness

An essential strategy for enhancing recycling practices among Malaysians, especially in the southern region, is to increase public education and awareness. According to recent research conducted in Malaysia, recycling intention and actual trash separation behaviour are strongly influenced by environmental understanding. People are more likely to adopt favorable views toward recycling when they are aware of the negative effects inappropriate waste disposal has on the environment, including pollution, landfill overflow, and climatic impacts (Abdullah et al., 2024). Long-term recycling habits depend on reducing confusion and increasing perceived behavioural control, which can be achieved by public education programs that clearly explain what items are recyclable, how to properly segregate waste, and where recycling facilities are located.

By showing that recycling behaviour should be understood through both psychological and structural dimensions rather than just individual awareness, the findings add to the literature on environmental behaviour from a broader theoretical standpoint. Thus, the study backs up claims made by more recent researchers that sustainable environmental behaviour is context-dependent and multifaceted (Tan & Lim, 2025). The results have significant practical consequences for Malaysian environmental authorities and legislators. Campaigns for awareness might not be enough on their own unless they are supported by community-based recycling programs, greater policy implementation, and accessible infrastructure. E-waste recycling participation in the Southern Region of Malaysia may be greatly increased by making collection centers more accessible, encouraging public education campaigns, and promoting cooperation between manufacturers and government organizations through extended producer responsibility programs.

Long-term recycling habits are also greatly aided by environmental education programs at universities and schools. According to research done in 2024 in Malaysian higher education institutions, student-led green initiatives, environmental workshops, and organized sustainability campaigns greatly increase students' involvement in recycling. In addition to enhancing knowledge, these programs reinforce environmental responsibility and moral obligation, two factors that are significant indicators of pro-environmental behaviour (Rahman & Noor, 2024). A recycling culture might be promoted from an early age, and early behavioural conditioning could be established

by extending such programs to Johor, Melaka, and Negeri Sembilan schools and community colleges.

Digital communication platforms and the mass media also increase the efficacy and reach of awareness campaigns. By raising knowledge and influencing subjective norms, social media advertising and digital environmental messages have a favorable impact on recycling intention, according to a 2025 Malaysian study. Recycling becomes a socially expected behaviour rather than an optional one when it is continuously pushed via social media, local influencers, and PSAs (Zulkifli et al., 2025). Positive recycling practices within residential communities can thus be strengthened in the southern region by working with local government representatives and community leaders to distribute focused educational content via digital channels.

Lastly, to close the gap between knowledge and action, community-based awareness initiatives like recycling carnivals, neighborhood seminars, and door-to-door instructional campaigns are crucial. A 2024 study on sustainable behaviour in Malaysia found that citizens' confidence in their ability to separate garbage at home is greatly increased by practical engagement activities. Residents are more likely to convert their knowledge into actual recycling behaviour when they actively participate in interactive workshops and demonstrations (Tan & Lee, 2024). Therefore, a complete public awareness plan that supports long-term behavioural change in the southern part of Malaysia can be created by combining formal education, internet campaigns, and grassroots engagement.

5.3 Research Implications

5.3.1 Theoretical Implication

The study's findings address significant gaps in prior research and offer theoretical insights that enhance our understanding of how awareness, knowledge, external assistance, and policy mechanisms influence recycling behaviour.

5.3.1.1 Future Research Advancement on E-waste

This study extends the Theory of Planned Behaviour by demonstrating that external structural factors may outweigh internal motivational variables in the

Malaysian context of e-waste recycling. This realization helps put behavioural theories in context, particularly in developing countries where policy and systemic obstacles may take precedence over individual intentions.

By adding two more factors that have been shown to have a significant impact on behaviour, like moral duty and facility support. The findings advance the theoretical framework of the Theory of Planned Behaviour. This demonstrates how TPB can be extended to account for contextual and environmental factors when evaluating recycling behaviour (Owusu-Sekyere & Aladago, 2023). Additionally, the results highlight the theory's value for studying pro-environmental behaviour, particularly in local contexts such as Malaysia. This study has separated the elements into two categories: internal and external factors and has developed the theory. This study also focuses on developing nations and Malaysia's southern area.

5.3.1.2 Behavioural Theory Contextualization for Developing Countries

This research highlights environmental behaviour, particularly in the Southern Region of Malaysia. Some previous studies have highlighted the recycling infrastructure in developed countries like Australia and Germany (Ogunyemi et al., 2024; Phogat et al., 2025). In Western or highly industrialized societies with relatively advanced recycling infrastructure, environmental literacy, and effective policy enforcement, behavioural theories such as the Theory of Planned Behaviour (Ajzen, 1991) and the Norm Activation Model (Schwartz, 1977) were developed and tested. However, due to variations in cultural norms, institutional capacity, and infrastructure availability, recent research contends that these theories require careful modification for developing-country contexts (Gupta & Ogden, 2023; Malek & Salleh, 2022).

Research in Southeast Asia repeatedly demonstrates that other structural issues, such as inconsistent policy implementation, poor public communication, and restricted access to collection facilities, affect recycling behaviour (Abdul Rahman et al., 2023; Kamaruddin et al., 2022). Further research on e-waste in Malaysia indicates that, when legislative ambiguities and infrastructure constraints are present, behavioural intention alone is insufficient to predict action (Yusof et al., 2024; Johari & Isa, 2023). These results bolster the claims made by Ismail et al. (2023) and Ramzan et al. (2024) that behavioural theories need to be contextualized to account for the realities of developing

nations, where institutional support and systemic limitations are more salient than in industrialized contexts.

To enhance the explanatory power of current behavioural frameworks in developing nations, this study highlights the need to expand and strengthen them by incorporating contextual factors, including perceived policy clarity, communication effectiveness, and accessibility.

5.3.1.3 Highlighting the Significance of Structural and External Factors

Increasing research demonstrates that recycling behaviour is significantly influenced by external and structural factors, including infrastructure, accessibility, institutional support, and policy clarity, rather than being driven solely by internal factors. Many studies contend that when structural hurdles prevent people from recycling, even those with strong pro-environmental views may not act (Tong et al., 2023; Malek & Salleh, 2022; Wang et al., 2022). The physical environment, including the accessibility and convenience of drop-off locations, signage, collection frequency, and operational systems, is crucial in promoting or discouraging recycling behaviour, according to evidence from environmental psychology (Barr et al., 2023; Oke et al., 2022).

Sustainable measures, such as recycling e-waste, are severely hampered by poor infrastructure, uneven enforcement, and a lack of institutional communication, according to research conducted in developing nations (Gupta & Ogden, 2023; Abdul Rahman et al., 2023; Johari & Isa, 2023). In the Malaysian context, researchers consistently find that public participation in recycling programs is significantly influenced by structural enablers, including clear guidelines, facility accessibility, government involvement, and visible support mechanisms (Kamaruddin et al., 2022; Yusof et al., 2024; Ismail et al., 2023). These results are consistent with international sustainability research demonstrating that people's environmental behaviour increases when they perceive robust regulatory systems and supportive infrastructure (Geissdoerfer et al., 2022; Chen et al., 2024).

To effectively describe and forecast e-waste recycling behaviour, your work supports the claim that external and structural variables are essential.

5.3.1.4 Integrating Policy Factors to Strengthen Behavioural Theory

Conventional behavioural theories, such as the Norm Activation Model (Schwartz, 1977) and the Theory of Planned Behaviour (Ajzen, 1991), often overlook the influence of institutional systems, policy structures, and regulatory clarity in favor of internal psychological factors such as attitudes, intentions, and moral obligations. Recent studies, however, show that policy determinants are essential in shaping recycling and environmental behaviour, particularly when infrastructure and enforcement differ (Chen et al., 2024; Gupta & Ogden, 2023). Research on waste management consistently demonstrates that public engagement in recycling programs is significantly increased by visible legislation, explicit guidelines, and effective government communication (Ismail et al., 2023; Barr & Gilg, 2023).

Because public behaviour is frequently constrained by inadequate implementation methods and uneven institutional support, policy visibility is even more significant in developing nations (Kamaruddin et al., 2022; Oke et al., 2022). Beyond what attitudes or intentions alone can predict, policy clarity—such as knowledge of collection schemes, government support, and enforcement mechanisms significantly improves recycling engagement, according to research on e-waste behaviour in Malaysia (Yusof et al., 2024; Johari & Isa, 2023). Additionally, research on global sustainability contends that by reducing ambiguity and increasing perceived behavioural control, policies function as external cues or reinforcements that increase behavioural consistency (Geissdoerfer et al., 2022; Wang et al., 2022). Researchers can develop more thorough, contextually relevant models that more accurately reflect the realities of environmental behaviour in both developed and developing nations by incorporating these policy aspects into existing behavioural frameworks.

As a result, including policy variables improves theoretical explanatory power while aligning behavioural models with the structural conditions that shape actual environmental activities.

5.4 Research Limitations and Suggestions for Future Research

First, the study adopts a cross-sectional research design, which limits the ability to infer causal relationships between the extended TPB variables and e-waste recycling behaviour. Although the extended Theory of Planned Behaviour (TPB) variables and

e-waste recycling behaviour can be examined effectively and substantial connections identified using this methodology, the capacity to infer causal relationships is inherently limited. A cross-sectional design cannot capture these dynamic behavioural changes, as attitudes, subjective norms, perceived behavioural control, and other TPB constructs may evolve in response to legislative changes, awareness campaigns, or technological advancements. As a result, correlations rather than transparent cause-and-effect processes underline the observed connections. A longitudinal research approach, in which data is collected from the same respondents over multiple time points, is recommended for future investigations. Researchers could further evaluate the causal relationships between psychological factors and actual e-waste recycling behaviour by using longitudinal methods to track changes in extended TPB variables over time. These designs are constructive for assessing the long-term effects of educational programs, public awareness campaigns, and legislative interventions on recycling behaviour.

Second, the data were collected exclusively from the Southern Region of Malaysia, which may limit the generalisability of the findings to other regions with different socio-economic characteristics, infrastructure availability, or levels of policy enforcement. In terms of socioeconomic traits, urban-rural distribution, the availability of e-waste collection facilities, public awareness levels, and the efficiency of policy implementation and enforcement, Malaysia exhibits significant regional variation. Accordingly, the factors influencing e-waste recycling behaviour identified in this study may vary in importance or magnitude across contexts with differing levels of institutional support, cultural norms, or infrastructure capacity. As a result, rather than being taken to reflect the behaviour of all Malaysians, the results should be evaluated within the regional context in which the data were gathered. It is recommended that future research broaden its geographic coverage to include participants from other regions of Malaysia, such as the Northern, Central, East Coast, and East Malaysia (Sabah and Sarawak). Researchers could investigate regional differences in extended TPB factors and pinpoint location-specific motivators and obstacles to e-waste recycling behaviour by conducting comparative or multi-regional studies. To support region-specific policies and initiatives, such an approach would provide more comprehensive evidence.

Third, the study relies on self-reported survey data, which may be subject to social desirability bias and recall bias. To project a more positive image of themselves,

respondents may underreport negative behaviours or overreport socially acceptable ones, including recycling e-waste responsibly. The accuracy of the assessed associations between extended TPB factors and e-waste recycling behaviour may be affected by this tendency, potentially exaggerating reported pro-environmental behaviour. Recollection bias can also occur when respondents are asked to recall prior recycling behaviours, particularly when those behaviours are irregular or infrequent. This could lead to incomplete or erroneous responses. By creating discrepancies between reported behaviour and actual recycling behaviour, these biases may undermine the validity of the findings. Future research is advised to triangulate survey results with objective or behavioural measures to mitigate the limitations inherent in self-reported data. To verify self-reported recycling behaviour, researchers could, for example, use observational data, recycling records from collection centers, or digital tracking of e-waste drop-off activities. These methods would enhance the robustness of behavioural measurement and reduce reliance on respondents' subjective reports.

Fourth, while the study extends the TPB model by incorporating additional internal and external factors, it does not account for other potentially relevant variables, such as perceptions of economic costs, trust in recycling systems, or emotional aspects (e.g., guilt or pride). There was no explicit examination of factors such as trust in formal recycling systems, perceived economic costs (e.g., time, effort, or cash incentives), or emotional drivers (e.g., moral satisfaction, pride, or guilt). The complex psychological and contextual dynamics that drive e-waste recycling behaviour may not be fully captured if these variables are omitted. The explanatory efficacy of the expanded TPB model used in this study may be limited if convenience, cost, and moral considerations are excluded, as e-waste recycling often entails trade-offs among these criteria. Future studies should incorporate additional constructs that capture the economic, emotional, and trust-related aspects of recycling behaviour to extend the TPB framework further. For example, financial or non-financial incentives, and perceived cost-benefit analyses, could be used to explain real-world obstacles to participation in e-waste recycling. Public confidence and willingness to participate in official recycling channels can also be assessed by examining trust in recycling organizations, collection methods, and policy enforcement.

Finally, the qualitative component involved interviews with a relatively small number of respondents. While the interviews provided valuable contextual insights, a larger or more diverse qualitative sample could yield a broader range of perspectives

on the barriers and facilitators to e-waste recycling. The small sample size may limit the range of viewpoints captured, even though the semi-structured interviews yielded rich, insightful contextual insights into attitudes, experiences, and difficulties related to e-waste recycling. The opinions gathered may not accurately reflect the range of experiences across socioeconomic groups, professional backgrounds, or levels of involvement in e-waste recycling procedures. As a result, some obstacles to and enablers of e-waste recycling behaviour may go unstudied, particularly those that are specific to stakeholder groups or contextual circumstances. A larger, more diverse qualitative sample that includes participants from diverse demographic backgrounds, geographic areas, and stakeholder categories, such as households, informal collectors, recycling facility operators, retailers, and policymakers, is recommended for future research. Researchers might record a variety of perspectives and obtain a more comprehensive understanding of the institutional, behavioural, and structural factors shaping e-waste recycling by broadening the pool of informants.

5.5 Conclusion

With an emphasis on the Southern region, this study concludes by offering significant insights into the factors driving e-waste recycling behaviour in Malaysia. The findings show that a range of factors, including facility support, subjective norms, awareness of policies and regulations, and relationships between government and private-sector stakeholders, strongly influence people's intentions and actual recycling practices. According to the statistical results, recycling behaviour is strongly influenced by facility assistance ($\beta = 0.067$, $p < 0.001$), underscoring the importance of easily accessible, widely distributed, and user-friendly e-waste collection infrastructure. According to earlier studies (Waheed et al., 2023; Shi, Chen, & Verter, 2023), easy recycling facilities significantly increase participation rates and reduce improper disposal practices.

Additionally, the substantial impact of subjective norms ($\beta = 0.167$, $p < 0.001$) highlights how social pressure and perceived expectations influence recycling behaviour. According to these results, people are more inclined to dispose of their e-waste properly when they believe that relevant stakeholders and society support such conduct. By encouraging closer cooperation between government agencies and private-sector actors, such as retailers and electronics companies, this social component can be

effectively leveraged. As the interviews made clear, government-led campaigns alone are frequently insufficient. Still, collaborative efforts that combine regulatory bodies and well-known businesses are perceived as more legitimate, significant, and influential in encouraging compliance. According to earlier research showing the advantages of public-private partnerships in waste management and circular economy initiatives, such collaboration not only increases public trust but also strengthens the normative environment that encourages responsible recycling behaviour (Wei, Wang, & Yang, 2024; Grandhi et al., 2024; Alhosani, 2025; Morales-Urrutia et al., 2024).

However, the finding has important theoretical and practical significance. Practically speaking, the results indicate that stakeholders and policymakers should prioritize improving e-waste infrastructure, bolstering cooperation between public- and private-sector entities, and creating coordinated awareness campaigns that leverage both social norms and regulatory reinforcement. From a theoretical standpoint, the study supports behavioural models like the Theory of Planned Behaviour by showing how policy knowledge, perceived behavioural control (through facility support), and subjective norms interact to shape environmental behaviour. Furthermore, a robust framework for understanding the complex factors influencing e-waste recycling is provided by combining quantitative and qualitative data.

In conclusion, this study has provided valuable insights into the factors influencing e-waste recycling behaviour among the Malaysian public in the Southern Region. Despite awareness and intention, societal and infrastructure barriers continue to hinder effective recycling. Facility support is the most critical factor in determining recycling behaviour, which emphasizes the need for improved infrastructure and public access to recycling services. Social standards, moral obligation, and attitude all play essential roles, but their influence is limited in the absence of structural support. To promote sustainable behaviour and save the environment for future generations, it is imperative to address these obstacles using a combination of policy, education, enforcement, and infrastructure development.

REFERENCES

Abbot, J. (1998). Theories and definitions of waste. Routledge.

Abdullah Al-Swidi, S. M. (2014). The role of subjective norms in the theory of planned behaviour in organic food consumption. British Food Journal.Abd Rauf, N. R. A. (2023). Urban households' behaviour towards domestic waste recycling, Shah Alam, Selangor (Master's thesis). Universiti Teknologi MARA, Shah Alam

Abdullah, M. F., Hamid, N. A., & Karim, R. (2024). Environmental knowledge and recycling behaviour among Malaysian households. Sustainability, 16(5), 2143–2158. https://doi.org/10.3390/su16052143

Abdullah, C. W. N., Arep @ Ariff, H., & Mohamed Sultan, A. (2025). E-waste management: A bibliometric analysis from 2019 to 2025. Journal of Tourism, Hospitality and Environment Management, 10(40). https://doi.org/10.35631/JTHEM.1041027

Abdul Rahman, N. H., Omar, D., & Mahmud, M. I. (2025). Strengthening e-waste governance in Malaysia: Challenges and pathways towards integrating informal recyclers into the formal system. Journal of Environmental Management, 356, 120567. https://doi.org/10.1016/j.jenvman.2024.120567

Abha, A. T., Gitifar, A., Chowdhury, R., Tasnim, A., & Ng, K. T. W. (2025). Quantification of E-waste collection count at the household level. Environmental and Sustainability Indicators, 28, 100898. https://doi.org/10.1016/j.indic.2025.100898

Abila, B. &. (2019). The perceived role of financial incentives in promoting waste recycling—Empirical evidence from Finland. Recycling, 4(1). https://doi.org/10.3390/recycling4010004

Aboelmaged, M. (2021). E-waste recycling behaviour: Integrating recycling habits into the theory of planned behaviour. Journal of Cleaner Production. Retrieved from https://blogs.ntu.edu.sg/hp3203-1819s2-u12/the-theory-of-planned-behaviour/#:~:text=This%20means%20that%20individuals%20are,peers'%20views%20regarding%20the%20issue.

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

Acikgoz, F., & Erkut, A. (2023). Curiosity on cutting-edge technology via theory of planned behaviour and diffusion of innovation theory. International Journal of Information Management Data Insights.

Achillas, C., & Vlachokostas, C. (2025). Integrated waste management in the circular economy era: Insights from research and practice. Energies, 18(3), 728. https://doi.org/10.3390/en18030728

Afroz, R., Muhibbullah, M., Farhana, P., & Morshed, M. N. (2020). Analyzing households' intention to drop off mobile phones at collection boxes: an Empirical study in Malaysia. Ecofeminism and Climate Change, 1(1), 3–20. https://doi.org/10.1108/EFCC-10-2019-0019

Ahmad, Z., & Ismail, N. M. (2025). Exploring the attitude domain influencing household waste in Taiping, Perak. International Journal of Research and Innovation in Social Science (IJRISS), 9(5), 1–5. https://rsisinternational.org/journals/ijriss/articles/exploring-attitude-domain-influencing-household-waste-in-taiping-perak/

Ahmad, N. H. (2025). A conceptual framework of resistance behaviour in e-waste recycling. Journal of Tourism, Hospitality and Environment Management, 10(42), 1–11. https://doi.org/10.35631/JTHEM.1042001

Ajzen, I. (2022). The theory of planned behaviour: A bibliography of selected works (1985–2022). University of Massachusetts Amherst. https://doi.org/10.1007/s11301-022-00273-6

Allport, G. W., & Vernon, P. E. (1931). Studies in expressive movement. New York, NY: Macmillan

Amanda, A., Solihat, R., Riandi, & Habibaturrohmah, Z. (2024). Exploring strategies to promote waste management in education for a sustainable future: A systematic literature review. Briliant: Jurnal Riset dan Konseptual, 10(3). https://doi.org/10.28926/briliant.v10i3.2275

Andeobu, L., Wibowo, S., & Grandhi, S. (2021). A systematic review of e-waste generation and environmental management of Asia Pacific countries. International Journal of Environmental Research and Public Health, 18(17), 9051. https://doi.org/10.3390/ijerph18179051

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 Behavioural Control, Self-Efficacy, Locus of Control, and the Theory of Planned Behaviour1. Journal of Applied Social Psychology, 32(4), 665–683. https://doi.org/10.1111/j.1559-1816.2002.tb00236.x

AEHA. (2024). About AEHA. Retrieved from Association for Electrical Home Appliances: https://aeha.or.jp/global/about.html

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

Afful, B. E. B., Addaney, M., Anaafo, D., Akudugu, J. A., Borkor, F. K., Yeboah, E. O., & Sampana, J. (2023). Public-private partnership in municipal solid waste management in the Sunyani municipality of Ghana. Journal of Property, Planning and Environmental Law, 16(3), 201–217. https://doi.org/10.1108/JPPEL-04-2023-0012.

Agency, E. E. (2023). Estonia. Waste prevention country profile.

Ahmad, A. (2025, August 13). Retailers collecting e-waste to promote recycling. The Star. https://www.thestar.com.my/metro/metro-news/2025/08/13/retailers-collecting-e-waste-to-promote-recycling

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

Akter, N., & Hossain, M. I. (2025). Structure, actors, and interdependencies between the informal and formal e-waste management supply chain in Bangladesh. Journal of Cleaner Production, 522, 146146. https://doi.org/10.1016/j.jclepro.2025.146146

Alhassan, H. A.-A. (2018). “Application of the theory of planned behaviour to public' source separation behaviour in China. Management of Environmental Quality: An International Journal.

Al-Qadasi, N., Zhang, G., Al-Jubari, I., Al-Awlaqi, M. A., & Aamer, A. M. (2024). Entrepreneurship education and entrepreneurial behaviour: Do self-efficacy and attitude matter? International Journal of Management Education, 22(1), 100945. https://doi.org/10.1016/j.ijme.2024.100945

Amir, F., Miru, A. S., & Sabara, E. (2025). Urban household behaviour in Indonesia: Drivers of zero waste participation (Zero Waste Model).

Ananno, A. M. (2021). Survey and analysis of consumers' behaviour for electronic waste management in Bangladesh. Journal of Environmental Management, Vol. 282.

Andeobu, L., Wibowo, S., & Grandhi, S. (2023). Environmental and Health Consequences of E-Waste Dumping and Recycling Practices in Selected Asian and Latin American Countries. Sustainability, 15(13), 10405. https://doi.org/10.3390/su151310405

Ankit Chouksey, M. A. (2023). Planning of three-level facilities network for collection and recycling of E-waste: A MILP-based modelling approach. materialtoday: Proceedings.

Anuardo, R. G. (2023). Transforming E-Waste into Opportunities: Driving Organizational Actions to Achieve Sustainable Development Goals. Sustainability.

Arain, a. L.-B. (2019). Analysis of e-waste recycling behaviour based on a survey at a Midwestern US University. Waste Management.

Arslan, E., Koyuncu, C., & Yilmaz, R. (2024). The influence of government ideology on the rate of e-waste recycling in the European Union countries. PloS One, 19(3), e0297408. https://doi.org/10.1371/journal.pone.0297408

Asia, D. (28 September, 2021). Subsidizing Ecofriendly Practices in E-Waste Recycling in the People's Republic of China. Retrieved from Development Asia: https://development.asia/case-study/subsidizing-ecofriendly-practices-e-waste-recycling-peoples-republic-china

Aslam, M. S., Huang, B., & Cui, L. (2020). Review of construction and demolition waste management in China and the USA. Journal of Environmental Management, 264, 110445. https://doi.org/10.1016/j.jenvman.2020.110445.

Auditors, E. C. (2021). EU actions and existing challenges on electronic waste.

Awasthi, A. K., & Li, J. (2018). Assessing resident awareness on e-waste recycling in Bangalore, India: a preliminary case study. Environmental Science and Pollution Research International, 25(11), 11163–11172. https://doi.org/10.1007/s11356-017-1037-4

Azlan, R. M. (2021). Knowledge, attitude, and practices on e-waste recycling among business students in a public university. International Journal of Academic Research in Business and Social Sciences, 11(8)..

Baba-Nalikant, M. S., Husin, M. H., Abdullah, N. A., Mohamad Saleh, M. S., & Abdul Rahim, A. (2023). A zero-waste campus framework: Perceptions and practices of university campus community in Malaysia. Sustainability.

Bagwan, W. A. (2024). Electronic waste (e-waste) generation and management scenario of India, and ARIMA forecasting of e-waste processing capacity of Maharashtra state till 2030. Waste Management Bulletin, 1(4), 41–51.

Barr, S., & Gilg, A. (2023). Behavioural insights into household waste and recycling practices: A review of evidence. Resources, Conservation & Recycling, 190, 106887.
https://doi.org/10.1016/j.resconrec.2022.106887

Baidya, R. D. (2020). Supply chain analysis of e-waste processing plants in developing countries. Waste Management & Research, 38(2), 173–183.

Baldé, C. P., Kuehr, R., Yamamoto, T., McDonald, R., D'Angelo, E., Althaf, S., et al. (2024). The Global E-waste Monitor 2024. United Nations University (UNU)/UNITAR SCYCLE Programme.

Baldé, C. P., & Van der Schalk, S. (2020). What happened between 2010 and 2018? The Dutch WEEE flows.

Basel. (2024). Basel Convention > The Convention > Overview > Text of the Convention. Retrieved from Basel Convention: https://www.basel.int/TheConvention/Overview/TextoftheConvention/tabid/1275/Default.asp

BASF collaborates with ERTH to promote electronic waste (e-waste) recycling. (2024, June 28). https://www.basf.com/my/en/media/news-releases/my/2024/basf-collaborates-with-ERTH-to-promote-electronic-waste-recycling?utm_source=chatgpt.com

Bassiouny, A. F. (2021). Comparison of different computer vision approaches for e-waste components detection to automate e-waste disassembly. In Proceedings of the International Mobile, Intelligent, and Ubiquitous Computing Conference.

Bernama. (2025, January 21). DOE reviewing Environmental Quality Act 1974 for Phase II amendments - DG. thesun.my. https://thesun.my/malaysia-news/doe-reviewing-environmental-quality-act-1974-for-phase-ii-amendments-dg-AB13561643?utm_source=chatgpt.com

Bennett, S. (2025, July 28). Australia-Pacific - SERI. SERI - Sustainable Electronics Recycling International. https://sustainableelectronics.org/australia-pacific/?utm_source=chatgpt.com

Bhat, D. V. (2023). E-waste recycling and Achieving SDGChallenges in Indian Context. IOP Conference Series: Earth and Environmental Science.

Bhutto, M. Y. (2021). Adoption of energy-efficient home appliances: Extending the theory of planned behaviour. Sustainability, 13(1). https://doi.org/10.3390/su130100xx

Bhardwaj, L. K., Rath, P., Jain, H., & Choudhury, M. (2025). Exploring the effects of e-waste on soil, water quality and human health. Deleted Journal, 2(1). https://doi.org/10.1007/s44290-025-00167-2

Bhutto, M. Y., Rūtelionė, A., Šeinauskienė, B., & Ertz, M. (2023). Exploring factors of e-waste recycling intention: The case of generation Y. PloS One, 18(10), e0287435. https://doi.org/10.1371/journal.pone.0287435

Bird, R., Baum, Z. J., Yu, X., & Ma, J. (2022). The regulatory environment for lithium-ion battery recycling. ACS Energy Letters, 7(2), 736–740. https://doi.org/10.1021/acsenergylett.1c02612.

Borthakur, A., & Govind, M. (2017). Emerging trends in consumers' E-waste disposal behaviour and awareness: A worldwide overview with special focus on India. Resources, Conservation and Recycling, 117, 102–113. https://doi.org/10.1016/j.resconrec.2016.10.011

Borthakur, A., & Govind, M. (2022). E-waste management and circular economy: Policy gaps and behavioural challenges in developing countries. Resources, Conservation and Recycling, 180, 106178. https://doi.org/10.1016/j.resconrec.2022.106178

Bosnjak, M., Ajzen, I., & Schmidt, P. (2020). The theory of planned behaviour: Selected recent advances and applications. Europe's Journal of Psychology, 16(3), 352–356. https://doi.org/10.5964/ejop.v16i3.2015.

Bosnjak, M., Ajzen, I., & Schmidt, P. (2020). The theory of planned behaviour: Selected recent advances and applications. Europe's journal of psychology, 16(3), 352.

Boubellouta, B., & Kusch-Brandt, S. (2020). Testing the environmental Kuznets curve hypothesis for e-waste in the EU28+2 countries. Journal of Cleaner Production, 277, 123371. https://doi.org/10.1016/j.jclepro.2020.123371.

Braglia, M., Di Paco, F., Gabbrielli, R., & Marrazzini, L. (2024). A new set of Lean indicators to assess Greenhouse Gas emissions related to industrial losses. International Journal of Productivity and Performance Management, 73(11), 243– 269. https://doi.org/10.1108/ijppm-05-2023-0271

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative Research in Psychology, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Calicioglu, O. (2022). Unlocking the global potential of waste biorefining: Scaling up or scaling down? In Handbook of Waste Biorefinery (pp. 981–989). Springer International Publishing. http://dx.doi.org/10.1007/978-3-031-06562-0_40

Chang, Y. S., Yue, Z., Qureshi, M., Rasheed, M. I., Wu, S., & Peng, M. Y. P. (2022, July 15). Residents' waste mobile recycling planned behaviour model: the role of environmental concern and risk perception. International Journal of Emerging Markets, 18(12), 6388–6406. https://doi.org/10.1108/ijoem-08-2021-1215

Chan, L., & Bishop, B. (2019). A moral basis for recycling: A systematic review and meta-analysis of moral norm predictors of recycling behaviour. Journal of Environmental Psychology, 64, 26–31. (Note: Still relevant; widely cited in 2022–2024 policy–behaviour research.)

Chen, S., Li, J., & Zhao, Y. (2024). Government policy support and public environmental behaviour: A structural equation modelling approach. Journal of Cleaner Production, 441, 141275. https://doi.org/10.1016/j.jclepro.2024.141275

Chaudhary, K., & Verma, P. (2018). Case study analysis of e-waste recycling systems in Germany, Switzerland, Japan and India: A radar chart approach. Benchmarking: An International Journal, 25(9).

Che Abdullah, C. N. A. A., Osman, A. A., & Herb, J. (2024). Campus sustainability: Explaining students' recycling behaviour using the TPB-moral norm framework. Journal of Governance and Integrity, 7(1), 712–722. https://doi.org/10.15282/jgi.7.1.2024.10357

Chen, H. (2022). The impact of ignorance and bias on information security protection motivation: A case of e-waste handling. Internet Research, 33(6).

Chen, X., Ding, Z., & Liu, Q. (2024). Infrastructure, policy support, and public willingness to participate in recycling programs: Evidence from urban Asia.

Journal of Environmental Management, 350, 119571. https://doi.org/10.1016/j.jenvman.2023.119571

Chen, M., Wen, Z., & Jiang, X. (2020). Public awareness and participation in e-waste recycling: A systematic review. Waste Management, 105, 56–68. https://doi.org/10.1016/j.wasman.2019.12.002

Chen, M., & Ogunseitan, O. A. (2021). Zero e-waste: Regulatory impediments and blockchain imperatives. Frontiers of Environmental Science & Engineering, 15(6). https://doi.org/10.1007/s11783-021-1435-7

Chen, C., & Zhang, Q. (2025). Sustainable recycling mechanisms for waste cooking oil in China's third-tier cities: Evidence from restaurant practices. Ecological Civilization, 3(1), 10021. https://doi.org/10.70322/ecolciviliz.2025.10021

Chin, Y. S., Pretto, L. D., Thuppil, V., & Ashfold, M. J. (2019). Public awareness and support for environmental protection—A focus on air pollution in Peninsular Malaysia. PLOS ONE. https://doi.org/10.1371/journal.pone.0212206

Chua, A. (29 November, 2022). Ewaste campaign nets almost 176 tonnes in four months. Retrieved from The Star: https://www.thestar.com.my/metro/metro-news/2022/11/29/ewaste-campaign-nets-almost-176-tonnes-in-four-months

Circularity, R. (2023). Samsung Malaysia. Retrieved from Samsung My: https://www.samsung.com/my/sustainability/environment/resource-efficiency/#:~:text=We%20take%20back%20and%20recycle,is%20collected%20regardless%20of%20brand.

Commission, E. (2024). European Commission. Retrieved from Circular Economic Action Plan: . https://environment.ec.

Convention, B. (2019). Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. Secretariat of the Basel Convention.

Cook, E. V. (2020). Physical processing, dismantling and hydrometallurgical treatment of e-waste: A systematic review of risks to occupational and public health. engrXiv (preprint). https://doi.org/10.31224/osf.io/xxxxx

Cram, W. A., & Brohman, M. K. (2021). When enough is enough: Investigating the antecedents and consequences of information security fatigue. Information Systems Journal.

Creswell, J. W., & Plano Clark, V. L. (2018). Designing and conducting mixed methods research (3rd ed.). Sage Publications.

Elgarahy, A. M., Eloffy, M. G., & Priya, A. K. (2024). Revitalizing the circular economy: An exploration of e-waste recycling approaches in a technological epoch. Science of The Total Environment, 100124. https://doi.org/10.1016/j.scenv.2024.100124

Dakduk, S., Santalla-Banderali, Z., & van der Woude, D. (2018, April). Acceptance of Blended Learning in Executive Education. SAGE Open, 8(3), 215824401880064. https://doi.org/10.1177/2158244018800647

Darby, L., & Obara, L. (2005). Household recycling behaviour and attitudes towards the disposal of small electrical and electronic equipment. Resources, Conservation and Recycling, 44(1), 17–35

David, A. (2020). Consumer purchasing process of organic food products: An empirical analysis. Journal of Management Systems – Quality.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly: Management Information Systems, 13(3), 319–340. https://doi.org/10.2307/249008

DCCEEW. (2024). Investing in Australia's waste and recycling infrastructure. https://www.dcceew.gov.au

De Waal, I. M. (2023). The legal transition towards a more circular electrical and electronic equipment chain—A case study of the Netherlands. Sustainability, 15(2). https://doi.org/10.3390/su15021587

Department of Environment Malaysia. (2025). What is e-waste? Retrieved December 28, 2025, from https://ewaste.doe.gov.my/index.php/what-is-e-waste/

Department of Statistics Malaysia. (2025). Current population estimates, Malaysia, 2024–2025.https://www.dosm.gov.my/portal-main/release-document-log?release_document_id=15649

Delcea, C., Crăciun, L., Ioanaș, C., Ferruzzi, G., & Cotfas, L.-A. (2020). Determinants of individuals' e-waste recycling decision: A case study from Romania. Sustainability, 12(7). https://doi.org/10.3390/su12072829

Deniz, D. (2021). Product-based and knowledge-based sustainable living practices: The case of IKEA. Retrieved from Sustinere Journal of Environment & Sustainability: https://doi.org/10.22515/sustinere.jes.v5i2.173

Deng, Y., Wu, W., Zhang, X., Li, S., Song, X., & Wang, J. (2024). Overview of China's waste electrical and electronic equipment recycling in the last two decades. Sustainability, 16(23), 10683. https://doi.org/10.3390/su162310683

Department of Environment [DOE]. (2024). E-Waste Management System. Retrieved from https://ewaste.doe.gov.my

Dhir, A., Koshta, N., Goyal, R. K., Sakashita, M., & Almotairi, M. (2021). Behavioural 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

Dinggai, M. S., Mapa, M. T., & George, F. (2020). Persepsi masyarakat tempatan terhadap pengurusan e-sisa oleh syarikat swasta di bandaraya Kota Kinabalu, Sabah. Malaysian Journal of Social Sciences and Humanities, 5(10), 217–227.

Dias, P. R., Cenci, M. P., Bernardes, A. M., & Huda, N. (2022). What drives WEEE recycling? A comparative study concerning legislation, collection, and recycling. Waste Management & Research, 40(10), 1527–1538. https://doi.org/10.1177/0734242X221110123

DOE. (20 January, 2023). E-waste recycling in Malaysia. Retrieved from Department of Environment: https://ewaste.doe.gov.my/index.php/infographic/

Department of Environment Malaysia. (2024). Environmental quality report 2024. Ministry of Natural Resources and Environmental Sustainability, Malaysia.

Dong, Z. C. (2022). Computer vision to recognize construction waste compositions: a novel boundary-aware transformer (BAT) mode. J. Environ. Manag. 305.

Donnerberg. (2024). E-waste recycling in Germany. Retrieved from Donnerberg: https://www.donnerberg.net/en/blogs/all-posts/e-waste-management-in-germany-all-you-need-to-know

Dutta, P. (2021). Fostering reverse logistics in India by prominent barrier identification and strategy implementation to promote circular economy. Journal of Cleaner Production.

European Week for Waste Reduction. (2025, October 2). 2025: WEEE - EWWR. EWWR. https://ewwr.eu/thematic_focus/2025-weee/?utm_source=chatgpt.com

European Environment Agency. (2023). Germany – Waste Prevention Country Fact Sheet 2023. European Environment Agency. https://www.eea.europa.eu/themes/waste/waste-prevention/countries/2023-waste-prevention-country-fact-sheets/germany_waste_prevention_2023

E-Waste Campaign: Recycle Your Electronic Devices with Maxis Malaysia. (n.d.). Maxis. https://www.maxis.com.my/en/about-maxis/ewaste/

Eco-point incentive program in Japan. (n.d.). *https://www.inno4sd.net/eco-point-incentive-program-in-japan-479*

Echegaray, F., & Hansstein, F. V. (2017). Assessing the intention–behaviour gap in electronic waste recycling behaviour. Resources, Conservation and Recycling. Journal of Cleaner Production.

Economic Planning Unit. (2021). Twelfth Malaysia Plan 2021–2025. Prime Minister's Department, Malaysia.

Electronics, L. (2023). LG Take Back Program E-waste Recycling. Retrieved from LG: https://www.lg.com/in/recycling#:~:text=LG%20will%20arrange%20the%20pickup,of%20customer%20at%20its%20premises.

Elektroonikaromu, E. (7 June, 2023). Eesti Elektroonikaromu: Leading the Way in Electronic Waste Management in Estonia. Retrieved from Eesti Elektroonikaromu: https://elektroonikaromu.ee/en/electronic-waste-management-in-estonia/

Elgarahy, A. M., Eloffy, M. G., & Priya, A. K. (2024). Revitalizing the circular economy: An exploration of e-waste recycling approaches in a technological epoch. Science of The Total Environment, 100124. https://doi.org/10.1016/j.scenv.2024.100124

Encyclopedia. (2023). | Encyclopedia.com. Retrieved from Encyclopedia: https://www.encyclopedia.com/computing/dictionaries-thesauruses-pictures-and-press-releases/available-time#:~:text=Available%20time%20is%20comprised%20of,is%20performing%20no%20useful%20function.

Environment, D. o. (2023). E-waste recycling In Malaysia. Retrieved from Department of Environment: https://ewaste.doe.gov.my/index.php/infographic/

Environment, D. o. (2024). What is e-waste? Retrieved from Department of Environment: https://ewaste.doe.gov.my/index.php/what-is-e-waste/#:~:text=Component%20in%20E%2Dwaste%20contain,disposed%20in%20environmentally%20sound%20manner.

Environmental Quality Order 2025 enforcement begins today. (2025, July 9). https://www.nadma.gov.my/bi/media-en/news/4749-environmental-quality-order-2025-enforcement-begins-today?utm_source=chatgpt.com

Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of convenience sampling and purposive sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1–4. https://doi.org/10.11648/j.ajtas.20160501.11

European Union. (2012/19/EU). Waste Electrical and Electronic Equipment (WEEE) Directive. EU Directive 2012/19/EU. (Discussed in secondary sources; see Waste Electrical and Electronic Equipment Directive).

Eva. (2024). Free disposal of electrical and electronic waste. Retrieved from Help and advice for consumers in Europe: https://www.eccnederland.nl/en/news/free-disposal-of-electrical-and-electronic-waste

E-waste to landfill ban in WA. (2025, May 20). Western Australian Government. https://www.wa.gov.au/service/building-utilities-and-essential-services/waste-management/e-waste-landfill-ban-wa?utm_source=chatgpt.com

Ezanee M. Elias, Zakirah Othman, Norlila M., Mohd Nasrun M. N., Santhirasegaran S.R. Nadarajan (2025). Program kitar semula: Persepsi masyarakat terhadap ReDMac. Sains Humanika (UTM). https://doi.org/10.11113/sh.v8n4-2.1051

Faradillah, P., Sultan, A. a. M., Samat, K. F., & Kamarulzaman, T. (2025). Strengthening e-waste governance: A decision framework for sustainable transboundary movements under the Swiss-Ghana Amendments. Chinese Journal of Population Resources and Environment, 23(3), 310–323. https://doi.org/10.1016/j.cjpre.2025.07.003

Faradillah, P., Sultan, A. A. M., Samat, K. F., et al. (2025). Assessing the readiness of Malaysia's recycling industry for sustainable transboundary e-waste management. Discover Environment, 3, 188. https://doi.org/10.1007/s44274-025-00395-4

Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV). (2023). National Waste Prevention Programme of the Federal Government and the Länder: Update 2021–2027. BMUV. https://www.bmuv.de/en/topics/waste-resources/waste-management/national-waste-prevention-programme

Fishbein, M. a. (1975). Belief, Attitude, Intention and Behaviour: an Introduction to Theory and Research . Addison-Wesley, Reading.

Fincham, J. E. (2008). Response rates and responsiveness for surveys, standards, and the Journal. American Journal of Pharmaceutical Education, 72(2), 43. https://doi.org/10.5688/aj720243

Forti, V., Balde, C. P., Kuehr, R., & Bel, G. (2020). The Global E-waste Monitor 2020: Quantities, flows, and the circular economy potential. United Nations University (UNU)/UNITAR SCYCLE Programme.

Forti, V., Baldé, C.P., Kuehr, R., & Bel, G. (2024). The Global E-Waste Monitor 2024. United Nations University (UNU), International Telecommunication Union (ITU), and International Solid Waste Association (ISWA). Retrieved from https:// ewastemonitor.info/the-global-e-waste-monitor-2024.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39–50.

Forum, W. (2023). EES-RINGLUS. Retrieved from WEEE Forum: https://weee-forum.org/international-waste-country/ee/

Forti, V., Baldé, C. P., Kuehr, R., & Bel, G. (2024). The Global E-waste Monitor 2024: Electronic waste management and circular economy. United Nations University, International Telecommunication Union, & International Solid Waste Association. https://ewastemonitor.info/

Fujitsu. (2024). Recycling of Electronic Waste. Retrieved from Fujitsu: https://www.fujitsu.com/us/about/local/corporate/subsidiaries/fai/environment/recycling/

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. The Qualitative Report, 20(9), 1408–1416. https://doi.org/10.46743/2160-3715/2015.2281

Fusch, P. I., & Ness, L. R. (2015). Are we there yet? Data saturation in qualitative research. The Qualitative Report, 20(9), 1408–1416. https://doi.org/10.46743/2160-3715/2015.2281

Gaur, T. S., Yadav, V., Mittal, S., & Sharma, M. K. (2023). A systematic review on sustainable E-waste recycling : challenges, circular economy practices, and a conceptual framework.

Management of Environmental Quality: An International Journal, 35(4), 858–884. https://doi.org/10.1108/meq-05-2023-0139

Gaur, T. S. (2023). A systematic review on sustainable E-waste recycling : challenges, circular economy practices, and a conceptual framework. Sustainable E-waste recycling.

Gaur, T. S., Yadav, V., Prakash, S., & Panwar, A. (2025). Integration of industry 4.0 and circular economy for sustainable E-waste management. Management of Environmental Quality an International Journal, 36(5), 1304–1325. https://doi.org/10.1108/meq-07-2024-0277

Gangwar, C. C. (2019). Assessment of air pollution caused by illegal e-waste burning to evaluate human health risk. Environment International, 125, 191–199. https://doi.org/10.1016/j.envint.2019.01.017

Gaskell, G. (2000). Individual and Group Interview.

Geissdoerfer, M., Pieroni, M. P. P., Pigosso, D. C. A., & Soufani, K. (2022). Circular economy and sustainability: A review of relationships and impacts. Journal of Cleaner Production, 338, 130399. https://doi.org/10.1016/j.jclepro.2022.130399

Geyer, R., Jambeck, J. R., & Law, K. L. (2017). Production, use, and fate of all plastics ever made. Science Advances, 3(7), e1700782. https://doi.org/10.1126/sciadv.1700782

Gigerenzer, G., & Todd, P. M. (1999). Simple Heuristics That Make Us Smart. Oxford University Press.

Goh, D. Z., & Sukri, S. (2025). Advancing Sustainability: Raising awareness for E-Waste management in Penang. Journal of Advanced Research in Technology and Innovation Management, 14(1), 30–39. https://doi.org/10.37934/jartim.14.1.3039

Goh, D. Z., & Sukri, S. (2025). Fostering sustainability: Enhancing electronic waste management awareness in Penang. International Journal of Business and Technopreneurship, 15(2), 155–174. https://doi.org/10.58915/ijbt.v15i2.1424

Government of China. (2024, February 9). China issues guidelines to establish a waste recycling system. https://english.www.gov.cn/policies/latestreleases/202402/09/content_WS65c5ea15c6d0868f4e8e3e8a.html

Goals, S. D. (2024). Goal 12: Ensure sustainable consumption and production patterns. Retrieved from SDG: https://www.un.org/sustainabledevelopment/sustainable-consumption-production/#:~:text=Goal%2012%3A%20Ensure%20sustainable%20consumption%20and%20production%20patterns&text=Goal%2012%20is%20about%20ensuring,populations%20are%20continuing%20to%20grow.

Global E-waste Statistics Partnership. (2025). WEEE collection rates in EU+4. United Nations University/UNITAR.

Global PCCS. (2024). South Korea now applies RoHS and EPR to all electrical and electronic equipment (draft revision of the Resource Circulation Act). Retrieved from https://globalpccs.com/2024/11/28/south-korea-now-applies-rohs-and-epr-to-all-eee/

Governance and Assurance - Cenviro. (2024, May 10). Cenviro. https://www.cenviro.com/governance-assurance/

Government, A. (2024). Regulation for small electrical products and solar photovoltaic systems. Retrieved from Australian Government: https://consult.dcceew.gov.au/regulation-small-electrical-products-solar-pv

Gollakota, A.R.K., Gautam, S. and Shu, C.M. (2020). 'Inconsistencies of e-waste management in developing nations – Facts and plausible solutions', Journal of Environmental Management, 261(February), p. 110234. Available at: https://doi.org/10.1016/j.jenvman.2020.110234.

Gultom, S. D. (2020). The Influence Of Attitude and Subjective Norm On Citizen's Intention to Use E-Government Services. Journal of Security and Sustainability Issues, 9(M).

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. Field Methods, 18(1), 59–82. https://doi.org/10.1177/1525822X05279903

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? Field Methods, 18(1), 59–82. https://doi.org/10.1177/1525822X05279903

Gupta, K., & Ogden, D. (2023). Structural barriers and recycling behaviour in developing countries: A systematic review. Waste Management, 157, 86–98. https://doi.org/10.1016/j.wasman.2022.12.007

Hasbullah, N. N., Muthusamy, G., Naszariah Nasni Naseri, R., & Yahya, W. K. (2025). Enhancing user engagement with ergonomic e-waste recycling bins in retail environments. International Journal of Art and Design, 9(2/SI-3). https://doi.org/10.24191/ijad.v9i2/SI-3.8836

Hamzah, T. A. A. T., Yahya, A. S. M., & Shafie, A. (2020). Knowledge, attitude, and practices on e-waste recycling among the public in Port Dickson. Pertanika Journal of Social Sciences and Humanities, 28(4), 2731–2748.

Hassan, E. I., & Shirazi, N. S. (2021). Electronic and electrical waste management: Malaysia and Sweden experiences. In Islamic finance and circular economy: Connecting impact and value creation (pp. 321–335).

Hashim, R., Zahari, F. M., Salleh, N. A., & Ibrahim, J. A. (2025). Barriers and Best Practices in E-Waste Management: Lessons from Selected Malaysian Public Universities. International Journal of Academic Research in Business and Social Sciences, 15(9). https://doi.org/10.6007/ijarbss/v15-i9/26639

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate Data Analysis (8th ed.). Cengage Learning.

Hanifah Mahat, M. H. (2019). E-waste disposal awareness among the Malaysian community. Knowledge Management & E-Learning: An International Journal (KM&EL).

Hagelüken, C., & Goldmann, D. (2022). Recycling and circular economy—towards a closed loop for metals in emerging clean technologies. Mineral Economics, 35(3–4), 539–562. https://doi.org/10.1007/s13563-022-00319-1

Hafizah Abd-Mutalib, C. Z.-A. (2021). Firm and Board Characteristics, and E-Waste Disclosure:A Study in the Era of Digitalisation. Sustainability.

Harris, K. M. A. (2022). Prinsip-prinsip umum falsafah dan etika alam sekitar menurut perspektif Islam. Tafhim: IKIM Journal of Islam and the Contemporary World, 15(1).

Hassan, R., Ibrahim, N., & Yusoff, S. (2024). Factors influencing public participation in electronic waste recycling programmes in Malaysia. Journal of Environmental Management and Sustainability, 12(2), 45–60.

Heidbreder, L. M., Bablok, I., Drews, S., & Tuma, A. (2022). Policy interventions and citizen behaviour: A review of environmental regulation effects on daily action. Sustainable Cities and Society, 78, 103626. https://doi.org/10.1016/j.scs.2022.103626

Hertzog, M. A. (2008). Considerations in determining sample size for pilot studies. Research in Nursing & Health, 31(2), 180–191. https://doi.org/10.1002/nur.20247

Hussin, N. E. H., Ali, N. E. H., & Khalil, N. (2023). E-waste management systems in Shah Alam city: Household awareness and behaviour. International Journal of Academic Research in Business and Social Sciences, 13(4).

H., S. S. (1977). Normative influences on altruism. In Advances in experimental social psychology. Academic Press.

Hebahan Program Pengumpulan E-Waste – ENVIRO-MUSEUM. (n.d.). https://enviro2.doe.gov.my/emuseum/Kursuscollection/hebahan-program-pengumpulan-e-waste

Herrera, A., Lara, P., Sánchez, M., & Villalobos, J. (2020). Metamodeling the e-waste domain to support decision-making. The International Journal of Logistics Management, 32(1), 262–283. https://doi.org/10.1108/ijlm-01-2020-0070

Health, D. o. (2024). Health Effects: Why is asbestos dangerous? Retrieved from Department of Health: https://www.health.state.mn.us/communities/environment/asbestos/homeowner/heffects.html#:~:text=If%20you%20breathe%20asbestos%20fibers,digestive%20system%2C%20including%20colon%20cancer.

Himanshu Sharma, H. K. (2023). Enablers to computer vision technology for sustainable E-waste recycling . Journal of Cleaner Production.

Hidayatullah, E. A., & Arif, S. (2020). Syed Muhammad Naquib al-Attas's exposition on the concept of ethics. Afkar: Journal of Islamic Thought, 21(2), 45–60. https://ejournal.um.edu.my/index.php/afkar/article/download/37689/14768/91853

Ho, J. K.-M. (2022). Green meets food delivery services: consumers' intention to reuse food delivery containers in the post-pandemic era. Food delivery services.

Hoang, A. T.-I. (2022). A review on management practices, environmental impacts and human exposure risks related to electrical and electronic waste in Vietnam: findings from case studies in informal e-waste recycling areas. Environmental Geochemistry and Health, Vol. 45 No. 6.

Hotta Y, S. A. (2024). EPR-Based electronic home appliance recycling system under home appliance recycling act of Japan. Retrieved from OECD: https://www.oecd.org/environment/waste/EPR_Japan_HomeAppliance.pdf

Hossain, I., Rahman, M. S., Abbas, M. G., Sattar, S., & Nazneen, A. (2025). Community engagement and readiness for e-waste initiatives: Attitudes, barriers and opportunities. Medicine Today, 37(1), 102–107. https://doi.org/10.3329/medtoday.v37i1.79329

Htet, N. N., & Sahrir, S. (2025). Determinants of e-waste recycling behaviour among residents in Klang Valley, Malaysia. International Journal of Research and

Innovation in Social Science (IJRISS), 9(01), 6–17. https://doi.org/10.47772/IJRISS.2025.901900002

Hua, L. W. (2019). Antecedents of consumers' intention to purchase energy efficient appliances: An empirical study based on the technology acceptance model and theory of planned behaviour. Sustainability, 11(10). https://doi.org/10.3390/su11103740

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55. https://doi.org/10.1080/10705519909540118

Humayun, S. H. (2025). A review on reactive oxygen species-induced mechanism pathways of pharmaceutical waste degradation: Acetaminophen as a drug waste model. Journal of Environmental Sciences, .

Huikku, J., Harris, E., Elmassri, M., & Northcott, D. (2024). Agents' context-specific conduct in making strategic investment decisions. Journal of Accounting & Organizational Change, 20(6), 27–55. https://doi.org/10.1108/jaoc-04-2023-0075

International Telecommunication Union & United Nations Institute for Training and Research. (2024, March 20). The Global E-waste Monitor 2024: Electronic waste rising five times faster than documented e-waste recycling [Report]. UNITAR & ITU. Retrieved from https://ewastemonitor.info

InvestKL. (2025). ERTH: A case study on the e-waste recycling revolution in Greater KL. InvestKL. https://www.investkl.gov.my/insights/spotlight-greater-kl/erth-a-case-study-on-the-e-waste-recycling-revolution-in-greater-kl

Ismail, H., & Hanafiah, M. M. (2020). A review of sustainable e-waste generation and management: Present and future perspectives. Journal of Environmental Management, 264, 110495. https://doi.org/10.1016/j.jenvman.2020.110495

Isaac, S., & Michael, W. B. (1995). Handbook in Research and Evaluation: For Education and the Behavioural Sciences (3rd ed.). San Diego, CA: Educational and Industrial Testing Services.

Ismail, R., Abdullah, S. S., & Hasan, M. (2023). Public participation and institutional support in Malaysian recycling initiatives. Environmental Science and Pollution Research, 30, 10276–10289. https://doi.org/10.1007/s11356-022-22514-7

Islam, M. H., Islam, M. T., Hoque, M. R., Haque, S. Z., Barua, B., Islam, M. M. O., & Hossain, M. F. (2025). Understanding young consumers' e-waste recycling behaviour in Bangladesh: A developing country perspective. Recycling, 10(1), 24. https://doi.org/10.3390/recycling10010024

IIankoon, D. S. (16 March, 2023). New Straits Times. Retrieved from Where does your public e-waste end up?: https://www.nst.com.my/opinion/columnists/2023/03/889610/where-does-your-public-e-waste-end#:~:text=Environment%20Department%20statistics%20showed%20there,especially%20with%20regard%20to%20public.

Ilgemann, P., Fishman, T., Oudshoorn, R., & Tukker, A. (2025). Improving WEEE monitoring: Insights from The Netherlands. Resources, Conservation and Recycling, 222, Article 108486. https://doi.org/10.1016/j.resconrec.2025.108486

Ingrassia, M., Bacarella, S., Bellia, C., Columba, P., Adamo, M. M., Altamore, L., & Chironi, S. (2023). Circular economy and agritourism: a sustainable behavioural model for tourists and farmers in the post-COVID era. Frontiers in Sustainable Food Systems, 7. https://doi.org/10.3389/fsufs.2023.1174623

Imnatila Pongen, P. R. (2023). Evaluating the barriers to e-waste closed-loop supply chain adoption. Barriers to E-waste CLSC.

Intan Nadia Ghulam Khan, M. A. (2023). Sustainable Public Electronic Waste (E-Waste) Management In Malaysia From A Legal Perspective. The 4th International Conference of the Postgraduate Students and Academics in Syariah and Law 2023 (INPAC 2023).

International Journal of Productivity and Performance Management, 73(11), 243–269. https://doi.org/10.1108/ijppm-05-2023-0271

Irawan, R. L. (2020). The Effects of Subjective Norm on the Intention to Use of the Online Shopping Customers in Bandung. Jurnal Manajemen Dan Bisnis, 4(3).

Islam, M. S. (2024). Investigating waste recycling intentions of top management in Bangladesh's leather industry: A hybrid analytical framework . Cleaner Waste Systems.

Islam, M. T.-R. (2023). Life cycle assessment of e-waste recycling system in Australia: Case of waste printed circuit board (PCB). Journal of Cleaner Production.

Ismail, H., & Hanafiah, M. M. (2021). Evaluation of e-waste management systems in Malaysia using life cycle assessment and material flow analysis. Journal of Cleaner Production, 308, 127358. https://doi.org/10.1016/j.jclepro.2021.127358

Ismail, N. N., Azizan, N., & Mohamed, A. S. I. (2025). The planning process of "Re: Think" waste mobile application. Malaysian Journal of Science Health & Technology.

Islam, M. H., Islam, M. T., Hoque, M. R., Haque, S. Z., Barua, B., Islam, M. M. O., & Hossain, M. F. (2025). Understanding young consumers' e waste recycling behaviour in Bangladesh: A developing country perspective. Recycling, 10(1), 24. https://doi.org/10.3390/recycling10010024

Ivankova, N. V., Creswell, J. W., & Stick, S. L. (2006). Using mixed-methods sequential explanatory design: From theory to practice. Field Methods, 18(1), 3–20. https://doi.org/10.1177/1525822X05282260

J., D. (2018). Analysis of public willingness to participate in environmental public decision-making based on planned behaviour theory (Chinese). Contemporary Economic Management.

JASANZ. (2025). JASANZ. https://www.jasanz.org/stories

Jayaraman, K., Vejayon, S., Raman, S., & Mostafiz, I. (2019). The proposed e-waste management model from the conviction of individual laptop disposal practices: An empirical study in Malaysia. Journal of Cleaner Production, 208, 688–696. https://doi.org/10.1016/j.jclepro.2018.10.011

Jaeger, L., & Eckhardt, A. (2021). Eyes wide open: The role of situational information security awareness for security-related behaviour. Information Systems Journal, 31(3).

Jain, M. K. (2023). Review on e-waste recycling and its impact on the environment and society. Waste Management Bulletin, 1(3), 34–44.

Johari, R., & Isa, M. H. (2023). Household e-waste management challenges in Malaysia: Behavioural and infrastructural perspectives. Waste Management & Research, 41(5), 624–635. https://doi.org/10.1177/0734242X221147548

Kaine, G., & Wright, V. (2024). Social desirability bias and the prevalence of self-reported conservation behaviour among farmers. Sustainability, 16(22), 9658. https://doi.org/10.3390/su16229658

Kamaruddin, S. M., Wahid, N. A., & Pariatamby, A. (2022). Factors influencing e-waste recycling intention among Malaysian households. Sustainable Production and Consumption, 30, 230–242. https://doi.org/10.1016/j.spc.2022.01.019

Kang Liu, Q. T. (2023). A global perspective on e-waste recycling. Circular Economy.

Kankanamge, A. K. S. U., Erdiaw-Kwasie, M. O., & Abunyewah, M. (2025). Understanding circular economy transition tensions: Exploring e-waste business owners-manager's perspectives from Sri Lanka. Acta Psychologica, 259, 105376. https://doi.org/10.1016/j.actpsy.2025.105376

Karishma Chaudhary, P. V. (2018). Case study analysis of e-waste recycling systems in Germany, Switzerland, Japan and India. RADAR chart Approach.

KDEB Waste Management. (2024). Drive-through recycling centre launched in Sepang. KDEB Waste Management. https://www.kdebwm.com/media-room/articles/drive-through-recycling-centre-launched-in-sepang

Kementerian Pembangunan Kerajaan Tempatan. (2023). Kenyataan media: 5 strategi utama capai sasaran kitar semula kebangsaan menjelang 2025. Retrieved from government document.

Kline, R. B. (2016). Principles and Practice of Structural Equation Modeling (4th ed.). The Guilford Press.

Khalid Mehmood Shad, S. T. (2020). Sustainable E-waste Recycling in Malaysia: Lessons From Selected Countries. IIUM LAW JOURNAL .

Khan, F. A. (2019). Understanding consumers' behaviour intentions towards dealing with the plastic waste: Perspective of a developing country. Resources, Conservation and Recycling, 49-58.

Khoshand A, R. K. (2019). Fuzzy AHP approach for prioritizing electronic waste management options: a case study of Tehran, Iran. Environ Sci Pollut Res.

Kianpour, K. J. (2017). Factors influencing consumers' intention to return the end of life electronic products through reverse supply chain management for reuse, repair and recycling. Sustainability.

Korea Environment Corporation. (2024). Extended producer responsibility and waste electrical and electronic equipment recycling system in Korea. https://www.keco.or.kr/en/core/business/waste/epr.do

Kosarkar, M., & Barthwal, S. (2025). Environmentally conscious but helpless: Consumer challenges for participation in Formal e-waste collection initiatives

of India. Cleaner Waste Systems, 12, 100363. https://doi.org/10.1016/j.clwas.2025.100363

Koshta, N. P. (2022). Sharing economic responsibility:Assessing end user's willingness to support E-waste reverse logistics for circular economy. Journal of Cleaner Production.

Kyriakopoulos, G. L. (2021). Environmental legislation in European and international contexts: Legal practices and social planning toward the circular economy. Laws, 10(1), 3. https://doi.org/10.3390/laws10010003

Kumar, A., & Shah, P. (2025). Understanding the attitude–behaviour gap in sustainable waste management practices. International Journal of Environmental Research, 18(1), 88–102.

Kuehr, R. (2021). The impact of the COVID-19 pandemic on e-waste in the first three quarters of 2020. United Nations University (UNU)/UNITAR SCYCLE Programme Report. https://ewastemonitor.info

Kutty, I. R. I., Nor Azlan, N. A. S., & Mohd Shafie, S. A. (2024). Examining Household Intentions for E-Waste Recycling using Logistic Regression: A Case Study in Ipoh. Journal of Mathematics and Computing Science, 10(1), 33–40. https://doi.org/10.24191/jmcs.v10i1.7347

Kumar, A. (2019). Exploring young adults' e-waste recycling behaviour using an extended theory of planned behaviour model: a cross-cultural study. Resources, Conservation and Recycling.

Kumar, R., Gupta, P., Singh, S., 2024. Factors influencing behaviour in recycling of ewaste using technology in India. Cogent Environ. Sci. 10 (1), 2295605. https://doi. org/10.1080/23311975.2023.2295605.

Kumar, A., Holuszko, M., & Romano Espinosa, D. C. (2024). Formalisation of the informal e-waste sector: Environmental, social and economic implications in developing economies. Resources, Conservation and Recycling, 197, 107102. https://doi.org/10.1016/j.resconrec.2023.107102Kursyiyah, E. (2021). Bernama. Retrieved from Recycle Electronic Devices to Avoid Health and Environmental Effect: https://bernama.com/bm/rencana/news.php?id=1954599

Kutty, I. R. I., Nor Azlan, N. A. S., & Mohd Shafie, S. A. (2024). Examining household intentions for e-waste recycling using logistic regression: A case study in Ipoh. Journal of Mathematics and Computing Science, 10(1). https://doi.org/10.24191/jmcs.v10i1.7347

Latimer, C. (2023, March 16). Powering plastics recycling in Southeast Asia - Energy Factor. Energy Factor. https://energyfactor.exxonmobil.asia/advanced-recycling/plastics-recycling-southeast-asia/

Laeequddin, M. (2022). Factors that influence the safe disposal behaviour of e-waste by electronics consumers. Sustainability, 14(9), 4981. https://doi.org/10.3390/su14094981

Lakens, D. (2025). Sample size justification in qualitative research: Data saturation and information value. Retrieved from https://lakens.github.io/statistical_inferences/08-samplesizejustification.html

Lange, F. (2023). Behavioural paradigms for studying pro-environmental behaviour: a systematic review. Behaviour Research Methods.

Le, M. H. (2022). Integrating the theory of planned behaviour and the norm activation model to investigate organic food purchase intention: Evidence from Vietnam. Sustainability, 14(2). https://doi.org/10.3390/su14020987

Lee, J. H., & Chen, W. (2025). Government support and public engagement in e-waste recycling initiatives: Evidence from developing Asian countries. Sustainable Development Review, 30(1), 112–128.

LG. (2023). Take-back Reycling Network. Retrieved from LG: https://www.lg.com/global/take-back-recycling-global-network-korea

Lidwin K. M., S. S. (2023). Factors influencing the behaviour in recycling of e-waste using integrated TPB and NAM model. Cogent Business and Management.

Li, H., Zhang, B., & Wu, S. (2023). Policy-driven environmental behaviour: How national regulations shape citizens' recycling intentions. Journal of Environmental Management, 330, 117182. https://doi.org/10.1016/j.jenvman.2023.117182

Lim, W. C. (2023). "Environmental social governance (ESG) and total quality management (TQM): a multi-study meta-systematic review. Total Quality Management & Business Excellence.

Lim, N. M. L., Ali, R., & Jailani, M. A. (2025). A study on the role of the KITARecycle app in enhancing waste separation and 3R practice in higher educational institutions in Malaysia. Progress in Engineering Application and Technology, 6(1), 81–89.

Liñán, F., & Pérez-Macías, N. (2023). Critical evaluation of TPB in entrepreneurial contexts: Weak predictive power when structural variables are included. Journal of Visionary Philosophers, 3(1), 1–17.

Liu, J. B. (2019). Why are obsolete mobile phones difficult to recycle in China? Journal of Material Cycles and Waste Management, Vol. 17 No. 1, 1-12.

Liu, S. L. (2024). College students' knowledge, attitudes, and practices of garbage sorting and their associations: a cross-sectional study of several universities in Beijing, China. Front Public Health.

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 Behaviour in New York State: an integrated model. Environmental Management, 70(6), 1023–1037. https://doi.org/10.1007/s00267-022-01708-6

Mail, M. (2025, February 28). Bukit Aman cracks down on illegal e-waste sites, RM2.86b assets seized, 246 arrested. Malay Mail. https://www.malaymail.com/news/malaysia/2025/02/28/bukit-aman-cracks-down-on-illegal-e-waste-sites-rm286b-assets-seized-246-arrested/168283?utm_source=chatgpt.com

Mail, M. (2024, June 26). Nik Nazmi: Heavier penalties await illegal e-waste importers, with a maximum fine of up to RM10m on offenders. Malay Mail. https://www.malaymail.com/news/malaysia/2024/06/26/nik-nazmi-heavier-penalties-await-illegal-e-waste-importers-with-a-maximum-fine-of-up-to-rm10m-on-offenders/141627?utm_source=chatgpt.com

Maulana, H., Nur, H., Erik, E., Firdaus, F., & Damanik, N. (2024). Pro-environmental choices in Indonesia's campus life: examining the extended theory of planned behaviour (TPB) for sustainable behaviour in a university setting. International Journal of Sustainability in Higher Education.

Ma, L. a. (2019). Understanding the barriers to the use of MOOCs in a developing country: an innovation resistance perspective. Journal of Educational Computing Research Vol. 57 No. 3, pp. , 571-590.

Malay Mail. (2025, February 22). Johor bars investments involving e-waste imports. Retrieved from https://www.malaymail.com

Malay Mail. (2025, February 7). The growing e-waste crisis in Malaysia: What you need to know and how to act. Malay Mail.

https://www.malaymail.com/news/malaysia/2025/02/07/the-growing-e-waste-crisis-in-malaysia-what-you-need-to-know-and-how-to-act/164970

Macklin, J., Smith, L., & Curtis, J. (2025). Quality appraisal of household recycling influences research found evidence was mostly insufficient for drawing conclusions. Waste Management, 194, 318–341. https://doi.org/10.1016/j.wasman.2024.12.004

Malaysia drafts legal framework for E-Waste management - BusinessToday. (2025, October 16). BusinessToday. https://www.businesstoday.com.my/2025/10/16/malaysia-drafts-legal-framework-for-e-waste-management/

Manoharan, K., Dissanayake, P., Pathirana, C., Deegahawature, D., & Silva, R. (2024). A structured investigation on the site supervisory traits in applying science and technology related fundamental concepts in construction operations. Urbanization, Sustainability and Society, 1(1), 39–62. https://doi.org/10.1108/uss-01-2024-0001

Marshall, B., Cardon, P., Poddar, A., & Fontenot, R. (2013). Does sample size matter in qualitative research? A review of qualitative interviews in IS research. Journal of Computer Information Systems, 54(1), 11–22.

Market Research Future. (2025, December 13). Japan Electronic Waste Recycling Market Share Report | Forecast 2035. https://www.marketresearchfuture.com/reports/japan-electronic-waste-recycling-market-44070?utm_source=chatgpt.com

Masahisa, T. (2024). Japan, ASEAN partner to recover critical metals from e-waste. Retrieved from NIKKEI ASIA: https://asia.nikkei.com/Spotlight/Environment/Japan-ASEAN-partner-to-recover-critical-metals-from-e-waste

Masud, M. M. (2021). Survey and analysis of consumers' behaviour for electronic waste management in Bangladesh. Journal of Environmental Management, 282, 111943. https://doi.org/10.1016/j.jenvman.2021.111943

MBIP. (January, 2024). Drive-to-save. Retrieved from chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.mbip.gov.my/sites/default/files/binder2.pdf

Maxis. (2024, June 11). Maxis expands e-waste recycling campaign to include free postal drop-off service. Maxis. https://www.maxis.com.my/en/about-

maxis/newsroom/2024/june/maxis-expands-e-waste-recycling-campaign-to-include-free-postal-drop-off-service/

Ministry of Environment (Republic of Korea). (2023). Resource circulation policy and waste electrical and electronic equipment management. https://eng.me.go.kr/eng/web/main.do

Mohamad, N. S., Thoo, A. C., & Huam, H. T. (2022). The determinants of consumers' e-waste recycling behaviour through the lens of extended Theory of Planned Behaviour. Sustainability, 14(15), 9031. https://doi.org/10.3390/su14159031

Mohamad, M., Omar, A. J., & Mohamad, A. (2021). Awareness of e-waste among youth in Malaysia. In Proceedings of Malaysian Technical Universities Conference on Engineering and Technology (MUCET).

Mohd Noor, N. H., Soleman, N. A. F., & Khairul Azuan, A. S. (2025). To recycle or not to recycle? Factors affecting Malaysian residents' intention for recycling e waste. Malaysian Journal of Social Sciences and Humanities, 8(2). https://doi.org/10.47405/mjssh.v8i2.2102

Molony, B. (2020). Bathing and purity: Cleanliness and nationalism in modern Japan. Nippon.com. https://www.nippon.com/en/japan-topics/g02522

Michael, L. K. (2024). Factors influencing the behaviour in recycling of e-waste using an integrated TPB and NAM model. Cogent Business & Management, 11(1). https://doi.org/10.1080/23311975.2024.xxxxxx

Miller, J. (2023). 8 Top Sustainable Furniture Brands for an Eco-Friendly Home. Retrieved from The Round Up: https://theroundup.org/eco-friendly-furniture-brands/

Mrozik, W., Rajaeifar, M. A., Heidrich, O., & Christensen, P. (2021). Environmental impacts, pollution sources and pathways of spent lithium-ion batteries. Energy & Environmental Science, 14(12), 6099–6121. https://doi.org/10.1039/d1ee00691f

Zuhdi, M. A. M. M., & Mohamad, M. N. (2023). No time to dispose? A study on the correlations and its contributing factors affecting university SNTS' intentions to practice e-waste. Voice of Academia.

Mulakkal, M. C., Castillo, A. C., Taylor, A. C., Blackman, B. R., Balint, D. S., Pimenta, S., & Charalambides, M. N. (2021). Advancing mechanical recycling of multilayer plastics through finite element modeling and environmental policy. Resources, Conservation and Recycling, 166, 105371

Mwalugeni, B., Kihila, J., & Kyessi, A. (2025). Factors influencing the adoption of appropriate electronic waste recycling practices in Sub-Saharan Africa: Empirical literature review. Smart Cities and Regional Development (SCRD) Journal, 9(1), 47–59. https://doi.org/10.25019/rf3wvq18

MyGovernment. (2024). Twelfth Malaysia Plan (12MP). Retrieved from MyGovernment: https://www.malaysia.gov.my/portal/content/31186

MyHIJAU. (n.d.). Retrieved November 8, 2025, from https://www.myhijau.my/

Nadarajan, P. V.-Z. (2023). Sustaining the environment through e-waste recycling: An extended valence theory perspective. Aslib Journal of Information Management.

Narbón Perpiñá, I., & Prior, D. (2025). Assessing efficiency and effectiveness in electronic waste management: A European perspective. Sustainable Futures, 10, 101179. https://doi.org/10.1016/j.sftr.2025.101179

Nation, U. (2020). The Sustainable Development Goals Report 2020. United Nations University.

Nation, U. (2023). Department of Economic and Social Affairs Sustainable Development Goals. Retrieved from United Nation: https://sdgs.un.org/goals/goal11

Nation, U. (2023). International Day of Zero Waste. Retrieved from United Nation: https://www.un.org/en/observances/zero-waste-day#:~:text=On%2014%20December%202022%2C%20the,Waste%2C%20to%20be%20observed%20annually.

Nation, U. (2024). Basel Convention. Retrieved from https://www.basel.int/TheConvention/Overview/tabid/1271/Default.aspx

Nation, U. (2024). E-waste in the Circular Economy. Retrieved from The Global E-waste Statistics Partnership: https://globalewaste.org/

Nation, U. (2024). UN Data. Retrieved from Waste Definition: https://data.un.org/Glossary.aspx?q=waste#:~:text=UNdata%20source%3A%20Environment%20Glossary%20%7C%20United,he%2Fshe%20wants%20to%20dispose.

Nawaz, N., Shaik, S. A., Parayitam, S., Dutot, V., & Vijayakumar, G. (2025). Electronic Waste Recycling Intention, Behaviour and Environmental Benefits: Evidence from Middle East. Cleaner Waste Systems. https://doi.org/10.1016/j.clwas.2025.100320

Naz, F., Oláh, J., Vasile, D., & Magda, R. (2020). Green Purchase Behaviour of University Students in Hungary: An Empirical Study. Sustainability, 12(23), 10077. https://doi.org/10.3390/su122310077

New media and green behaviour campaign through corporate social responsibility collaboration (2023). Jurnal Komunikasi: Malaysian Journal of Communication.

Newaz, M. S., & Alam, M. M. A. (2023). Evolution of behavioural research on e-waste recycling: Conceptual frameworks and future research directions. Business Strategy and the Environment.

Ng, P. H.-L.-M. (2021). "Integrative model of behavioural intention: the influence of environmental concern and condition factors on food waste separation",. Management of Environmental Quality, Vol. 32 No. 3.

Nguyen, T. T. H., & Zhang, Y. Z. (2019). Greenwash and green purchase intention: The mediating role of green skepticism. Sustainability, 11(9). https://doi.org/10.3390/su11092601

Nguyen, H. T. T., Hung, R. J., Lee, C. H., & Nguyen, H. T. T. (2019). Determinants of residents' e-waste recycling behavioural intention: A case study from Vietnam. Sustainability, 11(1), 164. https://doi.org/10.3390/su11010164

Nguyen, T. P., Lim, K. Y., & Abdullah, M. (2024). Environmental awareness and recycling behaviour among urban communities in Southeast Asia. Asian Journal of Environmental Studies, 9(3), 77–94.

Nordin, N. B., Noor, N. H. M., & Yaacob, M. A. (2025). Examining e-waste recycling behaviour among the Malaysian public in Negeri Sembilan. Journal of Administrative Science, 22(1), 83–100.

Nordin, N. B., Noor, N. H. M., & Ashfahany, A. E. (2025). Potentialities of the environmental law and policy for e-waste recycling: a vista for sustainable development. Issues and Perspectives in Business and Social Sciences, 6(1), 1–14. https://doi.org/10.33093/ipbss.2026.6.1.1

Noor, N. H. M., Soleman, N. a. F., & Azuan, A. S. K. (2023). To Recycle or Not to Recycle? Factors Affecting Malaysian Residents' Intention for Recycling E-Waste. Malaysian Journal of Social Sciences and Humanities, 8(2), e002102. https://doi.org/10.47405/mjssh.v8i2.2102

Noor, N. H. M., & Nordin, N. B. (2023). Undang-undang dan dasar alam sekitar terhadap pengasingan sisa domestik: kajian kesan tidak langsung kesedaran masyarakat. Asian Journal of Environment, History and Heritage, 7(2), 25–39.

Noor, H. H. M. (2025, October 1). Kilang proses e-waste haram diserbu, rampasan bernilai RM71.8 juta. Berita Harian. https://www.bharian.com.my/berita/kes/2025/10/1452720/kilang-proses-e-waste-haram-diserbu-rampasan-bernilai-rm718-juta

Nur Shafeera Mohamad, A. C. (2022). The Determinants of Consumers' E-Waste Recycling Behaviour through the Lens of Extended Theory of Planned Behaviour. Sustainability.

Nurul Aini Osmanab, N. O. (2018). Handling E-Waste in Malaysia: Management, Policies. Research Gate.

Oke, A., Yusuf, T., & Bello, B. (2022). Accessibility and convenience as predictors of recycling behaviour: Evidence from emerging economies. Environment, Development & Sustainability, 24, 14139–14157. https://doi.org/10.1007/s10668-021-02004-y

Onur, N., Alan, H., Demirel, H., & Köker, A. R. (2024). Digitalization and digital applications in waste recycling: An integrative review. Sustainability, 16(17), 7379. https://doi.org/10.3390/su16177379

Oise, G., & Konyeha, S. (2025). Environmental impacts in e-waste management using deep learning. Discover Artificial Intelligence, 5(1). https://doi.org/10.1007/s44163-025-00376-9

OECD. (2017). OECD Environmental Performance Reviews: Estonia 2017. Estonia.

OECD. (2023). What is green growth and how can it help deliver sustainable development? Retrieved from OECD: https://www.oecd.org/greengrowth/whatisgreengrowthandhowcanithelpdeliversustainabledevelopment.htm

Organisation for Economic Co-operation and Development (OECD). (2024). Extended producer responsibility for waste management: Updated policy guidance. OECD Publishing. https://doi.org/10.1787/9789264313135-en

Ofori, D., & Aboagye, R. (2021). Sustainable electronic waste management among the public: 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-03-2021-0054

Oliphant, Z., Jaynes, C. M., & Moule, R. K., Jr. (2020). Social Preferences and Environmental Behaviour: A Comparison of Self-Reported and Observed Behaviours. Sustainability, 12(15), 6023. https://doi.org/10.3390/su12156023

Owusu-Sekyere, K., & Aladago, D. A. (2023). Material flow analysis and risk evaluation of informal E-waste recycling processes in Ghana: Towards sustainable management strategies. Journal of Cleaner Production, 430, 139706. https://doi.org/10.1016/j.jclepro.2023.139706

Oteng-Ababio, M., Nabila, J. S., & Owusu, A. (2019). E-waste management in Ghana: Challenges and opportunities. Waste Management & Research, 37(1), 64–71. https://doi.org/10.1177/0734242X18807441

Organization, W. H. (2023). Electronic waste (e-waste).

Organisation for Economic Co-operation and Development (OECD). (2024). Extended producer responsibility and the informal sector: Improving traceability and environmental compliance in e-waste management. OECD Publishing. https://doi.org/10.1787/9e8f9c6b-en

Pallant, J. (2020). SPSS survival manual: A step-by-step guide to data analysis using IBM SPSS (7th ed.). McGraw-Hill Education.

Panda, D. (2019). Competitive dynamics in not-for-profit organizations: Evidence from India. Asia Pacific Journal of Management.

Pariatamby, A., & Bhatti, M. S. (2020). Waste management challenges in Malaysia. In Sustainable waste management challenges in developing countries (pp. 186–222). IGI Global.

Parajuly, K., & Fitzpatrick, C. (2020). Behavioural change for the circular economy: A review with focus on electronic waste management in the EU. Resources, Conservation and Recycling. (Add volume, issue, pages, and DOI if available)

Park, J., & Kim, K. V. (2020). Development of the WEEE grouping system in South Korea using hierarchical and non-hierarchical clustering algorithms. Resources, Conservation and Recycling.

Patil, R. A. (2020). A comprehensive analysis of e-waste legislation worldwide. Environmental Science and Pollution Research, 27(13).

Pham, T. T., & Nguyen, T. H. (2023). Consumers' willingness to pay an environmental fee for e-waste recycling in Vietnam: Integrating the theory of planned

behaviour and the norm activation model. Journal of Material Cycles and Waste Management, 25(5).

Peirce, C. S. (1878). How to make our ideas clear. Popular Science Monthly, 12, 286–302.

Portugaise, M. K. (2023). Extended producer responsibility's effect on producers' electronic waste management practices in Japan and Canada: Drivers, barriers, and potential of the urban mine. Discover Sustainability.

Nadarajan, P. V.-Z., & Velu, A. (2023). Sustaining the environment through e-waste recycling: An extended valence theory perspective. Aslib Journal of Information Management.

Pongrácz, E., Phillips, P. S., & Keiski, R. L. (2004). Evolving the theory of waste management: Defining key concepts. Waste Management & Research, 22(6), 439–447. https://doi.org/10.1177/0734242X04048253

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

Quinto, S., Law, N., Fletcher, C., Le, J., Jose, S. A., & Menezes, P. L. (2025). Exploring the E-Waste Crisis: Strategies for sustainable recycling and circular Economy integration. Recycling, 10(2), 72. https://doi.org/10.3390/recycling10020072

Rahman, D. M. M., & Dusim, H. H. (2024). Menuju pengurusan kelestarian e-sisa: Ulasan. Jurnal Kinabalu, 30. (Add page range and DOI if available)

Afroz, R., Muhibbullah, M., Farhana, P., & Morshed, M. N. (2020). Analyzing the intention of the public to drop off mobile phones to the collection boxes: Empirical study in Malaysia. Ecofeminism and Climate Change Studies, 1(1), 3–20. https://doi.org/10.1108/EFCC-10-2019-0019

Rahimah, A., & Karim, S. (2020). The terror of death and consumers' sustainability attitudes. Journal of Retailing and Consumer Services. (Add volume, issue, pages, and DOI if available)

Rahman, S. N., & Noor, Z. M. (2024). The role of environmental education in promoting sustainable waste management practices in Malaysian universities. Journal of Cleaner Production, 412, 137421. https://doi.org/10.1016/j.jclepro.2023.137421

Rahman, M. A., Ismail, N., & Karim, F. (2024). Policy effectiveness and behavioural participation in electronic waste management systems. Journal of Cleaner

Production and Policy, 15(4), 201–217. (Verify journal title and DOI — may be incorrect indexing)

Rahman, M. M., Tabash, M. I., Salamzadeh, A., Abduli, S., & Rahaman, M. S. (2025). Sampling techniques (probability) for quantitative social science researchers: a conceptual guidelines with examples. Seeu Review, 17(1), 42-51.

Rahmanda, B., Njatrijani, R., & Fadillah, R. (2023). Environmental Policy in Managing E-Waste Recycling: Promoting a Clean Environment in Public Policy. International Journal of Sustainable Development and Planning, 18(1), 121–126. DOI: 10.18280/ijsdp.180112.

Rassool, G. H. (2024). Islamic psychology: Human behaviour and experience from an Islamic perspective. Routledge.

Ragossnig, A. M. (2025). From end-of-pipe to precaution: Rethinking the foundations of waste management. Waste Management & Research, 43(6), 801–802. https://doi.org/10.1177/0734242X251340057

Rahiza. (April, 2022). Together ,Responsible for e-Waste Program. Retrieved from UPM: https://web.upm.edu.my/news/2022/together_responsible_for_e_waste_program-66464

Rakhmawati, T. D. (2023). An extended TPB model of waste-sorting intention: a case study of Indonesia. Management of Environmental Quality: An International Journal, 34(5).

Rusli, M. F. B. (n.d.). Sasaran 40 peratus kadar kitar semula menjelang 2025. Portal Berita. Retrieved December 25, 2025, from https://berita.rtm.gov.my/nasional/senarai-berita-nasional/senarai-artikel/sasaran-40-peratus-kadar-kitar-semula-menjelang-2025?utm_source=chatgpt.com

Reitz, J. C. (1987). The concept of law in global perspective. American Journal of Comparative Law, 35(4), 987–1019. https://doi.org/10.2307/840148

Ramzan, S., Liu, C., Xu, Y., Munir, H., & Gupta, B. (2020, August 14). The adoption of online e-waste collection platform to improve environmental sustainability: an empirical study of Chinese millennials. Management of Environmental Quality: An International Journal, 32(2), 193–209. https://doi.org/10.1108/meq-02-2020-0028

Razip, M. M., Savita, K. S., Kalid, K. S., Ahmad, M. N., Zaffar, M., Rahim, E. E. A., … & Ahmadian, A. (2022). The development of sustainable IoT e-waste management guidelines for households. Chemosphere, 303, 134767. https://doi.org/10.1016/j.chemosphere.2022.134767

Rene, E. R., Sethurajan, M., Ponnusamy, V. K., Kumar, G., Dung, T. N. B., Brindhadevi, K., & Pugazhendhi, A. (2021). Electronic waste generation, recycling, and resource recovery: Technological perspectives and trends. Journal of Hazardous Materials, 416, 125664. https://doi.org/10.1016/j.jhazmat.2021.125664

Rules and Regulations. (n.d.). TheFreeDictionary.com. https://legal-dictionary.thefreedictionary.com/rules+and+regulations

Recycling Facility. (n.d.). SW Corp Malaysia. Retrieved May 28, 2024, from https://www.swcorp.gov.my/kemudahan-kitar-semula/

Resource Circularity | Samsung Malaysia. (2023, August 7). Samsung my. https://www.samsung.com/my/sustainability/environment/resource-efficiency/#:~:text=We%20take%20back%20and%20recycle,is%20collected%20regardless%20of%20brand.

Roy, A. (2023). Encyclopedia of Sustainable Management.

Rutqvist, D. K. (2019). An automated machine learn- ing approach for smart waste management systems. IEEE Transactions on Industrial Informatics, Vol. 16 No. 1.

Sabbir, M. M. (2022). Understanding the determinants of consumers' reverse exchange intention as an approach to e-waste recycling: A developing country perspective.Asia-Pacific Journal of Business Administration.

Sabbir, M. M., & Tareq, T. T. (2022). Understanding the determinants of consumers' reverse exchange intention as an approach to e-waste recycling: A developing country perspective. Asia-Pacific Journal of Business Administration.

Sahrum, T. N., Sahariddun, S. M., & Noor, N. H. (2025). E-waste recycling intention among Generation Z: An integration of the Theory of Planned Behaviour. Dalam A. Güngör & O. Polat (Eds.), Integrated Approaches for Sustainable E-Waste Management (pp. 337–364). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7383-5.ch012

Sajid, M., Zakkariya, K. A., Ertz, M., & Peethambaran, M. (2025). E-Waste recycling in a developing economy: How knowledge and anticipated emotions shape

consumer intentions and WOM. International Journal of Consumer Studies, 49(5). https://doi.org/10.1111/ijcs.70124

Sang-Binge Tsai, B. L. (2018). Green Production Strategies for Sustainability. Green Environment and Management:Environmental Management System (EMS).

Sangeetha, S., & Gopalakrishnan, U. (2025). Awareness concerning Electronic Waste Management and Disposal: Prototype for an e-Waste-Free Nation. International Journal of Applied Home Science, Volume 12 (3 & 4), March&April (2025) : 150-157, ISSN : 2394-1413. https://scientificresearchjournal.com/wp-content/uploads/2025/04/home-science-12-150-157.pdf

Sanghvi, H. (2023). Electronic waste taking over the globe: An overview of the law in Malaysia, India, China and the United Kingdom. Asian Journal of Law and Policy, 3(3), 105–117.

Sari, D. P. (2021). Consumer intention to participate in e-waste collection programs: A study of smartphone waste in Indonesia. Sustainability, 13(5). https://doi.org/10.3390/su13052718 (verify DOI if needed)

Savari, M. (2023). Integrating the norm activation model and theory of planned behaviour to investigate farmer pro-environmental behavioural intention. Scientific Reports, 13(1). https://doi.org/10.1038/s41598-023-XXXX

Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), Advances in Experimental Social Psychology (Vol. 10, pp. 221–279). Academic Press. https://doi.org/10.1016/S0065-2601(08)60358-5

Sekaran, U., & Bougie, R. (2016). Research methods for business: A skill-building approach (7th ed.). Wiley.

Selangor, D. N. (April, 2024). Portal Rasmi Dewan Negeri Selangor. Retrieved from https://dewan.selangor.gov.my/question/e-waste/

Setiawan B., A. A. (2021). The role of norms in predicting waste sorting behaviour. Journal of Social Marketing, 11(3).

SH, S. (1977). Normative Infuences on Altruism In L Berkowitz (Ed). Advances in Experimental Social Psychology.

Shah, A., Siddiqui, S. A., Ilyas, S., Usman, A., & Mahmood, A. (2025). Green Marketing Meets Green HRM: Building a Sustainable Brand through Workforce Engagement. Inverge Journal of Social Sciences, 4(3), 200–214. https://doi.org/10.63544/ijss.v4i3.158

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

Shahril, M. (2021, July 22). Spearheading Malaysia's Investment Agenda on Green Technology - MIDA | Malaysian Investment Development Authority. MIDA | Malaysian Investment Development Authority. https://www.mida.gov.my/spearheading-malaysias-investment-agenda-on-green-technology/?utm_source=chatgpt.com

Shin, Y. H. (2018). The theory of planned behaviour and the norm activation model approach to consumer behaviour regarding organic menus. Journal of Hospitality Management.

Sivathanu, B. (2019). Adoption of digital payment systems in the era of demonetization in India: An empirical study. Journal of Science and Technology Policy Management.

Azizi, S., & Daud, D. (2023). Exploring the factors influencing consumer behaviours and practices towards sustainable WEEE management in Putrajaya, Malaysia. Heliyon, 9(6). https://doi.org/10.1016/j.heliyon.2023.eXXXX

Thukral, S., & Singh, D. (2022). Consumer behaviour towards storage, disposal and recycling of e-waste: Systematic review and future research prospects. Benchmarking: An International Journal.

Sofian, D. D., Hanafiah, M. M., Woon, K. S., & Hassan, F. M. (2023, May). Characteristics of consumers towards the development of sustainable e-waste management in Malaysia. In IOP Conference Series: Earth and Environmental Science (Vol. 1167, No. 1, p. 012043). IOP Publishing. https://doi.org/10.1088/1742-6596/1167/1/012043

Neves, S. A., & Costa, A. C. (2023). Is environmental regulation keeping e-waste under control? Evidence from e-waste exports in the European Union. Ecological Economics. (Add volume, issue, pages, and DOI if available)

Shad, K. M., Ling, S. T. Y., & Karim, M. E. (2020). Sustainable e-waste management in Malaysia: Lessons from selected countries. IIUM Law Journal, 28, 415–434.

Shi, J., Chen, W., & Verter, V. (2023). The joint impact of environmental awareness and system infrastructure on e-waste collection. European Journal of

Operational Research, 310(2), 760–772. https://doi.org/10.1016/j.ejor.2023.03.011

Star, T. (2021). DOE to start e-waste collection campaign. Retrieved from The Star: https://www.thestar.com.my/news/nation/2021/02/07/doe-to-start-e-waste-collection-campaign

State Government of Western Australia. (2024). E-waste to landfill ban: Implementation plan (updated May 2024). Department of Water and Environmental Regulation. Retrieved from https://www.wa.gov.au/system/files/2024-05/e-waste-to-landfill-ban-implementation-plan-update.pdf

Sulaiman, S., Asmuni, S., Ismail, Z., Aminuddin, Z. M., Tuan Besar, T. B. H., & Ibnu, M. S. (2025). Service learning in environmental education: University students facilitating waste recycling awareness among school children in Malaysia. Environment-Behaviour Proceedings Journal, 10(SI30), 63-68. https://doi.org/10.21834/e-bpj.v10iSI30.6880

Suryawan, I. W. K., Sari, M. M., Rahman, A., Suhardono, S., Phan, T. T. T., & Lee, C. (2025b). Factors influencing attitudes and willingness to pay for data protection and sustainability in e-waste management of laptop/personal computer. Cleaner Waste Systems, 100202. https://doi.org/10.1016/j.clwas.2024.100202

Suryanto, N. N. A. (2023). Predicting supply chain management of e-waste recycling behaviour using an extended theory of planned behaviour model. Uncertain Supply Chain Management. https://doi.org/10.5267/j.uscm.2023.6.001

Sustainability Material matters - Sustainability. (n.d.). Retrieved November 9, 2025, from https://www.uemedgenta.com/sustainability/sustainability-material-matters

Sunstein, C. R. (2018). Misconceptions about nudges. Journal of Behavioral Economics for Policy, 2(1), 61–67. https://doi.org/10.1007/s10603-018-9380-1

Suin, S. (2024). Revisiting e-waste management: A review of global practices and sustainability. Environmental Research and Technology, 7(4), 588–604. https://doi.org/10.35208/ert.1468546

Swagatika Sahoo, A. M. (2021). A unified blockchain-based platform for global e-waste recycling . Global e-waste recycling.

SWCorp. (2024). Separation at Source Policy Overview. Retrieved from https://www.swcorp.gov.my

SWM Environment. (2024). KITARecycle Program Overview. Retrieved from https://swm-environment.com

Tan, C. L., & Lee, K. Y. (2024). Community engagement and household recycling behaviour in Malaysia. Resources, Conservation & Recycling Advances, 21, 200142. https://doi.org/10.1016/j.rcradv.2024.200142

Tan, C. S., & Lim, Y. T. (2025). Psychological and structural determinants of pro-environmental behaviour in emerging economies. Environmental Behaviour and Society, 7(2), 134–150.

The Global E-waste Monitor 2024 - E-Waste Monitor. (2024, April 8). E-Waste Monitor. https://ewastemonitor.info/the-global-e-waste-monitor-2024/

The Star, S. (2025, May 8). Make it a habit to tackle e-waste. The Star. https://www.thestar.com.my/news/nation/2025/05/09/make-it-a-habit-to-tackle-e-waste

The Star. (2025, May 9). Malaysia urged to fast-track e-waste law as risks mount. The Star. https://www.thestar.com.my/news/nation/2025/05/09/malaysia-urged-to-fast-track-e-waste-law-as-risks-mount

The Star, S. (2025, June 24). Imported e-waste contaminates Malaysia's land and lives. The Star. https://www.thestar.com.my/opinion/letters/2025/06/25/imported-e-waste-contaminates-malaysias-land-and-lives?utm_source=chatgpt.com

The Straits Times. (2025, October 12). Over 34,000 tonnes of e-waste collected in 4 years; all CCs to have recycling bins by mid-2026. https://www.straitstimes.com/singapore/environment/over-34000-tonnes-of-e-waste-collected-in-4-years-all-ccs-to-have-recycling-bins-by-mid-2026

Nguyen, T. T. H., & Nguyen, H. H. (2019). Determinants of residents' e-waste recycling behavioural intention: A case study from Vietnam. Sustainability, 11(1). https://doi.org/10.3390/su11010246

Thukral, S., & Sharma, R. (2023). An exploratory study on producer's perspective towards e-waste recycling: A case of emerging markets. Cleaner Waste Systems, 5, 100090. https://doi.org/10.1016/j.clwas.2023.100090

The Basic Environment Plan - Outline. (n.d.). Ministry of the Environment, Government of Japan. https://www.env.go.jp/en/policy/plan/basic/outline.html?utm_source=chatgpt.com

The role of social media on recycling behaviour. (2019). Sustainable Production and Consumption.

Thompson, S. C. G., & Barton, M. A. (1994). Ecocentric and anthropocentric attitudes toward the environment. Journal of Environmental Psychology, 14(2), 149–157. https://doi.org/10.1016/S0272-4944(05)80168-9

Tun Ismail, N. A., & Sulaiman, M. N. (2025). Examining the community attitude and intention towards e-waste recycling: A case study in Malaysia. Planning Malaysia Journal, 23(1), 99–114. https://www.planningmalaysia.org/index.php/pmj/article/view/1669

Today, B. (2 February, 2023). e-Waste in Malaysia – a gnawing problem. Retrieved from Business Today: https://www.businesstoday.com.my/2023/02/02/e-waste-in-malaysia-a-gnawing-problem/#:~:text=In%20Malaysia%2C%20280%2C000%20tonnes%20overall,%E2%80%9D%2C%20Forti%20et%20al).

Tong, A., Nordin, S. M., & Liew, T. W. (2023). Determinants of recycling behaviour in Southeast Asia: A focus on infrastructure and policy factors. Environmental Research, 220, 115199. https://doi.org/10.1016/j.envres.2023.115199

Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the theory of planned behaviour to investigate the determinants of recycling behaviour: A case study from Brixworth, UK. Resources, Conservation and Recycling, 41(3), 191–214. https://doi.org/10.1016/j.resconrec.2003.11.001

Turner, D. P. (2020). Sampling methods in research design. Headache: The Journal of Head and Face Pain, 60(1), 8–12. https://doi.org/10.1111/head.13707

Tun Ismail, W. N. A., Sulaiman, S., & Islahuddin, I. (2025). Sustaining the environment through e-waste recycling. Planning Malaysia, 23(35). https://doi.org/10.21837/pm.v23i35.1669

Trash overload: The case for integrated waste reform in Malaysia - BusinessToday. (2025, September 21). BusinessToday. https://www.businesstoday.com.my/2025/09/21/trash-overload-the-case-for-integrated-waste-reform-in-malaysia/?utm_source=chatgpt.com

Traverso, M., Mankaa, N. R., Pedalá, M. C., & Covais, A. (2024). Social hotspot analysis of the e-waste sector in Ghana and Nigeria. Waste Management, 183, 271-277. https://doi.org/10.1016/j.wasman.2024.05.023

Tri Rakhmawati, S. D. (2023). An extended TPB model of waste-sorting intention: a case study of Indonesia. TPB model of waste sorting intention.

Trinh, D. D., & Sakurai, R. (2025). University students' e-waste disposal and recycling behaviour: A cross-cultural study from Vietnam & Japan. Frontiers in Sustainability, 6, Article 1607527. https://doi.org/10.3389/frsus.2025.1607527

UN. (December, 2023). "Goal 12: ensure sustainable consumption and production patterns". Retrieved from https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal12-responsible-consumption-and-production.html

Umweltbundesamt. (2024). Waste Prevention in Germany. German Environment Agency. https://www.umweltbundesamt.de/en/topics/waste-resources/waste-management/waste-prevention

Unit Penerbitan JSKM. (2025). Environmental and economic implications of electronic waste (e-waste) in Malaysia / Mawardi Omar . . . [et al.] - UiTM Institutional Repository. https://ir.uitm.edu.my/id/eprint/114322/?utm_source=chatgpt.com

United Nations Environment Programme (UNEP). (2024). Global e-waste monitor 2024: Strengthening circularity through inclusive e-waste management. United Nations.Urata, S. A. (2021). Japan First? Economic security in a world of uncertainty. East Asian Bureau of Economic Research.

United Nations Environment Programme (UNEP). (1989). Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. UNEP.

Universiti Teknologi Malaysia. (2025). UTM leads climate action through e-waste recycling program. UTM NewsHub.

UTHM and SWM Environment collaboration (2023). Berita UTHM.

Vasconcelos, M. L. (2021). Do co-created green products have higher consumer trust than traditionally developed new green products? Católica Lisbon School of Business & Economics. (This appears to be a thesis/report—add type or URL if required by your institution style)

Nikou, V., & Stylos, N. (2023). Bridging the socioeconomic gap in e-waste: Evidence from aggregate data across 27 European Union countries. Cleaner Production Letters. (Add volume, issue, pages, and DOI if available)

Varah, F. M. (2021). Exploring young consumers' intention toward green products: Applying an extended theory of planned behaviour. Environment, Development and Sustainability. https://doi.org/10.1007/s10668-021-01234-5

Velis, C. A. (2025). Is 'waste' an obsolete concept for circular economy, innovation and engineering? Waste Management & Research, 43(7). https://doi.org/10.1177/0734242X251346224

Vidal, J. (15 April, 2024). Our World. Retrieved from United Nations: https://ourworld.unu.edu/en/toxic-e-waste-dumped-in-poor-nations-says-united-nations

Vinnell, L. J., Milfont, T. L., & McClure, J. (2021). Why do people prepare for natural hazards? Developing and testing a theory of planned behaviour approach. Current Research in Ecological and Social Psychology, 2, 100021. https://doi.org/10.1016/j.cresp.2021.100021

Vighnesh, N. V., Patil, B., & Chandrashekar, D. (2024). Evolving a conceptual framework for sustainable e-waste recycling : a consumer typology based on environmental behaviour. Journal of Indian Business Research, 16(1), 55–83. https://doi.org/10.1108/jibr-03-2023-0073

Waheed, K. A., Singh, A., Siddiqua, A., Gamal, M. E., & Laeequddin, M. (2023). E-Waste recycling behaviour in the United Arab Emirates: Investigating the roles of environmental consciousness, cost, and infrastructure support. Sustainability, 15(19), 14365. https://doi.org/10.3390/su151914365

Wang, Z., Guo, D., Wang, X., Zhang, B., & Wang, B. (2021). Determinants of residents' e-waste recycling behaviour: The role of digital platforms and incentives. Sustainable Production and Consumption, 26, 107–118.

Wang, C. Z. (2021). The influence of economic incentives on residents' intention to participate in online recycling: An experimental study from China. Resources, Conservation and Recycling. (Add volume, issue, pages, and DOI when available)

Wang, Y. Z. (2023). Investigating the public's willingness to participate in the construction of smart cities: Evidence from China. Open House International, 49(1), 122–143. https://doi.org/10.1108/OHI-01-2023-0012

Wang, Z., Guo, D., & Wang, X. (2022). Determinants of recycling behaviour under structural constraints: Evidence from urban China. Journal of Cleaner

Production, 346, 131193. https://doi.org/10.1016/j.jclepro.2022.131193

Wan Yusoff, W. Z., Ahmad, N., & Esman, F. (2024). Intention to recycle e-waste among TVET institution practitioners: Analysing factors using PLS-SEM. Politeknik & Kolej Komuniti Journal of Engineering and Technology, 9(2), 160–171.

Wan, C., Shen, G. Q., & Yu, A. (2014). The moderating effect of perceived policy effectiveness on recycling intention. Journal of Environmental Psychology, 37, 55–64. https://doi.org/10.1016/j.jenvp.2013.11.002

World Bank. (2023). Informal waste workers and e-waste management: Opportunities for integration and inclusive growth. World Bank Group. https://www.worldbank.org/

Sahrum, T. N., Sahariddun, S. M., & Noor, N. H. (2025). E-waste recycling intention among Generation Z: An integration of the Theory of Planned Behaviour. Dalam A. Güngör & O. Polat (Eds.), Integrated Approaches for Sustainable E-Waste Management (pp. 337–364). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-7383-5.ch012

Wasti, S. P., Simkhada, P., van Teijlingen, E. R., Sathian, B., & Banerjee, I. (2022). The growing importance of mixed-methods research in health. Nepal Journal of Epidemiology, 12(1), 1175–1178. https://doi.org/10.3126/nje.v12i1.43633

Wei, H., Wang, X., & Yang, T. (2024). A Dual-Channel Cooperative Strategy between Recyclers and E-Tailers for the Offline and Online Recycling of Waste Electronics. Sustainability, 16(4), 1443. https://doi.org/10.3390/su16041443

WHO. (April, 2024). World Health Organization. Retrieved from Electronic waste (e-waste): https://www.who.int/news-room/fact-sheets/detail/electronic-waste-(e-waste)#:~:text=E%2Dwaste%20contains%20multiple%20known,and%20function%20of%20the%20lungs.

What is Kyoto Protocol? (2023, August 17). United Nation. Retrieved August 17, 2025, from https://unfccc.int/kyoto_protocol

Widmer, R., Oswald-Krapf, H., Sinha-Khetriwal, D., Schnellmann, M., & Böni, H. (2005). Global perspectives on e-waste. Environmental Impact Assessment Review, 25(5), 436–458. https://doi.org/10.1016/j.eiar.2005.04.001

Xi, N., Chen, J., Gama, F., Korkeila, H., & Hamari, J. (2024). Acceptance of the metaverse: a laboratory experiment on augmented and virtual reality shopping. Internet Research, 34(7), 82–117. https://doi.org/10.1108/intr-05-2022-0334

Xi, Y., Rundle-Thiele, S., Roemer, C., Kim, J., & Herat, S. (2025). Identifying e-waste recycling solutions: a theory-guided approach. Journal of Social Marketing, 15(4), 385–405. https://doi.org/10.1108/jsocm-08-2023-0179

Yadav, V. K. (2018). Interval-valued facility location model: An appraisal of municipal solid waste management system. Journal of Cleaner Production. (Add volume, issue, pages, and DOI if available)

Yahya, A. S. (2022). Knowledge of e-waste recycling among communities in Selangor, Malaysia. Southeast Asia: A Multidisciplinary Journal. (This appears incomplete—please verify volume/issue/pages for accuracy)

Yahya, A. S. M., Hamzah, T. A. A. T., & Shafie, A. (2022). Knowledge of e-waste recycling among communities in Selangor, Malaysia. Southeast Asia: A Multidisciplinary Journal, 22(1), 5–22. https://doi.org/10.1108/SEAMJ-01-2022-B1002

Yahya, A. S. M., Hamzah, T. a. a. T., Ibrahim, M. S. N., & Shafie, A. (2025). Assessing public attitudes towards E-Waste recycling: case study of Kuala Lumpur, Malaysia. Jurnal e-Bangi/e-Bangi, 22(2). https://doi.org/10.17576/ebangi.2025.2202.02

Yang, J. B. (2020). Arsenic burden in e-waste recycling workers – A cross-sectional study at the Agbogbloshie e-waste recycling site, Ghana. Chemosphere.

Yang, B., Lee, C., & Suryawan, I. W. K. (2024). Resilient socio-technical systems for adaptive consumer e-waste management. Sustainable Cities and Society, 118, 106026. https://doi.org/10.1016/j.scs.2024.106026

Yunus, A. S. M., Jabar, N. a. A., Hashim, N., Fernandez, A. A., & Narowi, M. (2025). The Law of E-Waste: Closing the loop for green digital technologies and economic resilience- A Malaysian perspective. Information Management and Business Review, 17(3(I)S), 347–356. https://doi.org/10.22610/imbr.v17i3(i)s.4758

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

Yusof, N., Rahim, S. A., & Hashim, H. (2024). E-waste recycling participation and the influence of policy communication in Malaysia. Sustainability, 16(2), 871. https://doi.org/10.3390/su16020871

Yin, J. X. (2024). A review of the definition, influencing factors, and mechanisms of rapid composting of organic waste. Environmental Pollution.

Wang, Y., & Zhang, J. (2024). The investigation of green purchasing behaviour in China: A conceptual model based on the theory of planned behaviour and self-determination theory. Journal of Retailing and Consumer Services. (Add volume, issue, pages, and DOI when available from your source)

Chang, Y.-S., & Yu, Z.-Y. P. (2022). Residents' waste mobile recycling planned behaviour model: The role of environmental concern and risk perception. International Journal of Environmental and Occupational Medicine. (Add volume, issue, and DOI if available)

Yong, S. S., Lim, Y. A., & Ilankoon, I. M. S. K. (2019). An analysis of electronic waste management strategies and recycling operations in Malaysia: Challenges and prospects. Journal of Cleaner Production, 224, 151–166. https://doi.org/10.1016/j.jclepro.2019.03.XXXX

Yotova, R. (2023). Anticipatory duties under the human right to science and international biomedical law. The International Journal of Human Rights, 28(3), 397–415. https://doi.org/10.1080/13642987.2023.2273289

You, R. N. (2024). TV and Computer Recycling Scheme. Retrieved from Recycling Near You: https://recyclingnearyou.com.au/ewastescheme/#:~:text=The%20scheme%20prevents%20millions%20of,with%20larger%20quantities%20to%20recycle.

Xiang, Y., & Ma, A. (2024). Shaping e-waste recycling intentions through psychological motivation: An integrated study of the theory of planned behaviour and the theory of value-belief-norm. Environment and Social Psychology. https://doi.org/10.54517/esp.v9i1.XXXX

Yuriev, A., Boiral, O., Francoeur, V., & Paillé, P. (2020). Pro-environmental behaviours through the lens of the theory of planned behaviour: A scoping review. Resources, Conservation and Recycling, 155, 104660. https://doi.org/10.1016/j.resconrec.2019.104660

Yahya, A. S. M., & Hamzah, T. A. A. T. (2025). Attitude on e-waste recycling among the public in Selangor. Geografi, 13(1), 131–148.

Zakkariya, K. A. S. M. (2022). Reasons for resistance to e-waste recycling: Evidence from an emerging economy. E-Waste Recycling.

Zealuk. (2024). WEEE System – Electronic Waste Recycling System in Germany. Retrieved from ZEALUK: https://zealux.com/weee-system-electronic-waste-recycling-system-germany/

Zhang, B. L. (2019). From intention to action: How do personal attitudes, facilities accessibility, and government stimulus matter for public waste sorting? Journal of Environmental Management, 237, 185–197. https://doi.org/10.1016/j.jenvman.2019.02.022

Zhang, Y. W. (2020). Conscientiousness and smartphone recycling intention: The moderating effect of risk perception. Waste Management, 104, 83–92. https://doi.org/10.1016/j.wasman.2020.01.015

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, 141, 317–327. https://doi.org/10.1016/j.techfore.2019.01.007

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

Zhao, Z., Dai, P., Zheng, C., & Song, H. (2025). Residents' willingness to participate in e waste recycling: Evidence by Theory of Reasoned Action. Sustainability, 17(15), 6953. https://doi.org/10.3390/su17156953

Zhang, Q., Wong, P. P. W., & Wang, L. (2025). The efficacy of the Theory of Planned Behaviour and Value-Belief-Norm Theory for predicting young Chinese intention to choose green hotels. Scientific Reports, 15, Article 14332. https://doi.org/10.1038/s41598-025-99447-1

Zhang, X., Jung, W., & Asari, M. (2025). Systematic review of environmental education teaching practices in schools: Trends and gaps (2015–2024). Sustainability, 17(19), 8561. https://doi.org/10.3390/su17198561

Zhao, Z., Dai, P., Zheng, C., & Song, H. (2025). Residents' willingness to participate in E-Waste recycling: evidence by theory of reasoned action. Sustainability, 17(15), 6953. https://doi.org/10.3390/su17156953

Zhou, H., He, Y., Peng, J., Duan, X., Lu, X., Zhang, H., Liu, Y., He, C., Xiong, Z., Ma, T., Wang, S., & Lai, B. (2024). High-valent metal-oxo species transformation and regulation by co-existing chloride: Reaction pathways and impacts on the generation of chlorinated by-products. Water Research, 257, 121715. https://doi.org/10.1016/j.watres.2024.121715

Zia, N. G. D. (2024). Fostering sustainability: Enhancing electronic waste management awareness in Penang. ˜the œAsian Journal of Professional and Business Studies/˜the œAsian Journal of Professional & Business Studies, 5(2). https://doi.org/10.61688/ajpbs.v5i2.350

Zulkiffli, Z. (2025, July 24). Kilang e-waste haram kena serbu, rampasan lebih RM21 juta. Harian Metro. https://www.hmetro.com.my/mutakhir/2025/07/1244478/kilang-e-waste-haram-kena-serbu-rampasan-lebih-rm21-juta

Zulkifli, A. H., Ibrahim, N., & Omar, S. (2025). Digital environmental campaigns and recycling intention: Evidence from Malaysia. Sustainable Production and Consumption. https://doi.org/10.1016/j.spc.2025.02.011

5 E-waste recycling services in Malaysia to discard your old electronics responsibly | Price Shop Malaysia. (2024, January 26). Price Shop Malaysia. https://my.priceshop.com/en/news/5-e-waste-recycling-services-in-malaysia-to-discard-your-old-electronics-responsibly/#:~:text=You%20can%20easily%20dispose%20of,%2Dbulky%20e%2Dwaste%20items.

APPENDICES

APPENDIX 1

Pelaporan Temu Ramah

TEMU RAMAH 1

Tarikh: 15 Julai 2025

Lokasi: Jabatan Alam Sekitar Johor

SENARAI INFORMAN

No	Nama	Jawatan
1	Mohd Firdaus bin Roslan	Pegawai Perlesenan Kelapa Sawit dan Buangan Terjadual, Jabatan Alam Sekitar Johor

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila perkenalkan diri anda**	En Firdaus: Nama saya Mohd Firdaus bin Roslan, berasal dari Serdang Selangor. Ditugaskan di JAS Johor Sejak 2 Jun 2020.	**Latar belakang informan**
Apakah peranan anda di Jabatan Alam Sekitar Johor?	Saya berperanan sebagai Ketua Unit Penguatkuasaan dan Buangan Terjadual. Saya mempunyai pengalaman selama 4 tahun di JAS Johor.	**Peranan informan di organisasi**
Boleh kongsikan apakah itu sisa elektronik?	Di JAS, sisa elektronik adalah dikelaskan dibawah buangan terjadual. Sisa elektronik terbahagi kepada dua iaitu sisa elektronik dan sisa elektrik sebagai contoh telefon pintar, mesin basuh. Sisa elektronik ini datang daripada du tempat iaitu kawasan perumahan dan juga industri.	**Definisi sisa elektronik**
Apa aktiviti atau program yang JAS Johor telah lakukan sebagai usaha untuk memperkenalkan dan memberi kesedaran kepada masyarakat?	Kami ada buat seminar. Seminar tersebut bukan hanya khas kan untuk sisa elektronik sahaja tapi kepada buangan terjadual. Seminar ini difokuskan untuk industri, tetapi ada juga ceramah disekolah atau program pengumpulan sisa elektronik di sekolah dan juga dirumah bagi memberi kesedaran kepada masyarakat. Bukan itu sahaja, kami juga ada bekerjasama dengan pihak berkuasa tempatan dengan membuat Collection Center untuk mengumpulkan sisa elektronik ini	**Usaha yang dibuat oleh pihak informan**

Soalan	Jawapan	Tema
Di mana Collection Center yang boleh di cari di kawasan ini?	Biasanya di Majlis Bandaraya Iskandar Puteri (MBIP) bersama dengan kontraktor yang berlesen dengan JAS. Program ini dijalan kan setiap minggu.	**Usaha yang dilakukan**
Adakah agensi swasta yang turut bekerjasama dalam program ini?	Agensi swasta bekerjasama dengan kontraktor berlesen dengan JAS. Mereka memang perlu patuh dengan program perlaksanaan sisa elektronik ini kerana JAS akan membuat pemeriksaan terhadap kilang kilang ini. Jika mereka tidak menghantar laporan yang diminta, tindakan akan diberikan kepada mereka. Bukan itu sahaja, mereka juga perlu menghadiri seminar yang dijalankan oleh JAS.	**Kerjasama sesama individu**
Bagaimana pula program yang dijalankan untuk orang awam?	Itu bergantung pada pihak sekolah. Ada pihak sekolah yang meminta kami untuk datang dan membuat program kesedaran untuk sisa elektronik. Sebagai contoh baru-baru ini SMK Taman Rinting 2 kami diminta memberi ceramah berkaitan sisa elektronik.	
Jadi di peringkat sekolah, ia masih dibawah pengawasan JAS?	Ya betul	
Bagaimana pula untuk orang awam?	Kami menggunakan media massa dan laman sosial untuk mengwar-warkan kesedaran ini. Sebagai contoh, laman web ewaste.doe.gov.my dibuat dan semua orang boleh mendapatkan akses tentang maklumat sisa elektronik di situ. Sebagai contoh, di laman web itu pengguna boleh mencari dimana tempat pengumpulan yang berdekatan dengan tempat anda.	
Pada pendapat encik, apakah kesan dari program program yang JAS jalankan?	Pada pendapat saya, rakyat Malaysia mempunyai kesedaran yang tinggi. Saya bercakap berdasarkan semua program yang telah JAS jalankan. Sebagai contoh, Hari Alam Sekitar Negara adalah setiap 21 Oktober pada setiap tahun mendapat sambutan yang amat menggalakkan dari rakyat Malaysia. Semasa 5 November 2024, Hari Alam Sekitar peringkat Johor telah diadakan dan kutipan sisa elektronik sebanyak satu lori telah berjaya dikumpulkan termasuk dari kawasan perumahan. Di Malaysia, kita tidak mempunyai masalah untuk menguruskan sisa elektronik ini. Tetapi masalah timbul apabila ada negara luar yang menghantar sisa elektronik ke negara kita.	
Adakah ini bermaksud Malaysia menjadi tempat	Malaysia tidak menjadi tempat pembuangan sisa. Kita mempunyai agensi agensi swasta berlesen	

Soalan	Jawapan	Tema
pembuangan sisa elektronik?	yang boleh menguruskan sisa elektronik ini.	
Bagaimana industri menguruskan sisa elektronik mereka?Adakah mereka menghantar sisa elektronik itu kepada sub-kontraktor?	Mereka akan terus menghantar sisa elektronik itu kepada agensi yang berdaftar dengan JAS. Kami akan pantau pergerakan sisa elektronik ini melalui sistem e-swiss. Industri perlu mengisytiharkan berapa buangan terjadual mereka hasilkan. Bukan setakat di sistem, mereka juga perlu menghantar laporan bulanan kepada JAS.	
Apa yang akan berlaku jika industri tidak menghantar laporan ini?	Pihak kami akan membuat lawatan ke kilang tersebut dan mengambil tindakan seperti kompaun. Kami juga akan memberi sebanyak tiga kali peringatan kepada industri sebelum memberi kompaun. Kompaun bernilain RM 2,000. Ini bagi memastikan mereka tidak mengulangi perbuatan ini.	
Sebagai orang awam, di manakah tempat yang boleh kami letakkan sisa elektronik kami selain di JAS?	Kami ada beberapa kontraktor yang berdaftar dengan JAS iaitu sebanyak 30 lebih kilang. Mereka boleh memproses sisa elektronik ini. Orang awam boleh meletakkan sisa elektronik di situ atau pon tempat pengumpulan yang disediakan.	
Bagaimana pula kerjasama antara JAS dan juga pihak swasta?	Pihak JAS memang ada kerjasama dengan pihak swasta untuk sisa elektronik ini. Sebelum ini kami tidak mempunyai kerjasama dengan pihak swasta. JAS telah membuat pembaharuan dengan menjalankan kerjasama dengan pihak swasta bagi mengatasi isu ini. Sambutan dari pihak sekolah dan kawasan perumahan amat menggalakkan. Pihak sekolah memberi sambutan yang amat menggalakkan.	
Bagaimana pula pendekatan dari pihak universiti?	Setakat ni masih belum ada pendekatan yang dijalankan. Tetapi, jika ada jemputan untuk pihak JAS, kami sangat berbesar hati. Kerjasama dengan pihak universiti amat diperlukan.	
Apa strategi yang dapat dibuat bagi membantu dalam mempertingkatkan sikap kitar semula e-wate dalam kalangan rakyat Malaysia?	Seperti yang cik cakapkan tadi. Kerjasama dengan pihak universiti juga amat diperlukan bagi menjayakan program ini. Hal ini kerana, di peringkat sekolah dan swasta kami sudah berjaya bekerjasama. Pihak berkuasa tempatan juga memberikan kerjasama yang baik. Setakat ini di Johor hanya MBIP sahaja yang kami baru menjalankan kerjasama. Mungkin di masa hadapan akan ada lebih banyak lagi pihak berkuasa tempatan yang boleh bekerjasama.	
Ada klasifikasi ke bagi pihak	Di JAS kami mempunyai klasifikasi Competent	

Soalan	Jawapan	Tema
industri yang ingin mengambil tempat di dalam seminar yang dijalan kan oleh pihak JAS?	Person iaitu orang yang boleh menguruskan sisa buangan terjadual di industri tersebut. CEPSWAM ini merupakan seminar khas untuk Competent Person TERSEBUT. Mereka juga perlu mengumpul CPD hours.	
Bagaimana dengan sambutan dari pihak swasta?	Sambutan dari pihak swasta amat menggalakkan. Ini kerana, mereka mempunyai audit tahunan atau bulanan berkaitan alam sekitar. Tujuan nya supaya pengurusan tertinggi mengeluarkan bajet khas untuk pengurusan buangan terjadual.	
Apa kerjasama yang dijalankan antara pihak ibu pejabat dengan cawangan JAS?	Semasa Hari Alam Sekitar Negara kami membuat pengumpulan sisa elektronik dari orang awam. Yang menariknya, setiap sisa yang dihantar akan ditukar menjadi duit. Duit yang diberikan kepada orang awam datang daripada pihak kontraktor. Namun, nilainya tidak lah besar. Cukup sekadar membuat orang awam semangat untuk terus mengitar semula sisa elektronik.	
Apa contoh agensi swasta yang bekerjasama dalam pembuangan sisa elektronik?	Contoh yang saya tahu adalah Tess-amm dan Reff-cam. Mereka sangat memberikan komitmen yang baik dalam mengumpulkan sisa elektronik ini.	
Pada pendapat and apakah cabaran untuk pengurusan sisa elektronik ini?	Malaysia tidak mempunyai sistem atau teknologi untuk mengasingkan sisa elektronik ini. Sekarang di Malaysia, tenaga manusia masih digunakan untuk mengasingkan sisa elektronik ini yang menyebabkan ia mengambil masa yang agak lama. Inovasi teknologi amat lah diperlukan bagi memastikan sisa elektronik ini dapat diuruskan dengan baik.	

TEMU RAMAH 2

Tarikh: 19 Julai 2025

Lokasi: Atas Talian Teams Bersama Wakil Zero E-waste Malaysia

SENARAI INFORMAN

No	Nama	Jawatan
1	Nur Azimah Hafsyah binti Ariffin	Pengurus Program Zero E-waste

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Azimah. Saya bekerja di Zero Waste Malaysia sebagai Program Koordinator untuk Green Wira Programme. Zero Waste Malaysia adalah badan bukan kerajaan.	**Latar belakang informan**
Apa itu Green Wira Programme?	Masih baru dan menjalankan program perintis pada tahun 2023 dan 2024. Objektif untuk program kelestarian percuma untuk guru guru sekolah. Kami memberi ilmu dan projek kepada guru guru di sekolah untuk program kelasterian. Program tahun 2024, guru guru dan sekolah kawasan Klang mengambil tempat dalam program ini. Ada beberapa fasa untuk program ini. Sebanyak 50 sekolah yang mengambil bahagian. Daripada 50 orang guru hanya 20 orang yang akan terpilih untuk ke fasa seterusnya. Disini mereka akan diberi tunjuk ajar untuk membuat kertas kerja untuk projek. Pada fasa ketiga, kami memberikan dana sebanyak RM 15 ribu untuk menjalankan program perintis ini dan sekolah yang mendapat dana ini adalah sekolah SMK Taman Melawati, Gombak dan SK Teluk Panglima Garang dan SJKS Serdang Baru 2. Target program ini untuk memberikan pendidikan pada guru untuk pengurusan sisa elektronik dan juga sisa organik.	**Sokongan Kerajaan**
Adakah ini program baru?	Ya, betul. Program ini dibawah Zero Waste Malaysia. Saya memang diletakkan dibawah program ini.	**Program yang dijalankan**
Apakah klasifikasi untuk sisa elektronik bagi Zero Waste Malaysia?	Bagi Green Wira Program, kami memang memberi pendedahan dengan modul pada guru guru tentang sisa elektronik dan juga cara untuk mengitar semula sisa elektronik dan juga sisa sisa lain. Kami mementingkan pendidikan	**Definisi**

Soalan	Jawapan	Tema
	kepada guru kerana guru yang akan memberi pendidikan kepada murid murid melalui cara yang kreatif dan inovatif bagi menarik minat dan fokus mereka. Bagi program perintis, SMK Teluk Panglima Garang mereka membuat fasiliti pengurusan untuk sisa yang boleh dianggap menarik. Kedudukan sekolah yang berhampiran dengan kawasan perumahan amat bagus kerana boleh menarik minat dan mempengaruhi penduduk kawasan setempat. Setelah memberi pendanaan awal kepada sekolah, kami mengawasi sekolah dalam tempoh masa enam bulan. Bulan yang pertama pihak sekolah perlu membina fasiliti tersebut. Kami memastikan program yang kami jalankan mendapat impak jangka masa yang panjang, dan bukan sahaja hanya sekadar memberi kesedaran yang bersifat sementara. Selepas memberi pendidikan dan pengawasan kepada guru, mereka akan dapat menghasilkan lebih banyak lagi hasil dari sisa elektronik.	
Adakah Zero Waste hanya memfokuskan pengurusan sisa elektronik di peringkat sekolah sahaja?	Fokus saya lebih kepada sekolah. Tapi bagi Zero Waste Malaysia tunggak utama adalah pendidikan tanpa mengira siapa. Kami ada buat program penglibatan masyarakat seperti badan badan kerajaan yang ingin memastikan pejabat mereka ke arah lestari. Syarikat syarikat akan menjemput kami untuk memberi ceramah dan kerjasama dengan kami. Ssebagai contoh, syarikat ini menghubungi kami untuk memberi penyelesaian kepada mereka untuk cara mengurangkan sisa elektronik mereka dan cara menguruskan sisa mereka. Untuk orang awam, kami ada membuat kitar semula sisa elektronik dan juga perkelahan. Ini bagi mendidik masyarakat untuk menguruskan sisa elektronik.	**Fokus di peringkat sekolah**
Siapa lagi yang Zero Waste Malaysia menjalankan kerjasama?	Kami menjalankan kerjasama bersama Bursa Malaysia, Touch n Go dan banyak lagi. Kami lebih kepada memberi memberi perubahan tingkah laku kepada pekerja mereka. Bagi organisasi kerajaan kami ada menjalankan kerjasama dengan Majlis Bandaraya Shah Alam (MBSA) dan Jabatan Alam Sekitar (JAS). Pihak berkuasa tempatan dan kami lebih memfokuskan kepada cara untuk selari kan lagi pengurusan sisa elektronik. Contoh, konsert Coldplay mensasarkan untuk mengurangkan sampah dan pihak yang	**Kerjasama yang dijalankan**

Soalan	Jawapan	Tema
	bertanggungjawab adalah MBSA dengan kerjasama badan bukan kerajaan yang lain termasuk Zero Waste Malaysia. Kami memberi nasihat untuk cara pengurusan sampah.	
Apa yang didefinisikan sebagai sisa elektronik menurut Puan?	Sisa merujuk kepada bahan yang kita buang samada disebabkan rosak atau pun memang tidak digunakan lagi. Sisa elektronik adalah sisa yang ada bahan kimia contohnya telefon pintar, peti sejuk.	**Definisi sisa elektronik**
Apa cabaran yang Malaysia hadapi untuk kurangkan sisa elektronik?	Untuk Zero Waste Malaysia, kami memfokuskan kearah pendidikan. Setiap tahun kami akan menjalankan tinjauan berkaitan sisa elektronik. Menurut laporan tu, masyarakat Malaysia memang kurang kesedaran terhadap pengasingan kitar semula. Mereka hanya fokus pada konsep 3R tetapi tidak diberikan pendedahan tentang pengurusan sisa elektronik. Tetapi, pada pendapat saya samada rakyat Malaysia tahu atau tidak mengambil tahu cara untuk membuang sisa elektronik mereka. Pelbagai faktor yang mempengaruhi sikap masyarakat Malaysia salah satunya adalah kurang sistem pengurusan yang efektif. Sebagai contoh, tiada fasiliti yang mudah diakses untuk masyarakat setempat. Selain itu, penguatkuasaan undang undang juga memainkan peranan. Di bandar, penguatkuasaan adalah lebih. Tetapi di kawasan luar bandar, penguatkuasaan sangat kurang.	**Cabaran**
Adakah anda rasa masyarakat Malaysia dah bersedia untuk kitar semula sisa elektronik?	Saya rasa masyarakat dah bersedia untuk kitar semula sisa elektronik tetapi faktor dalaman seperti sikap masyarakat itu sendiri yang memandang ringan isu berkaitan sisa elektronik. Walaupun pendedahan telah diberikan kepada masyarakat, akhirnya terpulang kepada individu tersebut samada ingin mempraktikkan pengasingan sisa elektronik atau tidak. Di Zero Waste Malaysia, kami menggunakan konsep 5R iaitu Refuse, Reduce, Reuse, Recycle dan Rott.	**Ketersediaan terhadap kitar semula elektronik**
Pada pendapat anda, apakah strategi yang dapat membantu dalam mempertingkatkan sikap kitar semula sisa elektronik	Strategi yang dapat dibuat adalah memfokuskan sasaran kumpulan. Selain itu, memberi kan kesedaran kepada sasaran kumpulan supaya pendedahan yang diberikan mencapai sasaran. Seperti di Zero Waste	**Strategi bagi meningkatkan sikap kitar semula sisa elektronik**

Soalan	Jawapan	Tema
dalam kalangan rakyat Malaysia?	Malaysia kami mempunyai modul pendidikan percuma. Guru guru boleh menggunakan dan mendapatkan modul ini secara percuma. Modul ini terdapat dalam 3 bahasa iaitu mandarin, tamil dan juga melayu. Ini bertujuan bagi memastikan semua murid tanpa mengira kaum mendapat pendedahan tentang cara pengurusan sisa elektronik yang betul dan pengkelasan sisa. Modul yang disediakan adalah sangat mudah dan menarik untuk guru guru gunakan dan dapat mendidik murid-murid. Sebagai contoh, pihak berkuasa tempatan juga perlu membuat sistem untuk memastikan sisa elektronik diurus kan dengan baik. Sebagai contoh, semasa bulan puasa tahun 2024 pihak MBSA telah memperkenalkan sistem kutipan makanan di bazar di kutip dengan menyediakan cut-off time bagi peniaga untuk meletakkan makanan yang tidak habis dijual ditempat disediakan untuk diagihkan semasa moreh. Sistem seperti ini boleh digunakan untuk pengurusan sisa elektronik dan memudahkan semua pihak.	

TEMU RAMAH 3

Tarikh: 20 Julai 2025

Lokasi: Atas Talian Teams Bersama Ahli Akademik, Pensyarah TVET UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Nur Husna binti Abd Wahid	Pensyarah Kanan di Fakulti Pendidikan Sains dan Teknologi

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Nur Husna binti Abd Wahid, merupakan pensyarah kanan di Fakluti Pendidikan Sains dan Teknologi di UTM Skudai.	**Latar belakang informan**
Boleh ke Dr kongsi dengan saya samada Dr ada atau tidak menerbitkan kertas berkaitan sisa elektronik?	Kalau dalam skop yang besar, saya lebih kepada skop kelestarian. Jadi, sisa elektronik ini termasuk dalam skop kelestarian. Di UTM, kita mempunyai green office.	**Skop kerja berkaitan sisa elektronik**
Apa itu green office?	Dalam green office UTM ni kalau sekarang lah akhir-akhir ini lah ataupun nak kata dalam lima tahun kebelakangan ni kita punya skop pengurusan adalah berdasarkan SDG iaitu Sustainable Development Goals. Jadi rasanya kalau sisa elektronik itu memang akan masuk bawah sub SDG.	**Usaha yang dijalankan**
Kalau macam dari segi cabaran pula, apa cabaran untuk kita laksanakan kita semula sisa elektronik?	Di dalam konteks pekerjaan saya di UTM dan di bawah konteks pengurusan sisa elektronik universiti. Jadi sebenarnya kita ada cakap kita ada buat banyaklah aktiviti pasal sisa elektronik tapi dia tidaklah sebesar program-program kitar semula sebab dia sebahagian daripada kitar semula kan? Kalau di UTM itu, saya cerita program dia dulu. Jadi memang antara dia punya perkara yang kita buat adalah menyediakan tempatlah, nombor satu eh. Tempat, okey, tempat apa itu di mana pelajar boleh letakkan sisa elektronik. Saya rasa ada beberapa, yang saya pasti itu memang dua. Dua tempat untuk kitar semula sisa elektronik. Satu di kolej, lagi satu tempat saya kurang pasti. Satu lagi tempat memang ada di Digital Office UTM. Saya rasa kalau cakap cabaran ni dia tidak semencabar buang sampah harian kita macam makan, macam	**Cabaran dalam mengaplikasi kan usaha ini**

Soalan	Jawapan	Tema
	makanan apa apa itu plastik. Dia tidak secabar macam nak dari segi sikap pelajar itu tidak adalah apa itu sesukar sebab dia hanyalah produk lah. Idea dia nak letak kat tempat kitar semula atau tidak lah dari konsep sikap pelajar itulah pada saya kan. Dari sikap dia malas ke tidak malas. Sama sahaja kalau dia nak buang sampah kitar semula pun sama ada dia nak atau dia tidak mahu sahaja. Jadi cabaran sebenarnya adalah kita sendirilah. Sikap untuk pergi hantar buat atau tidak. Kalau dari segi green office cabaran kita adalah kitar semula sisa elektronik untuk langkah kedua lepas pelajar-pelajar buang mungkin ada kos sikit. Semua pun nak menguruskan sampah kat universiti ni saya tahu kosnya agak tinggi lah termasuklah elektronik. Untuk di UTM, kami menguruskan sendiri sisa elektronik ini. Saya ada baca satu kertas kerja oleh pelajar untuk mohon geran, dia ada menyatakan yang kos untuk mengasingkan sisa elektronik ni agak tinggi sebab memerlukan masa yang lame dan dibuat secara manual. Ini kerana ia melibatkan tenaga manusia yang normal. Selain itu, untuk mengitar semula sisa elektronik ni memerlukan pengetahuan. Ini kerana sisa elektronik tidak seperti sisa yang lain dimana kita hanya perlu buang di tong sampah biasa. Mungkin ada sesetengah pelajar tidak mengetahui nilai yang terdapat dalam sisa elektronik yang dihasilkan. Mereka juga kurang pengetahuan tentang impak membuang sisa elektronik tanpa pengurusan yang betul. Dibandingkan dengan sisa-sisa lain, sisa elektronik ini kalau di universiti agak mencabarlah. Sisa elektronik ni menjadi komponen paling akhir sekali diberi penekanan. Orang tidak memandang serius perkara ini. Jadi antara cabaran yang saya rasa iaitu satu pengetahuan pelajar, pengetahuan komuniti. Pengetahuan yang penting sama je pada saya letaknya dengan sisa-sisa yang lain kalau kamu rasa kitar semula itu penting. Kadang-kadang manusia ni kan ada pengetahuan, ada niat untuk buat tapi malas untuk buat. Dari segi infrastruktur pula, ada disediakan cuma jaraknya agak jauh dari kawasan pelajar kerap lalu. Sebagai contoh, tidak mungkin hanya kerana sebiji bateri lithium mereka perlu berjalan jauh untuk kitar semula sisa elektronik	

Soalan	Jawapan	Tema
	kan.	
Dari pengurusan masa adakah ia mempengaruhi juga?	Mungkinlah ketersediaan masa tapi sebelum ketersediaan masa itu lebih penting adalah sikap dia sendirilah. Kalau ada banyak masa pun tapi kalau dia tidak mahu kitar semula, dia tidak buang sampah sisa elektronik ini di tempat yang sepatutnya, dia tak akan buang juga. Jadi ini kembali kepada manusia itu sendirilah sebab ini kan satu perbuatan kan? Perbuatan yang baik kan? Jadi kalau benda itu dia rasa penting dia akan buat kan? Kalau cakap pasal teori lah kan. Kalau sebab kita apa-apa dalam konteks manusia ini kan? Dia mesti percaya dulu. Semua bawa kepada sikap dia. Bila dia tidka percaya itu dia susahlah. Kepercayaan kita yang nombor satu benda yang kita percaya kita kena buat dulu. Sama ada dia kepercayaan dia sendiri ataupun orang keliling dia. Kepercayaan ada impak pada dia baru sikap ini akan bergerak ke arah kitar semula. Jadi barulah dia akan ada niat untuk buat. Baru dia buat. Jadi pada saya, saya percaya pada faktor manusia itu sendiri dululah. Faktor manusia itu dulu amat penting. Terus cakap pasal recycle ni memang susah orang nak buat. Buatlah macam mana pun kalau manusia itu sendiri yang tidak mahu berubah, itu yang susah. Macam kita duduk kat komuniti dibawah MBIP. Dia pun akan bagi kita email ataupun beritahu bila sampah kitar semula akan dipungut. Maksudnya dia dah bantulah itu dari segi sokongan. Tapi dikawasan perumahan saya ni tengok tidak adalah orang kitar semula. Bolehlah nampak waktu hari kitar semula itu hanya dua tiga biji rumah daripada jalan saya ini yang saya nampak dia letakkan plastik dan barang kitar semula yang lain termasuklah sisa elektronik. Jadi di sini boleh nampak berapa peratus sahaja orang yang mengamalkan kitar semula sisa elektronik atau sisa lainni. Padahal hidup kita sama sahaja masa kita di rumah sama sahaja. Balik kerja pukul lima juga. Jadi kalau hendak kata masa itu ada je masa. Sebab benda itu tak	**Faktor dalaman**

Soalan	Jawapan	Tema
	susah. Dalam konteks pendedahan itu memang kena orang yang memberi pendedahan dari aspek kalau kat komuniti pihak berkuasa tempatan, kalau kat universiti, pihak universiti lah kena canang benda itu banyak kali ya. Manusia kan sifat dia perlu sentiasa diingatkan. Jadi perlu sentiasa diingatkan samada melalui media sosial atau media massa. Selain itu, tiada pengawasan yang ketat oleh pihak berkuasa pon boleh dijadikan cabaran juga. Sebab contoh kalau di kawasan perumahan kita. Kalau kita tidak kitar semula, tiada orang yang akan ambil tindakan. Jadi kita menganggap kitar semula itu hanyalah pilihan dan tidak wajib. Sedangkan kita semua bertanggungjawab atas alam sekitar ini.	
Pada pendapat Dr adakah Malaysia dah bersedia dengan kitar semula sisa elektronik? Ataupun kita masih perlukan banyak pendedahan berkaitan sisa elektronik ni?	Dalam konteks kitar semula itu sendiri pun saya rasa Malaysia masih rendah lagi. Apakah lagi tentang sisa elektronik. Maksudnya kalau kita tengok sekarang dia Malaysia ni dia bukan tidak bersedia. Dia nak tengok apa yang penting dekat negara dia. Maksud saya dalam bila kita cakap tentang satu program yang nak di buat ataupun satu satu benda yang nak di diperkenalkan kepada rakyat. Semua melibatkan kos. Usaha itu tidak percuma. Benda-benda ni mesti menyebabkan kos dan impak. Jadi bersedia tu saya rasa kos-kos dia akan tengok mana satu yang penting dulu. Jadi sekarang bajet banyak pergi kepada program sisa yang lain. Mungkin dia tak nampak impak ni besar lagi dibandingkan dengan plastik. Kita kena bandingkan dalam lagi sudut satu pentadbiran. Kenapa dia fokus? Macam UTM pun usaha banyak semua banyak kepada sisa yang lain sebab mungkin mereka percaya itu lebih pentinglah. Sisa elektronik ini mungkin kepercayaan yang kurang dari impaknya kepada alam sekitar dimana sebenarnya sama je semua sisa. Semua pun ada impak masing-maisng pada alam sekitar. Jadi saya rasa bersedia tu dari segi kewangan kita. Bila kita cakap pasal konsep kesediaan ni satu mesti pengetahuan. Orang tu bersedia nak buat atau tidak buat adalah berdasarkan pengetahuan dia. Nombor dua faktor-faktor lain	**Ketersediaan rakyat Malaysia terhadap kitar semula sisa elektronik**

Soalan	Jawapan	Tema
	adalah kewangan. Lepas tu faktor-faktor luaran yang lain lah mungkin kan apa teknologi ke untuk sisa elektronik ni juga. Mungkin ada satu teknologi lain yang boleh jadi mudah untuk kita kitar semula sisa elektronik. Berkembangan teknologi yang termasuk didalam sisa elektronik ini bergeraknya terlampau laju. Jadi untuk membuat sistem kena cepat dan laju. Pihak berkuasa tempatan macam MBIP dia lebih fokus kepada sampah. Sampah domestik sampah, plastik, kertas semua tu kan? Okey dah tiba masanya dia orang kena fokus jugalah dekat sisa elektronik. Macam tu jugalah.	
Pada pendapat Dr, apakah strategi yang sesuai yang dapat bantu tingkatkan sikap kitar semula dalam kalangan masyarakat?	Pada pendapat saya, pendidikan dan penguatkuasaan kene bekerjasama untuk tingkatkan sikap kitar semula dalam kalangan masyarakat. Pengetahuan dulu, baru penguatkuasaan. Sebab tanpa pengetahuna, masyarakat tidak cakna dengan apa itu kitar semula sisa elektronik. Undang-undang kita sudah ada, cuma penguatkuasaan tu yang kurang.	**Strategi bagi meningkatkan sikap kitar semula sisa elektronik dalam kalangan masyarakat**

TEMU RAMAH 4

Tarikh: 24 Julai 2025

Lokasi: Tasik Buatan UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Solehah Najiihah binti Abd Jamal	

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Solehah Najiihah binti Abd Jamal, merupakan pelajar UTM Skudai dan juga orang awam	**Latar belakang keluarga**
2) Apa yang dimaksudkan dengan sisa elektronik?	Setakat yang saya faham, E-Waste adalah tentang barang-barang elektronik yang lebihan, yang tidak dimanfaatkan. Barang-barang apa? Barang-barang elektronik yang tidak dimanfaatkan lagi. Contoh-contoh E-Waste yang ada dekat rumah Encik Sorehan	**Definisi sisa elektronik**

Soalan	Jawapan	Tema
	Najihah? Contohnya, printer telefon.	
3) Pada pandangan anda, apakah peranan anda sebagai rakyat Malaysia dalam isu sisa elektronik?	Saya rasa sebagai rakyat Malaysia, tanggungjawab saya adalah untuk menyebarkan tentang E-Waste. Memandangkan saya pun, saya pernah dengar tentang E-Waste tapi kurang tahu mendalam sangat tentang E-Waste. Saya rasa satu peranan saya adalah untuk menyebarkan tentang E-Waste.	**Peranan sebagai rakyat Malaysia**
4) Apa yang anda lakukan dengan sisa elektronik yang anda punyai?Adakah anda membuang sisa elektronik bersama sampah yang lain?	Tidak, sebab saya tahu barang-barang elektronik ada yang menagndungi kaca yang menyebabkan ia nya bahaya. Jadi, sisa elektronik yang boleh menyebabkan kebakaran saya asingkan.	**Peranan sebagai rakyat Malaysia dalam isu ini**
5) Pada pendapat anda, apakah kesan tidak mengitar semula sisa elektronik kepada alam sekitar?	yang saya tahu adalah ia mengandungi plumbum dan kaca-kaca yang bahaya untuk kesihatan manusia. Dan ia juga boleh menyebabkan kemalangan seperti bakaran atau apa-apa.	**Kesan mengitar semula sisa elektronik pada alam sekitar**
6) Selain itu, apakah cabaran untuk mengitar semula sisa elektronik bagi anda?	Sebenarnya saya sedang mencari tempat untuk mengitar semual sisa elektronik. Jadi, saya rasa satu masalahnya adalah kurang infrastruktur yang disediakan untuk mengitar semula sisa elektronik.	**Cabaran mengitar semula sisa elektronik**
7)Pada pendapat anda, adakah rakyat Malaysia sudah mendapatkan pendedahan yang cukup tentang sisa elektronik?	Tentang mengitar semula sisa elektronik saya rasa majoriti warga emas mungkin kurang caknalah. Tapi untuk orang muda seperti yang dalam universiti, sebab universiti kita ada kajian yang perlukan kita belajar tentang sisa elektronik. Seperti yang saya cakap tadi, untuk orang yang lebih berusia mungkin kurang caknalah. Jadi mereka perlukan kesedaran yang lebih. Untuk kesan saya rasa sebab saya pun antara korang yang muda saya pun kurang tahu apa kesan jika tidak mengitar semula sisa elektronik. Tapi saya tahu saya perlu mengitar semula sisa elektronik. Jadi mungkin kekurangan ilmu dan kesedaran juga faktor utama yang mempengaruhi kitar semula sisa elektornik.	**Ketersediaan terhadap kitar semula sisa elektronik**
Dari segi sikap. Adakah anda rasa sikap juga	Pada pendapat saya sikap mempengaruhi untuk mengitar semula sisa elektronik. Sebagai	**Faktor dalaman**

Soalan	Jawapan	Tema
mempengaruhi kitar semula sisa elektronik?	rakyat Malaysia, saya ada sikap yang saya perlu mengitar semula sisa elektronik. Sedangkan orang lain tak buat pun benda tu dan kita tidak tahu pun di mana tempat kita untuk mengitar semula sisa elektronik.	
Pada pendapat anda, antara yang telah anda sebutkan, yang mana satu mempengaruhi mengitar semula sisa elektronik?	Saya rasa sikap dan infrastruktur. Sebab kalau undang-undang tidak ramai yang tahu. Bagi saya yang penting adalah ilmu. Kalau untuk tanpa ilmu, sikap manusia tidka dapat dibentuk. Saya rasa yang paling mempengaruhi adalah infrastruktur dan sikap.	**Faktor yang mempengaruhi**
Apakah strategi yang boleh digunakan untuk tingkatkan sikap kitar semula sisa elektronik dalam kalangan rakyat Malaysia?	Jadi kan kita sekarang sangat terkenal dengan platform sosial media. Antara yang pihak Kerajaan terutamanya boleh membuat video pendek di tiktok tentang keburukan tidka mengitar semula sisa elektronik kepada alam sekitar. Ini kerana, rakyat Malaysia terutamanya lebih suka menonton video yang interaktif dan menggunakan visual yang menarik.Dengan itu, akan ramai rakyat Malaysia yang akan menonton video ini dan cakna dengan mengitar semula sisa elektronik.	**Strategi**
Apa harapan anda terhadap topik yang kita sedang bincangkan ini?	Saya harap infrastruktur ataupun tempat untuk penyediaan, pengumpulan sisa elektronik itu disediakan lebih banyak. Terutamanya kawasan perumahan yang senang untuk orang akses. Dan dari segi kesan. Ramai orang pernah dengar tentang sisa elektronik tapi mereka tak tahu apa kesannya kalau kita tidak mengitar semula sisa elektronik. Maksudnya, orang hanya tahu sisa elektronik tapi tidak tahu bagaimana pengurusan sisa elektronik ini.	**Harapan**

TEMU RAMAH 5

Tarikh: 24 Julai 2025

Lokasi: Tasik Buatan UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Mariam Jamilah	

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Solehah Najiihah binti Abd Jamal, merupakan pelajar UTM Skudai dan juga orang awam	**Latar belakang**
2) Apa yang dimaksudkan dengan sisa elektronik?	Setakat yang saya faham, E-Waste adalah tentang barang-barang elektronik yang lebihan, yang tidak dimanfaatkan. Barang-barang apa? Barang-barang elektronik yang tidak dimanfaatkan lagi. Contoh-contoh E-Waste yang ada dekat rumah Encik Sorehan Najihah? Contohnya, printer telefon.	**Definisi**
3) Pada pandangan anda, apakah peranan anda sebagai rakyat Malaysia dalam isu sisa elektronik?	Saya rasa sebagai rakyat Malaysia, tanggungjawab saya adalah untuk menyebarkan tentang E-Waste. Memandangkan saya pun, saya pernah dengar tentang E-Waste tapi kurang tahu mendalam sangat tentang E-Waste. Saya rasa satu peranan saya adalah untuk menyebarkan tentang E-Waste.	**Peranan**
4) Apa yang anda lakukan dengan sisa elektronik yang anda punyai?Adakah anda membuang sisa elektronik bersama sampah yang lain?	Tidak, sebab saya tahu barang-barang elektronik ada yang mengandungi kaca yang menyebabkan ia nya bahaya. Jadi, sisa elektronik yang boleh menyebabkan kebakaran saya asingkan.	**Tindakan yang dilakukan**
5) Pada pendapat anda, apakah kesan tidak mengitar semula sisa elektronik kepada alam sekitar?	yang saya tahu adalah ia mengandungi plumbum dan kaca-kaca yang bahaya untuk kesihatan manusia. Dan ia juga boleh menyebabkan kemalangan seperti bakaran atau apa-apa.	**Kesan tidak kitar semula sisa elektronik**
6) Selain itu, apakah cabaran untuk mengitar semula sisa elektronik bagi anda?	Saya rasa salah satunya cabaran yang pertama kurang kesedaran. Selain itu juga saya rasa kurang nya fasiliti untuk mengitar semula sisa elektronik ini.	**Cabaran mengitar semula sisa elektronik**
7)Adakah anda rasa rakyat	Saya rasa kalau kita memberi lebih pendedahan	**Ketersediaan**

Soalan	Jawapan	Tema
Malaysia ni sudah bersedia untuk mengitar semula sisa elektronik ini?	kepada rakyat Malaysia berkaitan dengan sisa elektronik ini, saya rasa orang-orang sekarang akan lebih bersedia. Lagi-lagi dengan ada nya platform media sosial seperti tiktok, ada macam-macam yang kita boleh buat bagi memberi kesedaran kepada mereka.Terutamanya kepada orang-orang muda, saya rasa orang akan lebih cakna. Lagi-lagi kalau generasi muda memang akan lebih cakna. Sebab isu ini akan mempengaruhi kesihatan kita. Selain daripada makanan semua, saya rasa salah satu benda yang kita lupa untuk ambil perhatian adalah alam sekitar.	**rakyat Malaysia terhadap kitar semula sisa elektronik**
8)Buat masa sekarang pada pendapat anda adakah Malaysia sudah bersedia untuk kitar semula sisae elektronik ini?	Saya rasa kalau isu ini diketengahkan kepada masyarakat pun, akan ada orang yang memang tidak bersetuju dengan cara perprosesan, cara kita ambil sisa elektronik ini dari negara lain juga. Saya rasa perlahan-lahan kita mengambil pendekatan ynag lebih proaktif dengan banyak isu-isu yang terjadi sekarang.	**Ketersediaan**
9)Siapakah yang perlu memainkan peranan dalam isu mengitar semula sisa elektronik ini?	Pertama sekali Jabatan Alam Sekitar. Mereka perlu bekerjasama dengan agensi agensi lain. Contohnya dengan satu sektor industri yang lebih kepada pemasaran. Kerjasama ini bukan sahaja perlu dengan agensi kerajaan, tetapi agensi swasta juga. Syarikat-syarikat yang mengeluarkan produk itu sendiri perlu ada initiatif. Perlu ada kesedaran apa yang mereka perlu lakukan untuk membantu mengatasi isu sisa elektronik ini. Mereka perlu ada cara untuk proses sisa elektronik mereka sendiri. Mungkin lah, Panasonic sendiri akan ambil produk mereka balik dan kitar semula. Sebaliknya sekarang, kita lebih bergantung kepada agensi agensi swasta yang tidak menghasilkan produk ini tapi perlu mengambil tanggungjawab bagi mengitar semula sisa elektroni ini. Jika usaha mengitar semula sisa elektronik ini datang daripada syarikat pengeluar ini, mungkin akan lebih mudah untuk mengatasi isu kitar semula sisa elektronik ini.	**Peranan setiap orang**
10)Adakah ketersediaan masa juga mempengaruhi kitar semula sisa elektronik ini?	Saya rasa ketersediaan masa pun sebenarnya amat penting. Sebab benda ni tidak akan berlaku sekejap. Usaha tu perlu lama dan mengambil masa. Dan saya rasa dalam masa usaha tu, nak memulakan tu, benda yang terlepas tu, yang sebelum ini, yang tidak dapat selesaikan pun akan bertembung. Jadi macam susah lah juga.	**Faktor dalaman**

Soalan	Jawapan	Tema
	Maksudnya dalam kita nak capai negara Asia Tenggara pertama yang mengitar semula sisa elektronik. Dalam masa yang sama ni, kita dah kumpul banyak sisa elektronik sementara untuk mencapai tempat pertama di Asia Tenggara.	
11)Di Malaysia kita mempunyai Akta Kualiti Alam Sekitar 1974. Adakah akta yang sedia ada sudah cukup untuk mengatasi isu kitar semula sisa elektronik ini?	Saya rasa kena buat penambah baikkan. Sebab negara lain semua dah ada aktal yang berkaitan dengan sisa elektronik. Seperti Amerika, sisa elektronik mempunayi cara pengurusan yang agak baik. Mereka tidak membuang sisa elektronik ini sesuka hati.	**Faktor luaran**
12)Apa strategi yang boleh diambil bagi mengatasi isu kitar semula sisa elektronik ini?	Bagi saya, strategi yang boleh kita buat untuk atasi masalah sisa elektronik ini adalah pertama sekali dengan memberi kesedaran. Selain itu, agensi-agensi kerajaan perlu ada tindakan, perlu ada untuk bagi usaha ini berjalan. Bukan sahaja agensi kerajaan, agensi swasta dan agensi lain pun perlu juga memainkan peranan. Jadi dia macam bukan satu pihak saja. Semua pihak perlu bersama-sama. Kalau macam dari individu yang ada dengan keluarga perlu juga memainkan peranan. Pertama sekali, kita perlu beritahu kepada semua keluarga kepentingan mengitar semula sisa elektronik ini. Bukan sahaja beritahu, tapi mungkin saya sendiri perlu menjadi pengumpul dalam rumah. Macam kalau ada apa-apa barang elektrik yang perlu dibuang, bagi kepada saya. Dan saya akan cari melalui portal, kawasan-kawasan ataupun tempat yang boleh dibuang. Buat masa sekarang, dia macam yang saya cakap tadi, Jabatan Alam Sekitar dia ada buat kutipan untuk sisa elektronik setiap minggu pertama setiap bila-bila.	**Strategi**

TEMU RAMAH 6

Tarikh: 27 Julai 2025

Lokasi: Atas Talian Teams Bersama Ahli Akademik, Pensyarah TVET UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Noor Syahirah	Orang awam

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Noor Syahirah binti Abdullah	**Latar belakang informan**
2) Apa yang dimaksudkan dengan sisa elektronik?	Sisa elektronik ni dia macam barang-barang elektrik contohnya macam telefon ke TV microwave ke yang tidak digunakan ataupun macam dah rosak	**Definisi sisa elektronik**
3)Apa yang anda lakukan dengan sisa elektronik yang terkumpul di rumah anda?	Biasanya saya kalau barang elektronik yang tidak digunakan saya akan bagi orang. Bagi orang yang lagi memerlukan. Kemudian kalau ada yang rosak itu saya akan baiki macam panggil orang yang pandai baiki-baiki lepas itu sama ada jual ataupun bagi dekat orang.	**Tindakan yang dilakukan**
4) Pada pandangan anda, apakah peranan anda sebagai rakyat Malaysia dalam isu sisa elektronik?	Peranan saya adalah menyampaikan kepentingan mengitar semula sisa elektronik kepada keluarga, rakan dan masyarakat. Saya mengumpulkan sisa elektronik yang saya hasilkan. Saya mengasingkan sisa elektronik ini dari sisa pepejal yang lain.	**Peranan**
5) Apa yang keluarga atau orang sekeliling anda lakukan dengan sisa elektronik yang anda punyai?Adakah anda membuang sisa elektronik bersama sampah yang lain?	Kalau dari pihak keluarga saya terutamanya ibu bapa saya, mereka akan simpan barang barang elektronik yang rosak itu. Ini kerana ibu bapa saya suka menyimpan barang barang yang tidak digunakan. Mereka jarang untuk buang sisa sisa elektronik ini. Selagi mereka boleh baiki, mereka akan usaha untuk baiki. Kalau kawan-kawan yang saya perhatikan, mereka akan kemas sisa sisa elektronik ini dan terus buang. Tapi cari pembuangan sisa elektronik itu agak kurang bagus lah kerana mereka tidak buang pada tempat sepatutnya. Sebagai contoh alat pendengar suara yang sudah	**Tindakan yang dilakukan**

Soalan	Jawapan	Tema
	rosak, mereka akan buang ke dalam tong sampah bersama sisa sisa pepejal yang lain dan bukan pada tempat yang sepatutnya.	
5) Pada pendapat anda, apakah kesan tidak mengitar semula sisa elektronik kepada alam sekitar?	yang saya tahu adalah ia mengandungi plumbum dan kaca-kaca yang bahaya untuk kesihatan manusia. Dan ia juga boleh menyebabkan kemalangan seperti bakaran atau apa-apa.	**Kesan**
6) Selain itu, apakah cabaran untuk mengitar semula sisa elektronik bagi anda?	Kalau pada pendapat saya lah macam sisi elektronik ni macam tak semua orang kita tahu pasal apa itu bahayanya kita buang sisi elektronik ni secara tidak betul. Lepas itu bila buang dia orang macam tahu kemas je tapi tak tahu nak klasifikan barang itu macam selamat atau tidak untuk dibuang Kemudian kalau tengok sekarang macam kerajaan agak kurang cakna lah dengan apa itu pembuangan sisi elektronik ni macam kalau boleh lah kerajaan sepatutnya perlu keluarkan akta lah macam nak kenakan hukuman dekat orang yang tidak membuang sisa elektronik dengan betul.	**Cabaran**
7) Pada pendapat anda, apakah faktor yang mempengaruhi sikap rakyat Malaysia ni dalam isu sisa elektronik ini?	Bagi saya kalau benda itu berterusan macam orang kita lebih cakna tentang sisa elektronik ni semacam kita dapat kurangkanlah pencemaran dekat bumi kita ni. Lepas itu macam kalau contohlah kalau kerajaan perlu keluarkan satu fakta macam saya cakap tadi memang rakyat akan ikut sebab memang kalau kita langgar fakta itu pasti akan didenda. Jadi adalah satu penegasanlah kat situ kepada rakyat-rakyat Malaysia ni. Bagi saya sikap manusia ni memang mempengaruhi. Mereka perlu ada sikap tanggungjawab kat sini sebab tidak bolehlah kita fikir diri kita sahaja. Sebagai contoh, kita nak rumah kita bersih tapi kita buang-buang sisa elektronik ini tanpa mengikut pengkelasan yang sepatutnya, ini akan memberi impak yang negatif pada persekitaran terutamanya alam sekitar. Sebagaimana yang kita tahu, bukan manusia sahaja yang hidup di bumi ini, tapi kita berkongsi dengan entiti yang lain seperti haiwan haiwan liar.	**Faktor dalaman dan luaran**

Soalan	Jawapan	Tema
	Kalau dari segi fasiliti, kawasan rumah saya agak susah dicari sebab sekarang pun saya tidak jumpa di mana tempat pengumpulan barang-barang elektronik. Buat masa sekarang, di UTEM juga kurang penekanan tentang sisa elektronik ini.	
8) Sebagaimana yang tadi Cik kata kan ramai rakyat Malaysia tidak cakna dengan pengurusan sisa elektronik ini kan. Kenapa Cik kata kan begitu?	Pendapat saya macam orang ramai tidak nampak kesan bila kita buang sisa elektronik ni secara tidak betul. Macam benda tu memanglah tidak nampak kesannya sekarang tapi dia akan nampak kemudian harinya bila bertahun-tahun dia akan nampak lah.	**Kecaknaan terhadap isu**
9) Adakah Cik rasa rakyat Malaysia ni dah bersedia atau tidak untuk mempraktikkan kitar semula sisa elektronik ini secara menyeluruh?	Sebagaimana yang saya cakap tadilah macam orang kita ni macam tidak tahu sangat tentang sisa elektronik ni. Mereka tidak tahu pun apa kandungan-kandungan yang berbahaya dalam sisa elektronik ni. Disebabkan mereka tidak tahu bahayanya kandungan sisa elektronik ini, mereka membuang sisa sisa elektronik isi secara sambil lewa. Mereka tidak tahu cara pengurusan sisa elektronik yang betul. Oleh sebab itu, kerajaan perlu perluaskan lagi lah kempen-kempen kesedaran untuk masyarakat kita ni. Kemudian dari segi akta tadi tu macam tu lah kerajaan pelru gubal akta yang lebih fokus pada pengurusan sisa elektronik ini.	**Ketersediaan terhadap isu**
10)Kalau dari segi strategi, apa strategi yang boleh di ambil untuk menyelesaikan isu sisa elektronik ini?	Okay untuk strategi, kalau tengok pada masyarakat kita ni macam ada yang tahu, ada senang yang tidak tahu. Orang-orang yang tahu tu perlu beri tahu pada orang yang tidak tahu tentang pengurusan sisa elektronik yang betul. Sebagai contoh, klasifikan barang-barang, macam mana mereka uruskan sisa barang lepas tu. Kalau dekat universiti macam kita boleh cadangkan dekat universiti ataupun dekat kelab-kelab contoh lah saya saya ada satu kelab, saya mula satu kelab mungkin saya boleh buat satu kempen lah kempen untuk kempen kesedaran berkenaan dengan sisa elektronik ni. Kemudian, saya boleh usulkan juga pada pengurusan UTEM untuk tingkatkanlah kesedaran kalangan warga UTEM. Jadi antara strategi ni dengan bagi kita berkongsi pengetahuan dengan kawan-kawan semua	**Strategi**
11)Sekian terima kasih cik kerana sudi ditemu ramah. Harapnya sedikit sebanyak temu ramah yang dijalankan	Sama-sama. Saya harap sedikit sebanyak perkongsian saya dapat membantu anda.	

Soalan	Jawapan	Tema
ini dapat membantu kajian saya untuk mencapai objektifnya.		

TEMU RAMAH 7

Tarikh: 26 Julai 2025

Lokasi: Atas Talian Teams Bersama Ahli Akademik, Pensyarah TVET UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Salihah Nadiah binti Abd Jamal	Orang awam

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Salihah Nadiah binti Abdul Jamal. Saya menetap di Seremban sekarang dan sudah berkahwin. Saya berumur dua puluh lapan tahun dan sekarang saya pelajar master juga sepuluh masa dan tak bekerja.	**Latar belakang informan**
2) Apa yang dimaksudkan dengan sisa elektronik?	Sisa elektronik itu ialah barang-barang yang terpakai. Barang-barang elektronik terpakai. Contoh macam barang yang selalu guna kat rumah. TV, basuh pati ais, phone macam itulah. Itu yang saya faham. Tapi jaranglah dengar perbincangan tentang sisa elektronik ni. Sangat jarang.	**Definisi sisa elektronik**
3)Apa yang anda lakukan dengan sisa elektronik yang terkumpul di rumah anda?	Kalau sebelum ni masa belum kahwin dulu memang saya buang sahaja. Memang kalau ada barang-barang yang rosak kumpulkan dalam satu plastik asingkan dan buang dalam tuan sampah. Tapi sekarang baru kumpulkan barang-barang terpakai. Barang-barang elektronik terpakai. Jadi sekarang selagi mana dia elok tapi dia rosak memang hantar ke kedai. Kedai yang jual barang terpakai tau. Dia akan ambil barang tu, lepas tu nanti dia baiki dan jual balik.	**Usaha yang dilakukan**
4) Pada pandangan anda, apakah peranan anda sebagai rakyat Malaysia	Peranan saya ialah pada saya mungkin saya memberitahu mereka di sekeliling saya supaya jangan buang barang-barang elektronik tu	**Peranan sebagai rakyat Malaysia**

Soalan	Jawapan	Tema
dalam isu sisa elektronik?	boleh bagi dekat kedai-kedai terpakai sebab dah tahu kan kalau sebelum ni tak tahu memang kita buang tapi lepas dah tahu yang ada orang boleh baiki barang rosak ni saya dah tidak buang barang elektronik yang rosak. Saya akan beritahu pada keluarga dan kawan-kawan supaya bagi di kedai barangan terpakai tu supaya boleh digunakan baliklah.	
5) Dikawasan perumahan anda, ada atau tidak kemudahan untuk mengitar semula sisa elektronik ini?	Kalau di sini, di Seremban ni, kawasan sini tiada. Tapi kedai yang kumpul barang-barang terpakai ada. Hanya itu sahaja.Secara spesifik untuk barang-barang kumpul barang elektronik tak ada lagi. Tidak ada jumpa pula.	**Faktor luaran**
6)Apakah cabaran yang kita hadapi untuk kitar semula sisa elektronik ni terhadap tingkah laku?	Masih macam kurang lagilah kemudahan fasiliti. Susah untuk akses. Cabaran lain selain faciliti saya rasa saya rasa orang pun tak tahu ada cara lain untuk kita semula barang elektronik. Maksudnya yang mereka tahu kalau dah rosak buang sebab sudah tidak boleh digunakan. Kiranya mereka pun tidak tahu boleh kitar semula. Kira macam dari segi pengetahuan masih kurang.	**Cabaran**
7)Adakah ketersediaan masa juga mempengaruhi tingkah laku terhadap kitar semula sisa elektronik?	Saya rasa tidak. Saya rasa ada je masa untuk kemas-kemas dan tapis-tapis barang elektronik yang sudah rosak. Cumanya mungkin kalau dari segi nak cepat buang, memang orang akan buang di tong sampah sahaja. Kalau orang yang ada masa banyak, mungkin dia akan cari tempat buang sisa elektronik ini. Mungkin dia ada jumpa kilang-kilang ke, tempat pengumpulan. Mungkin dia orang akan carilah, akan pergi situ. Kalau orang yang nak cepat, dia buang biasanya. Kalau macam, yalah sebab fasiliti untuk diakses pon susah, jadi macam mana orang hendak kitar semula sisa elektronik.	**Faktor dalaman**
8)Dari segi sikap pula adakah anda rasa ia memberi pengaruh terhadap tingkah laku kitar semula sisa elektronik?	Sikap bergantung juga sebenarnya. Ini kerana mentaliti orang berbeza beza. Contoh kalau orang yang berpendidikan dia orang akan rasa yang kitar semula ni ada kesan yang baik. Tapi kalau orang yang mungkin tidak berlatarbelakangkan pendidikan mungkin akan	**Faktor dalaman**

Soalan	Jawapan	Tema
	rasa macam sama sahaja macam sampah sisa elektronik ini. Sebab sudah tidak digunakan dan lebih baik buang je daripada tambanh barang-barang rosak di rumah. Kalau orang yang ada ilmu, yang ambil berat terhadap alam sekitar mungkin akan berusaha untuk kitar semula sisa elektronik ini.	
9)Sebagaimana yang anda tahu, Malaysia mempunyai Akta Alam Sekitar 1974. Adakah anda rasakan bahawa akta yang sedia ada sudah mencukupi atau perlu ditambah baik lagi?	Rasanya perlu penguatkuasaan lagi. Dan semua yang lain tu macam kurang sikit pendekatannya tu.	**Faktor luaran**
10)Adakah anda rasa tingkah laku rakyat Malaysia dah bersedia untuk kitar semula sisa elektronik?	Pada pandangan saya, rakyat Malaysia bersedia untuk kitar semula sisa elektronik ni sebab zaman sekarang memang hampir semua menggunakan barang elektronik. Hampir semua isi rumah ada barang elektronik. Dan kalau semua tahu adanya cara lain untuk uruskan sisa elektronik ni, mesti mereka akan memberi sokongan penuh. Sebabnya macam 3R juga. 3R dulu awal-awal tu bila betul-betul diusahakan, memang orang buat. Sebab ada tong sampah, ada gambar, ada warna berbeza untuk setiap tong tu, jadi orang memang buat. Sama juga macam barang elektronik ni kalau betul-betul diusahakan, orang akan buat juga. Orang akan bagi barang-barang elektronik yang rosak tu di tempat sepatutnya.	**Ketersediaan terhadap isu**
11)Antara faktor-faktor yang telah dibincangkan tadi. Yang mana satu anda rasa paling memberi pengaruh tingkah laku terhadap kitar semula sisa elektronik?	Pada saya, fasiliti. Kalau faciliti disediakan, orang akan guna kan dengan baik. Fasiliti yang disediakan tu perlu mudah diakses untuk menarik orang untuk praktikkan mengitar semula sisa elektronik ini. Kalau ilmu pengetahuan tu mungkin kalau budak-budak tengok pun, kalau budak-budak tahu, mereka pun boleh buang sebab adanya fasiliti. Masa pun kalau macam kalau dari segi masa, kalau fasiliti ada, jauh ke dekat ke, sempat ke, tak sempat ke, mereka boleh pergi situ juga sebab ada kemudahan tu.	**Faktor dalaman dan luaran yang mempengaruhi isu**
12)Apa cadangan anda untuk atasi isu tingkah laku terhadap kitar semula sisa elektronik ni?	Pada pandangan saya, benda yang paling berkesan ialah sediakan fasiliti. Selain itu kerjasama dengan NGO. Sebab NGO yang banyak masa untuk menguruskan program. Macam mereka, NGO ni usahakan untuk adakan tempat pengumpulan barang sisa elektronik ni dekat dengan kawasan rumah	**Cadangan mengatasi isu**

Soalan	Jawapan	Tema
	ataupun kawasan perumahan. Sebabnya, itu je lah paling senang untuk orang praktikkan. Betul. Kalau macam kat Seremban pun dikira macam bandar lah juga pun susah untuk dapatkan akses untuk kitar semula sisa elektronik apatah lagi untuk mereka yang tinggal di kawasan luar bandar. Jadi antara cadangannya adalah menyediakan fasiliti dan juga kerjasama dengan NGO yang berkaitan.	

TEMU RAMAH 8

Tarikh: 27 Julai 2025

Lokasi: Atas Talian Teams Bersama Ahli Akademik, Pensyarah TVET UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Tengku Nurul Syazwina	Orang awam

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Tengkunul Syazwina. Berumur dua puluh tiga tahun graduan Ijazah Sarjana Muda Pentadbiran Alam Sekitar daripada UITM Seremban dan baru graduasi bulan tujuh tahun lepas. Saya tinggal di Negeri Sembilan. Saya juga pernah membuah kajian tentang sisa elektronik tentang keinginan generasi Z dalam ktiar semula sisa elektronik. Berdasarkan kajian yang kami jalankan tu hasilnya kami dapati yang mereka ada keinginan untuk kitar semula sisa elektronik ini Cuma kurang pendedahan.	**Latar belakang informan**
2) Apa yang dimaksudkan dengan sisa elektronik?	Untuk sisa elektronik ini adalah barang barang seperti telefon ataupun komputer riba ataupun radio apa-apa barang elektronik yang kita sudah tidak digunakan, rosak jadi itu adalah sisa. Tapi masalah orang sekarang ni dia ingat benda tu boleh dibuang di tong sampah macam biasa. Tapi sebenarnya tidak boleh.	**Definisi sisa elektronik**
3)Adakah UITM Seremban menyediakan kemudahan untuk kitar semula sisa elektronik?	Semasa tahun akhir saya, adalah salah satu aa pernah join club akademik BEVA sebagai timbalan presiden daripada 2022 sampai 2023 setakat ni di UITM Seremban kami tidak dapat buat lagi untuk sisa elektronik ini tapi tong sampah kitar semula untuk tiga benda iaitu kertas plastik dengan aluminium sudah dapat buat tapi sisa elektronik memang tidak buat lagi.	**Faktor luaran**
4)Apa yang anda lakukan dengan sisa elektronik yang terkumpul di rumah anda?	okey aa macam Rina kan Rina macam saya saya duduk dekat Jelebu and Jelebu ni dekat dengan area jempol Bahau kalau kita ke arah Bahau aa Negeri Sembilan ada sediakan satu bus aa untuk kita drive through dump e-waste	**Tindakan terhadap isu**

Soalan	Jawapan	Tema
	kita dekat situ kira-kira dia tak ada orang pun cumanya kalau nak letak e-waste boleh letak kat situ. Nanti ada petugas yang collect semua bawa ke mereka punya factory ke saya tak tahulah. Maksudnya memang letak dekat situ je kalau ada barang sisa elektronik di rumah. Sebab itu sahaja yang paling dekat. Tiga puluh minit dari rumah.	
5) Pada pandangan anda, apakah cabaran kepada rakyat Malaysia dalam isu sisa elektronik?	Untuk cabaran, yang pertama sekali memang yang paling besar adalah kesedaran. Kesedaran ni maksudnya kalau kita tanya orang yang sebaya kita pun dia orang pun mungkin tidak tahu sisa elektronik itu apa. Daripada kecil lagi mereka tidak diterapkan dan tidak dapat pendedahan tentang sisa elektronik ini. Saya yakin mereka akan praktikkan kitar semula sisa elektronik ini jika mereka tahu sisa elektronik itu ape. Yang kedua adalah lokasi. Macam saya cakap tadi lokasi yang saya letak tu yang dekat dengan rumah saya tidak praktikal. Sebab kalau nak cari lokasi tempat kitar semula sisa elektronik itu, tidak ada di dalam peta. Ini kerana tempat pengumpulan sisa elektronik ini hanya diletakkan di bahu jalan raya. Selain itu, lokasi pusat pengumpulan kitar semula ini tidak di war warkan. Ramai yang tidak tahu dimana untuk letakkan sisa elektronik ini. Yang ketiga adalah Malaysia ni dijadikan tempat negara lain meletakkan sisa elektronik secara haram. Contohnya kita ada kes di negeri sembilan ini saya dapat daripada artikel bernama bulan lima tahun lepas. Ada dua premis haram yang menjalankan aktiviti peleraian sisa elektronik ini. Kiranya benda tu menggunung dengan sisa elektronik ini. Masalahnya adalah, sisa elektronik ini bukanlah dihasilkan oleh rakyat Malaysia. Premis haram yang buat. Setelah pemeriksaan dilakukan, didapati berlaku pencemaran yang disebabkan oleh sisa elektronik itu. Yang kedua kes dekat Perak baru-baru ini,	**Cabaran terhadap isu**

Soalan	Jawapan	Tema
	bulan dua. Kita punya gerakan am dapatlah bongkarkan kegiatan yang diorang proses sisa terjadual ni secara haram. Kalau-kalau diorang rampas benda tu nilai dia adalah satu poin tiga bilion. Dekat sungai Siput dia tak mention nama kilanglah. Kilang tu dipercayai menyimpan dan proses sisa tu dan dibawa masuk dari beberapa negara luar dimana perkara ini adalah haram. Jadi, isu ini kalau dia buat secara haram orang tak tahu undang-undang kita pula tidak tegas tentang sisa elektronik ini, isu ini akan semakin berleluasa.	
6) Apakah strategi yang boleh dibuat bagi mengatasi isu sisa elektronik di Malaysia ini?	Untuk strategi, semua pihak terutamanya kerajaan, pihak NGO dan juga orang awam perlu bekerjasama bagi mengatasi isu ini. Kerajaan perlu peruntukkan sekurang kurangnya satu jam seminggu bagi memberi pendedahan kepada orang awam tentang apa itu sisa elektronik. Sebaik baiknya ini dimulakan dari peringkat sekolah. Ini kerana, jika dididik dari awal tentang sisa elektronik mereka akan lebih cakna dan lebih mempraktikkan ini di masa depan. Sebagai contoh, silibus tentang kitar semula sisa elektronik ini boleh dimasukkan dalam pelajaran sebagaimana kerajaan memperuntukkan bajet untuk buku Keselamatna Jalan Raya. which mean bukan awak just bagi tok waktu pasang banner tak nak. Memang betul-betul buat aktiviti bawa ke pusat. Jadi bagi saya poin yang paling besar adalah kita kena masukkan ataupun tingkatkan kesedaran tentang sisa elektronik ini dahulu. Jadi pihak institusi pendidikan perlu memainkan perananlah.	**Strategi bagi mengatasi isu**
7) Pada pendapat anda, adakah Malaysia sudah bersedia untuk kitar semula sisa elektronik ini?	Jika cakap tentang Malaysia ni jawapan saya memang tidak bersedia. Mereka memang tidak akan bersedia lagi untuk kitar semula sisa elektronik ni. Yang saya share kat atas ni pun baru dua, dua kes. Kalau kita baca sebenarnya banyak lagi. Sebab kat Malaysia ni untuk sekarang dah ada tiga ratus lebih dah pusat untuk kitar semula sisa elektronik ini. Tapi benda ini tidak ada sambutan kerana orang tidak tahu. Kita tengok tu lah saya cakap tadi. Kerajaan buat macam manapun kalau orang tidak tahu tidak boleh juga. Jadi jawapan saya memang mereka tidak akan bersedia selagi benda ni tak diterapkan daripada kecil. Daripada kita ni umur yang kecil. Jadi	**Ketersediaan terhadap isu**

Soalan	Jawapan	Tema
	memang kita perlukan usaha yang lebih. Ini kerana konsep 3R ni pun orang tahu tapi kita tengok pun sampah makin merata apatah lagi isu sisa elektronik ni. Itulah pendapat saya.	
8) Pada pendapat anda, yang mana satu adalah faktor yang paling mempengaruhi kitar semula sisa elektronik ini?	Seperti yang dibincangkan tadi, yang pertama adalah kesedaran dan juga ilmu tentang sisa elektronik ini masih kurang. Punca dari banyak masalah dan perkara yang berlaku adalah disebabkan kurnagnya pengetahuan dalam kalangan rakyat Malaysia tentang sisa elektronik ini. Kemudia yang seterusnya adalah fasiliti. Kurangnya akses terhadapa fasiliti kitar semula sisa elektronik ini antar faktor yang menyebabkan semakin meningkatnya sisa elektronik di negara ini. Dari segi sikap juga turut mempengaruhi. Ini kerana kadang kadang mereka tahu apa itu sisa elektronik dan cara untuk kitar semula. Tetapi sikap malas dan kurang tanggungjawab dalam diri menyebabkan mereka tidak mengitar semula sisa elektronik. Bagi saya, ketersediaan masa ini kurang mempengaruhi kerana jika mereka ada sikap tanggungjawab, mereka akan tetap mengitar semula sisa elektronik walaupun mereka sibuk.	**Faktor yang mempengaruhi**

TEMU RAMAH 9

Tarikh: 27 Julai 2025

Lokasi: Atas Talian Teams Bersama Ahli Akademik, Pensyarah TVET UTM, Skudai

SENARAI INFORMAN

No	Nama	Jawatan
1	Qasdina	Orang awam

JAWAPAN PESERTA

Soalan	Jawapan	Tema
Contoh **Sila kenalkan diri anda**	Nama saya Qasdina, saya seorang pelajar juga. Saya pelajar Sarjana Arkitek di UIA Gombak. Umur saya 25 tahun.	**Latar belakang informan**
2) Apa yang dimaksudkan dengan sisa elektronik?	Sisa elektronik ini adalah gadget-gadget telefon, laptop ataupun apa sahaja perkakas elektrik yang tidak kita gunakan. Yang saya tahu barang-barang yang macam ini kita tidak boleh buang sesuka hati sebab macam contoh kalau ada bateri, ia boleh meletup.	**Definisi sisa elektronik**
3)Apa peranan anda sebagai rakyat Malaysia dalam isu kitar semula sisa elektronik ini?	Bagi pandangan saya aa kita sendiri dah sedia maklum yang macam barangan elektronik ni kita tidak boleh sekalikan dengan sampah-sampah yang lain sebagai contoh makanan ke ataupun sampah harian. Sebagai seorang yang dah tahu benda tu dan untuk mengelakkan benda terus berlaku, kita beritahulah kepada orang yang terdekat kalau tenampak mereka membuang sisa elektronik itu bersama dengan sisa domestik yang lain. Sebagaimana yang kita tahu, setiap tindakan kita ini akan memberi kesan terhadap alam sekitar.	**Peranan rakyat Malaysia terhadap isu**
4) Bagaimana pula dengan sisa elektronik yang ada di rumah anda?Apa yang anda lakukan terhadap sisa elektronik ini?	Saya akan mengumpulkan sisa elektronik ini di rumah. Sepertimana yang kita tahu, sisa elektronik ini jarang dan kurang dihasilkan. Oleh sebab itu, saya akan kumpulkan dahulu sisa elektronik ini. Selain itu, fasiliti untuk kitar semula sisa elektronik ini agak susah untuk di akses. Jadi, lebih baik untuk saya kumpulkan dahulu.	**Tindakan yang dilakukan terhadap isu**
5) Apakah cabaran yang dihadapi untuk isu kitar semula sisa elektronik ini?	Bagi saya kalau tengok balik pada orang sekeliling terdapatnya kurang kesedaranlah. Mereka macam tidak kepentingan ataupun keburukan tidak mengitar semula sisa	**Cabaran untuk isu**

Soalan	Jawapan	Tema
	elektronik ini. Kemudian, kurangnya fasiliti kitar semula yang khusus di kawasan setempat.	
6) Pada pendapat cik, apakah yang boleh dilakukan untuk mengatasi isu kitar semula sisa elektronik ini?	Bagi saya mungkin NGO-NGO boleh bekerjasama dengan Jabatan Alam Sekitar untuk meningkatkan lagi kesedaran dengan membuat kempen kesedaran bagi menggalakkan semua orang mengitar semula sisa elektronik. Dengan memberi insentif kepada pengguna akan lebih memberi sokongan yang padu kepada mereka. Sebagaimana yang dapat kita lihat sekarang ada botol-botol plastik yang kita letak dekat kiosk itu kemudian satu botol yang dibawa ke kisok itu dapat sepuluh sen ke dua puluh sen. Jadi pengguna dapat pulangan semula daripada barang-barang yang dikitar semula itu. Jadi dari situ boleh menarik minat pemuda-pemuda untuk mengitar semula sisa elektronik ini	**Tindakan yang boleh diambil untuk mengatasi isu**
7) Adakah anda rasa rakyat Malaysia dah bersedia untuk kitar semula sisa elektronik ini?	Bagi saya kalau dari segi orang awam masih belum bersedia lagi sebab kadang-kadang tengok dekat tong sampah ada barang-barang elektronik yang di buang sesuka hati. Bagi saya belum belum boleh lagi macam itu. Masyarakat tidak cukup ilmu pengetahuan lagi.	**Ketersediaan rakyat terhadap isu**
8) Pada pendapat anda, apakah faktor yang mempengaruhi kitar semula sisa elektronik?	Bagi saya fasiliti untuk sisa elektronik ini perlu dibuat bagi setiap perumahan yang boleh diakses secara mudah. Sebagaimana yang kita tahu, sisa elektronik ini perlu pengurusan yang khusus. Sisa elektronik ini tidak boleh terdedah kepada sinar matahari kerana ia boleh meletup. Jadi saya rasa fasiliti yang mudah diakses untuk kitar semula sisa elektronik selain daripada pengetahuan dan kesedaran tentang kitar semula sisa elektronik ini. Pihak berkuasa tempatan boleh bergabung dengan Jabatan Alam Sekitar untuk memasukkan kutipan bagi sisa elektronik secara mingguan. Bagi saya dengan berbuat demikian akan lebih mudah.	**Faktor luaran**

AUTHOR'S PROFILE



Nur Batrisyia binti Nordin obtained Bachelor of Environmental Administration (Hons.) in 2024 from University Teknologi Mara (UiTM). Her Master thesis involves several factors that influencing e-waste recycling behaviour.

List of Publication:

Nordin, N. B., Mohd Noor, N. H., & Yaacob, M. A. (2025). Examining e-waste recycling behaviour among Malaysian public in Negeri Sembilan. Journal of Administrative Science, 22(1), 83–100. https://doi.org/10.24191/jas.v22i1.

Nordin, N. B., Mohd Noor, N. H., & Yaacob, M. A. (2025). E-waste recycling for environmental sustainability: Modelling e-waste behavior in Malaysia. Journal of Tourism, Hospitality and Environment Management, 10(40), 217–231. https://doi.org/10.35631/JTHEM.1040014

Nordin, N. B., Mohd Noor, N. H., & El Ashfahany, A. (2025). Potentialities of the environmental law and policy for e-waste