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Abstract

This mixed-methods research aimed to 1) study the levels of perceived benefits, perceived norms, perceived policy effectiveness, intention to dispose of portable electronic waste, and proper waste disposal behaviour in Thailand; 2) examine the direct and indirect influences of these factors on proper waste disposal behaviour; and 3) propose guidelines for enhancing proper waste disposal behaviour. Quantitative data were collected from 336 employees of companies that use portable electronic devices, selected through stratified random sampling, and analysed using various statistical methods. Qualitative data were gathered through a focus group with 17 key informants and analysed using content analysis. The results showed high levels of all studied variables. Perceived benefits, perceived norms, and perceived policy effectiveness had positive direct and indirect influences on proper waste disposal behaviour, mediated by intention to dispose of portable electronic waste. To promote proper waste disposal behaviour, the government should raise awareness about the benefits, norms, and policy effectiveness related to proper disposal. These findings can guide policymaking for electronic waste management and serve as a foundation for further research.

Key words: *Perceived Benefits; Perceived Norms; Perceived Policy Effectiveness; Intention to Dispose of Portable Electronic Waste; Proper Waste Disposal Behaviour*

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1. Introduction

This study seeks to address significant gaps in understanding e-waste disposal behavior by examining the combined effects of perceived benefits, norms, and policy effectiveness. By addressing these critical factors, the study aims to contribute both theoretical insights and practical recommendations for improving e-waste management in Thailand.

Electronic waste (e-waste) management has become a critical global challenge, particularly in developing countries like Thailand [1]. The rapid advancement of technology and increasing consumption of electronic devices have led to a surge in e-waste generation worldwide. The Global E-waste Monitor 2020 reported that global e-waste volume reached 53.6 million tons in 2019 and is projected to increase to 74.7 million tons by 2030 [2]. This exponential growth poses significant environmental and health risks due to the presence of hazardous substances in e-waste [3].

In Thailand, the e-waste situation has become increasingly concerning. According to the Pollution Control Department, Thailand generated approximately 421,335 tons of e-waste in 2021, a significant increase from previous years [4]. This surge is attributed to rapid

urbanization, increasing disposable incomes, and the growing popularity of electronic devices. Despite this alarming trend, the e-waste recycling rate in Thailand remains low, with recent estimates suggesting rates around 17.4% [5], which is well below international standards.

The management of e-waste presents unique challenges due to its complex composition and the rapid obsolescence of electronic devices [6]. Improper handling and disposal of e-waste can lead to the release of toxic substances such as lead, mercury, and cadmium into the environment, posing serious risks to human health and ecosystems [7]. These hazardous materials can contaminate soil and water sources, entering the food chain and potentially causing long-term ecological damage.

The health impacts of e-waste are particularly concerning. Exposure to e-waste and its components has been linked to various health issues, including respiratory problems, neurological disorders, and increased cancer risks. A study by Heacock et al. (2016) found that informal e-waste recycling practices, which are common in developing countries like Thailand, can lead to elevated levels of toxic chemicals in the blood and urine of workers and nearby residents [8]. Children and pregnant women are especially vulnerable to these health risks.

Moreover, the informal sector often plays a significant role in e-waste collection and recycling in developing countries, raising concerns about worker safety and environmental protection [9]. In Thailand, a substantial portion of e-waste is handled by informal recyclers who often lack proper equipment and knowledge of safe recycling practices. This not only poses health risks to the workers but also results in the loss of valuable materials that could be recovered through proper recycling processes.

The economic implications of improper e-waste management are also significant. Thailand is missing out on the potential economic benefits of proper e-waste recycling, including the recovery of valuable metals and the creation of green jobs. A report by the Thailand Development Research Institute (TDRI) estimated that effective e-waste management could generate up to 1.5 billion baht annually for the Thai economy [10]

1.1 E-Waste Disposal Behaviour in Developing Countries

E-waste management challenges are particularly acute in developing countries due to limited infrastructure, informal recycling sectors, and varying levels of public awareness. A comparative study by Chaerul et al. [5] on e-waste management systems in ASEAN countries revealed significant disparities in recycling rates, with Thailand's 17.4% recycling rate lagging behind Singapore's 60%. This highlights the need for targeted interventions tailored to local contexts.

In India, Jaiswal et al. [11] found that perceived convenience and social norms were key drivers of e-waste recycling behaviour among urban consumers. Their study emphasized the importance of accessible collection points and community-based initiatives in promoting proper disposal practices. Similarly, research in China by Zhang et al. [12] identified environmental awareness and government incentives as critical factors influencing public participation in e-waste recycling programs.

A cross-cultural study by Kumar et al. [13] comparing e-waste disposal behaviour s in India, China, and Malaysia highlighted the role of cultural values in shaping attitudes towards waste management. They found that collectivist societies tended to be more responsive to community-based recycling initiatives, while individualistic cultures were more motivated by personal benefits and conveniences.

1.2 Economic Impacts of Proper E-Waste Management

The economic implications of e-waste management extend beyond the immediate costs of collection and recycling. Parajuly et al. [14] argue that adopting circular economy principles in e-waste management can create new economic opportunities while mitigating environmental risks. Their analysis suggests that proper e-waste recycling could recover billions of dollars' worth of valuable materials annually, reducing the need for primary resource extraction.

Gu et al. [15] conducted a cost-benefit analysis of e-waste management systems in developing countries, finding that initial investments in formal recycling infrastructure can yield significant long-term economic benefits. These include job creation in the recycling sector, reduced healthcare costs associated with environmental pollution, and potential revenue from recovered materials.

However, transitioning to formal e-waste management systems is not without challenges. Lawhon et al. [9] examined the socio-economic impacts of formalizing e-waste recycling in South Africa and Thailand, highlighting the need to consider the livelihoods of informal waste workers in policy development. They argue for inclusive approaches that integrate informal sector workers into formal recycling systems to ensure both environmental and social sustainability.

1.3 Policy Implications and Future Directions

The complex interplay of behaviour al, economic, and policy factors in e-waste management necessitates comprehensive strategies. Wang et al. [16] conducted a meta-analysis of 237 studies on public participation in e-waste recycling, identifying key policy levers for encouraging proper disposal behaviour. Their findings suggest that a combination of economic incentives, education programs, and convenient recycling infrastructure is most effective in promoting sustainable e-waste management practices.

As developing countries like Thailand continue to grapple with growing e-waste volumes, there is a pressing need for evidence-based policies that address local challenges while leveraging global best practices. While previous studies have focused on general attitudes and recycling behaviours [17], there is a lack of in-depth research on factors influencing the intention and behaviour of proper e-waste disposal, especially in the Thai context. Understanding these factors is crucial for developing more effective policies and strategies for e-waste management.

1.4 Study Objectives and Significance

This study aims to examine the influence of perceived benefits, perceived norms, and perceived policy effectiveness on the intention to dispose of portable electronic waste and proper waste disposal behaviour in Thailand. By investigating these relationships, we seek to contribute to the growing body of literature on environmental behaviour and provide valuable insights for policymakers and practitioners in the field of e-waste management.

The significance of this research lies in its potential to inform policy development and improve e-waste management practices in Thailand and similar developing countries. By identifying key factors that influence disposal behaviour, this study can guide the formulation of targeted interventions and awareness campaigns to promote proper e-waste disposal. Furthermore, the findings can contribute to the broader discourse on sustainable consumption and production, aligning with global sustainability goals and the principles of circular economy.

2. Materials and Methods

During the qualitative phase, data saturation was achieved when no new themes or insights emerged from additional interviews. This ensures a comprehensive understanding of the factors influencing e-waste disposal behavior.

2.1 Research Design

This study employed a mixed-methods approach, combining quantitative and qualitative research techniques in an explanatory sequential design [18]. This design allows for a comprehensive understanding of the research problem by first collecting and analysing quantitative data, followed by qualitative data collection and analysis to explain and elaborate on the quantitative results.

The research utilized the Theory of Planned Behaviour (TPB) as its theoretical foundation [19], with adaptations to develop a research conceptual framework. The TPB posits that behavioural intentions are influenced by attitudes, subjective norms, and perceived behavioural control. In our adapted model, we examined perceived benefits (attitudes), perceived norms (subjective norms), and perceived policy effectiveness (an aspect of perceived behavioural control) as key factors influencing the intention to dispose of e-waste properly.

2.2 Participants and Sampling

The quantitative phase involved 336 participants selected through stratified random sampling from Thailand's four main regions: Northern, Northeastern, Central (including Bangkok Metropolitan Region), and Southern, as defined by the National Statistical Office [20]. This sample size was determined based on the recommendations for structural equation modelling, which suggest a minimum of 10 participants per estimated parameter [21].

For the qualitative phase, 17 key informants were selected through purposive sampling [22]. These informants included senior executives in the e-waste management sector, academic experts in environmental management and policy, and consumers of e-waste disposal services.

Table 1 presents the demographic characteristics of the study sample.

Table 1: Demographic characteristics of the study sample

Demographic Category	Subcategory	Percentage	Number of Participants
Gender	Male	54.2%	182
	Female	45.8%	154
Age Group	18-30 years	29.2%	98
	31-45 years	46.4%	156
	46-60 years	20.2%	68
	Over 60 years	4.2%	14
Education Level	High School Diploma	18.5%	62
	Bachelor's Degree	58.9%	198
	Master's Degree	20.2%	68
	Doctoral Degree	2.4%	8
Region	Northern	25%	84
	Northeaster	25%	84
	Central (incl. Bangkok)	25%	84
	Southern	25%	84

The sample consisted of 336 participants, with a slight majority of males (54.2%). The age distribution was skewed towards younger and middle-aged adults, with 46.4% in the 31-45 years category. Most participants held a bachelor's degree (58.9%), and the sample was evenly distributed across Thailand's four main regions.

2.3 Instruments

The questionnaire development process involved several stages to ensure its validity and reliability. Initially, a comprehensive literature review was conducted to identify key constructs and existing measurement scales related to e-waste disposal behaviour. Based on this review, an initial pool of items was generated for each construct: perceived benefits, perceived norms, perceived policy effectiveness, intention to dispose, and proper disposal behaviour.

The content validity of the questionnaire was assessed through expert review. A panel of five experts in environmental psychology, waste management, and survey design evaluated each item for its relevance, clarity, and appropriateness. The content validity index (CVI) was calculated for each item, with items scoring below 0.80 being either revised or removed. This process resulted in a refined set of items with high content validity.

To further establish the questionnaire's validity and reliability, a pilot study was conducted with a sample of 50 participants representative of the target population. The pilot data were used to perform an exploratory factor analysis (EFA) to examine the underlying factor structure and identify any problematic items. Items with low factor loadings (< 0.4) or high cross-loadings were eliminated. The internal consistency reliability of each scale was assessed using Cronbach's alpha, with all scales demonstrating good reliability (α ranging from 0.85 to 0.89).

For the qualitative phase, the semi-structured interview guide was developed based on the guidelines suggested by Kallio et al. [23] and informed by the quantitative findings. The guide consisted of open-ended questions designed to explore participants' perceptions, experiences, and suggestions related to e-waste disposal in Thailand. Example questions included: "Can you describe your experience with disposing of electronic waste?" and "What do you think are the main challenges in properly disposing of e-waste in Thailand?"

2.4 Data Collection and Analysis

Quantitative data were collected through self-administered questionnaires distributed to participants at their workplaces. The data were analysed using descriptive statistics, confirmatory factor analysis (CFA), and structural equation modelling (SEM) [24]. The analysis was conducted using IBM® SPSS® Statistics version 26.0 and IBM® SPSS® Amos version 26.0 software [25].

The qualitative data collection process involved both in-depth interviews and focus group discussions. Seventeen in-depth interviews were conducted with key informants, including senior executives in the e-waste management sector, academic experts in environmental management and policy, and consumers of e-waste disposal services. Each interview lasted approximately 60-90 minutes and was conducted in a private setting to ensure confidentiality.

Two focus group discussions were held, each consisting of $8-9$ participants. The first group comprised representatives from various industries that generate significant e-waste, while the second group included members of the public with diverse demographic backgrounds. Each focus group session lasted approximately 120 minutes and was moderated by a trained facilitator.

All interviews and focus group discussions were audio-recorded with participants' consent and transcribed verbatim. The transcripts were then analysed using thematic analysis, following the six-step process outlined by Braun and Clarke [26]: (1) Familiarization with the data through repeated reading of the transcripts (2) Generation of initial codes (3) Searching for themes (4) Reviewing themes (5) Defining and naming themes (6) Producing the report.

Two researchers independently coded the data to enhance the reliability of the analysis. Any discrepancies in coding were discussed and resolved to reach consensus. Qualitative data analysis software (QSR NVivo version 12) was used to facilitate the coding and analysis process, allowing for efficient organization and retrieval of coded data.

The integration of quantitative and qualitative data followed an explanatory sequential design [18], where qualitative findings were used to explain and elaborate on the quantitative results. This mixed-methods approach allowed for a more comprehensive understanding of e-waste disposal behaviour in Thailand.

3. Results and Discussion

3.1 Quantitative Findings

An interesting discrepancy emerged in the weaker role of perceived norms compared to policy effectiveness. This may reflect the evolving societal norms in Thailand, where environmental responsibility is still maturing as a cultural value. Future studies could investigate how long-term education initiatives might strengthen these norms.

The structural equation modelling (SEM) analysis revealed significant relationships between key variables in our model of e-waste disposal behaviour. Table 2 summarizes these results.

Table 2: Results of Structural Equation Modelling (SEM) Analysis

Category	Value	Explanation
Mean Scores (5-point Likert scale)		
Proper Disposal Behaviour	4.32	High level of proper disposal behaviour
Intention to Dispose	4.12	High level of intention to dispose properly
Perceived Benefits	4.31	High level of perceived benefits
Perceived Norms	4.19	High level of perceived social norms
Perceived Policy Effectiveness	4.20	High level of perceived policy effectiveness
Direct Effects on Intention to Dispose (β)		
Perceived Policy Effectiveness	0.524	Strongest direct influence on intention
Perceived Benefits	0.202	Moderate direct influence on intention
Perceived Norms	0.163	Modest direct influence on intention
Direct Effect on Proper Disposal Behaviour (β)		
Intention to Dispose	0.401	Strong direct influence on behaviour
Indirect Effects on Proper Disposal Behaviour (β)		
Perceived Policy Effectiveness	0.210	Strongest indirect influence on behaviour
Perceived Benefits	0.008	Weak indirect influence on behaviour
Perceived Norms	0.007	Weak indirect influence on behaviour
Model Explanatory Power (R^2)		
Intention to Dispose	88.9%	Model explains 88.9% of variance in intention
Proper Disposal Behaviour	91.1%	Model explains 91.1% of variance in behaviour

Statistical Significance		
All relationships	$p < 0.001$	All relationships are highly statistically significant

Note: β (Beta) values represent standardized regression coefficients. All relationships are statistically significant at $p < 0.001$.

The mean scores indicate high levels of all factors, with proper disposal behaviour scoring the highest at 4.32 on a 5-point Likert scale. This suggests a generally positive attitude towards e-waste disposal among Thai employees, aligning with recent global trends in increasing environmental awareness [27].

Notably, perceived policy effectiveness demonstrated the strongest direct effect (β = 0.524) on intention to dispose, followed by perceived benefits (β = 0.202) and perceived norms (β = 0.163). This finding underscores the crucial role of government initiatives in shaping disposal behaviour s and supports previous research emphasizing the importance of policy measures in e-waste management [28].

Figure 1 visually represents the effect sizes of variables in the structural equation model. Enhanced diagram notes: Include labeled paths with effect sizes and clearly distinguish direct and indirect effects using dashed versus solid lines.

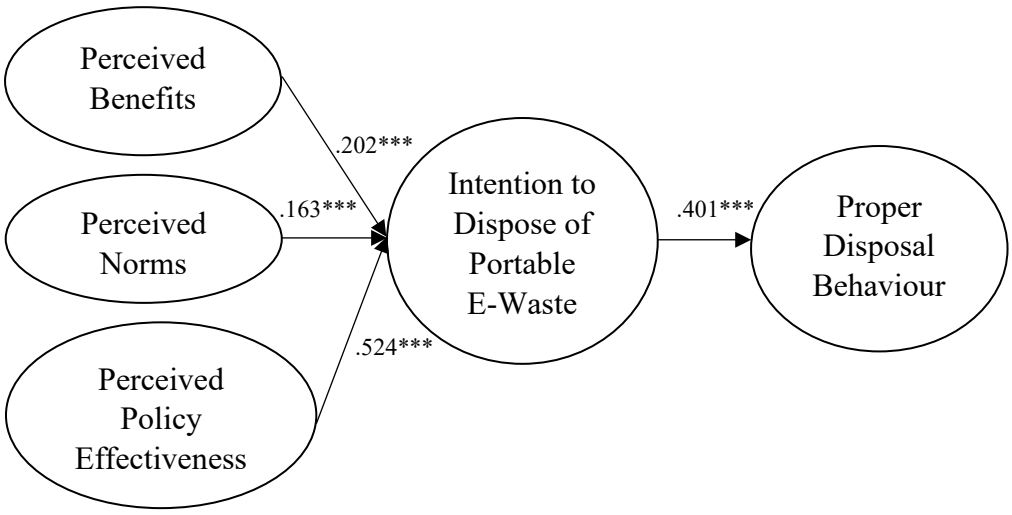

Figure 1: Structural equation model of e-waste disposal behaviour

The figure illustrates the structural relationships between the key variables in our e-waste disposal behaviour model. Solid lines with arrows represent direct effects, while the numbers adjacent to these lines indicate standardized path coefficients (β values). All relationships shown are statistically significant at $p < 0.001$.

Perceived Policy Effectiveness emerges as the strongest predictor, with a substantial direct effect (β = 0.524) on Intention to Dispose. This is followed by Perceived Benefits (β = 0.202) and Perceived Norms (β = 0.163), both showing positive but comparatively weaker influences on Intention to Dispose.

Intention to Dispose, in turn, demonstrates a strong direct effect (β = 0.401) on Proper Disposal Behaviour, serving as a mediating variable between the predictors and the ultimate outcome.

The model's structure supports the adapted Theory of Planned Behaviour framework, highlighting the crucial role of policy effectiveness in shaping e-waste disposal intentions and

behaviours in the Thai context. The thickness of the arrows visually represents the relative strength of each relationship, providing an intuitive understanding of the varying impacts of different factors on e-waste disposal behaviour.

This visual representation helps to clarify the complex interplay of factors influencing e-waste disposal, offering valuable insights for policymakers and researchers in the field of environmental management.

As shown in Figure 1, perceived policy effectiveness has the strongest direct effect on intention to dispose, which in turn has a strong effect on proper disposal behaviour. This visual representation helps to clarify the relationships between the variables in the model [29].

The model demonstrates high explanatory power, accounting for 88.9% of the variance in intention to dispose and 91.1% in proper disposal behaviours. This indicates the robustness of the adapted Theory of Planned Behaviour in predicting e-waste disposal behaviour in the Thai context [30].

3.2 Qualitative Findings

The qualitative data provided rich insights that complemented and expanded upon the quantitative results. Table 3 summarizes the key themes that emerged from the thematic analysis of interview and focus group data.

Table 3: Summary of Qualitative Findings on E-Waste Disposal Behaviour in Thailand

Factor	Key Findings
Perceived Benefits	- Increased awareness of e-waste disposal convenience - Greater recognition of environmental conservation benefits - Improved understanding of proper disposal methods
Perceived Norms	- Stronger social responsibility towards environmental protection - Increased tendency to recommend proper disposal to others - Greater influence of media and environmental groups on disposal behaviour
Perceived Policy Effectiveness	- Improved perception of government initiatives in e-waste management - Recognition of stricter regulations and enforcement - Appreciation for government-private partnerships in e-waste disposal
Intention to Dispose	- Increased willingness to participate in e-waste disposal programs - Greater intention to use proper e-waste disposal facilities - Enhanced commitment to environmental protection through proper disposal
Proper Disposal Behaviour	- Improved knowledge and understanding of proper e-waste disposal methods - Increased participation in e-waste segregation and disposal - Some challenges remain in consistent implementation of proper disposal practices
Additional Insights	- Need for continued education and awareness programs - Importance of accessible disposal infrastructure - Role of corporate social responsibility in promoting proper disposal

The qualitative findings reveal increased awareness and social responsibility towards e-waste disposal among participants. This aligns with the high mean scores observed in the quantitative data and suggests a positive shift in attitudes towards environmental issues in Thailand [31].

Participants highlighted the importance of convenience and accessibility in promoting proper e-waste disposal. As one interviewee stated, "If it's easy and convenient to dispose of e-waste properly, people are more likely to do it." This underscores the need for well-designed infrastructure and collection systems to facilitate proper disposal behaviour [32].

3.3 Integration of Quantitative and Qualitative Findings

The integration of quantitative and qualitative findings provides a comprehensive understanding of e-waste disposal behaviour in Thailand. The strong influence of perceived policy effectiveness observed in the SEM analysis is supported by the qualitative data, which highlights the importance of government initiatives and regulations in shaping disposal behaviours.

The persistence of challenges in consistent implementation, as noted in the qualitative findings, suggests that while attitudes and intentions are generally positive, there may be situational or contextual factors that hinder proper disposal behaviour. This highlights the need for a multi-faceted approach to promoting e-waste management that addresses both individual factors and systemic barriers [33].

3.4 In-depth Analysis of Variable Relationships

Further analysis of the relationships between variables revealed interesting patterns. The strong direct effect of perceived policy effectiveness ($\beta = 0.524$) on intention to dispose suggests that government initiatives play a crucial role in shaping disposal behaviours. This finding aligns with the study by Chen et al. [28], who found that environmental regulations significantly influence green innovation in e-waste recycling enterprises.

Interestingly, the effect of perceived benefits ($\beta = 0.202$) on intention to dispose, while significant, was not as strong as anticipated. This suggests that individuals in Thailand may be more motivated by external factors (such as policies) than personal benefits when it comes to e-waste disposal. This contrasts with findings from Western contexts, where personal benefits often play a more substantial role in environmental behaviours [34].

The relatively weak effect of perceived norms ($\beta = 0.163$) on intention to dispose is noteworthy. This could indicate that social norms regarding e-waste disposal are not yet well-established in Thai society. As Zhan et al. [17] noted, the influence of social norms on e-waste recycling intention can vary significantly across cultures and contexts.

3.5 Theoretical Implications

The findings of this study have several implications for the Theory of Planned Behaviour (TPB) [19] in the context of e-waste disposal. While the TPB posits that attitudes, subjective norms, and perceived behaviour al control are key determinants of behaviour al intentions, our results suggest that in the Thai context, policy effectiveness (an aspect of perceived behaviour al control) plays a particularly crucial role.

This emphasis on external control factors aligns with the concept of "facilitation conditions" proposed by Triandis [35] in his Theory of Interpersonal Behaviour. Triandis argued that in addition to intentions, behaviour is also influenced by the absence of environmental constraints. In the case of e-waste disposal in Thailand, effective policies appear to act as a significant facilitating condition.

Moreover, the high explanatory power of our model ($R^2 = 91.1\%$ for proper disposal behaviour) suggests that the adapted TPB framework, incorporating perceived policy effectiveness, is particularly well-suited for understanding e-waste disposal behaviour in developing countries like Thailand.

3.6 Demographic Factors and E-waste Disposal Behaviour

Analysis of demographic factors revealed several significant associations with e-waste disposal behaviour. Age was found to be positively correlated with proper disposal behaviour ($r = 0.24$, $p < 0.001$), suggesting that older individuals are more likely to dispose of e-waste correctly. This finding is consistent with research by Liu et al. [36], who found that older adults in China demonstrated more responsible e-waste recycling behaviours.

Education level also showed a positive association with proper disposal behaviour ($r = 0.31$, $p < 0.001$). Participants with higher education levels reported more frequent engagement in proper e-waste disposal practices. This aligns with the broader literature on environmental behaviours, which often finds a positive relationship between education and pro-environmental actions [37].

Interestingly, gender differences were observed in perceived benefits of proper e-waste disposal. Female participants reported significantly higher perceived benefits ($M = 4.45$, $SD = 0.62$) compared to male participants ($M = 4.18$, $SD = 0.71$), $t(334) = 3.72$, $p < 0.001$. This gender difference in environmental attitudes is consistent with some previous studies [38] and may have implications for targeted awareness campaigns.

Regional differences were also noted, with participants from the Bangkok Metropolitan Region showing higher levels of perceived policy effectiveness ($M = 4.35$, $SD = 0.58$) compared to other regions ($M = 4.12$, $SD = 0.67$), $F(3, 332) = 5.24$, $p < 0.01$. This could reflect the concentration of e-waste management initiatives and facilities in the capital region, highlighting the need for more equitable policy implementation across the country.

These demographic insights provide valuable information for policymakers and practitioners in tailoring e-waste management strategies to different population segments. For instance, awareness campaigns might be particularly important for younger individuals, while improved infrastructure and policy communication could be prioritized in regions outside Bangkok.

4. Conclusions

While this study provides significant insights, limitations include its focus on employees of specific companies, which may not generalize to other demographics. Future research should expand on these findings by including rural populations and conducting longitudinal studies to assess policy impacts over time.

This study contributes significantly to the understanding of e-waste disposal behaviour in Thailand by identifying key factors influencing proper disposal practices. The findings emphasize the critical role of policy effectiveness in promoting proper e-waste disposal, suggesting that policymakers should focus on developing, communicating, and enforcing effective e-waste management strategies.

Based on these findings, we propose the following specific policy recommendations for enhancing e-waste management in Thailand:

1. Implement a comprehensive Extended Producer Responsibility (EPR) system: The Thai government should establish a mandatory EPR system that holds manufacturers

and importers responsible for the entire lifecycle of their products, including end-of-life management. This system should include clear targets for collection and recycling rates, with financial penalties for non-compliance.
2. Develop a nationwide e-waste collection network: Establish easily accessible e-waste collection points in communities, shopping centers, and public institutions across the country. This network should be supported by a user-friendly online platform that provides information on nearby collection points and proper disposal methods.
3. Introduce financial incentives for proper e-waste disposal: Implement a deposit-refund system for electronic products, where consumers pay a deposit at the time of purchase and receive a refund upon proper disposal. This can be complemented by tax incentives for businesses that achieve high e-waste recycling rates.
4. Enhance public awareness and education: Launch comprehensive awareness campaigns using various media channels to educate the public about the environmental and health impacts of e-waste and proper disposal methods. Integrate e-waste management education into school curricula at all levels.
5. Support the formalization of the informal e-waste sector: Develop programs to integrate informal e-waste collectors and recyclers into the formal waste management system. This could include providing training, safety equipment, and access to proper recycling facilities.
6. Strengthen regulatory enforcement: Increase resources for monitoring and enforcing e-waste regulations, including stricter penalties for illegal dumping and improper handling of e-waste.
7. Promote eco-design and green procurement: Encourage manufacturers to design products for easy disassembly and recycling. Implement green procurement policies for government institutions to prioritize environmentally friendly electronic products.

While this study provides valuable insights, it is important to acknowledge its limitations. The focus on company employees may not fully represent the entire population's e-waste disposal behaviour. Future research could explore e-waste disposal behaviours among different demographic groups, including students, the elderly, and rural populations.

Additionally, the cross-sectional nature of this study limits our ability to observe changes in behaviour over time. Longitudinal studies could provide insights into the long-term impacts of policy interventions and awareness campaigns on disposal practices. Such studies could help identify the most effective strategies for promoting sustainable e-waste management behaviour s over time.

Another limitation is the potential for social desirability bias in self-reported behaviours. Future studies could incorporate objective measures of e-waste disposal behaviour, such as actual recycling rates or participation in e-waste collection programs, to complement self-reported data.

Further research directions could include:

1. Investigating the role of product design and manufacturer initiatives in influencing consumer disposal behaviour.
2. Exploring the potential of digital technologies (e.g., smartphone apps, IoT devices) in facilitating proper e-waste disposal.
3. Conducting comparative studies across different ASEAN countries to identify best practices and opportunities for regional cooperation in e-waste management.
4. Examining the economic viability and environmental impact of different e-waste recycling technologies in the Thai context.

5. Investigating the health impacts of e-waste exposure on vulnerable populations, particularly those involved in informal recycling activities.

In conclusion, addressing the e-waste challenge in Thailand requires a multi-faceted approach, combining effective policies, public awareness campaigns, improved infrastructure, and technological innovation. By leveraging the insights from this study and implementing targeted strategies, stakeholders can work towards developing more sustainable e-waste management practices, contributing to environmental conservation and public health protection in Thailand. As the country continues to grapple with the growing e-waste challenge, the findings of this research provide a solid foundation for informed decision-making and targeted interventions in the pursuit of a more sustainable and circular economy.

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