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A CONCEPTUAL FRAMEWORK OF RESISTANCE BEHAVIOR IN E-WASTE RECYCLING

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Abstract:

This conceptual study applies Innovation Resistance Theory (IRT) to examine the behavioral barriers that limit household participation in formal e-waste recycling in Malaysia. Although environmental awareness is increasing, actual recycling behavior remains low, indicating a persistent gap between intention and action. The study identifies three primary functional barriers infrastructural inaccessibility, data security concerns, and institutional distrust that contribute to this resistance. It also explores the moderating role of social norms, which tend to have limited influence in the Malaysian context, where recycling is not yet embedded as a widely practiced or socially reinforced behaviour. By framing resistance as a deliberate response to perceived risks, inconveniences and trust, this study extends the application of IRT to the domain of sustainable behavior. The proposed framework integrates both structural and psychological barriers to explain why many households choose not to engage with formal recycling systems. This research offers theoretical contributions by advancing IRT within the context of environmental behavior and practical insights for policymakers. Addressing systemic weaknesses, improving institutional transparency, and designing culturally appropriate social norm interventions may help reduce resistance and support Malaysia's national sustainability goals. The framework also provides a foundation for future empirical studies and targeted policy development.

Keywords:

E-Waste, Resistance, Household Behaviour, Innovation Resistance Theory (IRT)

Introduction

The term electronic waste, or e-waste, describes old electrical or electronic devices that are thrown away or discarded (Baldé et al., 2024). The accelerating pace at which electronic waste is produced is becoming one of the biggest challenges we face as a world today. Proper e-waste

management is critical, especially with the growing environmental concern and the fast-paced introduction of new electronic devices to the market (Baldé et al., 2024; Enginkaya & Sağlam, 2024; Ismail et al., 2025; Shah & Asghar, 2024). The disposal of outdated electronics is a nightmare from a logistics and ecological standpoint, and the problem will only get worse as technology continues to infiltrate everyday life. This scenario is particularly troubling in developing countries, where the infrastructure to manage waste often falls behind the level of technological consumption.

A report published in 2024 predicts that developing countries such as Malaysia will produce upwards of 24 million units by 2025 (Akhtar, 2024). While some efforts to promote recycling address global participation, the problem remains erratic at the household level especially in Malaysia, which in 2020 had a national e-waste recycling rate of only 25%, despite a relatively high public awareness of recycling's environmental benefits (Mohamad et al., 2022). This is a classic case of the 'knowledge-action' gap, and it continues to highlight the need to explore the barriers to effective e-waste recycling that are exposed in the household sector.

Recycling adoption offers clear environmental benefits such as resource recovery and reduced pollution. However, many households continue to resist formal recycling systems. Instead, they often rely on informal disposal methods, influenced by convenience or small financial incentives, despite being aware of the associated environmental risks (Jayaraman et al., 2019; Sofian Azizi et al., 2023). This suggests that awareness alone is insufficient to drive behavioral change, barriers such as distrust in formal recycling programs, perceived inconvenience, or the absence of immediate rewards, play a crucial role in sustaining resistance (Sajid & Zakkariya, 2023). These barriers align with Innovation Resistance Theory (IRT), which argues that resistance to new practices stems not from a lack of knowledge but from functional (e.g., accessibility issues) and psychological (e.g., habit persistence) obstacles (Ram & Sheth, 1989).

Existing research on e-waste management has predominantly focused on factors that encourage recycling, such as knowledge, social norms, and infrastructure availability (Verma et al., 2025; Sharma et al., 2024; Shaharudin et al., 2023; Yahya et al., 2022; Annamdevula et al., 2023; Bhutto et al., 2023; Shaharudin et al., 2023; Vijayan et al., 2023; Yahya et al., 2022). Meanwhile, Innovation Resistance Theory (IRT) has been applied to consumer behavior in various contexts, especially in marketing. Now its use in examining e-waste recycling resistance, particularly among households in developing economies which it is still remains unexplored (Verma et al., 2025; Sajid & Zakkariya, 2023; Dhir et al., 2021). This leaving a gap in understanding how functional and psychological barriers collectively sustain resistance in Malaysia's e-waste management landscape.

This study contributes to both theory and practice. Theoretically, it extends IRT to the context of e-waste recycling, offering a structured framework to analyze resistance behaviors beyond traditional motivational models. Practically, the findings can inform policymakers and environmental organizations in designing targeted strategies such as improving accessibility, enhancing trust in formal systems, or introducing incentive structures. Given Malaysia's goal of achieving a 40% national recycling rate under the 12th Malaysia Plan (12MP), addressing these resistance mechanisms is essential to closing the intention-behavior gap and promoting sustainable e-waste management.

Problem Statement

In Malaysia, there is a notable gap in the management of e-waste. E-waste is managed and disposed of differently compared to other household waste due to its hazardous components, data privacy concerns, and the need for specialized handling and recycling processes. A study shown that, 71.8% of households recognize the correct disposal methods, only 42.7% of the population recycles formally (Shaharudin et al., 2023). Malaysia's dilemma regarding e-waste is not due to inaction; it is a case of resistance. The intention to evade formal structures is prevalent, and systems are actively resisted. Evidence shows households are actively and consciously choosing to use informal disposal methods. 44% of the population admitted to not segregating e-waste, even when aware of the toxic components (Azizi et al., 2023). Moreover, the population resorts to informal e-waste dumping out of perceived ease (Sofian et al., 2023; Jayaraman et al., 2019).

This resistance behavior poses tremendous problems. The work of Islam et al. (2024) and Liu et al. (2023) describes the informal recycling industries located in Malaysia and the crude techniques of open burning and acid baths employed for metal retrieval from e-waste. These methods are crude and toxic, releasing lead, mercury, and cadmium, which not only contaminate the soil and water but also expose workers and surrounding communities to dire health risks. Most importantly, children are affected, including the regions with informal recycling centers, facing increased prevalence of respiratory problems, neurological damage, and a decline in overall development (Ismail et al., 2025; Andeobu et al., 2021; Dhir et al., 2021). The economic incentive due to informal recycling tends to lean towards serious health neglect for low-income families. This results in the continuous environmental decline and public health disaster.

Innovation Resistance Theory (Ram & Sheth, 1989) is applicable here, as specific aspects of this resistance take form through three functional barriers: (1) infrastructural inaccessibility, (2) fears concerning data security, and (3) weaker unlawful enforcement distrust. Importantly, the individualistic context of Malaysia (Sabbir et al., 2023) explains the absence of social norms, which further complicates overcoming these barriers (Shaharudin et al., 2023).

Malaysia's stagnating recycling rate of 25% (Mohamad et al., 2022), in contrast to the 12MP projected 40% target, illustrates the consequences of the gaps in socio-culture explained above. Current campaigns neglect or resist passive action actively, which no campaign behaviorally seeks to achieve. Bridging this gap requires systemic interventions designed on the functional barriers of the Innovation Resistance Theory, while also considering the Malaysian socio-cultural framework: the need to decouple informal recycling from public health crises.

Literature Review

This section examines resistance behavior in e-waste recycling, including the functional barriers, social norm as a moderator. In this conceptual paper, relevant literature was reviewed, and four hypotheses were proposed.

Resistance in E-waste Recycling Behaviors

Consumer resistance to innovative practices is not an outright rejection, but an outcome of perceived barriers which the resistance offered by consumers to an innovation, either because it poses potential changes from a satisfactory status quo or because it conflicts with their belief structure (Ram & Sheth, 1989). Kleijnen et al. (2009) conceptualize innovation resistance as a

conscious response by consumers to an innovation, which can manifest in various forms such as rejection, postponement, or opposition. Concerning sustainable practices like e-waste recycling, this resistance manifests as disengagement, a form of resistance to formally structured systems adoption. As Dhir et al. (2022) state, “reasons against” did not significantly impact attitudes but did have a negative influence on the intent to recycle. This underlines the importance of addressing barriers in the study, which is critical for increasing recycling participation rates.

Empirical data show that, while 71.8% of Malaysian households accept proper disposal methods, only 42.7% formally recycle (Shaharudin et al., 2023). A similar finding in Putrajaya, a study on e-waste management practices, found that a majority of respondents had a good grasp of e-waste management and recycling habits, along with sound knowledge of hazardous materials. However, despite high levels of awareness and expressed willingness, the actual inclination to separate e-waste from general household waste was low; only 44% reported they would separate e-waste (Azizi et al., 2023). This shows there is a persistent gap between willingness and actual disposal actions.

Functional Barriers: Infrastructure Inaccessibility

Functional barriers refer to consumers’ doubts about an innovation’s performance and reliability, which serve as significant hurdles to adoption and can lead to resistance when perceived functional risks are high (Kleijnen et al., 2009; Ram & Sheth, 1989). E-waste recycling efforts often falter when systems require excessive effort from households, making participation inconvenient or impractical. As Liu et al (2023), highlight, poor infrastructure significantly contributes to ineffective e-waste recycling practices. Especially developing countries such as China and Africa. The recycling infrastructure tends to be informal, with workers using crude methods to recover valuable materials from e-waste.

This lack of well-developed infrastructure results in negative impacts on local, regional, and global environments due to unsafe and unregulated recycling processes. Puzzo and Prati (2024) studied across Italian households and found that each additional kilometer to a collection center reduced recycling rates by 12%, underscoring how even marginal increases in effort can discourage engagement. In Malaysia, where formal recycling points remain limited and unevenly distributed, this issue is particularly acute. Meanwhile, according to Sofian et al. (2023), a significant number of households are unaware of nearby collection centers, prompting them to default to alternative disposal methods such as hoarding obsolete devices or resorting to informal dumping.

However, infrastructure can facilitate better recycling behaviour and not be framed as a direct disqualification or outright rejection of recycling practices. This implies that deficiencies in formal recycling infrastructure and the complexity of formal processes discourage proper disposal, encouraging informal, less regulated recycling practices instead (Islam et al., 2025; Liu et al., 2023; Puzzo & Prati, 2024; Sharma & Singh, 2024; Sofian Azizi et al., 2023). These behaviors are not merely the result of indifference but reflect a broader sense of disconnection from an inaccessible system. When formal recycling requires additional time, travel, or effort without offering adequate support or convenience, households are likely to resist adopting e-waste recycling behavior.

This pattern suggests that infrastructure inaccessibility plays a direct role in sustaining resistance to formal recycling participation.

Accordingly, the following hypothesis is proposed:

H1: Infrastructure inaccessibility positively influences resistance to e-waste recycling behavior.

Functional Barriers: Data Security Risks

Research indicates that concerns related to data theft while recycling devices such as laptops or smartphones can demotivate users from participating in e-waste recycling, even when they initially intend to do so (Islam et al., 2025). These findings highlight the presence of psychological barriers—barriers that are not necessarily rooted in logistical challenges, but in perceptions, fears, and uncertainties. In particular, these concerns often stem from limited knowledge about technical processes such as data sanitization, as well as anxiety over the misuse of sensitive information.

A common illustration of this issue is the reluctance to recycle older digital devices, where the fear of identity or data theft becomes a key deterrent (Gaur et al., 2023; Nadarajan et al., 2023). This barrier becomes even more pronounced in environments where formal recycling processes do not include clear, enforceable mechanisms for secure data erasure. In such cases, the absence of concrete guarantees and transparent protocols leads to growing uncertainty among users. As Sajid and Zakkariya (2022) emphasize, this lack of clarity within formal recycling channels significantly erodes public trust, thereby reinforcing psychological resistance to recycling behavior.

These concerns extend into the digital domain as well. Research examining the acceptance of online e-recycling services reveals that individuals with heightened privacy concerns are often discouraged from using digital recycling platforms due to apprehensions about how their data might be handled. Lyu et al. (2023) argue that establishing clear, criteria-based privacy and data handling policies is essential for building consumer trust and encouraging broader engagement. For many households, however, the absence of visible and credible mechanisms for ensuring data destruction transforms what should be a civic-minded activity into a perceived personal risk.

Thus, the following hypothesis is proposed:

H2: Perceived data security risks positively influence resistance to e-waste recycling behavior.

Functional Barriers: Institutional Distrust

The lack of trust in formal institutions is another critical factor contributing to resistance toward e-waste recycling. Prior studies emphasize that effective law enforcement plays a pivotal role in shaping the behaviors of stakeholders involved in e-waste management. However, when enforcement mechanisms are weak—failing to curb illegal exporting, unregulated dumping, and non-compliant recycling practices driven by profit motives—such regulatory gaps foster a culture of non-compliance and erode public confidence in the system (Islam et al., 2024; Liu et al., 2023; Azizi et al., 2023).

This erosion of trust extends beyond institutional performance and directly impacts household behavior. Users who perceive formal systems as unreliable or ineffective are more likely to withdraw from official recycling programs. Even when individuals recognize the environmental and health benefits of responsible e-waste disposal, skepticism toward the system leads to disengagement (Islam et al., 2024; Liu et al., 2023; Yahya et al., 2022; Nyeko et al., 2022). In the Malaysian context, this sentiment is further reinforced by public skepticism surrounding government-led recycling initiatives, which are often viewed as lacking transparency, consistent communication, and rigorous enforcement (Azizi et al., 2023; Yahya et al., 2022).

As a result, when users view recycling systems as mismanaged or untrustworthy, they are more inclined to disengage from formal channels and turn instead to informal, unregulated alternatives. This highlights institutional trust not merely as a peripheral factor, but as a central driver of behavioral resistance.

Accordingly, the following hypothesis is proposed:

H3: Low trust in formal recycling institutions positively influences resistance to e-waste recycling behaviour

Psychological Barriers: Social Norms as Moderator

Psychological barriers to innovation extend beyond tangible obstacles and are shaped by internal perceptions such as image concerns, stereotypes, emotional responses to perceived risks, and discomfort with altering established routines or societal roles. These barriers can trigger active opposition or outright rejection of new behaviors, independent of practical considerations (Kleijnen et al., 2009; Ram & Sheth, 1989). Among these, the role of social norms is defined as the implicit expectations from one's family, peers, and community, which has emerged as a particularly influential psychological factor shaping individual decision-making (Lyu et al., 2023; Sabbir et al., 2023; Shaharudin et al., 2023).

Extensive prior research underscores social norms as a central driver of consumer resistance or adoption behavior in innovation contexts (Islam et al., 2024; Kleijnen et al., 2009; Lyu et al., 2023; Sabbir et al., 2023; Shaharudin et al., 2023; Vijayan et al., 2023). Resistance rooted in social norms often stems from the perceived misalignment between the innovation and prevailing cultural values, traditions, or ethical expectations. In this concept paper, social norms are considered not as direct barriers but as potential moderators that influence the strength or direction of the relationship between functional barriers and recycling resistance, particularly at the household level.

Empirical studies further validate this moderating role. For instance, research conducted on online e-waste recycling platforms in China found that social influence significantly increased participation in recycling activities, demonstrating its power in enhancing behavioral engagement (Lyu et al., 2023). Similarly, in collectivist societies like Bangladesh, community expectations and peer behavior strongly encourage recycling practices, transforming them from personal choices into socially expected actions (Sabbir et al., 2023; Vijayan et al., 2023). In such contexts, social approval or disapproval plays a central role in shaping environmentally responsible behavior.

However, the influence of social norms appears considerably weaker in the Malaysian context. While certain collectivist tendencies do exist, recycling is not yet deeply embedded as a routine or culturally expected behavior. Shaharudin et al. (2023) report that subjective norms exert only a minimal influence on recycling participation in Malaysia, particularly in communities with limited recycling infrastructure or weak environmental engagement. Similarly, Afroz et al. (2020) highlight that although social norms are acknowledged as relevant, they do not exert a statistically significant impact on household recycling behavior. Reinforcing this view, Verma et al. (2025) suggest that the effect of social norms becomes meaningful only when pro-environmental actions are visible and socially reinforced such as through community programs or leadership modeling.

Consequently, in societies where recycling is neither highly visible nor strongly endorsed, social norms may fail to serve as motivational forces. Instead, they may function more effectively as moderators, either amplifying or diminishing the effects of functional barriers depending on the perceived social value of recycling (Shaharudin et al., 2023). This interpretation aligns with the findings of Concari et al. (2023), who observed that in environments lacking strong social incentives, such as adequate infrastructure or penalties for non-compliance, motivation to engage in recycling remains low. People's recycling behavior, therefore, is often shaped by their perception of whether it is socially expected and institutionally supported.

Rather than treating social norms as standalone barriers, this study positions them as conditional factors that can either facilitate or obstruct behavior, depending on their alignment with the innovation. When an innovation is perceived to reflect shared societal values, its acceptance increases; when it conflicts with those norms, resistance intensifies. In this regard, social norms can become a decisive force in determining behavioral outcomes. Accordingly, the following hypothesis is proposed:

H4: Social norms moderate the relationship between functional barriers and resistance to e-waste recycling behaviour

Conceptual Framework

The conceptual framework for this study is grounded in Innovation Resistance Theory (IRT) (Ram & Sheth, 1989), which explains that resistance to new systems such as formal e-waste recycling does not stem from inherent opposition, but rather from the perception of various barriers. IRT categorizes these barriers into two main types: functional barriers, which relate to practical difficulties such as inconvenience or system inefficiencies, and psychological barriers, which involve emotional, cognitive, or normative concerns. Both types of barriers are instrumental in shaping behavioral disengagement.

In the Malaysian context, where formal e-waste recycling remains significantly underutilized despite growing public awareness, resistance behavior is not merely passive neglect. Instead, it manifests as goal-directed avoidance such as hoarding obsolete devices, resorting to informal recycling channels, or completely withdrawing from participation. These actions are often triggered by frustration with inefficient systems, a lack of convenience, and deep-seated distrust in formal recycling mechanisms (Islam et al., 2024; Islam et al., 2025; Sajid & Zakkariya, 2023).

To address existing gaps in the behavioral literature on e-waste management, this study extends the original IRT framework by introducing social norms as moderating variables. This addition recognizes the influence of societal expectations in either amplifying or mitigating resistance, especially in household recycling behavior (Shaharudin et al., 2023). As illustrated in Figure 1, the proposed framework maps the complex interplay between functional and psychological barriers and the moderating role of social norms in shaping resistance toward formal e-waste recycling systems.

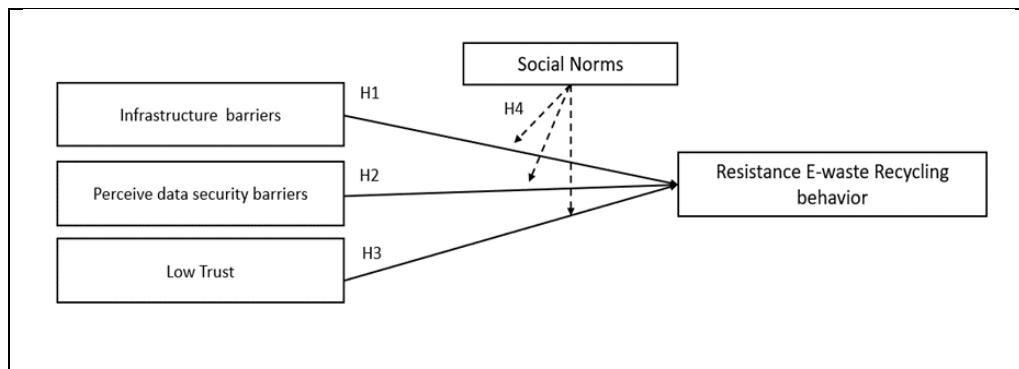


Figure 1: Resistance Framework for E-Waste Recycling Behavior

The proposed framework integrates IRT with recent empirical findings to explain resistance as a dynamic interplay between functional and psychological barriers. Specifically, functional barriers (H_1 – H_3) are posited to directly influence resistance, while social norms (H_4) are hypothesized to moderate these effects. Additionally, eco-consciousness is proposed as a future research variable that may buffer the impact of these barriers.

Conclusion and Recommendations

This paper has examined the growing resistance to formal e-waste recycling practices among Malaysian households through the lens of Innovation Resistance Theory (IRT). Unlike conventional approaches that emphasize motivational drivers such as environmental attitudes and incentives, this study positions resistance as an active behavioral disengagement triggered by both functional and psychological barriers. Drawing upon recent empirical evidence, the framework identifies infrastructural inaccessibility, perceived data security risks, and institutional distrust as key functional deterrents, while social norms are explored as a contextual moderator that can either buffer or amplify these barriers depending on cultural embedding.

This study advances IRT's application in sustainable behavior contexts, offering a nuanced understanding of why well-intentioned individuals continue to reject formal recycling channels. From a practical standpoint, the findings carry significant implications for policymakers, municipal authorities, and environmental advocacy groups. Addressing resistance requires more than informational campaigns; it demands structural interventions that directly tackle the barriers identified. For example, expanding the number and visibility of certified collection points, simplifying procedural requirements, and offering secure data-erasure assurances could alleviate functional concerns. Likewise, rebuilding institutional trust through transparent communication, reliable enforcement, and consistent service delivery is critical to shifting household perceptions of formal recycling systems.

Furthermore, social norms should be strategically leveraged. Public campaigns that feature trusted community figures, social comparison cues, or recycling success stories could help establish recycling as a shared cultural norm rather than an individual burden. Recognizing that behavior change is socially situated, interventions should foster a sense of collective efficacy, especially in urban communities where informal practices dominate.

Finally, future research should empirically validate the proposed framework across different demographic and geographic segments. Longitudinal studies could explore whether reductions in functional barriers lead to sustained engagement over time, while experimental interventions may help test the effectiveness of social norm messaging in moderating resistance behavior. In doing so, scholars and practitioners alike can move closer to bridging the gap between recycling awareness and recycling action an essential step in achieving Malaysia's broader sustainability targets.

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