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Applying the Theory of Planned Behavior Approach in the Sustainability of Electronic Waste Management: Critical Success Factors for Extended Producer Responsibility in Uganda

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Abstract

Governments and its citizens contribute enormously to the electronic waste problem in relation to the consumption and its generation posing serious threat to the management of wastes. Uganda government is yet to enact an Extended Producer Responsibility related laws within their national legislations to manage E-waste effectively. The paper aims to examine the Extended Producer Responsibility (EPR) system critical success factors based on the Theory of Planned Behavior (TPB) and consider ecological design concept as a potential extension of the TPB in promoting sustainable electronic waste management. The survey questionnaires were administered to expert environmental-oriented government employees. Data was analysed by means of the Partial-Least-Squares Structural-Equation-Modelling. The findings demonstrate that the developed conceptual framework explain 52.4% variance in the intentions to participate and practice EPR systems, thus reflecting a good explanatory power while confirming the model robustness. The results illustrate all TPB constructs of attitude, intentions, perceived behavioral control and subjective norm, towards EPR schemes have significant positive effect on the outcome of sustainable E-waste management. Exceptionally, it indicates ecological design is the most influential predictor of sustainable E-waste management for implementation of EPR systems. Building on the study results, for proper electronic waste management programs deployment, and successful implementation of EPR systems, developing countries should target the TPB constructs, and ecological design as an extension factor. As policy implication, government should emphasize the nurturing of good ecological design behavior of organizations and also encourage effort toward green actions taken through penalties and incentives and by laws and regulations.

Key words: *Theory of Planned Behavior*, Ecological design, E-waste, Sustainability, *Extended Producer Responsibility*

Introduction

Globally, the Waste Electronic and Electrical Equipment (WEEE) or electronic waste (E-waste) generation was estimated at 57.4million metric tonnes (Mt) in 2021 (Pan *et al.*, 2022) compared

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to 53.6 Mt in 2019 (Forti, Balde, Kuehr & Bel, 2020). Moreover, a global surge in E-waste generation is anticipated to grow to 74Mt by 2030 (Islam *et al.,* 2020). Western European countries, are the main nations watched as holding the extreme WEEE generation worldwide (Rautela *et al.,* 2021; Deathe, MacDonald & Amos, 2008). Practitioners and academics assert that over 50-80% of E-waste produced in developed and industrialized countries are undoubtedly exported to developing nations (Heacock *et al.,* 2016). In Uganda, the WEEE generated in the year 2019 was 32kilo tonnes whereas the WEEE properly documented and intended for collection as well as recycling in 2018 was at 0.18kilo tones (Forti *et al.,* 2020). The flow of E-waste to developing countries is largely undocumented yet they pose a severe impact to both human health and the environment. Indeed, Rautela *et al.* (2021) confirmed that WEEE burning in landfills and open garbage dumpsites lead to exposure of carbon-based toxins, negatively impacting human health. In addition, Tetteh and Lengel (2017) proved that the unregulated WEEE recycling leads to the hazardous emission of elements that pollute the environment, thus contributing to rise in cancerous illnesses. The harmful nature of WEEE associated with the unscientific practices in the informal sector leads to destruction of the environment and human death or incapacitation (Pradhan and Kumar 2014; Bandyopadhyay 2010). Islam and Huda (2019) recognize WEEE as the fastest growing waste stream, constituting twice to thrice the amount compared to municipal solid waste. Consequently, several countries are increasingly considering several options as solutions to match exponential growth of electronic waste or WEEE.

In 2021, the Uganda government through the National Enterprise Corporation (NEC) and the National Environment Management Authority established the national collection center for E-waste to address WEEE management challenges. Mostly, the E-waste management facility focuses on the collection, sorting, dismantling and support proper disposal and treatment center for E-waste in Uganda. Similarly, as in the context of this study, proposals to alleviate waste management challenges and consequential environmental protection pressures require the uptake of the Extended Producer Responsibility (EPR) system that extends the producer's product responsibility to all the product life cycle aspects. The EPR is an emerging policy concept adopted in developed countries for managing solid waste. Developing countries are increasingly but slowly embracing this concept by enacting EPR-related laws within their national legislations to manage E-waste effectively (Dong *et al.,* 2019). EPR integrates environmentally beneficial characteristics throughout the product chain. Recycling, and recirculation and coupled with final E-waste disposal stages after product consumption to reduce the environmental impact of the product throughout their product life cycle. Perfectly, EPR involves an incentive for manufacturers to factor into environmental considerations in the design of their products, so that waste is prevented at the source by way of better product design. (Pouikli, 2020; Steenmans, 2019). However, the EPR studies have largely focused on technology development that incorporates green design to support the waste prevention initiatives, rather than E-waste collection and recycling (Wang *et al.,* 2016), with less consideration of the Critical Success Factors (CSF) of EPR implementation. The aim of the paper is to examine the EPR system critical success factors based on the Theory of Planned Behavior and considering ecological design concept as a potential extension of the TPB in promoting sustainable electronic waste management.

Theoretical Framework and Hypotheses Development

Prior studies that employed the Behavioral Reasoning Theory (BRT) established the 'reasons for' were generally positively related to attitude, intentions, as well as behaviour (Westaby *et al.,* 2010; Claudy *et al.,* 2015; Tandon *et al.,* 2020). However, several studies have opted for the theory of planned behavior by (Ajzen, 1991) as theoretical framework to distinguish waste management (Greaves *et al.,* 2013; Chen & Tung, 2010; Taylor & Todd, 1995) and recycling behavior determinants (White & Hyde, 2012; Stancu *et al.,* 2016; Tonglet *et al*., 2004). We investigate the critical success factors for EPR and the E-waste management sustainability based on the EPR practices for electronic products within the TPB framework. EPR is a policy concept in which the producer is responsible for the product produced up to its end of life. The TPB puts an individual's intention to execute a certain behavior at the center, influenced by attitude, subjective norm and perceived behavioral control to explain behavior being its conceptually independent antecedents.

Attitude towards EPR schemes and sustainable E-waste management.

Attitude is cognition or perception towards the outcome (Kumar, 2019). Attitude towards EPR activity that involves recycling can be expressed as the degree to which users evaluate their behavior towards a recycling outcome. A positive recycling evaluation will most likely accelerate the intentions to perform action towards EPR yet a negative evaluation will eventually result into an unfavorable recycling intention and behaviour (Greaves *et al.,* 2013). Attitudes toward electronic wastes has been identified as a factor critical in the management of e-wastes in developing countries (Nnorom & Osibanjo, 2008). Attitude is critical in the final decision of consumers in relation to e-wastes (Inga, 2008). Engaging consumers continuously in recycling behaviors such collecting end-of-life equipment and handing them over to recyclers improves on consumer attitudes towards e-wastes; more so it enables consumers to start considering e-wastes as a resource that is of value (Nixon & Saphores, 2007). Government agencies especially in developing countries have had low attitude towards e-wastes in the aspects of trans- boundary movement into their countries resulting into low prevailing of recycling activities. This attitude leaves government officials far from the material flow and environmental implications of e-waste imports into their various countries (Osibanjo & Nnorom, 2007). Previous studies by Nixon *et al,* (2008) investigated attitudes and beliefs from environmental perspectives on consumer's willingness to pay for e-waste management approaches such as recycling on individuals. The findings reveal that consumer's attitudes towards recycling were hinged on environmental factors such as costs and convenience of recycling of e-wastes. This is similar to findings by Mannetti *et al.* (2004) who found that recycling convenience of e-wastes regularly depends on the progress in the development of the recycling infrastructure.

Prior studies by Zhang and Wakkary (2011) on public attitudes on the collection of e-wastes reveal that dwellers' willingness to hand over end-of-life electronic products to territorial government agencies depends on their positive attitude in relation to government efforts such as the collection procedures while negative attitude of dwellers towards e-waste collection is linked to the e-waste product specifically the working condition, the resale value. Consumers are unwilling to hand over their e-wastes to government but rather seek re-sale to second hand dealer or decide otherwise (Sahu *et al.,* 2020). Attitude share a significant positive association

with intentions to recycling E-waste. From these, attitudes influence the final decision of users, consequently determining their actions thus, we hypothesize that:

H_1: Attitude towards EPR schemes has a positive effect on the outcome of sustainable E-waste management.

Ecological design towards EPR schemes and sustainable E-waste management.
Ecological design refers to any form of design in the environment that lessens the environmentally destructive impacts while integrating with living processes (Van der Ryn & Cowan, 2014). Ecological design is vital in EPR implementation, and as such its development is an extended responsibility of organizations. Chen *et al.* (2017) assert that eco-design requires manufacturers to deliberate on the environmental pollution produced by manufacturing, use, and also processing during the product design process. This determines the significant role played by ecological design in the extended producer responsibility scheme/system. The core reason of eco-design is to reflect and deliberate the probable impact of the electronic products on the environment from its source, to assess the cost and benefit of the material life cycle (Khan *et al.*, 2008). Notably, most researches have focused on waste recycling (Wang *et al.*, 2016), with less emphasis on the challenge of product source design (Dong *et al.*, 2019). Ecological design behavior improves the environment and promote environmental protection. Empirical studies have revealed that consumers favour buying products which do not cause pollution to the environment (Ye, Lei & Chen, 2008). In the interest of e-wastes and land scape management, ecological design means obtaining echo systems services. Ecological design is significant factor that potentially tackles the ever-growing e-waste problems. It is an initiative that should be over seen by government or any other mandated entity within the country while reducing risks to people in the environment such as pollution prevention (Mead *et al.*, 1999). The drivers of ecological designs include product recycling obligations, for industry, financial responsibility for actions and schemes, greater attention to the role of new product design material and substance bans including stringent restrictions on certain substances, creating awareness by labelling computer products as environmental hazardous.

According to Steiner *et al.* (2014), the interest in ecological design is to have the environment remain useful and beneficial to the society amidst human activities. E-waste is a serious health and environmental issue common to most developing counties (Alibeli & Johnson, 2009) that require fixing appropriately. Therefore, e-waste management and eco-remediation technologies are necessary. Previous studies also confirm the impact of environmental concern on the behavior intention of electronic consumers to participate in the choice of echo friendly electronic devices, services and solutions with consumers' behavioural intentions to choose eco-friendly items (Borusiak *et al*., 2021; Poortinga *et al.*, 2004). The interest in the environmental design is to reduce the toxity of wastes. Garg *et al.* (2023) suggest that financial benefits and environmental designs play a relevant role in modeling the viable behavioral intention of young consumers of electronic products. Thus, we hypothesize that:

H_2: Ecological design towards EPR schemes has a positive effect on the outcome of sustainable E-waste management.

Perceived behavioral control towards EPR schemes and sustainable E-waste management

Perceived behavior control is the ability of an individual user to get over a challenging situation and move on with an action (Mancha & Yoder, 2015) .In relation to e-wastes it refers to the way individual consumers behave on the root of preceding experiences, resources within their disposal and the available and prospects or impediments encountered while handling e-wastes (Borthakur & Govind., 2018). It is the conviction that individuals have the capacity to influence the outcome of their actions in a positive manner, implying that if consumers of electronic products believe their behavior towards e-waste will not result into the intended outcome such as gain from the e-wastes, their behavior and intentions towards e-waste management activities is impacted on negatively (Sharma & Foropon, 2019).

Previous studies in relation to purchase intentions in hotels, organic foods and electronic products have been linked to perceived behavioral control (Maichum, Parichatnon & Peng 2016). As such there is a connection between perceived behavioral and intentions to separate household electronic wastes and hand them over to EPR organizations or government designated agencies of EPR schemes. Earlier studies in relation to smartphone wastes link Perceived Behavioral control as a key determinant to the intentions of consumers to engage in management of e-waste activities such as disposal, return back and hand over at a recycling facility/authority (Yadav & Pathak, 2017). The concept of perceived control relates to individual confidence towards the likelihood of performing certain behavior amidst existing constraints in the existing environment For instance, an electronic equipment user who is confident about how, what to do and when to do it during waste management is most likely to exhibit a recycling behavior compared to the consumers of electronics with who believes that they have limited control over existing or upcoming constrictions (Tonglet *et al,* 2004). As such, consumers of electronic items who know that electronic items can be recycled, recycling procedure involved in electronic items and would maneuver through recycling activities without any challenges have full control and influence on recycling of their electronic such as mobile phones, tablets, laptops etc. This influences their actions towards waste management (Kumar, 2019). We hypothesize that;

H_3: Intention and actual application to practice EPR schemes has a positive effect on the outcome of sustainable E-waste management.

H_4: Perceived behavioral control towards EPR schemes has a positive effect on the outcome of sustainable E-waste management.

Subjective norm towards EPR schemes and sustainable E-waste management.

Prior studies by Ajzen(1991), defined subjective norm as a set of beliefs, a collection of ideas, the existence of pressures plus influences that arise from an individual's inner social cycle which could be either positive or negative. Existing literature related to e-waste behavior of individuals such as recycling in the downstream of the value chain underscores that social pressure is a chief influencer of consumer intention participate in EPR activities such as take back of equipment (Kumar & Smith, 2018; Kaiser & Shimoda, 1999). Social norms are imaginative in nature and stems from the consumer perception of acceptable and unacceptable behavior from personal networks that over the time an individual established in the immediate community in which he or she takes part in an e-waste (Singh *et al.,* 2018). Furthermore,

subjective norm has been found to be useful in predicting consumer green purchasing of electronic products (Busu & Busu., 2020).

Garg *et al.* (2023) point out that subjective norm is the extensively perceived societal pressure to engage in or desist from a behaviour that drives an action. These are opinions on whether or not majority of the people in a common cycle agree to and or with a behavior (Alexa *et al.*, 2021). In a scenario where people experience frequent social pressure from those they regard as significant are more prepared to engage in environmentally friendly activities such as green purchasing. People who experienced more social pressure from significant others were observed as more prepared to be green, and as a result, they are more likely to purchase green products (Yarimoglu & Binboga, 2019) which resonates well with the sustainable management of e-wastes. Previous study by Alexa *et al*. (2021) across several countries in Europe revealed that subjective norms strongly influence green buying behaviour in most member countries. The importance of subjective norm has in relation to behavioral intentions to e-waste has been found to be a significant contributor to the management of electronic wastes (Garg *et al.*, 2023). Based on the context of the study, we hypothesize that;

H_5: Subjective norm towards EPR schemes has a positive effect on the outcome of sustainable E-waste management.

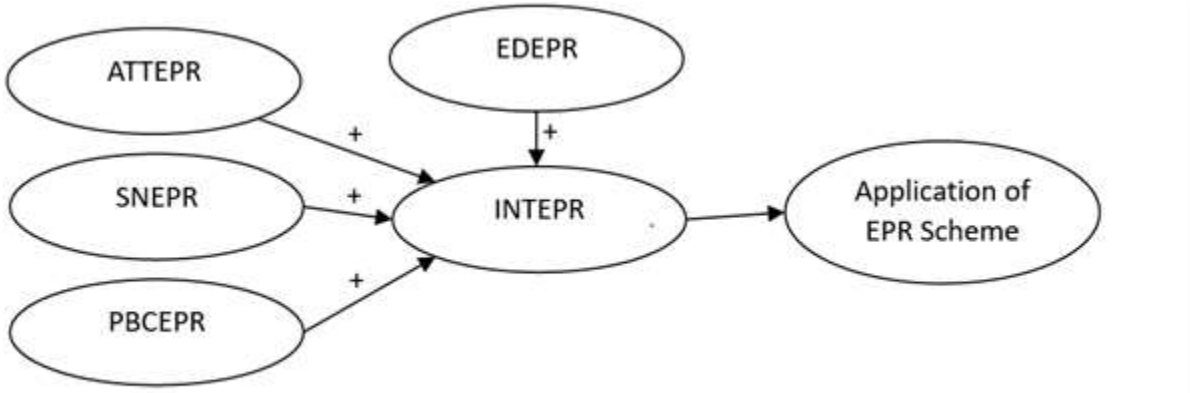

***Figure 1*: Proposed model for CSF for EPR. (ATTEPR:** *Attitude towards EPR Scheme;* **PBCEPR:** *Perceived Behavioral Control; Subjective Norm;* **EDEPR:** *Ecological Design;* **INTEPR:** *Intention to Practice EPR;* **AAEPR**: *Actual Application of EPR scheme)*

Methodology

The study adopted a cross-sectional and quantitative research design. A cross-sectional study emphasizes data collection at a single time period (Zikmund *et al*., 2013). The TPB variables included intentions to practices and actual application of EPR were measured by (Ghani, *et al.*, 2013) whereas ecological design was measured from the ideas of (Zhu *et al.*, 2008; Vanalle *et al*., 2017, Zhu *et al.*, 2013). A five-point Likert scale was adapted with anchors extending from strongly-disagree (1) to strongly-agree (5). Convenience sampling was adopted in this study. Convenience sampling allows quick collection of data from easily accessible pool of respondents. In this case, government employees with experience and vast knowledge in E waste and environmental preservation were duly invited to participate in the study. A sample

size between 30 and 500 is regarded appropriate for analysis (Roscoe, 1975). Of the 232 sampled survey questionnaires distributed, 183 valid questionnaires usable were returned having discarded the incomplete and redundant survey questionnaires. Tables1 indicates the sample demographics. As seen from Table 1, 98(54%) and 85(46%) were males and females, respectively. The majority of the respondents 61(33.3%) were aged between 36 and 45years an indicator that a youthful population is more knowledgeable about E-waste. 56% respondents with undergraduate degrees suggest a highly literate employee. Generally, all respondents are well educated.

Table 1. Demographic profile of participants

Variable	**Description**	**Frequency (Percentage)**
Gender	Female	85-(46%)
	Male	98-(54%)
Age bracket	20-35 years	49-(26.7%)
	36-45 years	61-(33.3%)
	46-55 years	49-(26.7%)
	56-65 years	18-(10%)
	>years	6-(3.3%)
Education level	Diploma & below	33-(18%)
	Undergraduate Degree	102-(56%)
	Postgraduate	48-(26%)
	Ph.D.	0-(0%)

Data Analysis

The partial least squares-structural equation modeling-(PLS-SEM) technique was used to analyze data whereas the SmartPLS3.0 software was employed to statistically evaluate or assess the hypotheses and was then followed by a two-stage analysis approach (Anderson & Gerbing, 1988). SmartPLS provides advantages such as permitting simultaneous assessment of both the outer and the inner models and a rare opportunity for analyzing fewer or small sample sizes (Chin, 1998). In addition, SmartPLS complies with the normality, that is no need to carry out a normality test, and also offers a somehow lenient randomness prerequisite with more advanced predictive research model (Hair *et al.*, 2017; Urbach & Ahlemann, 2010). The study employed the bootstrapping procedure to determine the developed hypotheses, and whereas data normalization may not be a pre-requisite under the PLS-SEM approach, it was done. The PLS-SEM approach depends on bootstrapping for checking and examining the path coefficients' significance.

Measurement model assessment

The measurement model assessed the study's validity and reliability, for the reflective constructs relying on the approach suggested by (Hair *et al.*, 2020). The measurement model results demonstrate that the reflective constructs items are appropriately developed and also valid for further analysis statistically, depicted in Table2. The R-squared (R^2) value is 0.524, from the measurement model assessment, which demonstrates that the exogenous variables, such as

attitude, perceived behavioral control, subjective norm, and ecological design, all towards EPR scheme, explain 52.4% variance in E-waste management sustainability. The highest and lowest outer loadings were 0.956 and 0.752 respectively. Since both the lowest and highest item loadings are above 0.70, it is an indicator of satisfactory results (Hair *et al.*, 2020). Meanwhile, the consistency and internal reliability have been evaluated through the average variance extracted-(AVE) and composite reliability-(CR) of the constructs. For constructs validity, CR should be above 0.70 and AVE above 0.50 (Vinzi *et al.*, 2010), as shown in Table 2 below.

Table2: Satisfactory Loadings due to PLS-SEM Analysis

Indicators /Measurement items/Model constructs/References	**CA**	**CR**	**AVE**
ATTEPR: *Attitude towards EPR Scheme* (Ghani *et al.*, 2013)	0.861	0.904	0.702
PBCEPR: *Perceived Behavioral Control* (Ghani *et al.*, 2013)	0.901	0.916	0.686
SNEPR: *Subjective Norm* (Ghani *et al.*, 2013)	0.925	0.952	0.732
EDEPR: *Ecological Design* (Vanalle *et al.*, 2017, Zhu *et al.*, 2008; 2013)	0.910	0.934	0.740
INTEPR: *Intention to Practice EPR* (Ghani *et al.*, 2013)	0.893	0.921	0.702
AAEPR*: Actual Application of EPR scheme* (Ghani *et al.*, 2013)	0.843	0.895	0.680
R^2	0.524		

Multicollinearity

The rule of thumb when assessing multicollinearity issues, provide for the VIF values less than 10 (Hair *et al.* (2020) and alternatively, a maximum of 5 for VIF (Ringle *et al.*, 2020). The lowest VIF value is 1.533 and highest is 4.632, thus meeting both requirements above, an indicator there is no common bias method, hence the model is adequate. Table 3 display the discriminant validity results by means of the (Fornel & Larcker, 1981) method. All diagonal values 0.895, 0.860, 0.843, 0.838, 0.828 and 0.735 are greater than other values below in the diagonal, thus confirming the discriminant validity of constructs.

Table3: Discriminant validity(Fornell-Larker)

	ACEPR	**ATTEPR**	**ECOEPR**	**INTEPR**	**PBC**	**SNEPR**
Actual Application of the EPR scheme (ACEPR)	0.895					
Attitude towards EPR scheme (ATTEPR)	0.404	0.860				
ED towards EPR scheme (ECOEPR)	0.458	0.372	0.843			
Intention to Practice EPR scheme (INTEPR)	0.373	0.363	0.661	0.838		
Perceived PBC towards EPR scheme (PBC)	0.521	0.202	0.445	0.333	0.828	
Subjective Norm towards EPR scheme (SNEPR)	0.398	0.193	0.422	0.222	0.260	0.735

Structural model estimation

To assess the direct relationships, the inner model / structural model assessment is used. The t-values and the path coefficient are evaluated to assess the structural model. A t-value greater or more than 1.64, shows the acceptance of a suggested hypothesis. Of the four (4) hypotheses that suggested direct relationships, they were all supported. Table4 shows the general structural-model estimation results of the direct effects hypotheses.

Table4: Direct Relationships (Structural Model Estimation) – Path Coefficient

Hypothesis	Relationships	Std. Beta Error	T value	P value	Decision
H1	ATT -> INTEPR	0.264	6.155	0.000	Supported
H2	EDEPR -> INTEPR	0.673	10.435	0.000	Supported
H3	INTEPR -> ACEPR	0.373	7.238	0.000	Supported
H4	PBC -> INTEPR	-0.175	2.095	0.037	Supported
H5	SNEPR -> INTEPR	-0.081	2.046	0.041	Supported

The outcome in Table 4 shows that all the hypotheses H1, H2, H3, H4 and H5 are supported. That attitude, ecological design, intentions, perceived behavioral control and subjective norm, all towards EPR schemes have positive effects on actual application of EPR schemes that results into sustainable E-waste management resulting in the proposed model for CSF for EPR as shown in figure 1.

Discussion of Findings

The study determines the critical success factors for the extended producer responsibility based on the Theory of Planned Behavior, in the sustainability of E-waste management in Uganda. The overall findings show evidence for the predictive power of CSF in predicting EPR system behavioral intention and behavior. Results indicate that the CSF, such as attitude toward EPR scheme, perceived behavioral control toward EPR scheme, subjective norm toward EPR scheme and ecological design toward EPR scheme, in predicting behavioral intention to practice EPR system and behavior and actual application of EPR schemes accounted for 52.4% and 13.9% of variances respectively. Based on the Theory of Planned Behavior, H1 (attitude), H3 (intention), H4 (perceived behavorial control) and H5 (subjective norm) analyzed positive relationships between EPR practices and E-waste management outcomes sustainability. H2 (ecological design), as an extension of the Theory of Planned Behavior, showed a positive relationship between EPR practices and E-waste management outcomes sustainability.

The relationship between attitude towards EPR schemes and the sustainability of E-waste management is significant at the 0.05 level, $\beta = 0.264$, $p<0.000$. This demonstrates that attitude towards EPR activities, influence the rate at which E-waste is collected and recycled to drive E-waste management sustainability effort. Consistent with Boldero (1995), Cheung *et al.* (1999), the study found attitude of government employees towards EPR schemes predict behavioral intentions to participate in favorable activities and behavior that results in E-waste sustainability. These include attitude to participating in E-waste recycling and collection effort. This was also highlighted by (Greaves *et al.,* 2013) who state that attitude towards EPR activity such as recycling can be expressed as the degree to which users evaluate their behavior towards an outcome. In other words, a positive evaluation such as recycling is most likely to accelerate the intentions to perform ac action towards EPR actions yet a negative evaluation will eventually result into a lower intention and behaviour (Greaves *et al.,* 2013).

Also, the link between ecological design towards EPR practices and E-waste management sustainability is positively significant at 0.05 level, $\beta = 0.673$, $p<0.000$. Hence, it's worth noting that the role of ecological design towards EPR practices is the most influential factor in ensuring management of electronic waste in a sustainable way. This is understandable because (Largo-Wight *et al.,* 2012) considered ecological behavior as an extension to TPB constructs to predict

recycling within the community. Yen and Yen (2012); Ghani *et al.*, (2013); Zhu *et al.*, (2013) emphasized that ecological design behavior improves the ecological environment and promote environmental protection. Congruent to the findings in this study, the interest in the environmental design is to reduce the toxicity of wastes (Borusiak, *et al.*, 2021; Vanalle *et al.*, 2017). Besides, findings of the study by Garg *et al.* (2023); Zhu *et al.* (2008) suggest that financial benefits and environmental designs play a relevant role in modeling the viable behavioral intention of young consumers of electronic products.

In addition, the relationship between the intentions and actual application to practice EPR schemes has a significant positive effect on the outcome of sustainable E-waste management at 0.05 level, $\beta = 0.373$, $p<0.000$. Furthermore, the perceived behavioral control (PBC) toward EPR practices and sustainability of E-waste relationship is positive and significant at the 0.05 level, $\beta = -0.175$, $p<0.005$. In line with Cheung *et al.* (1999), PBC was found to be an instant predictor of behavioral intentions. Congruent with Mannetti *et al.* (2004), PBC predicts a certain behavior toward EPR practices, although not very strong ($\beta = -0.175$). This is perhaps due to the hitch employees face during an effort, financial implications, and time to achieve sustainability of E-waste.

Similarly, the subjective norm and sustainability of E-waste management relationship is positively significant at the 0.05 level, $\beta = -0.081$, $p<0.005$. Hence, the subjective norm role towards EPR schemes will yield valuable E-waste effects desirable for E-waste management sustainability, although with a smaller magnitude ($\beta = -0.081$), consistent with (Klockner & Oppedal, 2011) on recycling behavior. This is also congruent with (Armitage & Conner, 2001) who reported a weak relationship between subjective norm on behavioral intentions. Cheung *et al.* (1999) demonstrated subjective norms as an instant predictor of behavioral intentions. The recycling behavior of employees towards EPR practices is favorable to sustainable E-waste management. This is also consistent with (Ramayah *et al.*, 2012) who found that subjective norms as the strongest contributor to recycling behavior among university students in Malaysia.

Conclusion and Policy Recommendations

The results illustrate all TPB constructs of attitude, intentions, perceived behavioral control and subjective norm, towards EPR schemes have significant positive effects on the outcome of sustainable E-waste management. Exceptionally, it indicates ecological design is the most influential predictor of sustainable E-waste management for implementation of EPR systems to expand the nature of resource utilization including E-waste, and encourage limiting environmental destruction during the production of electronic products at all stages. Building on the study results, for proper electronic waste management programs deployment, and successful implementation of EPR systems, developing countries should target the TPB constructs, and ecological design as an extension factor. The study's outcome could help governments in developing countries to develop more effective environmental management policies centered towards sustainable E-waste management with a focus on enacting legislations that promote EPR schemes. Government should emphasize the importance of product source design and also participate in nurturing good ecological design behavior of organizations. The government should encourage manufacturers to have green actions taken through penalties and incentives and by laws and regulations. Ecological design behavior improves the ecological environment and promote environmental protection.

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