

Understanding the determinants of consumers' reverse exchange intention as an approach to e-waste recycling: A developing country perspective

Abstract

Purpose: End-of-life electronic products exchange (EEPE) program could be an effective approach to e-waste recycling that requires consumers' participation. Thus, it is highly recommended to study factors stirring consumer behavior with regard to EEPE programs, which is largely under-explored in the existing literature. Hence, grounding on the Theory of Planned Behavior (TPB) and Attitude-Behavior-Context (A-B-C) model, this study attempts to understand the determinants of consumers' EEPE intention by adding contextual and non-cognitive factors to the proposed research model.

Design/methodology/approach: Employing a purposive sampling technique, respondents were drawn from university students and general consumers of electronic products in a developing country. Factor analysis, structural equation modeling, and SPSS PROCESS were used to analyze the collected data.

Findings: Empirical results confirm that subjective norm has the strongest positive impact on EEPE intention. Following this, attitude toward EEPE and perceived behavioral control play positive mediating roles in determining EEPE intention. Moreover, government initiatives moderate the unsolicited 'attitude-intention gap'.

Practical implications: Drawing on this study's outcomes, the study urges to form comprehensive awareness-building campaigns, rules, and regulations regarding proper e-waste management, promote 'exchange offer' programs, and educational programs to encourage EEPE.

Originality/value: This study makes two fresh contributions to the extant literature. First, by coupling the TPB and A-B-C theory, this study showed that both attitude (i.e., attitude toward EEPE) and context (i.e., government initiatives) are essential in eliciting individual-level post-consumption pro-environmental behavior (i.e., EEPE). Second, government initiatives elucidate the attitude-intention gap in the reverse logistics context, especially in developing countries.

Keywords: End-of-life electronic products exchange; reverse logistics; attitude-intention gap; government initiatives; post-consumption pro-environmental behaviors; Theory of Planned Behavior

Paper type: Research paper

1. Introduction

Along with economic and technological growth, the consumption of electronic goods and the resultant electronic waste or e-waste generation have escalated alarmingly. The global e-waste generation in 2019 reached a record of 53.6 million metric tons (MMT) and is predicted to reach 74 MMT by 2030, which is nearly twice the 2014 figure (Forti *et al.*, 2020). Improper e-waste management is largely accounted for both health and environmental hazards. On the contrary, planned e-waste management (e.g., recycling) facilitates solving the material shortage problems and contributes to ecological well-being by lessening carbon emissions (Zhong and Huang, 2016).

It is worth mentioning that Asia is the highest contributor, generating 18.2 MMT of e-waste annually (Mahmud *et al.*, 2020). In fact, emerging countries in Asia, such as Bangladesh, are one of the fastest-growing e-waste generators where only 30% of annual e-waste is appropriately disposed of or recycled, whereas the remaining is dumped in landfills (Masud *et al.*, 2019). In Bangladesh, e-waste generation is rising at an alarming rate of 20% each year and is projected to increase to 4.19 MMT by 2035 (Farhat, 2021). Mobile and television sets are the major contributors to e-waste (Masud *et al.*, 2019). In the last 21 years, Bangladesh has generated 0.011 MMT of e-waste only by mobile sets. Besides, 0.17 MMT of e-waste is generated each year from scrape television sets (Environment and Social Development Organization-ESDO, 2010). Adding to that, unstructured and illegitimate recycling is rising (Resmi and Fasila 2017), causing additional environmental threats. For example, it is found that of 1,000 women living close to informal e-waste recycling spots in Sylhet district of Bangladesh, 36.3% lost their babies, and 64% experienced hearing or eyesight difficulties (Alam and Bahauddin, 2015). It was also reported that due to ineffective e-waste management structure, around 15% of the illegitimate child workers die in this sector, and 83% suffer from chronic health difficulties in Bangladesh (Environment and Social Development Organization-ESDO, 2012).

To this end, increased government and private interventions are highly essential. In the context of developed countries, policies and formal procedures are in place to urge the electronics producers and retailers to provide consumers with the facilities for proper dumping of their end-of-life (EoL) electronic products (Kumar, 2019). Given that such policies and procedures are still in their infancy in most emerging economies (e.g., India, Bangladesh) (Al Amin, 2018; Kumar, 2019), reverse logistics could be an effective solution to get rid of the growing e-waste problem (Khan *et al.*, 2019).

The reverse flow of unused, EoL electronic products and parts, and the relevant information from final consumers to producers, is referred to as reverse logistics or reverse supply chain management (Kumar, 2017; Islam *et al.*, 2021). Within the reverse logistics context, manufacturers frequently provide EoL electronic products exchange (EEPE) offer (Yuan *et al.*, 2016), which is described as the process of returning EoL electronic products from consumers to the producers for sustainable e-waste management (Blackburn *et al.*, 2004). Reverse logistics or EEPE programs should receive incremental attention as such

programs allow firms: (1) to develop strong and trustworthy interactions with its customers by exchanging timely information (Zeng *et al.*, 2013); (2) to respond to the essential legitimacy of having a channel of proper retrieval and disposing of e-waste for ensuring an environmentally-friendly e-waste management system as envisioned by ‘Extended Producer Responsibility’ (EPR) guideline (OECD, 2001; Rahman, 2021).

The effectiveness of reverse logistics or EEPE programs predominantly rests on final consumers who are the primary suppliers of this process (Gaur and Mani, 2018). Nonetheless, the paucity of consumer awareness and the resultant low participation rate discourage firms from extemporaneously continuing such programs (Abdulrahman *et al.*, 2014). Thus, it is highly recommended to study factors stirring consumer behavior with regard to reverse logistics or EEPE programs (Budijati *et al.*, 2016), yet scant attention has been drawn to investigate such areas in the existing literature (e.g., Khan *et al.*, 2019; Kumar, 2019; Yuan *et al.*, 2016). A few extant studies (e.g., Jena and Sarmah, 2015; Kianpour *et al.*, 2017) have focused on consumers’ e-waste recycling intention, while the majority is concentrating on recycling performances from the suppliers’ end (Khan *et al.*, 2019; Kochan *et al.*, 2016; Yuan *et al.*, 2016). In this regard, a review of the existing reverse logistics studies (e.g., Arain *et al.*, 2020; Delcea *et al.*, 2020; Dixit and Badgaiyan, 2016; Kianpour *et al.*, 2017; Kumar, 2019; Mahmud *et al.*, 2020; Nguyen *et al.*, 2018) has driven the current study to unfold the following key research gaps.

First, within the broad domain of reverse logistics (e.g., Khan *et al.*, 2019; Kumar, 2019) and reverse supply chain management (e.g., Kianpour *et al.*, 2017; Wang *et al.*, 2019), little importance has been given to the predictors of consumers’ reverse exchange intention (e.g., EEPE) (Yuan *et al.*, 2016). Second, relating to reverse exchange behaviors, scholars (Kianpour *et al.*, 2017; Parajuly *et al.*, 2020) contended that the investigation of associated contextual (e.g., government initiatives) and non-cognitive factors is still insufficient, requiring subsequent examination. Third, consumers’ attitudes do not essentially lead to intention, causing the ‘attitude-intention gap’, which is an ongoing concern in sustainability literature (Vermeir and Verbeke, 2006; ElHaffar *et al.*, 2020). Accordingly, many consumer behavior studies, including organic food consumption (Tandon *et al.*, 2020a), brand switching intention (Aw and Chong, 2019), and recycling intention (Wan *et al.*, 2014), addressed this gap by employing some context-specific moderators. However, examination of such intervening mechanisms is rarely explored in reverse logistics literature. Finally, former studies (e.g., Guarnieri *et al.*, 2020; Koshta *et al.*, 2022; Kumar, 2019) advised verifying extant findings on reverse logistics in diverse contexts (especially in developing countries’ contexts) and cultural settings as consumer behavior is primarily affected by social and cultural nuances. In line with these gaps, the subsequent research questions are put forward:

- What psychological predictors are affecting consumers’ (e-waste) reverse exchange intention?
- Do relevant contextual and non-cognitive factors influence consumers’ (e-waste) reverse exchange intention?

- How do government initiatives as a contextual factor moderate the attitude-intention relation with regard to reverse exchange?
- How manufacturers and marketers would adjust their e-waste management strategies in developing countries?

With an aim to address the mentioned research questions, this study intends to examine the determinants of consumers' EEPE intention by employing the Theory of Planned Behavior (TPB) (Ajzen, 1991) as the underpinning model considering its predominant effectiveness in understanding individuals' pro-environmental behavior (PEB) (Alzubaidi *et al.*, 2020). Second, to answer the call for examining relevant contextual and non-cognitive factors in reverse exchange context, this study extends the TPB model by incorporating government initiatives and consumer knowledge in the current research model. Importantly, the study explores how additional contextual and non-cognitive factors interact with the original TPB framework in predicting consumers' intention. Third, grounded in the Attitude-Behavior-Context (A-B-C) theory (Guagnano *et al.*, 1995), this study tests the moderation effect of government initiatives in the attitude-intention relation, thereby contributing to the elucidation of the 'attitude-intention gap'. This would provide an inclusive understanding of how contextual factors could lead consumers' pro-environmental attitudes to their intention to perform PEB. Adding to these theoretical contributions, the current study offers several policy recommendations to help stakeholders (e.g., electronic manufacturers, policymakers) in the current and other emerging markets re-assess their e-waste management strategies.

2. Background

2.1 An overview of the recent literature

Identifying consumers' importance in e-waste recycling, many past scholars have attempted to investigate consumers' willingness to partake in e-waste recycling. For example, Gilal *et al.* (2019) found that e-waste disposal-related positive word-of-mouth messages highly motivate consumers to perform e-waste disposal behavior. Likewise, Jayaraman *et al.* (2019) stated a positive relationship between individuals' awareness and the conviction of laptop disposal practices. In a developing country (India) context, Koshta *et al.* (2022) further commented that perceived behavioral control, awareness of consequences, and intentions to recycle e-waste are significant in predicting consumers' willingness to pay (WTP) for disposing of e-waste. They also found that attitude, subjective norms, and environmental concerns have a favorable impact on WTP through intentions to recycle e-waste. In this connection, Kumar (2019) demonstrated that attitude, subjective norms, perceived behavioral control, sense of duty, and end-user's responsibility are positive predictors of end-user's intention to recycle e-waste. In addition, Dixit and Badgaiyan (2016) attested that e-waste recycling intention is greatly influenced by subjective norms, perceived behavioral control, moral norms, and willingness to sacrifice, while intentions are not influenced by attitude. However, Aboelmaged (2021) indicates that despite no relationship between perceived behavioral control and behavioral intention, habit positively influences intention to recycle e-waste. Focusing on normative and hedonic goals, Siringo *et al.* (2020) illustrated that

information and convenience have the highest correlation with e-waste recycling intention, whereas knowledge has the least correlative value. Furthermore, Ran and Zhang (2022) demonstrated that price comparison and proactive personality positively moderates the recycling intention-behavior relationship, price sensitivity on the other hand has negative effect. Using the Behavioral Reasoning Theory, Dhir *et al.* (2021) affirmed that reasons for and attitude are positively related to e-waste recycling intention, while reasons against negatively associates with intention.

Although these prominent studies significantly contribute to the current knowledge of consumers' e-waste recycling behavior, some essential areas need further research attention. For example, no existing research has specifically explored consumers' EoL electronic products reverse exchange intention as an approach to e-waste recycling focusing on consumer knowledge and government initiatives. Moreover, as mentioned earlier, context-specific factors such as government initiatives are rarely examined as moderators in the attitude-intention link within e-waste recycling studies. Our study draws on these research voids and thus, adds new knowledge to the extant literature.

2.2 Recycling and e-waste management initiatives in Bangladesh

Digital Bangladesh Vision 2021, coupled with an increased purchasing power of general people, is fueling the incremental use of electronic gadgets, boosting e-waste production in Bangladesh (Masud *et al.*, 2019). However, as there are no extensive e-waste management guidelines by the government of Bangladesh, large-scale informal recycling remains a standard method of getting rid of EoL electronic devices. Even though the government recently issued the Hazardous Waste (e-waste) Management Rules, 2021 under the Bangladesh Environmental Protection Act, 1995, it is yet not in effect (Farhat, 2021). Under this new rule, the electronic goods producers, traders, collection centers, recyclers will be registered, and their activities will be monitored. Moreover, the inflow of old or used electrical and electronic products will strictly be prohibited. Offenders of this rule will be penalized with imprisonment (two to ten years) and/or a financial penalty (BDT 2 Lac to 10 Lac) (Envilience ASIA, 2021).

Many private organizations are also adopting reverse logistics to collect old or EoL electronic products. For example, renowned suppliers and amalgamators in Bangladesh, such as Transcom Digital, Walton, Best Electronics, and Sony Rangs, have started electronic product exchange offer program as part of their promotion and EPR (Best Electronics, 2019; Rangs Electronics Limited, 2019; Transcom Digital, 2019; Walton, 2019). Under such programs, they deliver new electronic appliances in exchange for old ones, which they further reuse, repair, recycle, or dispose of by following standard procedures. In addition, leading telecommunications service provider 'Grameenphone' has inaugurated a campaign called "Mobile Handset recycling" (Grameenphone, 2019).

3. Theoretical framework and hypotheses

In the broad scope of examining consumers' pro-environmental behavioral intentions and behaviors, the Theory of Planned Behavior (TPB) is the most powerful and applicable model (Alzubaidi *et al.*, 2020; Zaremohzzabieh *et al.*, 2021). The classical TPB model (Ajzen, 1991) incorporates three antecedents (attitude toward behavior, subjective norm, and perceived behavioral control) of individuals' behavioral intention, which subsequently could influence actual behavior. The TPB model has a high predictive power as some former studies found it to be explaining above 60% variances in consumers' PEB (e.g., Moser, 2015; Yazdanpanah and Forouzani, 2015). Drawing on its robustness, the TPB model has been used by past researchers in a broad range of research areas, including health, green behavior, technology, and environmental studies (Kumar, 2019).

Specifically, several former studies employed the TPB model in analyzing consumers' behavior with regard to e-waste recycling and management. For example, Echegaray and Hansstein (2017) attested that TPB variables (attitude toward behavior, subjective norm, and perceived behavioral control) with individuals' awareness positively influence individuals' intention to recycle e-waste. The applicability of the TPB model was also verified by Kianpour *et al.* (2017) in examining customers' participation to recycle e-waste in Malaysia. In line with this, Kumar (2019) endorsed that the TPB variables and other associated variables (e.g., sense of duty) positively predict young adults' intention to recycle e-waste. Besides, recycling attitude and subjective norms were found significant, while perceived behavioral control was insignificant in eliciting e-waste recycling intention among electronics store managers in Bangladesh (Mahmud *et al.*, 2020). In the e-waste reverse logistics context, Koshta *et al.* (2022) also validated the TPB model's relevance in investigating end users' intention and willingness to pay for e-waste recycling. The current study therefore has decided to use the TPB as a basic theoretical model in analyzing consumers' intention on EEPE.

However, the TPB primarily includes individual-level cognitive predictors (Dixit and Badgaiyan, 2016; Parajuly *et al.*, 2020), limiting its predictive relevance in situations where other context-related predictors could influence individuals. Thus, past studies assessing consumer behavior (e.g., Russell *et al.*, 2017; Wang *et al.*, 2018) criticized the TPB model for underplaying relevant non-cognitive predictors. In a similar vein, a meta-analysis by Zaremohzzabieh *et al.* (2021) asserted that the TPB has better explanatory power when it is extended by integrating other context-related predictors. Indeed, former prominent studies have used the extended TPB model in examining consumers' PEB (e.g., Alzubaidi *et al.*, 2020; Bamberg, 2003; Tonglet *et al.*, 2004).

In response to the above-mentioned arguments, our study integrated government initiatives as a contextual factor and consumer knowledge as a non-cognitive factor in the basic TPB model. To this end, we draw upon the A-B-C theory (Guagnano *et al.*, 1995), which put forward that individuals' PEBs are equally influenced by individuals' attitudes toward the behavior and external contexts. The A-B-C theory is specifically applicable in

studying individuals' pro-environmental behavioral intention (Ertz *et al.*, 2016), allowing many past researchers (e.g., Ertz *et al.*, 2016; Wang *et al.*, 2021; Xu *et al.*, 2017) to employ this theory in the PEB domain. Based on A-B-C theory, Okumah and Ankomah-Hackman (2020) asserted that an individual's behavior is affected by several factors, including attitude (e.g., beliefs), situational (e.g., government regulations), personal (e.g., knowledge, social status), and habits. Moreover, government initiatives have been attested as significantly influential in stimulating residents' waste separation intention (Xu *et al.*, 2017) as well as e-waste recycling intention (Yu *et al.*, 2014). It is also argued that government initiatives in motivating proper e-waste management are critical in developing countries' contexts (Kumar, 2019). Besides, previous studies endorsed the dominant role of consumer knowledge (Jalil *et al.*, 2016; Arain *et al.*, 2020) in explaining consumers' PEB. Consumers' product-related knowledge (e.g., ingredient, lifespan, environmental impact) is specifically essential in the case of electronic goods as spotting the detrimental effects of e-waste on humans and the environment might influence an individual to follow an appropriate e-waste management approach. The following section presents the reasoning for this study's proposed hypotheses.

3.1 Attitude toward EEPE

Attitude toward a particular behavior is one of the key elements to explain a person's behavioral intention. Ajzen (1991) defined attitude as favorable or unfavorable perceptions of a person toward performing a particular behavior. Many former studies (Echegaray and Hansstein, 2017; Zhang *et al.*, 2020) investigated and found a positive connection between attitude and intention to recycle. In the developing countries context, Kumar (2019) demonstrated that an individual's attitude toward recycling is a significant positive determinant of e-waste recycling intention. Mahmud *et al.* (2020) reported that recycling attitudes positively impact the recycling intention of electronics store managers. In the context of reverse logistics, past scholars further revealed a positive influence of recycling attitude on behavioral intention to return e-waste (Kianpour *et al.*, 2017; Wang *et al.*, 2016; Yuan *et al.*, 2016).

Moreover, former studies in diverse contexts of PEB, such as organic food consumption (Tandon *et al.*, 2020b, 2020a), using electric vehicles (Gulzari *et al.*, 2022), and anti-littering behavior (Ibrahim *et al.*, 2021), assert that positive individuals' attitudes generate an increased level of adoption intention. Nonetheless, findings regarding attitudes are inconclusive as some studies (e.g., Dixit and Badgaiyan, 2016; Khan *et al.*, 2019) found its insignificant impact on individuals' intention to perform PEB, necessitating subsequent examination of this association. Thus, taking the core logic of the TPB model into consideration, in this study, we argue that if people perceive EEPE as an appropriate and responsible behavior to perform, then their intention toward EEPE will be escalated. Accordingly, we put forward the following hypothesis:

H1. Attitude toward EEPE has a positive impact on EEPE intention.

3.2 Subjective norm

Subjective norm refers to the perceived social pressure or expectation of significant others (e.g., friends, family members) in determining whether to undertake a certain behavior or not (Ajzen, 1991). Tonglet *et al.* (2004) hypothesized that subjective norm is a positive predictor of behavioral intention to recycle household waste. Besides, the empirical results of Bakshan *et al.* (2017) demonstrated that social pressure significantly and positively influences the behavior in construction waste management. Indeed, the significance of subjective norms in promoting sustainable consumer behavior is well-documented (e.g., Gulzari *et al.*, 2022; Kumar *et al.*, 2021; Tewari *et al.*, 2022).

In the e-waste recycling literature, past scholars (Dixit and Badgaiyan, 2016; Kumar, 2019; Mahmud *et al.*, 2020) affirmed the importance of subjective norms in predicting consumers' intentions. In this regard, Kianpour *et al.* (2017) indicated that subjective norm positively influences consumers' intention to recycle end-of-life electronic goods. Koshta *et al.* (2022) further asserted that subjective norm positively triggers consumers' e-waste recycling intention. That is, the more the consumer associates them with those significant others (e.g., friends, family members), the greater the influence. In line with this, in the current study's context, we assume that the behavior of other social members such as friends, peers, or family members, might put pressure on promoting an individual's intention toward EEPE. Such predisposition is also consistent with the primary rationales of the TPB model. Successively, we propose that:

H2. Subjective norm has a positive impact on EEPE intention.

In addition, extant studies argued that subjective norms could be an essential predictor of an individual's attitude toward a certain behavior. For instance, Han *et al.* (2010) demonstrated that subjective norms influence individuals' attitudes toward green hotels. The positive effect of subjective norms has also been endorsed in reinforcing attitudes toward the environment (Sabbir and Taufique, 2022). Such a relationship is also validated in organic food consumption literature (Bai *et al.*, 2019; Testa *et al.*, 2019). Consistent with this, we contend that:

H3. Subjective norm has a positive impact on attitude toward EEPE.

Moreover, the intermediary role of attitude in green consumption literature is well-established (e.g., Carfora *et al.*, 2021; Qi *et al.*, 2021; Tandon *et al.*, 2020b, 2020a; Zhu *et al.*, 2020). Thus, in relation to H3 and H1 as well as considering Baron and Kenny's (1986) logic (if A influences B and B influences C, then B intermediates the relationship between A and C), we posit that attitude toward EEPE positively mediates the association between subjective norm and EEPE intention. Furthermore, the mediating effect of attitude in the relationship between subjective norm and intention is reported in green hotel choice (Han *et al.*, 2010) and organic food consumption (Bai *et al.*, 2019; Testa *et al.*, 2019). In this regard, Sabbir and Taufique (2022) confirmed the positive mediating influence of attitude between subjective

norms and pro-environmental behavior in workplace settings. Building on this evidence, we argue the perceived social expectation from important others triggers a positive attitude toward EEPE among consumers, motivating them to engender more EEPE intentions. Thus, it is proposed that:

H4. Attitude toward EEPE positively mediates the association between subjective norm and EEPE intention.

3.3 Perceived behavioral control

Perceived behavioral control is referred to the extent to which an individual has control over undertaking a behavior (Ajzen, 1991). In other words, it involves people's perception about their ability and available opportunity to perform a behavior (Russell *et al.*, 2017). Several elements, including convenience, opportunity, knowledge, or ease of behavior, estimate the level of perceived behavioral control (Davies *et al.*, 2002; Tonglet *et al.*, 2004). In both developed and developing countries perspectives, perceived behavioral control was substantiated as one of the significant predictors of an individual's green consumption behavior (Mufidah *et al.*, 2018), including organic food (Aitken *et al.*, 2020; Canova *et al.*, 2020), natural food (Carfora *et al.*, 2021), and organic milk (Carfora *et al.*, 2019).

In the context of this study, former researchers pointed out that lost time, inconvenience, and complex processes are the main reasons for customers' reluctance to partake in recycling activities (Vining and Ebreo, 1990; Gamba and Oskamp, 1994). Conversely, the external factors that make the process of reversing e-waste easy and comfortable are important in eliciting consumers' intention to return e-waste for recycling (Kianpour *et al.*, 2017). Similarly, the existing studies (e.g., Dixit and Badgaiyan, 2016; Koshta *et al.*, 2022; Kumar, 2019) have confirmed the positive impact of perceived behavioral control on e-waste recycling intention. Drawing on this discussion, we argue that if individuals have sufficient skills, availability, and convenience (in terms of exchange location) with regard to EEPE, they will be more likely to display EEPE intention. Thus, we put forward the following hypothesis:

H5. Perceived behavioral control has a positive impact on EEPE intention.

3.4 Government initiatives

In the case of waste management, companies or residences and the government have responsibilities. Government is the ultimate authority of a country responsible for developing and implementing rules and policies. The government can drive people's behavior by implementing rules and regulations, including green behavior (Budijati *et al.*, 2016). In this context, Mei *et al.* (2012) suggest that the government promotes sustainability activities to trigger a sense of sustainable behavior among citizens. In response, people would feel motivated to participate in recycling and relevant green activities. For example, it is

demonstrated that government initiatives positively shape residents' intentions to separate household waste in China (Xu *et al.*, 2017).

The macro-level and context-specific government supports/initiatives have a profound effect on fostering micro-level sustainable behaviors. As such, Mufidah *et al.* (2018) affirmed that authority supports positively motivate individuals' intention to use eco-labeled products. Similarly, trust in government initiatives was found influential in elevating citizens' intention to buy organic milk (Carfora *et al.*, 2019). In the context of this study, the Chinese government enforced several laws and regulations with different investment programs and projects (Yu *et al.*, 2014) that have proven vital in managing e-waste properly. The development and implementation of environment-friendly laws can improve the awareness of general people about green issues and make them ready to adopt e-waste recycling behaviors (Wang *et al.*, 2016). That means the proper solution to the e-waste problem is mostly dependent on government initiatives and performances (Nguyen *et al.*, 2018; Delcea *et al.*, 2020). Furthermore, it is argued that reverse exchange is one of the best ways of effective e-waste recycling, and thus, government initiatives could have a substantial positive role in stimulating consumers' intention to participate in such reverse exchange programs (Budijati *et al.*, 2016; Yuan *et al.*, 2016). Drawing on this discussion, we hypothesize that:

H6: Government initiatives have a positive impact on EEPE intention.

This study's examination of government initiatives as contextual factors is also linked to the core tenets of the A-B-C theory (Guagnano *et al.*, 1995), suggesting that contextual factors coupled with attitude are important in triggering an individual's willingness to perform PEBs (e.g., recycling). Drawing on the A-B-C theory, Xu *et al.* (2017) showed that contextual factors (e.g., organizational supports) positively moderate the relationship between employees' attitude and willingness to save energy in the organization. This is an important finding as such moderation assessed the discrepancy between an individual's attitude and intention (also known as attitude-intention gap). In fact, investigating moderators and mediators in the relationship between attitude and intention is crucial in bridging the attitude-intention gap (Aschemann-Witzel and Niebuhr Aagaard, 2014) and providing additional understanding regarding consumers' behavior (Tandon *et al.*, 2020a). Similarly, when assessing the attitude-intention gap in the context of consumers' reverse exchange behavior, Yuan *et al.* (2016) revealed the significant positive moderating effect of neutralization techniques (e.g., denial of responsibility) and consumer knowledge. Yet no former study has explored the role of government initiatives as a positive moderator in addressing the attitude-intention gap. However, a higher level of government initiatives was found to positively augment individuals' environmental citizenship behavior (Song *et al.*, 2019) and carbon mitigation practices in the workplace (Wang *et al.*, 2019). Accordingly, former researchers (e.g., Al-Swidi and Saleh, 2021; Johnstone and Hooper, 2016) called for more government initiatives to inspire consumer-level green practices. Thus, building on the A-B-C theory and above evidence, we argue that interventions from the government could play a significant moderating role in translating an individual's positive attitude into intention toward EEPE.

That is, consumers' positive attitude toward EEPE would induce more EEPE intention when there is a higher level of government initiatives and vice-versa. Hence, we postulate that:

H7. Government initiatives strengthen the positive relationship between attitude toward EEPE and EEPE intention.

3.5 Consumer knowledge

Consumer knowledge could be divided into two types: subjective knowledge and objective knowledge (Schlegelmilch *et al.*, 1996; Tilikidou, 2007). Subjective knowledge represents consumers' perception of a particular product, whereas how much a customer knows about a product is objective knowledge (Alba and Hutchinson, 1987). There is a positive relationship between recycling behavior and subjective and objective knowledge (Ellen, 1994). That is, knowledge plays a vital role in driving consumer behavior (Haron *et al.*, 2005).

Many former studies (Aitken *et al.*, 2020; Han and Cudjoe, 2020; Jalil *et al.*, 2016; Kushwah *et al.*, 2019; Pandey *et al.*, 2021) have found that consumers' knowledge and environmental-friendly behavior are positively connected. For example, scholars reported that consumer knowledge shares a positive relationship with organic food purchase intention (Gundala and Singh, 2021; Li *et al.*, 2021; Testa *et al.*, 2019). Consumers' knowledge about environmental protection and associated environmental issues is also crucial in the recycling behavior context. Accordingly, past empirical studies attested that consumer knowledge is significantly related to provoking consumers' participation in e-waste recycling (Kianpour *et al.*, 2017; Siringo *et al.*, 2020). Since EEPE is an essential part of reverse logistics, which is one of the most effective and efficient ways of recycling, consumer knowledge might play an essential role in this context. With proper knowledge, consumers' can particularly identify what actions are beneficial or what are detrimental to the environment (Tanner and Kast, 2003), which subsequently would help consumers adopt EEPE. In line with this, our study estimates consumers' objective knowledge measuring what is kept in an individual's memory about a particular product or a situation. Consumers with such knowledge are recognized as expertise (Anderson, 1987), who are highly expected to have more positive intentions toward PEBs (Yuan *et al.*, 2016), such as exchanging end-of-life electronic products. Based on the above-mentioned literature, this study postulates the following hypothesis:

H8. Consumer knowledge has a positive impact on EEPE intention.

Another possible link worth exploring is between consumer knowledge and perceived behavioral control. It is endorsed that individuals' self-confidence influences their perceived control over performing a behavior (Cheng *et al.*, 2006; Baker *et al.*, 2007). Such self-confidence could be enhanced by training, knowledge, or perceived power. Cop *et al.* (2020) attested that perceived behavioral control is positively influenced by green training that eventually enriches individuals' knowledge. In this regard, Pookulangara *et al.* (2011) argued that facilitating conditions such as information and product-related knowledge enhance

consumers' perceived control over purchasing that product. Besides, the positive effect of consumer knowledge on perceived behavioral control was found in promoting voluntary carbon offsetting behavior (Kim *et al.*, 2014). Past researchers (e.g., Aitken *et al.*, 2020; Tanner and Kast, 2003) in the organic food context also reported that consumer knowledge is required to heighten consumers' perceived behavioral control. In addition, Zahan *et al.* (2020) affirmed that consumer knowledge is positively related to perceived behavioral control in purchasing green housing. In a similar vein, Mucinhato *et al.* (2022) verified the positive role of consumers' product-related knowledge in uplifting perceived behavioral control to adopt safe food-handling practices. In sum, consumer knowledge has a significant positive impact on augmenting perceived behavioral control within a diverse range of consumers' PEBs. In light of this evidence, we conjecture that a more knowledgeable consumer will enjoy higher perceived control in showing PEBs, such as EEPE intentions, compared to a less knowledgeable consumer. Thus, this study proposes that:

H9. Consumer knowledge has a positive impact on perceived behavioral control.

Most previous studies in consumers' green behavior literature (e.g., Ghazali *et al.*, 2017; Pookulangara *et al.*, 2011; Testa *et al.*, 2019) overlooked the potential connection among consumer knowledge, perceived behavioral control, and behavioral intention. Though one recent study (Mucinhato *et al.*, 2022) revealed a positive indirect effect of consumer knowledge on behavioral intention via perceived behavioral control, it did not hypothesize such a relationship. Thus, relating to H9 and H5 as well as considering Baron and Kenny's (1986) rationale, we propose a new link in PEB literature where perceived behavioral control positively mediates the association between consumer knowledge and EEPE intention. Here, the underpinning reasoning is that a higher level of consumer knowledge can foster the conviction that one has perfect control over EEPE behavior, thereby generating greater intentions toward EEPE. Thus, it is hypothesized that:

H10. Perceived behavioral control positively mediates the association between consumer knowledge and EEPE intention.

Figure 1 below illustrates this study's hypothesized relationships:

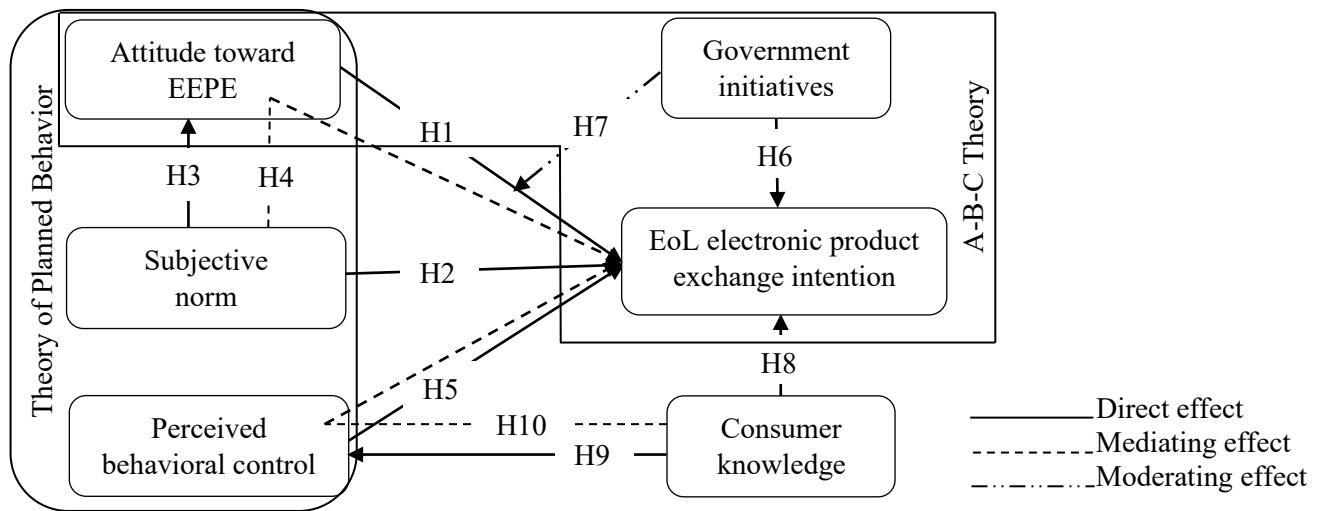


Figure 1: Proposed research model of this study.

4. Method

This study conducted two independent empirical studies with exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) for a comprehensive and robust analysis (Boyer and Swink, 2008; Boiral and Paillé, 2012). To avoid the risk of occurring overfitting model, it is highly suggested to use two separate datasets for performing EFA and CFA (Fokkema and Greiff, 2017). Thus, former studies in PEB (e.g., Boiral and Paillé, 2012) and non-PEB (e.g., Rabbanee *et al.*, 2020) domain used distinct student and general consumer samples for performing EFA and CFA, respectively. In line with this, we conducted Empirical study 1 on a student sample to explore the patterns of independent predictors' dimensions and determine the corresponding factors' unidimensionality with EFA. Empirical study 2 was conducted on a general consumer sample to confirm the reliability and validity of the measurement model and test the proposed hypotheses with CFA. The study used SPSS (version 26) and AMOS (version 23) to perform the analysis.

4.1 Measures

All measures used in the study (Study 1 and 2) were adapted from past studies to ensure content validity. Necessary modifications were done in the adapted items to fit the current study's context, retaining the original meaning. A five-point Likert-type scale (anchored as 1=strongly disagree to 5=strongly agree) was used for all measurement items, which were further assessed by two voluntary academic experts from the department of marketing and psychology to confirm accuracy. A pilot survey with 23 university students was performed, and changes were made to some question wordings. The measurement items along with sources are illustrated in Appendix.

4.2 Sample and data collection

Sample 1-(Study 1, EFA). Engaging a purposive sampling method (Khan *et al.*, 2019), respondents for Study 1 were recruited from students attending the undergraduate and the graduate program at the University of Dhaka, the University of Rajshahi, and the University of Chittagong (Sabbir, Akter, *et al.*, 2020; Sabbir, Islam, *et al.*, 2020). With students from different regions of Bangladesh, these universities are the largest ones in Bangladesh. There are at least three reasons for the appropriateness of university students as the sample for this study. First, young adults/students are defined as “the intellectual vanguard of the future and reference points for other consumers” (Izagirre-Olaizola *et al.*, 2015, p. 1-2). Second, young university students are the prime consumers of the latest technological and electronic goods (Kumar, 2019). Third, it is more likely that this group will reiterate their present behaviors in their future life (Vermeir and Verbeke, 2006), making them a significant target group for the next 50 years (Brusselsaers *et al.*, 2020).

Primarily, five graduate students from the above-mentioned universities were contacted. These students initially communicated information about this study’s survey with their classmates in their online social media groups (e.g., Facebook groups). Those who expressed their willingness to partake in the survey were further enquired about their EoL electronic product exchange awareness. This process generated 519 potential participants who were provided with the link to a Google Docs questionnaire via messenger or email. At the completion of the data collection period (December 2020), 369 participants eventually responded. After data-cleansing, 334 responses were deemed usable.

Sample 2-(Study 2, CFA). Employing a purposive sampling procedure (Khan *et al.*, 2019), participants for Study 2 were selected from electronic products consumers. Primarily, several renowned electronic retailers (e.g., Sony Rangs, Walton) in Bangladesh were contacted to provide this study’s investigators with a list of their consumers. After being satisfied with this study’s purposes and data privacy policy, those retailers provided a list of 609 consumers with their email addresses. These potential respondents were sent an email enquiring whether they are aware of the electronic product ‘exchange offer’ program and outlining this study’s purpose, participation request, and their freedom to leave participation at any moment. If respondents were unaware of the ‘exchange offer’, they were discouraged from continuing with the Google Docs questionnaire’s link (attached in the email). A total of 379 responses were finally returned at the completion of the data collection period from January to April 2021. After checking for data completeness, 330 responses were found usable.

4.3 Data normality and method bias

Data non-normality is assumed to be noncritical where a substantial sample size (e.g., 200 or more) is used (Hair *et al.*, 2014) with a multivariate data analysis using maximum likelihood approximation in AMOS (Chung *et al.*, 2009). Yet we assessed data normality by calculating skewness and kurtosis values (Hasan and Kashif, 2021; Tandon *et al.*, 2021). The

absolute values of skewness and kurtosis of Sample 1 and 2 were within the recommended threshold (skewness ≤ 3 and kurtosis ≤ 10), indicating that our data is not severely deviated from normality (Kline, 2015). Our analysis is also devoid of any multicollinearity issue as the calculated VIF values for all constructs were below the (restrictive) threshold of 3 (Hair *et al.*, 2019).

To reduce this study's potential method bias, including social desirability and subjective bias, we undertook the following steps: (a) measurement items of each construct were placed in different sections, (b) participants' anonymity was clearly highlighted, and (c) participants were enthused to respond honestly considering this study's sole academic nature (Podsakoff *et al.*, 2003). In addition, participants were not provided with any incentive or compensation. Moreover, Harman's Single Factor test was conducted for both samples where calculated variance for the single factor was within the suggested value ($< 50\%$), confirming the absence of significant method bias (Podsakoff *et al.*, 2003). We also assumed respondent fatigue to be minimum considering (a) respondents' spontaneous participation was ensured by explicitly asking their willingness to participate in the survey, (b) responses were collected at respondents' most convenience (home or office) with an online questionnaire (Sherry *et al.*, 1993), and (c) the number of measurement items was fairly concise (Anselmsson *et al.*, 2017), allowing respondents to complete the survey within a reasonable short time.

5. Results

5.1 Empirical study 1

Empirical study 1 was conducted for one specific purpose: exploring the patterns of independent predictors' dimensions and determining the unidimensionality of the corresponding factors. Table I below demonstrates the demographics of Study 1's sample.

[Please insert Table I here]

5.1.1 Exploratory factor analysis

At this stage, the study undertook principal component analysis to assess the measurement items' factor structure. The estimated KMO value is 0.892, and Bartlett's Test of Sphericity is significant ($.000 < .05$), indicating the satisfactory level of sampling sufficiency (Tabachnick and Fidell, 2014; Hair *et al.*, 2014). The analysis resultant in six factors with eigenvalues above 1.0 and explicating 77.70% of the total variance. As reported in Table II, a distinctive factor structure has been achieved as the factor loadings exceeded the suggested value of 0.70 (Hair *et al.*, 2014). Moreover, alpha values are above 0.70, suggesting acceptable internal consistency among the items (Nunnally, 1978).

[Please insert Table II here]

In summary, the results of empirical study 1 present that unidimensionality of the factors has been obtained as all the measured items loaded on their corresponding factors.

Such results have led this study to proceed with the current factors and measurement items to test this study's proposed hypotheses. Accordingly, we performed empirical study 2 on a separate sample of general consumers of electronic products by following Anderson and Gerbing's (1988) suggestion of a two-step technique to structural equation modeling (SEM).

5.2 Empirical study 2

Empirical study 2 was conducted for two specific purposes: (1) confirming the reliability and validity of the measurement model; (2) testing this study's hypotheses using structural analysis. Table III below illustrates the demographics of Study 2's sample.

[Please insert Table III here]

5.2.1 Measurement model: reliability and validity

The measurement model's goodness-of-fit indices (i.e., $\chi^2_{(df=155)}=228.044, p=0.000$, GFI=.938, CFI=.984, TLI=.981, RMSEA=.038, SRMR=.032) are within the suggested values, verifying an acceptable model fit (Doll *et al.*, 1994; Hu and Bentler, 1999). Next, the analysis evaluated the construct reliability, convergent validity, and discriminant validity. As illustrated in Table IV, the composite reliability and Cronbach's alpha of all measured constructs are above .867, substantiating satisfactory constructs' reliability (Fornell and Larcker, 1981). In addition, the values of average variance extracted (AVE) vary from .655 to .826, composite reliability varies from .867 to .934, and factor loadings vary from .736 to .928, which are all confirming the necessary conditions of convergent validity of measurement scales (Fornell and Larcker, 1981; Hair *et al.*, 2014).

[Please insert Table IV here]

Discriminant validity is reported in Table V below, where non-diagonal values denote correlation among constructs, and diagonal values are the square root of the corresponding constructs' AVE values. The diagonal values of all six constructs exceeded inter-construct correlation coefficients, confirming Fornell and Larcker's (1981) requirements for discriminant validity. Furthermore, all non-diagonal values are lower than 0.85, representing that the analysis is free from multicollinearity issues (Kline, 2015).

[Please insert Table V here]

5.2.2 Structural model: testing hypotheses

The structural model's goodness-of-fit indices (i.e., $\chi^2_{(df=160)}=258.201, p=0.000$, GFI=.930, CFI=.979, TLI=.975, RMSEA=.043, SRMR=.063) are within the recommended values (Doll *et al.*, 1994; Hu and Bentler, 1999).

[Please insert Table VI here]

The analysis uncovered that the predictors explain 52.0% ($r^2 = 0.520$) variations in EEPE intention. Moreover, as presented in Table VI, subjective norm ($\beta = .330$, $p < 0.001$) is determined as the most significant positive determinant of EEPE intention, followed by attitude toward EEPE ($\beta = .259$, $p < 0.001$), consumer knowledge ($\beta = .194$, $p < 0.01$), perceived behavioral control ($\beta = .149$, $p < 0.01$), and government initiatives ($\beta = .110$, $p < 0.05$). Thus, H1, H2, H5, H6, and H8 are supported, outlining that attitude toward EEPE, subjective norm, perceived behavioral control, government initiatives, and consumer knowledge significantly and positively affect EEPE intention. Besides, the positive impact of the subjective norm ($\beta = 0.391$, $p < 0.001$) on attitude toward EEPE and consumer knowledge ($\beta = 0.434$, $p < 0.001$) on perceived behavioral control is significant, thereby supporting H3 and H9, respectively.

In addition, the mediating effects were estimated by performing bootstrapping analysis with 2000 bootstrap samples and 95% confidence intervals (Sabbir and Taufique, 2022). The results of indirect effect (Table VII) show that subjective norm ($\beta = .104$, $p < .01$; 95% CI, [0.177, 0.054]) and consumer knowledge ($\beta = .074$, $p < .05$; 95% CI, [0.169, 0.012]) has a significant positive indirect effect on EEPE intention via attitude toward EEPE and perceived behavioral control respectively, confirming H4 and H10. These results imply that attitude toward EEPE and perceived behavioral control play a positive mediating role in the current research model (Baron and Kenny, 1986).

[Please insert Table VII here]

5.2.3 Moderating effect of government initiatives

To estimate the moderating effect of government initiatives, SPSS PROCESS (version 3.5) Model 1 was used with Johnson-Neyman significance area for floodlight analysis (Hayes, 2013). In the model, attitude toward EEPE served as the independent variable (X), EEPE intention was inserted as the dependent variable (Y), and government initiatives functioned as the moderator.

The interaction term of attitude toward EEPE and government initiatives on EEPE intention was significant ($\beta = 0.13$, $t = 2.18$, $p = 0.03$, 95% CI, [0.244, 0.013]). Further assessment of Table VIII indicates the conditional effect of attitude toward EEPE at focal values of the government initiatives (moderator). The Johnson-Neyman point for the moderator variable was 2.5749, meaning when government initiatives equal or surpass that value, the association between attitude toward EEPE and EEPE intention gets strengthened (i.e., the effect size becomes positive, substantial, and greater as the moderator value changes from 2.5749 to 5.0). This significance area is shaded in Table VIII.

[Please insert Table VIII here]

6. Discussions

This study highlights the underlying determinants of consumers' EEPE intention by investigating relevant cognitive, non-cognitive, and contextual factors under-investigated in the existing literature. The result regarding H1 suggests that if people consider EEPE as a responsible, sound, and wise move, then they would be more likely to exchange their EoL electronic products. While this finding concurs with that of past studies (Kumar, 2019; Mahmud *et al.*, 2020), our study adds to the current reverse logistics literature by verifying the positive cognitive link between attitudes and intentions in a unique EEPE context. In relation to the subjective norm, this study confirms three hypotheses, including subjective norm have a strong positive impact on EEPE intention (H2) and attitude toward EEPE (H3). This supports Hofstede's predisposition that in a collective culture prevailing in Bangladesh (Hofstede Insights, 2021), people like to comply with significant others' (e.g., friends, neighbors) opinions in showing willingness toward EEPE. This adds to the current knowledge by establishing that not only in purchasing (Si-dai *et al.*, 2021) but also in reverse exchanging electronic equipment, people value significant others' opinions or perceived social pressures from group belongingness. Lastly, the subjective norm has a substantial positive indirect effect on EEPE intention via attitude toward EEPE (H4). In sum, these findings imply that the influence of social members or expectations from them shapes an individual's attitude and intention, making those social members (e.g., friends, neighbors) an important consideration for electronic retailers.

Though past studies (Echegaray and Hansstein, 2017; Kianpour *et al.*, 2017; Mahmud *et al.*, 2020) in developing countries' contexts reveal inconsistent findings regarding perceived behavioral control, the current results present it to be positively significant in predicting consumers' EEPE intention (H5). This finding contradicts that of Koshta *et al.* (2022), positing that people might prefer the informal sector due to its ease and convenience to the formal sector of e-waste recycling. Whereas, our study shows that consumers' opportunities and skills of knowing how and where to exchange EoL electronic products would heighten their intentions to EEPE. The results also unveil that government initiatives significantly influence EEPE intention (H6). This finding implies that people would be interested in adopting exchange programs if government-initiated laws and regulations and community-driven campaigns make them aware of the benefits of the reverse logistics program. We therefore showed that macro-level and context-specific government initiatives and programs could substantially generate micro-level PEB intentions even in the context of a reverse exchange. Indeed, it is a reasonable inference in developing countries' perspective where the proper waste management predominantly depends on government-initiated rules, financial incentive programs, and projects (Nguyen *et al.*, 2018; Xu *et al.*, 2017).

Moreover, government initiatives significantly and positively moderate the association between attitude toward EEPE and intention (H7), meaning the presence of higher levels of government initiatives would reinforce an individual's intention to EEPE and vice-versa. This provides empirical support to the A-B-C theory (Guagnano *et al.*, 1995), suggesting that attitude together with contextual factors influence behavioral intention. This

potential new addition to the existing reverse logistics literature indicates the importance of contextual factors in predicting consumers' reverse exchange behaviors. Following this, consumer knowledge has been found substantially influential in eliciting EEPE intention (H8) and enhancing perceived behavioral control (H9). The former result verifies previous findings (Han and Cudjoe 2020; Jalil *et al.*, 2016) in other contexts reporting a positive connection between consumers' pro-environmental knowledge and behaviors. Consumer knowledge is particularly relevant when the intended behavior is new, infrequent, or involves a complex decision-making process, such as purchasing organic food (Gundala and Singh, 2021; Li *et al.*, 2021). As the reverse exchange is not a habitual but a new and infrequent behavior for Bangladeshi people, our findings show that consumers significantly depend on their knowledge to exhibit reverse exchange intentions. Besides, this study's validated indirect path from consumer knowledge to EEPE intention via perceived behavioral control (H10) is another addition to reverse logistics literature. Inclusively, these findings affirm that if consumers are aware that EoL electronic products contain harmful toxic substances and proper management of such substances can benefit the environment, they would be more likely to exhibit EEPE intention. That is, individuals' concern for environmental degradation is also highly relevant to their sustainable post-consumption behavior (e.g., EEPE).

7. Implications

7.1 Theoretical implications

This study offers at least four theoretical contributions to the extant environmental sustainability and reverse logistics literature while exploring post-consumption pro-environmental behavior. First, considering that the TPB is not a comprehensive model (Ajzen *et al.*, 2011), past studies mostly extended it by incorporating context-specific predictors. However, essential non-cognitive (e.g., consumer knowledge) and contextual (e.g., government initiatives) factors have been insufficiently explored in the e-waste recycling and reverse logistics literature (Echegaray and Hansstein, 2017; Parajuly *et al.*, 2020). In response to this research gap, our study theoretically extended and empirically validated the TPB model with consumer knowledge and government initiatives in a new perspective of EEPE intention. This study thereby contributes to the extant scholarly knowledge by evaluating psychological predictors of consumers' reverse exchange intentions.

Second, by revealing the significance of attitude and contextual factors (i.e., government initiatives) in stimulating consumers' EEPE intention, this study has substantiated the A-B-C theory's (Guagnano *et al.*, 1995) applicability in reverse logistics literature. In this connection, our study extends on past findings (Xu *et al.*, 2017), suggesting that both attitude and contextual factors are significant in elevating individuals' PEBs. This study thus enhances the extant knowledge by assessing the simultaneous effect of macro-level context-specific factors influencing Bangladeshi consumers' intention to perform PEBs (i.e., EEPE). The third theoretical contribution relates to the finding that the government initiatives significantly moderate the attitude-intention link. Essentially, this finding contributes to the

theoretical arguments on the attitude-intention gap by establishing that government initiatives could be accounted for the unsolicited discrepancy between consumers' attitudes and intentions in the context of e-waste management. In this regard, the current study responds to the research call made by Tandon *et al.* (2020a) to examine relevant contextual factors in bridging the attitude-intention gap, especially in developing country perspectives.

Fourth, in response to the call for (Russell *et al.*, 2017; Wang *et al.*, 2018) integrating additional non-cognitive factors in the TPB model, this study has added consumer knowledge and substantiated its significance. Importantly, it is shown how non-cognitive and cognitive factors interact to promote sustainable post-consumption behavior. To this end, our proposed research model provides an enriched and holistic understanding of consumers' behavior in an e-waste reverse exchange context.

7.2 Practical implications

The growing trend of e-waste generation and the inadequate waste management policies and practices in developing countries draw increased attention from stakeholders, including policymakers, non-government organizations (NGOs), media, and researchers. Hence, exploring and identifying factors encouraging individuals to adopt a practical pro-environmental approach becomes essential, especially in emerging countries like Bangladesh. To this end, this study presents several practical implications for electronics retailers and policymakers.

First, given that attitude toward EEPE is significantly predicting EEPE intention, publicity (e.g., television ads, billboards, seminars) on the positive outcomes of exchange programs should be engaged on a massive scale. Specifically, the electronic suppliers or manufacturers can arrange yearly/monthly campaigns at different parts of the country highlighting the financial and environmental benefits of e-waste recycling through EEPE. Such activities would create favorable perceptions about EEPE and strengthen the effect of influential social members (e.g., friends, co-workers) on individuals not partaking in exchange programs. As Bangladesh belongs to a collectivistic culture, people are primarily influenced by their family members, role models, and friends. This is also apparent in our finding as the subjective norm has the most significant effect on EEPE intention. Thus, electronic suppliers or manufacturers can strengthen the influence of subjective norms by (1) using influential social members' testimonials; (2) creating awareness in educational institutions; (3) engaging people through social media (e.g., Facebook) where people frequently meet and share information (Devi and Ganguly, 2021). Second, the manufacturers should take initiatives (e.g., 'exchange offer' program), which are likely to increase opportunities and abilities for consumers to be more pro-environmental in their e-waste related performances. Moreover, suppliers can set up exchange points at convenient locations as lack of ease and convenience often lead consumers' to use informal e-waste recycling options (Koshta *et al.*, 2022). Third, the government should form and enforce comprehensive laws to reinforce the country's e-waste management system. In fact, the legal environment and law-making process are not a straight one and are influenced by several other factors

(e.g., maintaining stakeholders' interests), which is ubiquitous in most developing countries. However, proper and strict implementation of these laws must be ensured by seeking accountability from both the suppliers' and the consumers' end. In this regard, responsibilities should be taken by the relevant authorities (e.g., government, suppliers), which is especially important in developing countries' perspectives (Khan *et al.*, 2019).

Fourth, awareness-building campaigns should go beyond implementing new laws by making people aware of the negative impacts of e-waste on humans, animals, and the environment. It is argued that companies hide much information from consumers regarding social and environmental vandalism caused by their products (Baron, 2013). If the consumers are made aware of environmental concerns by providing relevant information, they can contribute more by influencing and extending the lifecycle of their purchased products (Baron, 2013). Practically, this awareness issue is considerably under-focused from the manufacturers' perspective as they mostly try to maximize sales by making consumers feel comfortable with their choices. Nevertheless, product-related information (e.g., origin, dumping, environmental impacts of electronic products) should be made available through publicity or product labeling to increase consumer knowledge. In response, consumers may increasingly perceive EEPE as an essential part of e-waste management, and their EEPE intention might escalate.

In sum, by taking these explored dimensions into consideration, suppliers and manufacturers would implement an appropriate e-waste management system. Eventually, it might help them accomplish the EPR obligations and ensure the optimal use of resources.

8. Conclusion, limitations and recommendations for further research

Mounting e-waste is an ongoing concern worldwide, especially in developing countries where sound e-waste management policies are significantly lacking. In this context, the EEPE program could provide an effective solution to e-waste recycling that requires consumers' participation. Thus, our study applied an extended TPB model to evaluate consumers' intention to use EEPE for e-waste recycling. It is demonstrated that TPB constructs with government initiatives and consumer knowledge positively influence EEPE intention. Moreover, subjective norm and consumer knowledge indirectly affect EEPE intention, while government initiatives moderate the attitude-intention relation.

Despite these contributions, the current study has multiple limitations that future investigators are encouraged to address. The first limitation relates to measuring consumers' intention instead of actual behavior. Future research might explore whether consumers' EEPE intention essentially predicts actual behavior to tackle this limitation. Second, using participants from a developing country might limit the generalization of current findings as participants' responses could be attributed to social and cultural nuances. Thus, a cross-cultural study in this regard would increase the robustness of these findings. Third, this

study's respondents were mostly contacted via email or messenger, meaning other potential respondents not using email or messenger were overlooked. This is due to the unprecedented outbreak of Covid-19, where face-to-face interviews became inconvenient. Thus, future researchers might incorporate face-to-face and online surveys to include a sizeable nationwide sample for similar studies. Fourth, the current inferences might suffer from temporal effects (consumers' perception might vary from time to time) as this study only analyzed cross-sectional data. Against this drawback, further studies could use longitudinal data to measure consumers' responses at different periods. Lastly, it could be worth exploring whether the effect of cognitive, non-cognitive, and contextual factors differ based on demographics (e.g., age, income) in future reverse logistics studies.

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Appendix: Measurement items

Constructs	Indicators	Wording	Sources
Attitude toward EEPE (ATT)	ATT1	Exchanging EoL electronic products is a good move.	Tonglet <i>et al.</i> (2004)
	ATT2	Exchanging EoL electronic products is beneficial.	
	ATT3	Exchanging EoL electronic products is responsible behavior.	
Subjective norm (SN)	SN1	Most of my friends think that exchanging EoL electronic products is the right thing to do.	Al-Swidi <i>et al.</i> (2014)
	SN2	Most of my colleagues think that exchanging EoL electronic products is the right thing to do.	
	SN3	Most of my family members think that exchanging EoL electronic products is the right thing to do.	
Perceived behavioral control (PBC)	PBC1	I believe that I am capable of exchanging EoL electronic products.	Cheung <i>et al.</i> (2017)
	PBC2	I have the knowledge and skills to exchange EoL electronic products.	
	PBC3	It is mostly up to me whether I exchange EoL electronic products.	
	PBC4	I have plenty of opportunities to exchange the EoL electronic products.	Tonglet <i>et al.</i> (2004)
Government initiatives (GI)	GI1	The government initiated laws and regulations encourage me to recycle e-waste.	Wan <i>et al.</i> (2014)
	GI2	Government and community-driven campaigns clearly explain the benefits and importance of exchanging EoL electronic products.	Xu <i>et al.</i> (2017)
	GI3	Government and community-driven campaigns effectively improve residents' awareness of exchanging EoL electronic products.	
Consumer knowledge (CK)	CK1	I know that many valuable components are still available (which can be used later) in EoL electronic products.	Yuan <i>et al.</i> (2016)
	CK2	I know different parts of discarded electronic products also contain toxic substances.	
	CK3	I know that electronic waste recycling can reduce environmental pollution.	
	CK4	I know that electronic waste recycling can reduce the consumption of natural resources.	
EoL electronic products exchange intention (EEPEI)	EEPEI1	I am willing to exchange the EoL electronic products for new electronic products.	Yuan <i>et al.</i> (2016)
	EEPEI2	I plan to exchange the EoL electronic products for new electronic products.	
	EEPEI3	I will make an effort to exchange my EoL electronic products for new electronic products.	

Table I: Sample demographics.

		n=334	
		Frequency	Percentage
Age (years)	18-24	285	85.3
	25-31	49	14.7
Household income (BDT per month)	Less than 25,000	154	46.1
	25,001 - 50,000	127	38.0
	50,001 - 75,000	32	9.6
	75,001 - 100,000	17	5.1
	More than 100,000	4	1.2
Gender	Female	213	63.8
	Male	121	36.2
Education	Bachelor's degree	263	78.7
	Master's degree	71	21.0

Table II: Results of principal component analysis.

	Attitude toward EEPE (ATT)	Subjective norms (SN)	Perceived behavioral control (PBC)	Consumer knowledge (CK)	Government initiatives (GI)	EoL electronic product exchange intention (EEPI)
ATT1	.802	.105	.179	.207	.100	.184
ATT2	.826	.154	.064	.278	.036	.158
ATT3	.803	.167	.125	.242	.093	.073
SN1	.083	.844	.077	.130	.172	.080
SN2	.111	.831	.142	.138	.065	.150
SN3	.203	.864	.087	.118	.125	.092
PBC1	.084	.051	.819	.259	.100	.123
PBC2	.124	.063	.821	.182	.117	.188
PBC3	.057	.110	.787	.124	.201	.223
PBC4	.153	.156	.741	.138	.067	.236
CK1	.184	.054	.193	.803	.163	.110
CK2	.251	.105	.202	.784	.114	.178
CK3	.265	.107	.182	.794	.205	.141
CK4	.165	.255	.177	.777	.123	.043
GI1	.046	.096	.105	.171	.836	.031
GI2	.087	.184	.166	.093	.871	.078
GI3	.083	.083	.127	.194	.848	.118
EEPEI1	.152	.154	.207	.060	.044	.832
EEPEI2	.123	.125	.242	.179	.052	.832
EEPEI3	.124	.061	.238	.141	.143	.808
Cronbach's alpha (α)	.856	.866	.877	.894	.870	.864

Method: varimax rotation with Kaiser Normalization

Table III: Sample demographics.

		n=330	
		Frequency	Percentage
Age (years)	18-24	13	3.9
	25-31	115	34.8
	32-38	149	45.2
	39-45	43	13.0
	More than 45	10	3.0
Household income (BDT per month)	Less than 25,000	49	14.8
	25,001 - 50,000	136	41.2
	50,001 - 75,000	108	32.7
	75,001 - 100,000	27	8.2
	More than 100,000	10	3.0
Gender	Female	194	58.8
	Male	136	41.2
Occupation	Business	59	17.9
	Service holder	167	50.6
	Student	66	20.0
	Unemployed	38	11.5
Education	Secondary	2	.6
	Higher secondary	46	13.9
	Bachelor's degree	128	38.8
	Master's degree	128	38.8
	Above Master's degree	26	7.9

Table IV: Summary of the construct reliability and convergent validity assessment.

Constructs	Indicators	α	Average variance extracted	Composite reliability	CFA load*
Attitude toward EEPE (ATT)	ATT1	.883	.716	.883	.898
	ATT2				.905
	ATT3				.885
Subjective norm (SN)	SN1	.933	.826	.934	.880
	SN2				.928
	SN3				.918
Perceived behavioral control (PBC)	PBC1	.883	.655	.883	.867
	PBC2				.842
	PBC3				.736
	PBC4				.787
Government initiatives (GI)	GI1	.867	.685	.867	.818
	GI2				.838
	GI3				.827
Consumer knowledge (CK)	CK1	.894	.680	.895	.783
	CK2				.836
	CK3				.819
	CK4				.858
	EEPEI1	.924	.803	.924	.898

Constructs	Indicators	α	Average variance extracted	Composite reliability	CFA load*
EoL electronic product	EEPEI2				.905
exchange intention (EEEPI)	EEPEI3				.885

*factor loadings are significant at $p < 0.001$

Abbreviations: α =Cronbach's alpha; CFA=confirmatory factor analysis

Table V: Summary of the discriminant validity assessment.

Constructs	Government initiatives	Consumer knowledge	Perceived behavioral control	Subjective norm	Attitude toward EEPE	EoL electronic product exchange intention
Government initiatives	.828					
Consumer knowledge	.352*	.824				
Perceived behavioral control	.298*	.417*	.810			
Subjective norm	.362*	.545*	.396*	.909		
Attitude toward EEPE	.305*	.337*	.197**	.383*	.846	
EoL electronic product exchange intention	.408*	.549*	.433*	.621*	.502*	.896

Significance level = * $p < .001$, ** $p < .01$

Table VI: Hypotheses testing results.

Hypothesis	Hypothesized paths	Std. estimate (β)	SE	t value	p -value	Hypothesis supported
H ₁	ATT $\rightarrow$ EEPEI	.259	.053	5.080	.000	Yes
H ₂	SN $\rightarrow$ EEPEI	.330	.063	5.409	.000	Yes
H ₃	SN $\rightarrow$ ATT	.391	.058	6.585	.000	Yes
H ₅	PBC $\rightarrow$ EEPEI	.149	.051	2.907	.004	Yes
H ₆	GI $\rightarrow$ EEPEI	.110	.060	2.158	.031	Yes
H ₈	CK $\rightarrow$ EEPEI	.194	.073	3.070	.002	Yes
H ₉	CK $\rightarrow$ PBC	.434	.070	7.118	.000	Yes

Abbreviations: ATT=attitude toward EEPE; SN=subjective norm; PBC=perceived behavioral control; GI=government initiatives; CK=consumer knowledge; EEPEI= EoL electronic product exchange intention.

Table VII: Mediation analysis results

Hypothesis	Hypothesized paths	Std. estimate (β)	95% CI		<i>p</i> -value	Hypothesis supported
			Upper Limit	Lower Limit		
H ₄	SN $\rightarrow$ ATT $\rightarrow$ EEPEI	.104	.177	.054	.001	Yes
H ₁₀	CK $\rightarrow$ PBC $\rightarrow$ EEPEI	.074	.169	.012	.017	Yes

Abbreviations: ATT=attitude toward EEPE; SN=subjective norm; PBC=perceived behavioral control; CK=consumer knowledge; EEPEI= EoL electronic product exchange intention; CI=confidence intervals.

Table VIII: Floodlight analysis with attitude toward EEPE and government initiatives

Conditional effect of attitude toward EEPE at values of the government initiatives (GI)						
GI	Effect	SE	<i>t</i>	<i>p</i>	LLCI	ULCI
1.0000	-.0062	.1861	.0331	.9736	-.3722	.3599
1.2000	.0195	.1747	.1116	.9112	-.3242	.3632
1.4000	.0452	.1634	.2763	.7825	-.2764	.3667
1.6000	.0708	.1522	.4652	.6421	-.2287	.3703
1.8000	.0965	.1411	.6837	.4947	-.1812	.3741
2.0000	.1222	.1302	.9385	.3487	-.1339	.3782
2.2000	.1478	.1193	1.2388	.2163	-.0869	.3825
2.4000	.1735	.1087	1.5963	.1114	-.0403	.3873
2.5749	.1959	.0996	1.9673	.0500	.0000	.3918
2.6000	.1991	.0983	2.0259	.0436	.0058	.3925
2.8000	.2248	.0883	2.5467	.0113	.0511	.3984
3.0000	.2505	.0787	3.1813	.0016	.0956	.4053
3.2000	.2761	.0699	3.9516	.0001	.1387	.4136
3.4000	.3018	.0620	4.8674	.0000	.1798	.4238
3.6000	.3274	.0555	5.8970	.0000	.2182	.4367
3.8000	.3531	.0510	6.9251	.0000	.2528	.4534
4.0000	.3788	.0489	7.7414	.0000	.2825	.4750
4.2000	.4044	.0497	8.1451	.0000	.3067	.5021
4.4000	.4301	.0531	8.1071	.0000	.3257	.5345
4.6000	.4558	.0587	7.7696	.0000	.3404	.5711
4.8000	.4814	.0659	7.3036	.0000	.3517	.6111
5.0000	.5071	.0743	6.8213	.0000	.3608	.6533