

Consumers' reverse exchange behavior and e-waste recycling to promote sustainable post-consumption behavior

Authors

Md. Mahiuddin Sabbir, Khan Md. Raziuddin Taufique, Marzia Nomi

Abstract

Purpose: This study aims to have a holistic understanding of psychological determinants of consumers' e-waste recycling behavior to promote sustainable post-consumption behavior through EEPE program.

Design/methodology/approach: The study integrated additional cognitive and non-cognitive factors within the Theory of Planned Behavior. Data was collected from 334 participants who were purposively recruited from well-known online retailers in an emerging market, with the data analyzed using structural equation modeling.

Findings: The results provide some fresh insights, such as the significant positive influence of recycling habits, economic benefits, and attitudes toward nudging on EEPE, with a distinct serial mediation link from recycling habits to EEPE behavior.

Practical implications: This study highlights some relevant sustainable marketing strategies including the integration of nudging and habits as behavioral interventions for promoting e-waste recycling.

Originality/value: The originality of this study relates to 1) testing the significance of nudging in promoting sustainable post-consumption behavior; 2) revealing a serial mediation effect of recycling habits on EEPE behavior via attitude toward e-waste recycling and EEPE intention.

KEYWORDS: electronic waste (e-waste); reverse logistics; recycling habits; nudging; Theory of Planned Behavior

1. INTRODUCTION

Continual economic growth and technological advancements have escalated the consumption of electronic equipment, triggering significant electronic waste (e-waste). Global e-waste was predicted to be at 74 million metric tonnes (MMT) by 2030 (Forti *et al.*, 2020). If not properly disposed of, e-waste can spread hazardous chemicals into the water, and worryingly it is responsible for greenhouse emissions. However, proper e-waste management such as recycling can contribute to environmental protection by reducing carbon emissions (Xia *et al.*, 2023). Efficient recycling can also contribute to material scarcity issues, such as platinum and silver retrieved from recycled e-waste offering monetary benefits to business (Seif *et al.*, 2023).

In most developed countries, regulations and formal structures (e.g. having e-waste disposal centers, extended producer responsibility or EPR) urge suppliers and manufacturers to include options for consumers to appropriately dispose of end-of-life (EoL) electronic products (Kumar, 2019). Such formalized systems are still in their initial stages in most developing countries (e.g. China, India and Bangladesh) (Kumar, 2017). In this context, reverse logistics (RL) might play an essential role in addressing the burgeoning e-waste problem (Khan *et al.*, 2019). The terms ‘reverse logistics’ and ‘reverse supply chain management’ (RSCM) are often used synonymously, with both focused on managing the flow of products, parts and information exchanges from consumers to suppliers and manufacturers (Kumar, 2017). RL in particular has gained attention from policymakers and researchers (e.g. Liang and Lee, 2018), viewed as providing a necessary balance between an organization’s financial performance and environmental management (Yuan *et al.*, 2016).

By using RL, firms can enhance customer satisfaction and attain a competitive advantage (Yuan *et al.*, 2016). Specifically, the customers feel content that their suppliers will take care of EoL products, while they get financial benefits (e.g. discounts for new electronic items upon returning the used ones). Moreover, firms can promote RL as part of their sustainability strategies to enhance their distinctiveness. Within the RL context, companies often provide EoL electronic products exchange (EEPE) opportunities, which is the practice of returning these products to suppliers for proper recycling.

The effective implementation of RL depends on consumers as the primary supplier source. Yet a lack of consumer awareness of RL and subsequent low participation rates deter many firms from adopting RL programs such as EEPE. While this indicates the importance of understanding those factors motivating consumers to participate in RL or EEPE programs (Budijati *et al.*, 2016), past studies (Dixit and Badgaiyan, 2016; Khan *et al.*, 2019; Yuan *et al.*,

2016) highlighted that such areas have rarely been touched on in extant literature. Most e-waste-related studies have focused on recycling initiatives from the manufacturer's perspective (Yuan *et al.*, 2016). This study therefore undertook a desk review of extant literature and uncovered the following research gaps.

First, there has been minimal investigation of the determinants of consumer motivations to adopt RL programs such as EEPE (Yuan *et al.*, 2016). Specifically, the exploration of behavioral interventions (e.g. nudging) (Parajuly *et al.*, 2020) and non-cognitive factors (e.g. access to proper channels, habits) (Parajuly *et al.*, 2020) is scarce in RL context. Second, past studies focusing on consumers' e-waste recycling intentions (e.g. Kumar, 2019; Yuan *et al.*, 2016) called for further study to explore consumers' actual reverse exchange behaviors. Third, consumers' e-waste management behavior appears to vary across cultural and broader demographics and requires contextualization. Therefore, acknowledging the wide exploration of e-waste recycling in developed countries (Dwivedy and Mittal, 2013), recent studies recommended attention to developing markets (e.g. Koshta *et al.*, 2022).

Fourth, waste recycling involves time and energy costs that could be weighed against intrinsic and extrinsic motivations (Gilal *et al.*, 2019). Therefore, former studies indicated the importance of intrinsic motivations (e.g. recycling habit) (Aboelmaged, 2021), extrinsic motivations (e.g. economic benefits) (Wang *et al.*, 2019), and the Theory of Planned Behavior (TPB)'s determinants (Koshta *et al.*, 2022) in the e-waste recycling context. However, such determinants were never coupled within one theoretical framework to explain consumers' e-waste recycling behavior, let alone the EEPE behavior. Fifth, extant e-waste literature (e.g. Gilal *et al.*, 2019; Kumar, 2019; Koshta *et al.*, 2022) mostly examined the direct paths linking predictors and outcome variable(s), ignoring the dynamic underlying mechanisms (interrelations through mediation/serial mediation) among variables (Li *et al.*, 2021).

In addressing these gaps, this study integrated cognitive and non-cognitive factors relevant to Bangladeshi consumers' EEPE behaviors into the TPB (Ajzen, 1991) framework. Owing to a growing economy, the use of electronic goods in Bangladesh has been increasing at a faster rate heightening e-waste generation which is predicted to reach at 4.19 MMT by 2035 (Farhat, 2021), making Bangladesh a suitable context to study consumers' EEPE behavior.

This study subsequently adds three main contributions to the RL literature: 1) examining the impact of consumers' psychological factors in determining EEPE behaviors (where a new connection: Social Identity Theory-Hofstede's assumption-RL has been established in a developing country context); 2) testing how relevant cognitive and non-cognitive factors

interplay in determining consumers' EEPE behaviors (a new serial mediation path - RH → attitudes toward e-waste recycling → EEPE intentions → EEPE behaviors – was examined, which is another extension of earlier findings); and 3) outlining some of the policy implications for key stakeholders such as marketers and policymakers when re-evaluating RL and e-waste recycling strategies.

2. THEORETICAL FRAMEWORK AND HYPOTHESES

The TPB model has been deemed most appropriate for conducting theory-based research of consumer pro-environmental behavior (PEB) (e.g. Kumar, 2019; Koshta *et al.*, 2022). TPB postulates that human behavior is significantly guided by an individual's intention which are most often a function of three main components: 1) attitudes toward the behavior; 2) subjective norm (SN); and 3) perceived behavioral control (PBC) (Ajzen, 1991). However, as the TPB model predominantly focuses on psychological and cognitive factors (Dixit and Badgaiyan, 2016; Parajuly *et al.*, 2020), it has been criticized for under-representing relevant non-cognitive factors such as habits (Wang *et al.*, 2018).

As discussed, individuals are motivated to waste recycling if financial incentives are involved. In line with this, the idea of EEPE is rooted in the economic benefits (EB) consumers are supposed to get through an exchange. Therefore, it is worth examining the impact of EB on EEPE behavior. In addition, reverse exchange and e-waste recycling are recurrent and frequent behavior where recycling habit (RH) is the strongest predictor (Aboelmaged, 2021). In this regard, Triandis (1977) argued that habit should be included in the TPB model as an added predictor. In response, while previous studies (e.g. Dwivedy and Mittal, 2013; Aboelmaged, 2021) examined only the influence of e-waste RHs on e-waste recycling intention, how non-e-waste RHs (e.g. household and plastic waste) may trigger EEPE behavior remains unexplored. Drawing on this discussion, this study has integrated (non-e-waste) RH and EB as non-cognitive, context-specific factors into the extended TPB model, as the original TPB excludes such predictors.

Within the application of behavioral interventions, nudging is a relatively new strategy in intervening consumers' PEBs (Parajuly *et al.*, 2020). Nudging involves elusive manipulation of individuals' behavior in certain direction while preserving their freedom of choice (Sunstein, 2018). For example, a reminder of diet through leaflets is a nudge, while providing monetary incentive is not. The effectiveness of nudging strategy in lessening food and plastic waste has only been reported in limited experimental studies (Parajuly *et al.*, 2020), calling for additional

validation in survey-based studies with larger samples (Parajuly *et al.*, 2020) as done by this study.

2.1 Attitudes toward e-waste recycling (ATT)

Attitude refers to a positive or negative perception of an individual toward accomplishing a certain behavior (Ajzen, 1991). Attitude is one of the key components in understanding individual's pro-environmental behavior (Garg *et al.*, 2023), and a positive relationship between attitude and intention has been reported with respect to recycling in general (e.g. Ofstad *et al.*, 2017) as well as e-waste recycling (Kumar, 2019). However the influence of attitude on intention has also been portrayed as non-significant in other research focused on consumer PEB (e.g. Dixit and Badgaiyan, 2016; Dong and Ge, 2022), which requires further verification.

As a form of PEB, EEPE has been recognized as a viable solution to e-waste recycling (Yuan *et al.*, 2016). It was therefore posited in this study that if individuals perceive e-waste recycling as a responsible behavior, their intention would be to accept EEPE. Accordingly, this study proposes that:

H1. *ATT significantly and positively influences EEPE intentions.*

2.2 Subjective norm (SN)

SN refers to the social pressure and the expectation of close people to an individual to perform a specific behavior (Ajzen, 1991). The positive influence of SN on consumers' PEB is well-documented (e.g. Dong and Ge, 2022; Garg *et al.*, 2023).

The impact of SN on consumer behavior is often connected to Social Identity Theory, which proposes that individuals are likely to be classified by related social classes or clusters (Stets and Burke, 2000). In the context of consumption, an individual might exchange an old television set for a new one, after finding out that one of their friends or colleagues they can or would like to be identified with has already done so. This scenario is particularly relevant to a collective society such as Bangladesh, where others' opinions (e.g. friends and peers) are valued when making pro-environmental decisions (Kumar, 2019) or ethical consumption decisions (Liu *et al.*, 2021). This study therefore presumed that the expectation of social members (e.g. friends, peers or family) could prompt an individual's EEPE intentions, and proposed that:

H2. *Subjective norm significantly and positively influences EEPE intentions.*

2.3 Perceived behavioral control (PBC)

PBC refers to the degree of ease or hardship an individual experiences while performing a specific behavior (Ajzen, 1991). Different control factors like ease, opportunity, level of convenience, and knowledge of behavior have been recognized as ways to attain a more accurate measure of PBC (Tonglet *et al.*, 2004). While some studies found a positive relationship between PBC and e-waste recycling intentions (Kumar, 2019; Dong and Ge, 2022; Garg *et al.*, 2023), others reported an insignificant impact of PBC on PEBs (Khan *et al.*, 2019), which requires further examination. As EEPE is an essential component of RL and e-waste management, PBC could be a logical consideration in this study. Based on the assumption that an individual with opportunities (convenience in exchanging through ‘exchange offer’ programs) and the knowledge of ‘what, how, where’ to exchange is more likely to exhibit such intentions compared to someone who lacks such knowledge and/or opportunities over existing obstacles (e.g. inconvenience), the following hypothesis was proposed:

H3. *Perceived behavioral control significantly and positively influences EEPE intentions.*

2.4 Recycling habits

Recycling habits is the reiteration of the past behavior of partaking or not partaking in recycling (Dwivedy and Mittal, 2013).

The Theory of Interpersonal Behavior (TIB) highlights that individuals’ past behaviors or habits should predict their willingness to participate in PEBs (Triandis, 1977). The learning theories also suggest that individuals acquire knowledge from habits and experience that, in turn, trigger their understanding and undertaking of future activities. Given that certain recycling behaviors (e.g. plastic, household) are already part of an individual’s routine activities, this habit acts as a strong driver of other forms of recycling (e.g. mobile phone) (Welfens *et al.*, 2016). Empirical studies have also illustrated the significant positive impact of conservation and RH on electricity-saving (Wang *et al.*, 2019) and household waste recycling behaviors (Liu and Yang, 2022), respectively.

RH has similarly been identified as influential in the context of e-waste recycling intentions and behavior (Dwivedy and Mittal, 2013; Vijayan *et al.*, 2023). Drawing on this discussion and evidence, it was deemed worthwhile in this study to be one of the first to examine the influence of RH on EEPE intentions and behaviors, and it was postulated that:

H4. *RH significantly and positively influences EEPE intentions.*

H5. *RH significantly and positively influences EPEE behaviors.*

Furthermore, it is argued that behavior that is recurrently performed can influence favorable feelings toward that particular behavior. For instance, it has been reported that pro-environmental habits in general can positively impact employees' attitude toward the environment in workplace settings (Sabbir and Taufique, 2022). In addition, managers' favorable attitude toward ethical decision-making can be positively influenced by past habitual ethical behaviors (Kashif *et al.*, 2017). In line with this, the current study assumed that if recycling behaviors (e.g. plastic or newspaper) become typical in daily life, this will create a more positive attitude toward e-waste recycling, and was therefore hypothesized that:

H6. *RH significantly and positively influences attitudes toward e-waste recycling.*

In addition, pro-environmental attitude is a well-documented mediator between antecedents (e.g. habit, subjective norms) and outcome variables (e.g. organic food consumption) (e.g. Qi *et al.*, 2021). In this context, Sabbir and Taufique (2022) remarked that environmental attitudes positively mediate the relationship between pro-environmental habits and employee green behavior. However, the mediating role of pro-environmental attitudes on e-waste recycling behavior has not yet been explored. Based on this evidence and considering H1 and H6, we put forward the following hypothesis:

H7. *The relationship between RH and EEPE intentions is positively mediated by attitudes toward e-waste recycling.*

2.5 Economic benefits

In the context of PEBs, EB relates to any economic incentives that drive an individual's environment-friendly behaviors (Budijati *et al.*, 2016). In the context of this study, examples of EB in RL programs such as EEPE include discounts, cashbacks, and trade-ins (Budijati *et al.*, 2016).

The Social Marketing Theory asserts that the right combination of offers, facilities, information, and promotion can effectively modify public behavior (Kotler and Roberto, 1989). In line with this, Hornik *et al.* (1995) classified four key groups of determinants of consumer recycling behaviors, which are intrinsic and extrinsic incentives, and internal and external facilitators. Based on this argument, the current study has subsequently determined that as an extrinsic incentive, EB could be influential in shaping consumers' EEPE intentions. Several

former studies similarly reported the significance of EB in encouraging individual's willingness to recycle e-waste (Dwivedy and Mittal, 2013; Garg *et al.*, 2023; Sajid and Zakkariya, 2022). It was therefore deemed as important to examine the potential association between EB and EEPE intentions, and was hypothesized that:

H8. *EB significantly and positively influences EEPE intentions.*

2.6 Attitudes toward nudging (AN)

The term 'nudging' relates to the more subtle manipulative steering of consumer behavior in a specific direction without eliminating the alternatives (Sunstein, 2018). In this study's context, attitudes toward nudging measures whether consumers feel pleased or motivated about using nudges (e.g. providing leaflets, holding competition) to promote EEPE. Nudges have been identified as significant positive influences within the PEB context of reducing food (Kallbekken and Sælen, 2013) and plastic waste (Rivers *et al.*, 2017). With most of these former studies being experimental, scholars have urged further examination of nudging within survey-based studies, including those relating to e-waste management (Parajuly *et al.*, 2020). Recognizing EEPE as an essential approach to e-waste management, this study subsequently examined whether consumer attitudes toward nudging have a positive impact on EEPE intentions, with it posited that:

H9. *AN significantly and positively influence EEPE intentions.*

2.7 EEPE intentions

TPB conceptualizes that an individual's intention toward a specific behavior is an important driver of the actual behavior (Ajzen, 1991), which has also been well documented in PEB literature (e.g. Bamberg and Möser, 2007; Taufique and Vaithianathan, 2018). For example, some former studies have reported that consumers' electricity-saving intentions significantly and positively predict their electricity-saving behavior (e.g. Wang *et al.*, 2018). Moreover, e-waste recycling intentions is reportedly a strong positive determinant of recycling behaviors (Dixit and Badgaiyan, 2016). This study therefore envisaged that higher-level EEPE intentions are more likely to influence EEPE behaviors, and postulated that:

H10. *EEPE intentions significantly and positively influence EEPE behaviors.*

Ideally, it has been determined that if there is hypothesized influence from A to B and B to C, then B intermediates the association between A and C, suggesting the test of B's

mediating effect being worth (Baron and Kenny, 1986). Drawing on this notion, Taufique and Vaithianathan (2018) examined the mediating impact of intentions between TPB's constructs (i.e. attitude, SN, and PBC) and actual green behavior where except one path (SN-intentions-behavior), others were significant. Sultan *et al.* (2020) found a significant positive mediating effect of intentions between TPB's constructs and organic food consumption behavior. However, extant e-waste-related studies (e.g. Gilal *et al.*, 2019; Koshta *et al.*, 2022) lack such an examination. It was therefore surmised that EEPE intentions will mediate the association between attitudes toward e-waste recycling, SN, PBC and outcome variable, with the following hypotheses proposed:

H11. *The relationship between ATT and EEPE behaviors is positively mediated by EEPE intentions.*

H12. *The relationship between SN and EEPE behaviors is positively mediated by EEPE intentions.*

H13. *The relationship between PBC and EEPE behaviors is positively mediated by EEPE intentions.*

Furthermore, research indicates that behavioral intention mediates the association between other (cognitive and non-cognitive) constructs (e.g. environmental knowledge, awareness, emotions) and actual behaviors. For instance, Bamberg and Möser (2007) remarked that environment-friendly behavioral intention intermediates the impact of all other psychosocial factors (e.g. social norm, guilt feeling) on pro-environmental consumer behavior. Similarly, the indirect effect of environmental knowledge via intentions is evidenced in food waste reduction behavior (Mumtaz *et al.*, 2022). In line with this, this study speculated that:

H14. *The relationship between RH and EEPE behaviors is positively mediated by EEPE intentions.*

H15. *The relationship between EB and EEPE behaviors is positively mediated by EEPE intentions.*

H16. *The relationship between AN and EEPE behaviors is positively mediated by EEPE intentions.*

The incremental role of habit toward explaining consumer behavior intrigued scholars (Triandis, 1977) to suggest habit as an additional factor to the TPB. In line with this, waste

recycling literature has proved that RHs promote recycling intentions (e.g. Aboelmaged, 2021) and recycling behavior (e.g. Ofstad *et al.*, 2017). Nevertheless, such explorations remain limited to examining the direct link between habit and behavior. Like extant consumer PEB-related studies (e.g. Li *et al.*, 2021), serial mediation analysis in this context will provide further insights into the possible indirect impact of RH on EEPE behaviors. Thus, taking H1, H6, and H10 into account, this study determined that RH can indirectly influence EEPE behaviors through attitudes toward e-waste recycling and EEPE intentions. Accordingly, the following hypothesis was proposed:

H17. *ATT and EEPE intentions serially mediate the relationship between RH and EEPE behaviors.*

Figure 1 below presents this study's conceptual research model with the above corresponding hypotheses.

[Insert Figure 1 here]

3. METHODS

The hypotheses outlined in the preceding section were tested by gathering and examining responses to a survey with a structured questionnaire well-tested in the relevant literature.

3.1 Measures

This study adopted previously validated measures to ensure content validity (Hair *et al.*, 2014), which were slightly modified to the current research context. Reported reliability values (Cronbach's Alpha or CFA factor loading ≥ 0.70) were used as selection criteria for the items. A five-point Likert-type scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree) was employed for all measurement items. These measures were further evaluated by two academic experts from marketing and psychology, to avoid ambiguity and ensure precision. Some question wording was modified based on the subsequent pilot survey with a conveniently selected sample of 21 electronic product consumers.

The study used 27 measurement items, where four items for each ATT and PBC were adopted from Tonglet *et al.* (2004) and three items of SN from Al-Swidi *et al.* (2014). Moreover, three items of RH were taken from Zhang *et al.* (2013), three items for each EB and EEPEI from Yuan *et al.* (2016), four items of AN from Zhou *et al.* (2019), and three items of EEPEB from Lopes *et al.* (2019).

3.2 Sample and data collection

There is no nationwide database of electronic equipment (e.g. TV, refrigerator) users in Bangladesh. Thus, the respondents were purposively (Khan *et al.*, 2019) drawn from well-known electronic retailers, including Sony Rangs, Transcom Digital, Walton, and Best Electronics. The purposive sampling technique was used as it allows to include only the relevant participants to the study.

After postulating this study's core objective and confirming data confidentiality, the selected retailers supplied a list of their customers with corresponding email addresses, which generated 711 prospective respondents. These prospective participants were emailed asking if they had heard about and actively participated in the electronic equipment (e.g. TV, refrigerator) exchange offer campaign. Participants who know about and actively participate in the campaign are only requested to go through the attached survey link. The email also outlined the current study's objective and asked for participants' consent to participate in the survey. The survey was conducted from January to February 2021, with 417 responses, which resulted in 334 respondents deemed as usable after data cleaning.

A sample size of 200 respondents is recommended to be critical for assessing a model using structural equation modeling (Hair *et al.*, 2014). Besides, a sample size equivalent to 10 times of the number of measurement items is suggested for multivariate analysis (Roscoe, 1975). The current study's sample size (n=334) is deemed to be appropriate meeting all these recommended criteria.

Among the respondents, 67% were male, and 85% had a minimum bachelor's degree. The majority of the respondents were in the age group 18-31 years (55%), followed by 32-38 years (32%). Most of the respondents were either service holders (51%) or business owners (18%), and the rest were students (20%) and unemployed (12%). Respondents with a household income of 25,001-50,000 BDT/per month were around 45%, followed by 34% with 50,001-above 100,000 BDT/per month.

4. ANALYSIS AND RESULTS

The analysis was performed using structural equation modeling (SEM) with AMOS (version 23) software. SEM was used based on its suitability for theory testing (Hu and Bentler, 1999) and its capability of capturing associated measurement errors in the observed variables (Hu and Bentler, 1999; Hair *et al.*, 2014).

4.1 Measurement model

Construct reliability, convergent validity, and discriminant validity were assessed in the measurement model with 27 items of eight constructs. The composite reliability (CR) and Cronbach's alpha of all constructs were greater than 0.79, signifying adequate construct reliability (Fornell and Larcker, 1981). The minimum value for CR, AVE, and factor loadings (λ) were 0.79, 0.55, and 0.70 respectively (see results in Table I), confirming the requirements of the convergent validity of measurement scales (Fornell and Larcker, 1981; Hair *et al.*, 2014). The satisfactory fit indices for overall measurement model were as follows: $\chi^2/df = 1.576$, GFI = 0.911, AGFI = 0.886, CFI = 0.969, TLI = 0.963, RMSEA = 0.042, and SRMR = 0.037 (Hu and Bentler, 1999; Hair *et al.*, 2014).

[Insert Table I here]

Results from the discriminant validity assessment are presented in Table II, where non-diagonal elements represent inter-correlation among constructs, and diagonal elements represent square root of the corresponding construct's AVE. All diagonal elements are greater than the non-diagonal elements in the corresponding rows and columns, meeting the conditions for satisfactory discriminant validity (Fornell and Larcker, 1981).

[Insert Table II here]

4.2 Structural model

Drawing on the acceptable measurement model, this study estimated the structural model to test the proposed hypotheses (see results in Table III). The research model provides acceptable fit values as follows: $\chi^2/df = 1.832$, GFI = 0.896, AGFI = 0.871, CFI = 0.954, TLI = 0.947, RMSEA = 0.050, and SRMR = 0.072 (Hu and Bentler, 1999; Hair *et al.*, 2014).

[Insert Table III here]

The analysis revealed that the predictors explain 69.3% ($r^2 = 0.693$) variations in EEPE intentions. Furthermore, attitudes toward e-waste recycling was found to have the most significant positive impact on EEPE intentions ($\beta=0.287$, $p<0.001$), followed by PBC ($\beta=0.247$, $p<0.01$), RH ($\beta=0.205$, $p<0.05$), EB ($\beta=0.152$, $p<0.01$), SN ($\beta=0.145$, $p<0.01$), and attitudes toward nudging ($\beta=0.131$, $p<0.05$). Accordingly, H1, H2, H3, H4, H8, and H9 were supported, denoting that attitudes toward e-waste recycling, SN, PBC, RH, EB, and AN have significant positive impact on EEPE intentions.

In addition, RH and EEPE intentions cumulatively explain 30.0% ($r^2 = 0.300$) variations in EEPE behaviors, where EEPE intentions had a significant positive impact on EEPE behaviors ($\beta=0.497$, $p<0.001$), supporting H10. In contrast, RH had no significant impact on EEPE behaviors ($\beta=0.069$, $p>0.05$) (H5), but the positive impact of RH on attitudes toward e-waste recycling (H6) was significant ($\beta=0.538$, $p<0.001$), explaining 29.0% ($r^2 = 0.290$) variance in attitudes toward e-waste recycling. Hence, H6 and H10 are supported, while H5 is not.

4.3 Mediating effects

Bootstrapping analysis (2,000 bootstrap samples with 95% confidence intervals) was used to test the mediating effects. Table IV shows that ATT (H11), SN (H12), PBC (H13), RH (H14), EB (H15), and AN (H16) had a significant positive indirect influence on EEPE behaviors via EEPE intentions. These findings were confirmed by the resultant p values ($p<.05$), with 95% confidence intervals where upper and lower limits were not including zero. It is worth noting that direct influence of RH on EEPE behaviors was insignificant, while indirect influence was significant via EEPE intentions, indicating that EEPE intentions fully mediates the relationship between RH and EEPE behaviors. Despite this strong impact, EEPE intentions only plays a partial mediation role in the other mediation paths.

Furthermore, the results established that the ATT play a significant positive intermediary role between RH and EEPE intentions; thereby supporting H7. In regard to H17, Table V demonstrates a positive serial mediation path (RH \rightarrow ATT \rightarrow EEPE intentions \rightarrow EEPE behaviors), indicating that RH significantly and positively escalates EEPE behaviors by enhancing ATT and EEPE intentions.

[Insert Table IV here]

5. DISCUSSION

The results suggest that ATT has a significant direct influence on consumers' EEPE intentions, supporting H1. This result is congruent with former findings revealed in general recycling (e.g. household, plastic) (e.g. Ofstad *et al.*, 2017) and e-waste recycling (e.g. Kumar, 2019; Garg *et al.*, 2023) contexts. It further highlights that ATT indirectly enhances EEPE behaviors through EEPE intentions (H11) which again is supported by past studies on PEBs (e.g. Sultan *et al.*, 2020).

Similarly, the significant positive link between SN and EEPE intentions (H2) confirms the past research findings in comparable studies (e.g. plastic or paper recycling) (Ofstad *et al.*, 2017; Dong and Ge, 2022). In addition, EEPE intentions mediate the association between SN and EEPE behaviors (H12) which is similar to the findings uncovered in mobile waste recycling (Dixit and Badgaiyan, 2016) context. Furthermore, this study has identified PBC as having a strong direct effect on EEPE intentions (H3), which agrees with the previous outcomes Kumar, 2019; Dong and Ge, 2022; Garg *et al.*, 2023). This study's results also outline a positive indirect effect of PBC on EEPE behaviors via EEPE intentions (H13), and this concurs with that of previous studies on ecologically conscious consumer behavior (Taufique and Vaithianathan, 2018) and packaging recycling behavior (Hua and Dong, 2022). The essence of these findings is that if consumers have knowledge and opportunities about where and how to exchange electronic products, they are more likely to be interested in EEPE intentions and behaviors.

In the context of RH, this study has substantiated five primary relationships. First, consumers with household RH will probably have more positive EEPE intentions (H4). Second, consumers' RH indirectly augments EEPE behaviors via EEPE intentions (H14). This supports the earlier argument stating that habit influences intentions that, in turn, stimulate behaviors (Carrus *et al.*, 2008). Third and fourth, typically-performed RH behaviors are more likely to engender positive attitudes toward e-waste recycling (H6) and to indirectly increase EEPE intentions via attitudes toward e-waste recycling (H7), which are new additions to the RL literature. Fifth, in a serial mediation process, RHs indirectly influence EEPE behaviors via attitudes toward e-waste recycling and EEPE intentions (H17), which is another distinctive finding for the RL literature.

Despite this apparent impact on intentions, the study results suggest that RH does not have any significant direct influence on EEPE behaviors; thereby not supporting H5. Yet while this finding is contrary to the TIB's reasoning, an earlier meta-analysis uncovered that any new behavior is less likely to be influenced by habits compared with intentions (Klöckner, 2013). This also applies to the current study context where EEPE is relatively new behavior which is not performed habitually on a daily or weekly basis.

The results of H8 and H15 suggest that financial benefit may enhance participation in EEPE program. The direct association between EB and EEPE intention is in consonance with what was found earlier in the e-waste literature (Wang *et al.*, 2019; Garg *et al.*, 2023). Another fresh contribution to the RL literature is this study's finding of the significance of AN (H9 and H16), implying that consumers' intentions and behaviors could be altered by employing certain types of nudges (e.g. leaflets), even in the context of EEPE. Nudges have similarly been

influential in minimizing plastic waste (Rivers *et al.*, 2017). Finally, in line with the TPB's thesis (Ajzen, 1991), this study shows that consumers' intentions significantly influence their actual EEPE behavior (H10).

6. CONTRIBUTIONS TO THEORY

The study makes at least five critical theoretical contributions to the PEB domain, especially in the context of RL and e-waste recycling behavior literature.

First, drawing on the Social Identity Theory (Stets and Burke, 2000) and Hofstede's cultural classifications (Hofstede Insights, 2021), the current finding relating to SN in a collective culture like Bangladesh presents a new theoretical link (Social Identity Theory-Hofstede's assumption-RL) that deepens the knowledge that upholding sustainable consumer behavior (e.g. e-waste reverse exchange) is largely attributable to Social Identity Theory within collective cultures.

Second, in response to calls for further research (e.g. Parajuly *et al.*, 2020), this study unveils the significance of incorporating nudging as a behavioral intervention within the environmental sustainability literature, which no former studies have done.

Third, in response to the criticism of the TPB disregarding non-cognitive factors, this study has added and verified the relevance of RH and EB in determining e-waste recycling behaviors. In particular, the direct and indirect paths from RH to EEPE behaviors relate to the TIB's (Triandis, 1977) core reasoning within an RL context. Moreover, unlike previous studies, the current study illustrates how non-e-waste RH (e.g. household and plastic waste) trigger e-waste recycling (i.e. EEPE behavior). Furthermore, the inclusion of EB is rooted in Social Marketing Theory (Kotler and Roberto, 1989) that is fundamentally concerned with altering public behavior to socially-beneficial behavior (e.g. community safety, environmental protection). Embedding this concept, this study has unfolded that certain tenets (i.e. offers and facilities) of this theory are particularly effective in eliciting micro-level PEB (i.e. EEPE).

Fourth, the current study explored several mediation paths to show that determinants of EEPE behavior are not only complementary to each other, instead they are interrelated. Fifth, the positive serial mediation role of attitudes toward e-waste recycling and EEPE intentions in the connection between RH and EEPE behaviors is the most significant finding, making it distinct from other comparable studies. The TIB and most former studies have presented habit as a direct predictor only (Wang *et al.*, 2019) or as an indirect predictor of behaviors via attitudes (Sabbir and Taufique, 2022). This research has instead identified habit as a significant indirect predictor of behaviors via attitudes and intentions. It was thereby established in this

study that the interrelationship of these four constructs (i.e. habit, attitudes, intentions, and behaviors) is also significant, worth examining in future exploration of individual-level PEBs.

7. IMPLICATIONS FOR STRATEGIES

These findings offer multiple insights for relevant strategies addressing the escalation in e-waste, coupled with a lack of domestic waste management policies within developing countries (e.g. Bangladesh). For example, as attitudes toward recycling is a significant predictor of EEPE intentions and behaviors, different promotional activities (e.g. television advertisements, seminars, and posters) about the positive effects of EEPE programs could be employed, to broaden favorable perceptions of proper e-waste management practices. As customers buy and return electronic products to the retailers or other intermediaries, marketers can also use these mediating channels to communicate and promote EEPE program where intermediaries could be incentivized through different trade promotions.

These findings also suggest that consumers like to think and act ‘in-group’ in a collective society, enabling marketers to leverage the referrals of significant social members to induce others to elicit EEPE behaviors. This can be further implemented at retail setting through referral marketing where the existing customers of EEPE might be incentivized for introducing their family, friends, and other contacts to become member of EEPE program. Marketers could also facilitate retail infrastructures (e.g. exchange centers at convenient locations) and opportunities (e.g. promoting ‘exchange offer’) to enable consumers to partake in EEPE programs with adequate awareness-raising campaigns to educate people on the detrimental effects of e-waste on living organisms and the entire ecosystem. Furthermore, the significance of nudges suggests using different cues (e.g. pro-environmental labeling, recycling visuals, leaflets) may induce customers at point-of-sale. Nudging can also be enhanced by demonstrating the e-waste recycling behavior of the social reference group such as similar neighbors.

The significance of RHs in triggering EEPE behavior suggest policymakers to activate and reinforce recycling behavioral habit. One way of directing individuals to form a habit of proper recycling from early childhood could be implemented by educational institutions by undertaking environmental action programs to educate students about recycling and its effects on the environment and society. Mass media could also help to progressively change individuals’ habits from ‘go out and dump it anywhere’ to proper dumping, recycling, or exchanging. Besides, electronic retailers could reinforce the habit of e-waste recycling by rewarding those who are already demonstrating such behavior.

8. LIMITATIONS AND FUTURE RESEARCH RECOMMENDATIONS

There are potential areas for future researchers that will help to address this study's limitations. First, as this study used cross-sectional data that only investigated self-reported responses, future research could apply a longitudinal study with time gaps in data collection relating to antecedents (e.g. attitudes, SN, PBC) and outcome variables (e.g. intentions, behaviors). Second, the intention-behavior gap is an ongoing concern in PEB literature. Future research could examine relevant contextual factors (e.g. government initiatives) as moderators between EEPE intentions and behaviors, to understand whether more robust government regulations can drive higher-level EEPE behaviors. Third, the insignificant direct path from RH to EEPE behaviors highlights a need for further investigation, to examine whether this finding is consistent within an RL context based on different time points and other developing countries' perspectives.

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