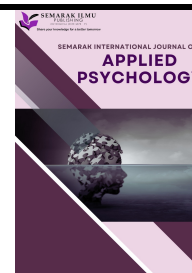




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# Navigating E-Waste Disposal: Formal Practices among Residents of Bukit Sentosa, Rawang, Selangor

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### ABSTRACT

Electronic waste (e-waste) contains harmful materials that require specialized end-of-life handling. This study aims to analyse formal e-waste disposal practices among residents in Bukit Sentosa, Rawang, Selangor. Employing a quantitative research approach, data were collected from 367 respondents residing in Bukit Sentosa to examine the relationship between knowledge, awareness, and attitudes towards e-waste disposal practices. Spearman's correlation test revealed positive correlations between knowledge, attitudes, and awareness, and formal e-waste disposal practices. These findings indicate that improved knowledge, attitudes, and awareness lead to more responsible disposal behaviours, including increased recycling, reduced waste production, and proper disposal of hazardous materials, thereby mitigating environmental pollution. The findings suggest to enhanced public awareness and education can foster better e-waste management practices among urban households. Furthermore, the results highlight the potential for collaboration between policymakers, government agencies, local authorities, and NGOs, contributing to the development of more comprehensive and effective waste management regulations.

## 1. Introduction

Electronic waste (e-waste) has become a critical environmental issue due to the rapid proliferation of electronic devices and the short lifecycle of modern electronics. E-waste includes a variety of discarded electronic appliances such as computers, smartphones, televisions, and other consumer electronics that contain hazardous materials like lead, mercury, cadmium, and brominated flame retardants [1]. These materials pose significant risks to human health and the environment when not properly managed.

Globally, the generation of e-waste has been on a steep rise. In 2019, the world generated approximately 53.6 million metric tons of e-waste, a figure projected to reach 74.7 million metric tons by 2030 if current trends continue [2]. In Malaysia, the e-waste generation was estimated at

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364,000 metric tons in 2019, placing the country among the significant contributors to e-waste in Southeast Asia [2]. Among households, the accumulation of e-waste has been steadily increasing. This trend underscores the necessity for effective e-waste management practices, particularly formal disposal methods. Formal e-waste disposal involves systematic processes such as collection, transportation, recycling, and proper disposal of electronic waste in compliance with regulatory standards. Such practices ensure that hazardous substances are safely managed and valuable materials are recovered [2].

The importance of formal disposal methods for e-waste cannot be overstated. Proper management of e-waste through formal channels helps prevent environmental contamination and reduces the health risks associated with exposure to toxic substances. Improper disposal methods, such as informal recycling and illegal dumping, can lead to severe environmental degradation. Toxic substances from e-waste can leach into soil and water, contaminating local ecosystems and posing threats to wildlife and human populations [3]. Failure to manage e-waste properly has far-reaching consequences. Environmental impacts include soil and water pollution, which can lead to the bioaccumulation of hazardous substances in food chains. This poses significant health risks, including neurological damage, respiratory problems, and other serious health issues [5]. Additionally, improper e-waste management contributes to resource depletion, as valuable materials that could be recovered and reused are lost [4]. In recent years, there has been growing recognition of the need for robust e-waste management systems. Effective policies and regulations are essential to ensure that e-waste is managed responsibly. Governments, policymakers, and stakeholders must collaborate to establish comprehensive e-waste management frameworks that promote formal disposal practices [5]. Furthermore, public awareness and education campaigns are crucial to inform households about the importance of proper e-waste disposal and the environmental and health risks associated with improper practices [6].

The focus of this study is to examine the formal e-waste disposal practices among residents in Bukit Sentosa, Rawang, Selangor based on their knowledge, attitude and awareness on e-waste. By understanding the current disposal behaviours and the factors influencing them, this research aims to provide insights into improving e-waste management at the household level, thereby contributing to a more sustainable and environmentally friendly approach to handling electronic waste.

### *1.1 The Knowledge, Attitude and Practices (KAP) Theory*

This study employed The Knowledge, Attitude, and Practices (KAP) Theory [7] that is a well-established framework used to understand and analyse human behaviours in various domains, including health, environment, and social sciences. The theory posits that an individual's knowledge, attitudes, and practices are interconnected and influence each other. This framework can help identify gaps in knowledge, misconceptions, and behaviours that need to be addressed to promote positive changes. As for knowledge, this component refers to the information and understanding that individuals have about a particular topic. Knowledge is crucial as it shapes how individuals perceive and react to various issues. In the context of e-waste management, knowledge includes awareness of what e-waste is, its potential hazards, and the proper methods for its disposal. Attitude involves the feelings, beliefs, and values that individuals hold towards a subject. Positive attitudes towards environmental conservation and proper waste management can motivate individuals to engage in responsible e-waste disposal practices. Conversely, negative attitudes can hinder such behaviours. Practices refer to the actual behaviours and actions that individuals perform. These are influenced by their knowledge and attitudes. In the study context, practices would include how individuals dispose of their electronic devices, whether they recycle, and if they follow formal disposal methods. KAP

Theory has been widely utilized in environmental studies such as evaluation household waste management practices [8] as well as in water conservation practices [9] to assess and encourage sustainable behaviours. In addition, it also can be understood in other domains in social sciences and health, as in knowledge and practices among students [10] and healthy eating practices [11]. By examining the levels of knowledge, attitudes, and practices among individuals or communities, researchers and policymakers can develop targeted interventions to improve environmental outcomes. This suggests that educational campaigns can effectively foster positive environmental behaviours. These studies demonstrate that KAP Theory can provide valuable insights into designing effective environmental interventions by highlighting the importance of knowledge and attitudes in shaping sustainable practices.

### 1.2 Practices in Formal E-waste Disposal

Environmental behaviour encompasses a wide range of practices aimed at reducing ecological footprints and promoting sustainable lifestyles. Recent empirical studies have shed light on various practices that individuals and communities adopt to mitigate environmental impacts, including e-waste disposal. According to Norimah *et al.*, [12] recycling behaviours have become increasingly prevalent, with households actively participating in curb side recycling programs to reduce waste sent to landfills. In the context of e-waste disposal, research by Smith *et al.*, [13] underscores the importance of proper disposal methods for electronic devices to prevent environmental contamination from hazardous materials. Smith *et al.*, [13] conducted a study examining household behaviours towards electronic waste management. They found that awareness and access to formal e-waste disposal facilities significantly influence disposal practices. Effective communication and education campaigns were identified as key factors in promoting proper e-waste disposal behaviours among households. Moreover, a longitudinal study by Lee and Choi [14] explored the evolution of e-waste disposal practices in urban areas over the past decade. The findings indicated a gradual shift towards more responsible disposal practices, driven by regulatory frameworks and public awareness campaigns. This shift highlights the role of policy interventions in shaping sustainable behaviours related to e-waste management. In contrast, recent research by Harfadli *et al.*, [15] highlighted persistent challenges in informal e-waste recycling practices in developing countries. They emphasized the need for enhanced regulatory measures and infrastructure development to address environmental and health risks associated with informal recycling methods. Furthermore, the integration of digital platforms for e-waste collection and recycling has gained traction. Studies by Zhang and Li [16] and Chen *et al.*, [17] explored the effectiveness of mobile applications and online platforms in facilitating convenient and environmentally sound e-waste disposal practices among urban residents. In conclusion, recent empirical literature underscores the significance of diverse environmental practices, including proper e-waste disposal, in addressing global environmental challenges. By adopting and promoting these practices, individuals, communities, and organizations can contribute to sustainable development and mitigate the adverse impacts of climate change.

### 1.3 Knowledge

Knowledge is considered a sustainable competitive advantage that individuals should possess, especially in the context of e-waste management [18]. Furthermore, empirical studies underscore the critical role of knowledge in shaping household e-waste disposal practices. Research in India by [19] further supports these findings, indicating that increasing public knowledge about e-waste and its impacts significantly improved recycling behaviours. The study emphasized the need for public

education campaigns to raise awareness about the importance of proper e-waste disposal and the existence of authorized recycling centres. These campaigns were found to be effective in changing household attitudes and practices towards e-waste management. According to Dwivedy *et al.*, [20], having knowledge about recycling and technical disposal can significantly increase individuals' motivation to engage in these activities. Conversely, insufficient knowledge related to e-waste poses potential dangers to both the environment and human health during the handling, use, reuse, or recycling of e-waste. Azodo [21] found widespread public ignorance about e-waste, emphasizing the urgent need for awareness and knowledge campaigns to address the growing e-waste problem. Meanwhile, Rasheed *et al.*, [22] have concluded that knowledge about waste collection and separation is crucial for understanding and influencing disposal behaviour. By addressing knowledge gaps through targeted educational campaigns and public awareness initiatives, policymakers can enhance e-waste management practices and mitigate the environmental and health risks associated with improper e-waste disposal. Further research in this area is vital to developing sustainable e-waste management strategies that are informed by a comprehensive understanding of household knowledge and behaviour dynamics.

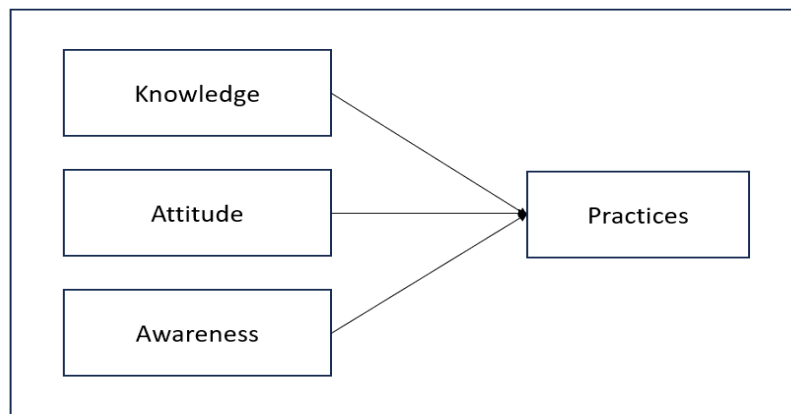
#### 1.4 Attitude

Attitude refers to an individual's cognitive and affective evaluation of a subject, reflecting positive or negative psychological sentiments about their conduct. Attitude significantly affects purchases of electronic and electrical equipment (EEE). Wang *et al.*, [23] revealed that attitudes impact pro-environmental behavioural intentions. Lin [24] showed that consumers often replace their personal computers or mobile phones with new products due to the innovative features associated with them. Liu *et al.*, [25] highlighted the boldness exhibited by consumers in India who store e-waste or leave it unattended in their houses, eventually disposing of it in landfills. Therefore, attitudes towards a particular behaviour reflect the individual's assessment of the action, ranging from positive to negative. Saritha *et al.*, [26] found that attitude is one of the significant determinants impacting residents' behaviour.

#### 1.5 Awareness

Awareness of formal disposal practices plays a crucial role in promoting environmentally responsible behaviours among households. Recent empirical studies have examined various factors influencing awareness and its impact on waste management practices. Norimah *et al.*, [12] concluded awareness campaigns have been instrumental in increasing knowledge about formal disposal options among households. While Harfadli *et al.*, [15] conducted research specifically on electronic waste (e-waste) disposal awareness among households, highlighted that access to information about the environmental and health risks associated with improper e-waste disposal significantly influences awareness levels. He also mentioned that an effective communication strategy, such as community workshops and digital media campaigns, were identified as effective tools in raising awareness about formal e-waste disposal practices. Zhang and Li [16] explored changes in awareness of formal disposal practices over time in urban areas. The findings revealed a gradual increase in awareness due to continuous public outreach efforts and policy initiatives aimed at promoting sustainable waste management behaviours. In contrast, Chen *et al.*, [17] underscored persistent gaps in awareness among households in developing countries, particularly regarding formal disposal practices for hazardous waste materials. They emphasized the need for tailored educational interventions and improved communication channels to bridge these knowledge gaps effectively. In conclusion,

empirical evidence demonstrates that increasing awareness of formal disposal practices is essential for fostering environmentally responsible behaviours among households. Effective communication strategies, continuous educational programs, and supportive policy frameworks are critical in promoting widespread adoption of formal waste disposal systems.



**Fig. 1.** Conceptual framework

Figure 1 depicts the conceptual framework adopted from KAP Theory. The independent variables consist of knowledge, attitude and awareness that are believe plays an important role influencing the formal practices to dispose e-waste. In the study, knowledge involves information, and education about a particular subject, while attitude reflects beliefs, feelings, and values shaped by the knowledge acquired. As for practices, it represents the actions, behaviours, and habits influenced by the individual's attitude. Thus, the objective of this study is to investigate the relationship between those independent variables towards formal disposal e-waste among urban residents in Bukit Sentosa, Rawang, Selangor.

## 2. Methodology

This research employs a quantitative approach that utilizes a cross-sectional survey design to provide a snapshot of the disposal practices among the urban residents in Bukit Sentosa, Rawang, Selangor. With the total population of residents in Bukit Sentosa, Rawang was 8,013 [27]. Thus, the sample collected for the study was 341 [28]. Convenience sampling method has been applied for sample selection, where physical and digital questionnaires have been distributed to the residents of Bukit Sentosa. The questionnaires divided into five sections named as resident's background, knowledge on e-waste, attitude as well as awareness on formal disposal on e-waste. All sections were measured based on Likert Scale 1 (Strongly Disagree) to 5 (Strongly Agree) except for demographic background. Descriptive analysis was used to summarize the residents background, while Spearman Correlation analysis was applied to complete the research objective. This is to ensure a comprehensive understanding of e-waste disposal method among urban residents of Bukit Sentosa, Rawang, Selangor.

## 3. Results

### 3.1 Demographic Background

This section describes on the respondent's background. Table 1 summarizes the profiling of residents that is participated in the survey. Most of the respondents were female (58.0%), aged

between 21 – 30 years old (71.1%) and were graduated from college/university (76.3%). Most of the respondents owns the terrace house type (69.5%).

**Table 1**

Demographic background of resident's in Bukit Sentosa, Rawang, Selangor

Resident's Profile	Classification	Frequency	Percentage (%)
Gender	Male	154	42
	Female	213	58
Age	Below 20 years	54	14.7
	21-30 years	261	71.1
	31-40 years	34	9.3
	Above 40 years	18	4.9
Education	Primary	1	0.3
	Secondary	86	23.4
	Tertiary	280	76.3
Type of Housing	Terrace	255	69.5
	Semi-Detached	29	7.9
	Townhouse	32	8.7
	Bungalow	51	13.9

### 3.2 Spearman Correlation Results

This section discusses the results obtained from the Spearman Correlation Analysis. Table 2 summarizes there is relationship between knowledge, attitude and awareness towards disposal practices among residents at Bukit Sentosa, Rawang, Selangor by using Spearman Correlation Test. The present study's finding that knowledge has a significant positive correlation with formal disposal e-waste practices ( $r = 0.867$ ) underscores the critical role that appropriate information and understanding play in shaping environmentally responsible behaviours. This strong correlation indicates that individuals who possess greater knowledge about e-waste and its associated environmental impacts are more likely to engage in proper disposal practices. This finding is consistent with recent literature, which highlights the importance of knowledge as a key driver of sustainable behaviour. For instance, Krejcie *et al.*, [29] found that educational campaigns and enhanced access to information significantly increased public engagement in formal e-waste disposal practices. Their research demonstrated that when individuals are well-informed about the detrimental effects of improper e-waste disposal on the environment and public health, they are more inclined to use formal recycling and disposal services. Zhang and Li [16] reported similar results, noting that knowledge dissemination through community programs and public outreach significantly improved e-waste management behaviours in urban areas. Their study emphasized that informed individuals are more likely to recognize the importance of formal disposal methods and are thus more proactive in seeking out and utilizing appropriate disposal facilities. As highlighted by Chen and Wang [30], comprehensive educational programs that provide clear information about e-waste hazards and proper disposal options can significantly boost participation in formal recycling programs. Such initiatives could include community workshops, informational campaigns, and partnerships with local schools and businesses to disseminate knowledge more effectively.

The present study's finding that attitude has a significant positive correlation with formal disposal e-waste practices ( $r = 0.785$ ) indicates a robust relationship between individuals' attitudes towards e-waste disposal and their actual disposal behaviours. This strong correlation suggests that positive attitudes towards environmental stewardship and responsible waste management significantly influence the likelihood of engaging in formal e-waste disposal practices. This result is consistent with

Nguyen *et al.*, [31] who found that individuals that hold positive attitudes towards environmental conservation are more likely to participate in formal recycling programs and other sustainable waste management practices. Their research demonstrated that attitudes reflecting concern for the environment and a sense of personal responsibility are critical determinants of pro-environmental behaviours. Furthermore, Brown [32] reported similar findings, emphasizing that attitudes towards the environmental impact of e-waste play a crucial role in motivating formal disposal behaviours. Their study revealed that individuals with a strong belief in the importance of proper e-waste management are more likely to utilize formal disposal methods, such as recycling centres and designated e-waste collection points, rather than resorting to informal or improper disposal practices.

The present study's finding that awareness has a significant positive correlation with formal disposal e-waste practices ( $r = 0.888$ ) highlights the critical role that awareness plays in promoting environmentally responsible behaviours. This strong correlation indicates that individuals who are more aware of formal e-waste disposal practices and the associated environmental impacts are significantly more likely to engage in proper disposal methods. This result is also consistent with Smith [33] which found that increased awareness about the hazards of improper e-waste disposal and the benefits of formal recycling programs significantly boosted participation rates in formal disposal practices. Their research demonstrated that well-informed individuals are more likely to utilize designated e-waste collection facilities and services. Moreover, Nguyen *et al.*, [31] highlighted the effectiveness of public awareness campaigns in raising awareness about formal e-waste disposal options. Their longitudinal study revealed that continuous public outreach and education efforts resulted in higher levels of awareness and, consequently, greater adoption of formal disposal practices among households. This finding underscores the need for sustained and comprehensive awareness initiatives to maintain high levels of public knowledge and engagement. The strong correlation coefficient observed in this study also aligns with the findings of Lin [24] who reported that awareness is a key determinant of environmentally responsible behaviours. Their study indicated that individuals with higher awareness of the environmental and health risks associated with e-waste are more likely to engage in proper disposal methods, reducing the likelihood of harmful practices such as informal recycling or dumping.

**Table 2**  
 Spearman correlation coefficient

Spearman's rho	Dependant Variable: Formal Disposal E-Waste Practices	
<b>Independent Variable 1:</b> Knowledge on proper e-waste disposal	Correlation Coefficient	.867**
	Sig. (2-tailed)	<.001
	N	367
<b>Independent Variable 2:</b> Awareness on proper e-waste disposal	Correlation Coefficient	.888**
	Sig. (2-Tailed)	<.001
	N	367
<b>Independent Variable 3:</b> Attitude on formal disposal e-waste	Correlation Coefficient	.785**
	Sig. (2-Tailed)	<.001
	N	367

#### 4. Conclusions

In conclusion, the significant positive correlations between knowledge, attitude, and awareness with formal e-waste disposal practices among households underscore the critical need for targeted educational and awareness initiatives. Enhancing public understanding of e-waste management can significantly boost formal disposal rates, reducing environmental impacts. Cultivating positive

attitudes towards environmental responsibility through public education can shape behaviours, promoting sustainable disposal practices within households. Effective awareness campaigns addressing the benefits and proper methods of e-waste disposal are essential for fostering responsible behaviours. These efforts are crucial for ensuring that households adopt proper e-waste disposal methods in the future, thereby mitigating the adverse effects of electronic waste on the environment.

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