



Determinants of E-waste Recycling Intention in India: The Influence of Environmental Concern, Attitude and Economic Incentives

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Abstract

The primary objective of this empirical study is to identify the antecedents of e-waste recycling and the role played by economic incentives in encouraging this behaviour among Indians. The theory of planned behaviour was employed to achieve the motive, and a web-based survey was used to collect data. A total of 338 responses from Indian urban households were taken for the PLS-SEM analysis. The statistical analysis revealed that environmental concern and attitude contribute to e-waste recycling intention. The study also documented the insignificant moderating role of green economic incentives in the relationship between the antecedents and e-waste recycling intention. This paper offers practical implications for fuelling e-waste recycling, especially regarding the implementation of economic incentives to promote e-waste recycling.

Keywords: E-waste, Recycling Intention, Environmental Concern, Environmental Attitude, PLS-SEM

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Introduction

E-waste is a disastrous genre of waste that could inauspiciously impact both humankind and the environment (Li & Achal, 2020). Of the total e-waste generated in global households, 98.2 % ends up in landfills (Forti et al., 2020). Even though e-waste is disastrous, efficient recycling and management may substantially reduce its consequences (Cui & Zhang, 2008). For instance, recycling 1 kilogram of Aluminium prevents 2 kilograms of Carbon dioxide emissions, 11 grams of Sulphur dioxide emissions and 1.3 kilograms of Bauxite emissions (United Nations Environment Programme, 2009). However, informal recycling practices are a considerable threat to the proper management of e-waste (Manomaivibool, 2009; Toxics Link, 2019).

Scholars have widely explored various aspects of e-waste recycling globally (Ackah, 2017; Shaikh et al., 2020; Song et al., 2012) and previous e-waste recycling literature indicates differences in e-waste recycling behaviour across different geographical locations. For example, the household e-waste recycling status in emerging economies is far behind developed nations (Forti et al., 2020). These behavioural heterogeneities demand researchers to scrutinize the e-waste recycling behaviour in each country's context.

The Indian scenario is not that different from other developing nations in the globe (Singh, 2020) and in the Indian frame of reference, research in e-waste recycling is advancing rapidly. Indian researchers have examined different aspects of e-waste recycling, such as investigation of e-waste flows (Dwivedy & Mittal, 2012), comparison of e-waste management in India and other emerging economies (Garlapati, 2016), trends in e-waste disposal (Borthakur & Govind, 2017) and barriers to e-waste management implications (Kumar & Dixit, 2018). Further, behavioural elements of e-waste recycling have also been explored in the Indian context (Borthakur & Govind, 2018; Kumar, 2019).

Indian households generate a massive amount of e-waste every year (Ravindra & Mor, 2019) and over 90% of that leak into the informal e-waste recycling industry for a feeble monetary return (Singh, 2020). This apparent inclination for monetary returns among Indians requires behavioural researchers to examine the influence of economic incentives on the relationship between e-waste recycling intention and its determinants. Interestingly, no studies have hitherto focused on examining the moderating role of economic incentives in the relationship between antecedents and the e-waste recycling intention. This research gap is one worth addressing, especially

when the viability of existing economic incentives is being questioned (Shevchenko et al., 2019).

In addressing the stated research gap, this study aims to achieve two objectives. First, explain the effect of environmental concern, environmental attitude, subjective norm, and perceived behavioural control as critical determinants of the e-waste recycling intention of Indians. Second, examine the moderating role of green economic incentives on the relationship between the above determinants and the e-waste recycling intention. In order to accomplish these objectives, this study develops a conceptual framework derived from the Theory of Planned Behaviour (TPB) (Ajzen, 1991).

The current study enhances the Indian environmental marketing literature with the following theoretical implications: (1) The study scrutinizes the relationship between attitude, subjective norm, perceived behavioural control, environmental concern and e-waste recycling intention while considering the moderating role of green economic incentives. (2) Examining the moderating role of green economic incentives in the relationship between the antecedents and e-waste intention would help gain knowledge regarding the role of existing economic incentives on e-waste recycling intention.

Following this introduction section, the authors present the literature review and formulation of the conceptual model and hypotheses. Subsequently, the research methodology is narrated, followed by results and discussion.

Literature Review

E-waste Recycling Behaviour

Electronic waste or e-waste is defined as “any electrical or electronic product, which in its original form cannot be further used, repaired or reused as whole as or a part of it” (Kwatra et al., 2014, p. 753). E-waste is one of the most hazardous pollutants for both the environment and humans (Kahhat et al., 2008; Thakur & Kumar, 2021). Recycling e-waste using approved methods is the only viable solution to reduce its impact (Gonul Kochan et al., 2016). Even though India occupies the third position in the generation of e-waste (Forti et al., 2020), majority of the country’s approved e-waste recycling centres are underutilized, while the informal recycling industry is in full swing (Toxics Link, 2019). This disproportion between e-waste generation and recycling raises many risks for the developing nation.

Since e-waste recycling is an indispensable activity for the well-being of society, researchers have widely investigated factors that contribute to e-waste recycling behaviour. Some of these factors include age (Saphores et al., 2012), income (Dwivedy & Mittal, 2013), education (Nixon & Saphores, 2007), convenience (Wang et al., 2011), awareness (Echegaray & Hansstein, 2017), cost of recycling (Wang et al., 2016) and environmental consciousness (Kwatra et al., 2014). In addition, limited studies have explored the role of economic incentives in e-waste recycling behaviour (Sari et al., 2021). Nonetheless, no study to date has investigated the moderating influence of incentives on the association between determinants and the e-waste recycling intention.

Moreover, a popular stream of the literature concludes that e-waste recycling behaviour is highly country specific. For instance, according to Saphores et al. (2012) and Echegaray and Hansstein (2017), age significantly impacts e-waste recycling behaviour among Americans and Brazilians. In contrast, Wang et al. (2016) unveiled the insignificance of age in their Chinese study. Besides this, there are many other diverse findings: perceived behavioural control was found to be significant among Indians and Chinese (Kumar, 2019) while it was not for Nigerians (Nduneseokwu et al., 2017). Moreover, Nguyen et al. (2018) found that prior recycling experience does not influence recycling behaviour among Vietnamese, while Saphores et al. (2012) uncovered it to be an influencing factor for Americans. Further, Indonesian consumers were found to consider economic drivers trivial (Sari et al., 2021) while it has been a significant contributor to e-waste recycling behaviour in some other developing economies (Jafari et al., 2017; Wang et al., 2011). Despite the differences, scholars have also reported that storing obsolete electronic products at home is a frequent practice across geographical boundaries (Dixit & Vaish, 2015; Miner et al., 2020; Ylä-Mella et al., 2015).

As a developing country, the consumer behaviour related to e-waste in India also exhibits some different characteristics from other country contexts. For example, Indians gift their unused e-products to their children or relatives (Borthakur & Govind, 2018), a possibly uncommon practice in the rest of the world. Once the product becomes obsolete, Indians store the e-waste at home rather than recycling it (Dixit & Vaish, 2015). Like other developing countries, Indians expect financial gain from their e-waste (Dwivedy & Mittal, 2013). In this context, this study investigates an influencing factor that could be of special significance for household recycling behaviour in India, and possibly other developing countries, namely, the influence of

economic incentives. This will be explained in detail in the discussion on hypothesis development based on the theoretical background of the TPB.

Theoretical Background

Most of the behavioural studies in e-waste recycling employ the TPB as its basic theoretical foundation (Kumar, 2019; Sari et al., 2021; Wang et al., 2018), except a few (Dhir et al., 2021; Saphores et al., 2012). This is because of the accuracy that TPB holds in predicting human behavioural intention (Sajid et al., 2022). TPB is a meticulous framework to concisely elucidate behavioural intention (Ajzen, 1991; Liu et al., 2019). According to TPB, the intention is derived from three factors, namely attitude, subjective norm and perceived behavioural control (Ajzen, 1991). Since TPB is a precise framework, it has been applied in various contexts to examine the intention (Hamzah & Tanwir, 2021; Sajid & Zakkariya, 2022). As mentioned earlier, many scholars have devised TPB to investigate the consumer behaviour related to e-waste recycling in various country contexts (Liu et al., 2019; Nguyen et al., 2018). These research outcomes affirm the suitability of TPB for this research. However, the pilot study that was carried out with 104 participants propounded that subjective norm and perceived behavioural control are not a concern in this study context. Considering this finding, the final conceptual framework of the study excluded perceived behavioural control and subjective norms and only retained attitude from the TPB framework as the possible antecedent of behavioural intention in the recycling context. (See ‘Pilot study’ under section ‘Research methodology’ for a detailed explanation).

Formulation of Conceptual Model and Hypotheses

The hypotheses depicted in the conceptual model (see Figure 1) are as follows:

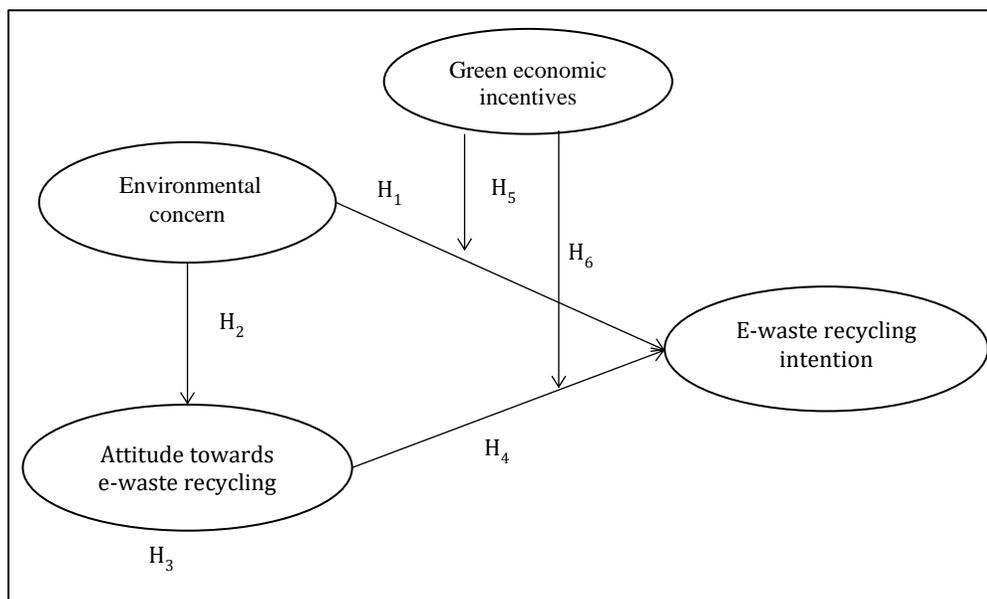
Environmental Concern

Environmental concern is the concerns and understandings of environmental problems (Chen et al., 2019). In this study, environmental concern is operationalized as an individual's concern for conserving the environment and its resources. A wide stream of literature has evidenced the impact of environmental concerns on behavioural intention (Shalender & Sharma, 2021; Yadav & Pathak, 2016a). For instance, Paul et al. (2016), documented the positive association between environmental concern and attitude. Further, e-waste recycling is considered an environment-friendly behaviour (Darby & Obara, 2005). Hence, those concerned about their environment are more likely to participate in e-waste recycling (Nnorom

et al., 2009). This is possible because concern for the environment impacts attitude toward behaviour as well as behavioural intention (Jafari et al., 2017; Yadav & Pathak, 2016b). Although, the above literature suggests an association between environmental concerns and e-waste recycling intentions, and an association between environmental concern and attitude, empirical evidence for the indirect effect of environmental concern on behavioural intention through attitude is somewhat limited. In a green electricity study, Bamberg (2003) documented the indirect influence of environmental concern on intention mediated by attitude towards the behaviour. However, the same study pointed out that the indirect influence could not be generalized and needs to be verified in different contexts. Thus, it is necessary to examine the indirect influence of environmental concern on intention mediated by attitude along with the direct relationship. The above discussion leads to formulating the following hypotheses:

- H₁: Environmental concern has a positive effect on e-waste recycling intention.
- H₂: Environmental concern has a positive effect on attitude towards e-waste recycling.
- H₃: Environmental concern has an indirect effect on e-waste recycling intention mediated by attitude towards e-waste recycling.

Figure 1: Proposed Conceptual Framework



Attitude Towards E-waste Recycling

Fishbein et al. (1980) define the attitude toward a behaviour as an individual's beliefs toward behaviour and evaluation that captures an individual's perceptions about that behaviour. For this study, the authors operationalize attitude toward e-waste recycling as a person's positive or negative assessment of participating in e-waste recycling programs. Attitude has been proclaimed as a critical determinant of behavioural intention in diverse contexts, such as green product consumption (Paul et al., 2016), ridesharing (Abutaleb et al., 2020) and telemedicine (Della et al., 2008). When individuals have a favourable judgment regarding participation in e-waste recycling programmes, that judgment will induce their behavioural intention (Wang et al., 2019). Therefore, the following hypothesis is proposed:

H₄: Attitude towards e-waste recycling has a positive effect on e-waste recycling intention.

The Moderating Role of Green Economic Incentive

Green economic incentive is defined as the rewards granted by the government and non-government organizations for following eco-friendly practices (Agnello et al., 2015; Moorthy et al., 2012). It can be conceived as a money-saving approach that has a beneficial impact on consumer perception (Dickinger & Kleijnen, 2008). For this study, we operationally define green economic incentives as the monetary benefits provided by the government in return for participating in e-waste recycling programs. The implementation of economic incentives has been found successful in protecting the environment from the early decades (Dales, 1968; Pigou, 1920). More recently, Schuyler et al. (2018) reported that the enactment of economic incentives aided in reducing plastic pollution in the ocean. Concurrently, prior literature reports the attitude-behaviour gap in many environmentally friendly behavioural contexts (Claudy et al., 2013; Farjam et al., 2019). Similarly, Echegaray and Hansstein (2017) unveils the attitude-intention gap in the e-waste recycling context in their Brazilian study. These studies underline the need for an external intervention to stimulate e-waste recycling intention. The economic incentive being a significant determinant of e-waste recycling intention (Wang et al., 2011), it could be assumed that instigating economic incentive for participating in e-waste recycling programs would induce the determining factors to have a stronger impact on e-waste recycling intention. More specifically, higher levels of economic incentive would strengthen the relationship between the determinants and e-waste recycling intention (Wang et al., 2016). Thus, the authors postulate the following hypotheses:

H₅: Green economic incentives positively moderate the relationship between environmental concern and e-waste recycling intention.

H₆: Green economic incentives positively moderate the relationship between attitude towards e-waste recycling and e-waste recycling intention.

Research Methods

Population and Sampling

The population for this study consists of Indian urban households. The reason for selecting urban households is that they generate a large amount of e-waste every year (Ravindra & Mor, 2019). A fast-developing Indian city, Cochin, was chosen as the geographical location of the study. Since a sample frame was unavailable, the authors employed a judgmental sampling technique to extract the sample from the population. For deriving the required sample size for this study, the researchers followed Hair et al. (1998), who suggested 15-20 responses per item. This study has 4 variables and 12 items, constituting a sample size of 260 (=12 X 20).

Among the sample, 196 (58%) were male, and 142 were female respondents (42%). Further, 186 (55%) of them were aged less than 30 years, 64 (19%) were aged 31 years to 40 years, 54 (16%) of them were aged in the range 41 years to 50 years, and 34 (10%) were aged above 50 years. The majority of respondents had full-time jobs, and were graduates, with a monthly income between USD 320 and USD 645.

Scales

The scale used to measure environmental concern is adopted from Kilbourne and Pickett (2008). The authors measured attitude toward e-waste recycling using the scale adopted from Nguyen et al. (2018). Further, pre-validated scales were used to measure e-waste recycling intention (Wang et al., 2019) and economic incentives for recycling (Nduneseokwu et al., 2017). The items were measured with a five-point Likert scale. All the constructs used in this study are reflective in nature. (See Appendix 1 for all scale items.)

Pilot Study

Before stepping into the data collection, the researchers conducted a pilot study among 104 households to confirm the reliability and validity of the scales. Cronbach's alpha was computed to ensure that the adopted scales have internal consistency reliability. The minimum Cronbach's alpha value observed was 0.738, which is greater than the threshold (Fornell & Larcker, 1981). Apart from the quantitative

evaluation, the clarity/understandability of the items was examined by asking the participants how straightforward the questions were. Based on the feedback, discussions were carried out with the experts and the scales were slightly modified.

In addition, following Dhir et al. (2021), the authors tested the significance of hypothesized relationships using the pilot study data. PLS-SEM methodology was used to test the significance level. The results revealed an insignificant association for the relationship between subjective norm, perceived behavioural control and e-waste recycling intention. Since PLS-SEM yields good statistical reports even for smaller data sizes, the authors took this result seriously and moved on to a qualitative assessment of these two relationships. For this, the researchers randomly picked up a few pilot study respondents for the qualitative assessment. In this qualitative evaluation, the authors asked the participants two questions: (1) Do you think that the social norms have an impact on your e-waste recycling intention/behaviour? Why? (2) Do you think that the perceived behavioural control or the perceived ease impacts your e-waste recycling intention/behaviour? Why?

More than 75% of the respondents underlined the disassociation between subjective norm, perceived behavioural control and e-waste recycling intention. The most prominent explanation given for the disassociation of subjective norm and e-waste recycling intention was that society does not project e-waste recycling as an environmentally friendly practice due to lack of awareness. Thus, society does not consider e-waste recycling as 'expected' behaviour. The unavailability of e-waste collection centres was quoted as the main reason for the disassociation between perceived behavioural control and e-waste recycling intention. As the reasons aligned with the existing literature (Borthakur & Govind, 2018; Nduneseokwu et al., 2017), the authors decided to remove the two constructs from the framework.

Data Collection

The study utilised a web-based survey methodology to collect data from the sample using Google forms. The questionnaire was split up into two parts. The first part is the introductory section, which provides the necessary information regarding the aim and scope of the study and collects some relevant information. This section acted as a colander that helped exclude those who had not participated in any recycling programme. After removing incomplete and missing values, 338 responses were taken for the statistical analysis. Data collection lasted for three months, from April 2021 to June 2021.

Data Analysis

Since the population of the study is very peculiar in nature and difficult to reach out to, the researchers applied a non-random sampling technique. This resulted in a non-normal data set. For this reason, this study uses PLS-SEM for the data analysis using SmartPLS 3.3, which does not demand normal distribution of data (Dash & Paul, 2021; Hair Jr. et al., 2017).

Results

Descriptive Statistics

The mean values oscillated between 4.12 (attitude), 3.29 (environmental concern), 3.92 (e-waste recycling intention) and 2.66 (green economic incentives). All factors had significant positive correlations with each other.

Common Method Bias

As the study employed survey methodology, there is a probability of Common Method Bias (CMB). The researchers devised the single factor Harman test to ensure that the study is free from CMB. According to the results, the maximum variance described by a single factor is 33.67% within the conventional limit (Podsakoff & Organ, 1986).

Analysis of the Measurement Model

The measurement model is found to have a good model fit according to the PLS-SEM model fit indices (SRMR= 0.056; NFI= 0.891). However, experts state that model fit indices for PLS-SEM are not that reliable and are still evolving (Dash & Paul, 2021). Thus, confirmed the measurement model fit using Goodness of Fit (GoF) (Tenenhaus, 2005), R^2 and Q^2 . GoF value was calculated with average variance extracted (AVE) and R^2 . The result exhibited a GoF value of 0.67, par with the standard threshold (Wetzels et al., 2009). Further, the authors adopted the methodology of coefficient of determination (R^2) to assess the conceptual model. The R^2 values ranged between 0.47 and 0.59, which is within the conventional limits (Hair, Risher et al., 2019). Later, the researchers evaluated the predictive relevance of the model using the blindfolding procedure (Q^2). The Q^2 values were between 0.27 to 0.39, meeting the PLS-SEM criteria (Hair, Risher et al., 2019).

Further, the collected data was analysed to confirm reliability and validity. Since the least value documented for the factor loadings and coefficients is 0.792, greater than the conventional limit of 0.70 (Hair, Risher et al., 2019), the reliability of the

measures is assured (Table 1). Further, convergent validity is also confirmed for the measurement model as AVE values (Table 1) for each construct are above the threshold value (Fornell & Larcker, 1981). The authors adopted the Fornell and Larcker (1981) criterion to confirm the discriminant validity. According to Fornell and Larcker (1981), the square root of the AVE should be greater than correlation values to corroborate discriminant validity, and the results satisfy the criterion guidelines (Table 2).

Table 1: Descriptive Statistics, Validity and Reliability

Construct	Item	Loadings	Mean	α	rho_A	CR	AVE
Attitude	AT1	0.949	3.577	0.933	0.933	0.957	0.881
	AT2	0.927					
	AT3	0.94					
Environmental Concern	EC1	0.880	3.956	0.930	0.933	0.950	0.826
	EC2	0.936					
	EC3	0.910					
	EC4	0.908					
Economic Incentives	EI1	0.891	3.562	0.844	0.995	0.924	0.858
	EI2	0.961					
E-waste Recycling Intention	ERI1	0.898	3.645	0.912	0.912	0.938	0.792
	ERI2	0.914					
	ERI3	0.851					

Table 2: Discriminant Validity

	AT	EC	EI	ERI
AT	0.939			
EC	0.377	0.909		
EI	0.091	0.359	0.926	
ERI	0.624	0.562	0.248	0.89

Note: The diagonal values in bold denote the square root of the AVE for every factor and the figures below the diagonal represent the correlations between each pair of factors.

Analysis of the Structural Model

The results of hypothesis testing (see Table 3) revealed that environmental concern is positively associated with attitude ($H_2: \beta = 0.377; p < 0.001$). The most substantial direct relationship in this framework was between attitude and intention ($H_4: \beta = 0.490; p < 0.001$), while the weakest relationship was between environmental

concern and e-waste recycling intention ($H_1: \beta = 0.358; p < 0.001$). The indirect relationship between environmental concern and e-waste recycling intention mediated by attitude was also statistically significant ($H_4: \beta = 0.531; p < 0.001$). Since the results exhibited a significant direct relationship between environmental concern and e-waste recycling intention, the mediated relationship is partial (Baron & Kenny, 1986). Moreover, the R^2 value for the model is 0.512, which means that the framework described a 51.2% variance in e-waste recycling intention.

Table 3: Results of Primary Hypotheses

	Path	Path Coefficient	Standard Deviation	<i>t</i>	<i>p</i>	Result
H ₁	EC > ERI	0.358	0.052	6.63	< 0.001	Supported
H ₂	EC > AT	0.377	0.063	5.899	< 0.001	Supported
H ₃	EC>AT>ERI	0.531	0.057	7.93	< 0.001	Supported
H ₄	AT > ERI	0.490	0.054	9.255	< 0.001	Supported

Analysis of Moderation

The moderation analysis was performed utilizing the interaction effect in path analysis of PLS-SEM. The results unveiled an insignificant moderation effect of economic incentives on the hypothesized relationships (H5 & H6) (Table 4).

Table 4: Results of Secondary Hypotheses

	Path Coefficient	Standard Deviation	<i>t</i>	<i>p</i>	Result
H ₅	0.020	0.057	0.349	0.727	Unsupported
H ₆	0.005	0.053	0.101	0.919	Unsupported

Discussion

The main aim of this study was to identify the determinants of e-waste recycling among Indians. The theoretical underpinnings of the TPB were used to achieve this aim. The study tested three primary hypotheses (H1, H2, H3, H4) and two secondary hypotheses (H5, H6).

The environmental concern was found to be a significant predictor of e-waste recycling intention (both direct and indirect) and attitude (H1, H2 & H3). This finding is consistent with prior studies that have been conducted in other contexts (Paul et al., 2016; Sajid & Zakkariya, 2022; Shalender & Sharma, 2021) and the current context

(Nnorom et al., 2009). This result could be explained by the prior findings of Garlapati (2016) and Li and Achal (2020), who documented that e-waste contains venomous components that could deteriorate the environment and that when consumers are informed about the environmental consequences of e-waste, they would prefer to act with greater concern about the environment. Further, H4 is also supported, in line with many prior observations (Paul et al., 2016; Tonglet et al., 2004; Wang et al., 2018). This confirms that positive evaluations and beliefs regarding the behaviour under consideration would facilitate the behavioural intention (Liu et al., 2019; Paul et al., 2016).

The researchers excluded two important constructs of TPB, subjective norm and perceived behavioural control, based on the pilot study results. The outcomes of the pilot study were then confirmed with a qualitative study comprising a few selected pilot study respondents. The significant reasons quoted by the respondents for the insignificant association of subjective norm, perceived behavioural control and e-waste recycling intention, were the lack of awareness and unavailability of e-waste collection centres, respectively. These reasons were in line with previous literature (Borthakur & Govind, 2018; Nduneseokwu et al., 2017).

Surprisingly, the moderation hypotheses H5 and H6 were found statistically insignificant. However, this finding confirms the motivation crowding theory (Frey & Jegen, 2001), which states that monetary incentives undermine intrinsic motivation when employed as an external intervention. A possible explanation for this finding is that if the environmental concern is high, an external stimulant such as an economic incentive would contribute little to increase a person's e-waste recycling intention. This result is also consistent with Nduneseokwu et al. (2017) and Xu et al. (2014), who documented that economic stimulus did not act as a moderator on the association between the antecedents and recycling intention.

Theoretical Contributions

This study makes three main contributions to literature: (1) This research analysed the moderating role of green economic incentives in the relationship between the determinants and e-waste recycling intention and identified the insignificant moderating impact. This result sheds light on the insignificant role played by existing economic incentive systems for encouraging e-waste recycling. (2) The study excluded subjective norm and perceived behavioural control from the TPB framework based on a two-tier pilot study, thereby enabling the investigation of only the TPB variables most relevant to the phenomenon. (3) The research framework

derived from TPB explained 51.2% variance in e-waste recycling intention, which is also a significant theoretical contribution of this study.

Practical Implications

This research identified attitude and environmental concern as the antecedents of e-waste recycling intention. Based on these results, this study proposes several practical implications to the stakeholders such as policymakers, electronics manufacturers and, recyclers. First, since environmental concern is evidenced to be a significant predictor of e-waste recycling intention and attitude, we suggest policymakers and companies build awareness about the environmental impacts that are resulted from improper management of e-waste to encourage consumers to become environmentally concerned and thereby, motivate them to recycle their e-waste. In addition, the authors advocate for the stakeholders to propagate the environmental benefits of e-waste recycling. Second, measures should be taken to influence and change the attitude toward e-waste recycling by creating a positive image of the same with the help of promotions that demonstrate the benefits of recycling.

Third, e-waste recycling awareness campaigns should be conducted to make it a socially expected behaviour and thereby manipulate subjective norm. Moreover, the discussions with the selected members of the pilot study respondents unfolded the inconvenience caused due to the unavailability of e-waste collection centres. Thus, authorities should ensure the convenient collection of e-waste to influence perceived behavioural control as well. Lastly, special care should be taken while implementing the existing financial incentives for e-waste as it is insignificant in moderating the relationship between antecedents and behavioural intention. Instead, the authors suggest implementing an electronic bonus card system (an individual bonus card that allows consumers to accrue bonuses and swap them for a new planned product without incurring additional costs) to reward consumers in place of the existing economic incentives (Shevchenko et al., 2019).

Limitations and Future Research

This study has a few limitations. First, social desirability bias is a considerable challenge, for studies conducted in the domain of environmental marketing. Thus, we suggest that future researchers take the necessary steps to control such biases. Second, since the study used a non-probability sampling technique, it reduces generalizability. Therefore, we suggest future researchers use probability sampling to improve the

generalizability in similar contexts. Third, as mentioned in the literature review, the antecedents of e-waste recycling intentions are highly country specific. Thus, the findings of this study could not be generalized even to other developing countries. Therefore, we motivate scholars to replicate the study in emerged as well emerging economies. Fourth, previous literature enumerates the influence of demographic variables on e-waste recycling behaviour. However, this study does not consider the effect of such factors in the model. Thus, we advise future researchers to control the demographic elements in future studies. Finally, future research can be enriched by proposing some additional predictors of e-waste recycling intention to the existing framework, as the R^2 value of the present conceptual model is 51%.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article

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References

- Abutaleb, S., El-Bassiouny, N., & Hamed, S. (2020). Sharing rides and strides toward sustainability: an investigation of carpooling in an emerging market. *Management of Environmental Quality: An International Journal*, 32(1), 4–19. <https://doi.org/10.1108/MEQ-02-2020-0031>
- Ackah, M. (2017). Informal e-waste recycling in developing countries: review of metal(loid)s pollution, environmental impacts and transport pathways. *Environmental Science and Pollution Research*, 24(31), 24092–24101. <https://link.springer.com/article/10.1007/s11356-017-0273-y>
- Agnello, X., Naveen, J., Ravichandran, M., & Balamurugan, J. (2015). Clean technology and its efficacy: Strategies of environmental management. *Journal of Environmental and Social Sciences*, 2(2), 110–116. <http://opensciencepublications.com/fulltextarticles/ESS-2454-5953-2-110.html>
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211.
- Bamberg, (2003). How does environmental concern influence specific environmentally related behaviors? A new answer to an old question. *Journal of Environmental Psychology*, 23(1), 21–32. [https://doi.org/10.1016/S0272-4944\(02\)00078-6](https://doi.org/10.1016/S0272-4944(02)00078-6)

- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research. Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6), 1173–1182. <https://doi.org/10.1037/0022-3514.51.6.1173>
- Borthakur, A., & Govind, M. (2017). Emerging trends in consumers' E-waste disposal behaviour and awareness: A worldwide overview with special focus on India. *Resources, Conservation and Recycling*, 117, 102–113. <https://doi.org/10.1016/j.resconrec.2016.11.011>
- Borthakur, A., & Govind, M. (2018). Public understandings of e-waste and its disposal in urban India: From a review towards a conceptual framework. *Journal of Cleaner Production*, 172, 1053–1066. <https://doi.org/10.1016/j.jclepro.2017.10.218>
- Chen, D., Ignatius, J., Sun, D., Zhan, S., Zhou, C., Marra, M., & Demirbag, M. (2019). Reverse logistics pricing strategy for a green supply chain: A view of customers' environmental awareness. *International Journal of Production Economics*, 217, 197–210. <https://doi.org/10.1016/j.ijpe.2018.08.031>
- Claudy, M. C., Peterson, M., & O'Driscoll, A. (2013). Understanding the attitude-behavior gap for renewable energy systems using behavioral reasoning theory. *Journal of Macromarketing*, 33(4), 273–287. <https://doi.org/10.1177/0276146713481605>
- Cui, J., & Zhang, L. (2008). Metallurgical recovery of metals from electronic waste: A review. *Journal of Hazardous Materials*, 158(2–3), 228–256. <https://doi.org/10.1016/j.jhazmat.2008.02.001>
- Dales, J. (1968). Land, water, and ownership. *The Canadian Journal of Economics/Revue Canadienne d'Economique*, 791–804. <https://doi.org/10.2307/133706>
- Darby, L., & Obara, L. (2005). Household recycling behaviour and attitudes towards the disposal of small electrical and electronic equipment. *Resources, Conservation and Recycling*, 44(1), 17–35. <https://doi.org/10.1016/j.resconrec.2004.09.002>
- Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change*, 173. <https://doi.org/10.1016/j.techfore.2021.121092>
- Della, L. J., Dejoy, D. M., & Lance, C. E. (2008). Promoting fruit and vegetable consumption in different lifestyle groups: Recommendations for program development based on behavioral research and consumer media data. *Health Marketing Quarterly*, 25(1–2), 66–96. <https://doi.org/10.1080/07359680802126087>

- Dhir, A., Koshta, N., Goyal, R. K., Sakashita, M., & Almotairi, M. (2021). Behavioral reasoning theory (BRT) perspectives on E-waste recycling and management. *Journal of Cleaner Production*, 280. <https://doi.org/10.1016/j.jclepro.2020.124269>
- Dickinger, A., & Kleijnen, M. (2008). Coupons going wireless: determinants of consumer intentions to redeem mobile coupons. *Journal of Interactive Marketing*, 23(3), 23–39. <https://doi.org/10.1002/dir.20115>
- Dixit, S., & Vaish, A. (2015). Perceived barriers, collection models, incentives and consumer preferences: An exploratory study for effective implementation of reverse logistics. *International Journal of Logistics Systems and Management*, 21(3), 304–318. <https://www.inderscienceonline.com/doi/abs/10.1504/IJLSM.2015.069729>
- Dwivedy, M., & Mittal, R. K. (2012). An investigation into e-waste flows in India. *Journal of Cleaner Production*, 37, 229–242. <https://doi.org/10.1016/j.jclepro.2012.07.017>
- Dwivedy, M., & Mittal, R. K. (2013). Willingness of residents to participate in e-waste recycling in India. *Environmental Development*, 6, 48–68. <https://doi.org/10.1016/j.envdev.2013.03.001>
- Echegaray, F., & Hansstein, F. V. (2017). Assessing the intention-behavior gap in electronic waste recycling: the case of Brazil. *Journal of Cleaner Production*, 142, 180–190. <https://doi.org/10.1016/j.jclepro.2016.05.064>
- Farjam, M., Nikolaychuk, O., & Bravo, G. (2019). Experimental evidence of an environmental attitude-behavior gap in high-cost situations. *Ecological Economics*, 166. <https://doi.org/10.1016/j.ecolecon.2019.106434>
- Fishbein, M., Jaccard, J., Davidson, A., Ajzen, I., & Loken, B. (1980). Predicting and understanding family planning behaviors. In I. Ajzen & M. Fishbein (Eds.), *Understanding attitudes and predicting social behavior*.
- Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. <https://doi.org/10.2307/3151312>
- Forti, V., Baldé, C. P., Kuehr, R., & Bel, G. (2020). *The global e-waste monitor 2020*. https://ewastemonitor.info/wp-content/uploads/2020/11/GEM_2020_def_july1_low.pdf
- Frey, B. S., & Jegen, R. (2001). Motivation crowding theory. *Journal of Economic Surveys*, 15(5), 589–611. <https://doi.org/10.1111/1467-6419.00150>
- Garlapati, V. K. (2016). E-waste in India and developed countries: Management, recycling, business and biotechnological initiatives. *Renewable and Sustainable Energy Reviews*, 54, 874–881. <https://doi.org/10.1016/j.rser.2015.10.106>

- Gonul Kochan, C., Pourreza, S., Tran, H., & Prybutok, V. R. (2016). Determinants and logistics of e-waste recycling. *International Journal of Logistics Management*, 27(1), 52–70. <https://doi.org/10.1108/IJLM-02-2014-0021>
- Hair, J., Black, W., Babin, B. ., & Anderson, R. . (1998). *Multivariate data analysis* (vol. 5). Upper Saddle River.
- Hair, J., Black, W., Babin, B., & Anderson, R. (2019). *Multivariate data analysis*, Cengage Learning
- Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
- Hair J. F., Jr., Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: updated guidelines on which method to use. *International Journal of Multivariate Data Analysis*, 1(2), 107–123. <https://doi.org/10.1504/ijmda.2017.10008574>
- Hamzah, M. I., & Tanwir, N. S. (2021). Do pro-environmental factors lead to purchase intention of hybrid vehicles? The moderating effects of environmental knowledge. *Journal of Cleaner Production*, 279. <https://doi.org/10.1016/j.jclepro.2020.123643>
- Jafari, A., Heydari, J., & Keramati, A. (2017). Factors affecting incentive dependency of residents to participate in e-waste recycling: a case study on adoption of e-waste reverse supply chain in Iran. *Environment, Development and Sustainability*, 19(1), 325–338 <https://link.springer.com/article/10.1007/s10668-015-9737-8>
- Kahhat, R., Kim, J., Xu, M., Allenby, B., Williams, E., & Zhang, P. (2008). Exploring e-waste management systems in the United States. *Resources, Conservation and Recycling*, 52(7), 955–964. <https://doi.org/10.1016/j.resconrec.2008.03.002>
- Kilbourne, W., & Pickett, G. (2008). How materialism affects environmental beliefs, concern, and environmentally responsible behavior. *Journal of Business Research*, 61(9), 885–893. <https://doi.org/10.1016/j.jbusres.2007.09.016>
- Moorthy, M. K., Peter, A., Yacob, L., Kumar, M., Chelliah, L., & Arokiasamy, L. (2012). Drivers for Malaysian SMEs to Go Green. *International Journal of Academic Research in Business and Social Sciences*, 2(9), 74. www.hrmas.com/journals
- Kumar, A. (2019). Exploring young adults' e-waste recycling behaviour using an extended theory of planned behaviour model: A cross-cultural study. *Resources, Conservation and Recycling*, 141, 378–389 <https://doi.org/10.1016/j.resconrec.2018.10.013>

- Kumar, A., & Dixit, G. (2018). An analysis of barriers affecting the implementation of e-waste management practices in India: A novel ISM-DEMATEL approach. *Sustainable Production and Consumption*, 14, 36–52.
<https://doi.org/10.1016/j.spc.2018.01.002>
- Kwatra, S., Pandey, S., & Sharma, S. (2014). Understanding public knowledge and awareness on e-waste in an urban setting in India: A case study for Delhi. *Management of Environmental Quality: An International Journal*, 25(6), 752–765. <https://doi.org/10.1108/MEQ-12-2013-0139>
- Li, W., & Achal, V. (2020). Environmental and health impacts due to e-waste disposal in China – A review. *Science of the Total Environment*, 737. <https://doi.org/10.1016/j.scitotenv.2020.139745>
- Liu, J., Bai, H., Zhang, Q., Jing, Q., & Xu, H. (2019). Why are obsolete mobile phones difficult to recycle in China? *Resources, Conservation and Recycling*, 141, 200–210.
<https://doi.org/10.1016/j.resconrec.2018.10.030>
- Manomaivibool, P. (2009). Extended producer responsibility in a non-OECD context: The management of waste electrical and electronic equipment in India. *Resources, Conservation and Recycling*, 53(3), 136–144.
<https://doi.org/10.1016/j.resconrec.2008.10.003>
- Miner, K. J., Rampedi, I. T., Ifegbesan, A. P., & Machete, F. (2020). Survey on household awareness and willingness to participate in e-waste management in jos, plateau state, Nigeria. *Sustainability*, 12(3).
<https://doi.org/10.3390/su12031047>
- Nduneseokwu, C. K., Qu, Y., & Appolloni, A. (2017). Factors influencing consumers' intentions to participate in a formal e-waste collection system: A case study of Onitsha, Nigeria. *Sustainability*, 9(6), 1–17.
<https://doi.org/10.3390/su9060881>
- Nguyen, H. T. T., Hung, R. J., Lee, C. H., & Nguyen, H. T. T. (2018). Determinants of residents' E-waste recycling behavioral intention: A case study from Vietnam. *Sustainability*, 11(1), 1–24. <https://doi.org/10.3390/su11010164>
- Nixon, H., & Saphores, J.-D. M. (2007). Financing electronic waste recycling Californian households' willingness to pay advanced recycling fees. *Journal of Environmental Management*, 84(4), 547–559.
<https://doi.org/10.1016/j.jenvman.2006.07.003>
- Nnorom, I. C., Ohakwe, J., & Osibanjo, O. (2009). Survey of willingness of residents to participate in electronic waste recycling in Nigeria - A case study of mobile phone recycling. *Journal of Cleaner Production*, 17(18), 1629–1637.
<https://doi.org/10.1016/j.jclepro.2009.08.009>
- Paul, J., Modi, A., & Patel, J. (2016). Predicting green product consumption using theory of planned behavior and reasoned action. *Journal of Retailing and*

- Consumer Services*, 29, 123–134.
<https://doi.org/10.1016/j.jretconser.2015.11.006>
- Pigou, A. (1920). The report of the Royal Commission on the British income tax. *The Quarterly Journal of Economics*, 34(4), 607–625.
<https://doi.org/10.2307/1885159>
- Podsakoff, P. M., & Organ, D. W. (1986). Self-reports in organizational research: Problems and prospects. *Journal of Management*, 12(4), 531–544.
<https://doi.org/10.1177/014920638601200408>
- Ravindra, K., & Mor, S. (2019). E-waste generation and management practices in Chandigarh, India and economic evaluation for sustainable recycling. *Journal of Cleaner Production*, 221, 286–294.
<https://doi.org/10.1016/j.jclepro.2019.02.158>
- Sajid, M., & Zakkariya, K. A. (2022). Factors affecting ridesharing intention in the context of COVID-19. *International Journal of E-Adoption*, 14(1), 1–14.
<https://doi.org/10.4018/IJEA.299037>
- Sajid, M., Zakkariya, K. A., Peethambaran, M., & George, A. (2022). Determinants of on-demand ridesharing: The role of awareness of environmental consequences. *Management of Environmental Quality*, 33(4), 847–863.
<https://doi.org/10.1108/MEQ-10-2021-0235>
- Saphores, J.-D. M., Ogunseitan, O. A., & Shapiro, A. A. (2012). Willingness to engage in a pro-environmental behavior: An analysis of e-waste recycling based on a national survey of U.S. households. *Resources, Conservation and Recycling*, 60, 49–63. <https://doi.org/10.1016/j.resconrec.2011.12.003>
- Sari, D. P., Masruroh, N. A., & Asih, A. M. S. (2021). Consumer intention to participate in e-waste collection programs: A study of smartphone waste in Indonesia. *Sustainability*, 13(5), 1–28. <https://doi.org/10.3390/su13052759>
- Schuyler, Q., Hardesty, B. D., Lawson, T. J., Opie, K., & Wilcox, C. (2018). Economic incentives reduce plastic inputs to the ocean. *Marine Policy*, 96, 250–255. <https://doi.org/10.1016/j.marpol.2018.02.009>
- Shaikh, S., Thomas, K., Zuhair, S., & Magalini, F. (2020). A cost-benefit analysis of the downstream impacts of e-waste recycling in Pakistan. *Waste Management*, 118, 302–312. <https://doi.org/10.1016/j.wasman.2020.08.039>
- Shalender, K., & Sharma, N. (2021). Using extended theory of planned behaviour (TPB) to predict adoption intention of electric vehicles in India. *Environment, Development and Sustainability*, 23(1), 665–681.
<https://doi.org/10.1007/s10668-020-00602-7>
- Shevchenko, T., Laitala, K., & Danko, Y. (2019). Understanding consumer e-waste recycling behavior: Introducing a new economic incentive to increase the collection rates. *Sustainability*, 11(9), 2656. <https://doi.org/10.3390/su11092656>

- Singh, S. G. (2020). *E-waste management in India challenges and agenda*. Centre for Science and Environment. <https://www.cseindia.org/e-waste-management-in-india-10593>
- Song, Q., Wang, Z., & Li, J. (2012). Residents' behaviors, attitudes, and willingness to pay for recycling e-waste in Macau. *Journal of Environmental Management*, 106, 8–16. <https://doi.org/10.1016/j.jenvman.2012.03.036>
- Tenenhaus, M. (2005). PLS path modeling. *Computational Statistics & Data Analysis*, 48(1), 159–205. <https://doi.org/10.1016/j.csda.2004.03.005>
- Thakur, P., & Kumar, S. (2021). Evaluation of e-waste status, management strategies, and legislations. *International Journal of Environmental Science and Technology*, Advance online publication. <https://doi.org/10.1007/s13762-021-03383-2>
- Tonglet, M., Phillips, P. S., & Read, A. D. (2004). Using the theory of planned behaviour to investigate the determinants of recycling behaviour: A case study from Brixworth, UK. *Resources, Conservation and Recycling*, 41(3), 191–214. <https://doi.org/10.1016/j.resconrec.2003.11.001>
- Toxics Link (2019). *Informal e-waste recycling in delhi*. <http://www.toxicslink.org/docs/Informal%20E-waste.pdf>
- United Nations Environment Programme (2009). *Sustainable innovation and technology transfer industrial sector studies: Recycling – from e-waste to resources*. <https://wedocs.unep.org/handle/20.500.11822/33112;jsessionid=6A0FEA3089E05BBA24203949FFC0C660>
- Wang, B., Ren, C., Dong, X., Zhang, B., & Wang, Z. (2019). Determinants shaping willingness towards on-line recycling behaviour: An empirical study of household e-waste recycling in China. *Resources, Conservation and Recycling*, 143, 218–225. <https://doi.org/10.1016/j.resconrec.2019.01.005>
- Wang, Z., Guo, D., & Wang, X. (2016). Determinants of residents' e-waste recycling behaviour intentions: Evidence from China. *Journal of Cleaner Production*, 137, 850–860. <https://doi.org/10.1016/j.jclepro.2016.07.155>
- Wang, Z., Guo, D., Wang, X., Zhang, B., & Wang, B. (2018). How does information publicity influence residents' behaviour intentions around e-waste recycling? *Resources, Conservation and Recycling*, 133, 1–9. <https://doi.org/10.1016/j.resconrec.2018.01.014>
- Wang, Z., Zhang, B., Yin, J., & Zhang, X. (2011). Willingness and behavior towards e-waste recycling for residents in Beijing city, China. *Journal of Cleaner Production*, 19(9–10), 977–984. <https://doi.org/10.1016/j.jclepro.2010.09.016>

- Wetzels, M., Odekerken-Schröder, G., & Oppen, C. van. (2009). Using PLS path modeling for assessing hierarchical construct models: Guidelines and empirical illustration. *MIS Quarterly*, 33(1), 177–195. <https://doi.org/10.2307/20650284>
- Xu, F., Wang, X., Sun, X., & Abdullah, A. (2014). *Influencing factors and moderating factors of consumers' intentions to participate in e-waste recycling* [Paper presentation]. 11th International Conference on Service Systems and Service Management (ICSSSM).
- Yadav, R., & Pathak, G. S. (2016a). Intention to purchase organic food among young consumers: Evidences from a developing nation. *Appetite*, 96, 122–128. <https://doi.org/10.1016/j.appet.2015.09.017>
- Yadav, R., & Pathak, G. S. (2016b). Young consumers' intention towards buying green products in a developing nation: Extending the theory of planned behavior. *Journal of Cleaner Production*, 135, 732–739. <https://doi.org/10.1016/j.jclepro.2016.06.120>
- Ylä-Mella, J., Keiski, R. L., & Pongrácz, E. (2015). Electronic waste recovery in Finland: Consumers' perceptions towards recycling and re-use of mobile phones. *Waste Management*, 45, 374–384. <https://doi.org/10.1016/j.wasman.2015.02.031>

Appendix 1: The Measurement Scales

Environmental Concern

I am very concerned about the environment.

Humans are severely abusing the environment.

I would be willing to reduce my consumption to help protect the environment.

Anti-pollution laws should be enforced more strongly.

Attitude

I feel very satisfied when recycling e-waste.

E-waste recycling is useful to create a better community environment.

E-waste recycling is everyone's responsibility to reduce the volume of e-waste generated.

Economic Incentive

I am more likely to participate if collection schemes are linked with financial incentives.

Governments financial incentives will encourage me to drop off my e-waste at a collection centre.

E-waste Recycling Intention

Dealing with e-waste in the future, I am willing to contact voluntarily professional recycling organizations or manufacturers.

I tend to buy electronic products which promise recycling more in the future.

I am willing to tell my friends about the experiences of e-waste recycling.