Cross-Cultural Adaptation and Validation of a Consumer-Centric value Co-Creation Scale for E-waste Management: An Extended Theory of Planned Behavior Approach

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ABSTRACT

Background

Electrical and Electronic Waste (e-waste) has emerged as a significant environmental challenge in India, with consumer behavior playing a critical role in determining how electrical and electronic products are used, stored and ultimately discarded.

Objective: The study focuses on the translation and validation of a Hindi version of an extended Theory of Planned Behavior (TPB) based scale. It is seeks to examine the consumer engagements in e-waste management by adopting a consumer-centric approach that integrates value co-creation.

Method

The original scale was translated into Hindi following a structured cross-cultural adaptation procedure. To ensure conceptual clarity and contextual relevance for the target population, cognitive interviews were conducted, followed by expert-based content validation and pre-testing of the instrument. Data collected from 450 respondents were analyzed using Structural Equation Modeling (SEM) to assess the reliability and validity of the scale.

Findings

The Hindi version of the scale demonstrated strong internal consistency and satisfactory model fit. Core constructs, including attitude, subjective norms, perceived behavioral control, intention, responsible consumer behavior, and co-creation, retained their theoretical coherence in the adapted version. Minor refinements were introduced to enhance gender neutrality, simplify item wording, and incorporate commonly used English terms in cases where suitable Hindi equivalents were not available. Overall, the scale was effective in capturing responsible e-waste management behavior and revealed noticeable gaps in knowledge across different demographic groups.

Conclusion The validated Hindi scale offers a reliable, culturally relevant way to assess consumer behavior on e-waste. It can guide targeted awareness and policy efforts, supporting broader goals of sustainable consumption and urban responsibility in line with SDGs 11 and 12.

Keywords: *Consumer behavior, E-waste management, translation and adaptation, co-creation, TPB, India.*

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INTRODUCTION

E-waste generation has become a serious environmental and societal concern, as it is rapidly increasing five times faster than earlier expected. While earlier, waste was seen as material to be discarded, it is now more often seen as a useful resource within the principles of the circular economy. In many production cycles, waste can be repurposed, recovered and brought back into the system i.e. reintegrated through multiple methods. By doing this, resources are saved and waste is managed properly as well as effectively. This change may bring benefit to society as a whole (UNEP, 2021; Ellen MacArthur Foundation, 2019).

In recent years, Waste Electrical and Electronic Equipment (WEEE), commonly referred to as e-waste, has been drawing more attention. This is mainly because of it negative effects on everyday life and society as a whole. E-waste contains a mix of hazardous and valuable materials. As if, everyday electrical and electronic items/appliances such as computers, mobile phones,/smart phones, televisions, large appliances etc often contain toxic materials, including lead, mercury and flame retardants (UNEP, 2015; CPCB, 2020; CPCB, 2023). And the consumption and market demand for these appliances are quite high, which is the reason that has led to a rapid rise in their volume. As a result, e-waste is now considered a serious risk to both the environment and human health (Kumar, Holuszko & Espinosa, 2017; Sethurajan et al., 2019).

As per the data from the Global E-waste Monitor indicate that global e-waste generation exceeded 62 million tonnes in 2022. However, the figures do not remain the same, it is been rising continuously by 2.6 million tonnes annually (Global E-waste Monitor Report-2024). Despite this, only about 22% of e-waste was formally collected and recycled through authorized channels. The remaining waste makes the situation worse as it is improperly handled by untrained people or dumped into landfills without following any proper procedure or method (Statista, 2023). On the other hand, in India, the challenge is steadily increasing, with annual e-waste generation exceeding 2 million tonnes. A significant portion of this waste is managed by informal sectors which includes untrained workers (male, female or sometimes even minors). This raises serious concerns for individual health, public health as well as and environmental safety (Dutta, 2021; MoEFCC, 2022).

To overcome or manage these pressing issues, various regulatory measures such as the E-Waste Management Rules (2011; revised in 2016, 2018 and 2023) and the Extended Producer Responsibility (EPR) framework have been introduced. Despites these, their implementation remains limited or still become a challenge.

However, several academic studies have identified multiple barriers to effective e-waste management. Among the most critical are the dominance of informal recycling channels, limited formal infrastructure, and low levels of public engagement (Kiddee, 2013; Rajaram & Pekeur, 2014). In particular, low public engagement stands out as an area with significant potential for intervention and improvement. This concern is also mentioned in Sustainable Development Goal (SDG) 12, which emphasizes the need to shift away from wasteful patterns of production and consumption. The goal highlights behavioral change at the consumer level, where individual participation is crucial for managing e-waste through practices such as reduced consumption, reuse of products, proper recycling and engagement with formal recycling systems (UNEP, 2021). Despite this, the role of consumers as active contributors to solutions remains insufficiently explored in the existing literature.

Most published studies have primarily focused on consumer purchasing behavior or on the challenges associated with e-waste disposal. Comparatively fewer studies have examined how consumers themselves can take an active role in addressing the e-waste problem through responsible decision-making and participation. Although previous research has addressed consumer attitudes, awareness, intentions as well as habits. Further, there remains a need to better understand how these factors translate into responsible consumer behavior in the context of e-waste management (Kumar, 2019; Aboelmaged, 2021). In this regard, involving consumers as key stakeholders is increasingly recognized as a vital step in addressing the growing e-waste

challenge. Yet, despite rising interest in consumer awareness, limited attention has been paid to their actual behavioral engagement, particularly in developing country contexts.

Against this backdrop, a promising yet understudied concept is co-creation, defined as a collaborative process in which consumers actively engage with stakeholders such as service providers, producers and policymakers to develop shared solutions. Simply put, co-creation refers to active participation in the process rather than a passive role as end users of final outcomes (Prahalad, C. K., & Ramaswamy, V, 2004). Co-creation has been widely discussed as a mechanism for promoting sustainable consumption; however, its application within e-waste management remains limited (Vargo & Lusch, 2008; Shamim & Ghazali, 2017). This gap warrants further exploration, as co-creation offers opportunities to involve consumers more directly through initiatives such as participatory product design, recycling campaigns and take-back programs. At the same time, reverse logistics has gained increasing attention for its role in managing e-waste through processes such as reuse, resale, refurbishment and recycling. Nevertheless, many reverse logistics frameworks fail to adequately incorporate behavioral dimensions of consumers. As a result, without meaningful public involvement, e-waste continues to be poorly managed, thereby contributing to persistent environmental challenges (Mohd Sharif, 2017).

Several behavioral theories have been applied to understand recycling behavior such as Valence Theory, Technology Acceptance Model, Norm Activation Theory and Theory of Interpersonal Behavior. Among the various behavioral models discussed above, the Theory of Planned Behavior (TPB) is one of the most widely used and accepted frameworks. It helps explain how attitudes, subjective norms, perceived control, and intentions influence a person's behavior (Ajzen, 1991). However, the model has some limitations particularly in explaining how consumers weigh the pros and cons of recycling-related decisions (Awasthi, 2018; Nguyen, 2019; Patrao, 2023).

To address the limitations and gaps identified in the literature, the study was conducted in two phases. In the first phase, a consumer-centric value co-creation scale for e-waste management was developed and validated. The scale was grounded in an extended Theory of Planned Behavior (TPB) framework with Responsible Consumer Behavior (RCB) and Co-creation (CoC) incorporated as additional constructs. This extended framework offered a comprehensive understanding of how consumers engage with e-waste management practices. The findings further indicated that co-creation plays a moderating role in strengthening the relationship between intention and responsible consumer behavior.

During the initial phase of data collection, several participants particularly those from non-English speaking or linguistically diverse backgrounds, reported difficulties in fully understanding the English version of the scale. This highlighted the need for research instruments that are both culturally and linguistically appropriate, in order to ensure clarity, inclusiveness as well as meaningful participation.

Accordingly, the focus of the present phase of the study is to translate and culturally adapt the scale into Hindi. This process aims to enhance the validity, reliability and practical applicability of the instrument for Hindi-speaking populations. By validating the adapted version, the study contributes to making e-waste research more inclusive and enables a more accurate representation of diverse consumer perspectives in the Indian context, with implications for both academic inquiry and policy development.

MATERIALS AND METHODS

The scale was originally developed in English, followed by validation and reliability assessment of all constructs (Dave K et al., 2025_under peer review). Since the study was conducted in a predominantly Hindi-speaking context, cross-cultural adaptation and validation were necessary to ensure accurate data collection. Accordingly, the English version of the scale was translated into Hindi to enhance comprehensibility and relevance for the study participants.

The translation process followed the step-by-step guidelines proposed by Beaton et al. (2000) for the cross-cultural adaptation of self-report measures, with an emphasis on maintaining both linguistic accuracy and cultural appropriateness. In addition, the scale was evaluated for content validity and reliability prior to its administration, in order to confirm its suitability for use in the target population.

Translation, Validation and Internal Consistency of the Hindi Scale

The study involved the translation and cultural adaptation of the English version of the "Holistic Consumer-Centric Value Co-Creation Scale", along with an assessment of the content validity and reliability of its Hindi version. The objective was to ensure that the adapted instrument was both conceptually appropriate and psychometrically sound for use among Hindi-speaking respondents.

The translation and cross-cultural adaptation process followed the guidelines proposed by Beaton et al. (2000) for the adaptation of self-report measures. The procedure was carried out in two stages: first, the translation of the scale from English to Hindi along with cultural adaptation; and second, the evaluation of content validity and internal consistency of the Hindi version of the scale.

Part 1: Translation and Cultural Adaptation:

The following five steps were performed in "Part 1"

1. Forward translation
2. Synthesis of 2 translations
3. Back translation
4. Creation of pre-final version
5. Test of pre-final version

Forward Translation: This step was carried out by 2 bilingual and independent translators, who translated the scale from English into Hindi. One of the translators (T1) was familiar to the subject, while the other (T2) was not.

Synthesis of translations (T1 & T2): In this step, both the translations were read thoroughly by the third person who was known to the subject and good command on the language. A discussion was held amongst the third person and the translators (T1 and T2) to compare the 2 versions and analyze any ambiguous expressions. The aim of this step was to reach a consensus and a single version of the translated questionnaire.

Back-translation: In this step new bilingual translators were invited to back translate the questionnaire into English. The purpose of this step to check if the translated version truly captured the meaning of the original questionnaire.

Creation of the Pre-Final Version (Expert Committee Review): The fourth step involved forming an expert committee comprising methodologists, subject matter experts, language professionals, and the translators responsible for both forward and back translations.

The authors of the original English version of the questionnaire were also involved in the review process to ensure conceptual consistency and preserve the integrity of the original constructs. An expert committee examined all versions of the questionnaire, discussed areas of discrepancy and refined both the translated and back-translated items.

Following these deliberations, a set of modifications was proposed, leading to the development of the pre-final version of the questionnaire. This process ensured adequate cultural and linguistic equivalence of the instrument for the target population.

Suggestions included removing technical words with simpler terms wherever appropriate and add English words in parentheses for clarity (e.g.,"नवीनीकृत" (refurbished)"), and rephrasing complex sentences to make them shorter and easier to understand.

It was also advised to use gender-neutral expressions by including both "रखता हूँ" and "रखती हूँ" where appropriate and to avoid repeating words within items.

Furthermore, it was recommended that the language used in the questionnaire be kept at a level understandable to someone with approximately a 7th-grade education, ensuring accessibility for all respondents.

Test of the pre-final version: In this last step of the translational and cultural adaptation, the questionnaire was administered to 30 individuals from Delhi region, who have passed the eligibility criteria (inclusion criteria).

Participants were asked about their understanding on the questionnaire (process known as 'Cognitive Debriefing') and any difficulties in completing the questionnaire.

There were five questions (table 1) on each "Item" of the questionnaire which were asked to reach the consensus and participants' understanding towards the concept of the questionnaire. This process also helps establishing the acceptability of the Hindi version of the 'Holistic Consumer-Centric and Value Co-Creation Scale'.

Table 1: Cognitive Interview Questions for Scale Validation

Hindi	English Translation
क्या सवाल सामान्यतः स्पष्ट, समझने में आसान और उत्तर देने में सरल हैं?	Are the questions generally clear, easy to understand, easy to answer?
क्या ये सवाल आपके लिए महत्वपूर्ण और सार्थक हैं?	Are the items meaningful and important to you?
क्या निर्देश स्पष्ट और समझने में आसान हैं?	Are the instructions clear and easy to understand?
क्या प्रारूप (फार्मेट) समझने में आसान है? (क्या इसे खुद से भरना आसान है?)	Is the format easy to follow? (Is it easy to complete on your own?)
क्या आपको इस सवाल को समझने में कोई कठिनाई हुई?	Did you have any difficulty understanding this item/question?
यह सवाल आपके लिए क्या अर्थ रखता है?	What does this item mean to you?
क्या आप इस आइटम को पुनः लिखना चाहेंगे? (यदि हां, तो आप इसे कैसे पुनः लिखेंगे?)	Would you like to reword this item? (If so, how would you reword it?)
क्या यह सवाल आपकी स्थिति से संबंधित है?	Is this item relevant to your situation?
क्या इस सवाल के उत्तर विकल्प इसके साथ मेल खाते हैं? (अगर नहीं, तो कृपया कठिनाई बताएं और सुझाव दें कि आप इन्हें कैसे शब्दबद्ध (सुधारेंगे) करेंगे?)	Are the response options consistent with this item? (If no, please explain the difficulty and suggest how you would reword them.)

Source: Authors' own compilation

Twelve out of thirty participants reported difficulties with certain items (Item numbers 19, 20, 43 & 44) while completing the Hindi version of the Holistic Consumer-Centric and Value Co-Creation Scale for E-Waste Management during pre-testing. In addition, participants needed help understanding some words before answering, such as नवीनीकृत (refurbished), हितधारक (stakeholders), उत्पाद विकास (product development), and आवासीय सोसायटी (residential society).

Item 43: मुझे पता है कि अपने ई-कचरे का प्रबंधन कैसे करना है।

Item 44: मेरा मानना है कि मैं अपने ई-कचरे का प्रबंधन करने में सक्षम हूं।

Item 20: ई-कचरा प्रबंधन संतोषजनक है।

Item 19: ई-कचरा प्रबंधन लाभदायक है।

However, all thirty participants were able to read the Hindi version of the scale with little to no assistance. Participants generally reported that they understood the language and the concepts of the items in the questionnaire, except for a few difficult words.

Therefore, the English meanings of these difficult words were added in parentheses in the Hindi version of the scale after discussion with translators (T1 and T2).

Part 2: Content Validity

The following three steps were taken to establish content validity for the current study:

1. *Establishment of the Panel of Experts:*

   A total of eleven experts were requested to participate in the validation process of Hindi scale. Seven of them accepted the formal invitation, consisting of 2 subject experts from marketing, 1 language expert, 1 environmentalist, 1 methodologist, and 2 consumers. The study material and evaluation sheets were provided to these experts for their suggestions and feedback. Rest of them refused to participate as the scale was in Hindi and due to their busy schedule.

2. *Qualitative Review of the Items in the Scale:*

   Experts were asked to review the scale and provide feedback on the appropriateness of the title, clarity, conciseness and completeness of the directions, as well as the relevance and completeness of the content areas. Additionally, they were asked to evaluate the appropriateness and clarity of the items and whether the response options for each item were adequate.

3. *Quantitative Review of the Items in the Scale:*

   In this section, all the scoring were based on the factors such as 'Relevance, Clarity and Essentiality. All experts were requested to score under the following criteria to avoid bias. Therefore, all the responses/suggestions were recorded in an excel spreadsheet and codes were also assigned to avoid discrepancies.

   - *Relevance'* were scored under: not relevant (0), somewhat relevant (1), quite Relevant (2), very Relevant (3).
   - *Clarity'* was recorded under: not clear (0), item needs some revision (1), very Clear (2).
   - *Essentiality'* was rated as: not essential (0), useful but not essential (1), essential (2)

   Furthermore, the content validity ratio (CVR) calculated through the following formula introduced by Lawshe 1975:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}}$$

Furthermore, the CVR was calculated for the entire set of questions based on the "Essentiality" scores. Only ratings marked as "essential" were considered for the CVR calculation; the other two categories "not essential" and "useful but not essential" were excluded from the calculation. This method ensures that the items included in the scale are highly relevant and important by the expert panel.

As a result, the present study established the content validity of the "A Holistic Consumer-Centric and Value Co-Creation Scale for E-Waste Management _ Hindi version." Items with a Content Validity Ratio (CVR) of at least 0.43 were retained, while those below 0.43 were either removed or revised based on the feedback from the 7 experts on the panel.

As per the expert panel's feedback, items numbered 3, 6 and 7 required modifications. Specifically, the phrase "रखती/रखता हूँ।" was missing at the end of certain sentences. For example, Item 3 was revised as follows:

"मैं अपने ई–कचरे को नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों से बदलने का इरादा रखती / रखता हूँ।"

Previously, the sentence was presented as:

"मैं अपने ई–कचरे को नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों से बदलने का इरादा रखता हूँ।"

These changes ensure gender-neutral language and grammatical completeness, enhancing the clarity and inclusivity of the scale items. Since the English version of the scale had already undergone content validity assessment, no major corrections were required in the Hindi version beyond minor linguistic adjustments. The expert panel recommended replacing certain technical terms with simpler words or adding English terms in parentheses for better understanding. For example:

Q6: "मरम्मत (रिपेयर)" instead of only "मरम्मत"

Q7: "नवीनीकृत (रिफर्बिश्ड)"

Q27: "डिस्पोज (निपटान)"

After incorporating the suggested revisions, the Hindi version of the scale was resubmitted to the same panel of experts for final review and approval prior to its administration to the participants. After re-evaluating the Content Validity Ratio (CVR) scores, none of the items fell below the threshold value of 0.43. The overall CVR for the scale was 0.90, reflecting a high level of agreement among the experts regarding the relevance and clarity of the items (Tables 2 and 3) (Lawshe, 1975). In addition, the Content Validity Index (CVI) was calculated for the Hindi version of the scale based on expert assessments of item relevance. For this purpose, relevance ratings were recoded such that scores of 2 or 3 were treated as relevant (coded as 1), while scores of 0 or 1 were treated as not relevant (coded as 0). The same coding procedure was applied to the English version of the scale (Table 2).

The item-level CVI (I-CVI) values for the Hindi version were all 0.85 or higher, indicating satisfactory relevance across all items. The scale-level indices also indicated satisfactory content validity, with S-CVI/Ave = 0.91 and S-CVI/UA = 0.34, meeting established benchmarks for content validity.

These findings establish a strong foundation for proceeding to subsequent phases of scale validation and implementation, ensuring the tool is linguistically and conceptually appropriate for use among Hindi-speaking participants in future research on e-waste management behaviors.

Table 3: Content Validity Index (CVI) for Hindi Scale Items

S.No.	Questions	Essentiality						
		Not essential (0)	Useful, but not essential (1)	Essential (2)	N (total number of experts)	Ne (number of experts indicating "essential")	N/2	CVR
1.	मैं अपने ई–कचरे (वेस्ट) को रिसाइकिल करने का इरादा रखती/रखता हूँ।		1	6	7	6	3.5	**0.71**
2.	मैं अपने ई–कचरे (वेस्ट) को पास के रिसाइकिलिंग स्टेशन पर छोड़ने का इरादा रखती/रखता हूँ।		1	6	7	6	3.5	**0.71**
3.	मैं ई–कचरे (वेस्ट) को रिटेलर या निर्माता को वापस करने का इरादा रखती/रखता हूँ।		1	6	7	6	3.5	**0.71**
4.	यदि आवश्यक हुआ तो मैं ई–कचरा रीसाइक्लिंग या प्रबंधन शुल्क का भुगतान करने का इरादा रखती/रखता हूँ।			7	7	7	3.5	**1.00**
5.	मैं अपने ई–कचरे को नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों से बदलने का इरादा रखती/रखता हूँ ।			7	7	7	3.5	**1.00**
6.	मैं अपने इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों के लिए ई–कचरे की मरम्मत (रिपेयर) का इरादा रखती/रखता हूँ।			7	7	7	3.5	**1.00**
7.	मैं नवीनीकृत (रिफर्बिश्ड) इलेक्ट्रिकल एवं इलेक्ट्रॉनिक उत्पाद खरीदने का इरादा रखती/रखता हूं।			7	7	7	3.5	**1.00**
8.	मेरा परिवार और दोस्त मुझसे अपेक्षा करता है कि मैं अपने ई–कचरे (वेस्ट) का सुरक्षित प्रबंधन करूँ।	1	1	5	7	6	3.5	**0.71**
9.	मेरा कार्यस्थल मुझसे अपेक्षा करता है कि मैं अपने ई–कचरे का सुरक्षित प्रबंधन करूँ।	1	1	5	7	5	3.5	**0.43**
10.	मेरे अधिकांश मित्र और सदस्यों सोचते हैं कि ई–कचरे का प्रबंधन करना सही काम है।			7	7	7	3.5	**1.00**

11.	मेरे अधिकांश सहकर्मियों का मानना है कि ई–कचरे का प्रबंधन करना सही काम है।		1	6	7	6	3.5	0.71
12.	यदि मेरे परिवार और मित्र ई–कचरे का उचित प्रबंधन करेंगे, तो मैं भी ऐसा करूँगी/करूँगा!			7	7	7	3.5	1.00
13.	मेरी आवासीय सोसायटी मुझे ई–कचरा प्रबंधन प्रथाओं में भाग लेने के लिए प्रभावित करता है।			7	7	7	3.5	1.00
14.	ई–कचरा प्रबंधन जिम्मेदारी है।		1	6	7	6	3.5	0.71
15.	ई–कचरा प्रबंधन अच्छा है।		1	6	7	6	3.5	0.71
16.	ई–कचरा प्रबंधन लाभदायक है।		1	6	7	6	3.5	0.71
17.	ई–कचरा प्रबंधन आसान है।		1	6	7	6	3.5	0.71
18.	ई–कचरा प्रबंधन समझदारीपूर्ण है।			7	7	7	3.5	1.00
19.	ई–कचरा प्रबंधन लाभदायक है।			7	7	7	3.5	1.00
20.	ई–कचरा प्रबंधन संतोषजनक है।			7	7	7	3.5	1.00
21.	एक उपभोक्ता के रूप में, मैं ई–कचरा प्रबंधन प्रथाओं में सुधार के लिए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों की डिजाइनिंग और निर्माण प्रक्रिया में भाग लेना चाहूंगा।			7	7	7	3.5	1.00
22.	एक उपभोक्ता के रूप में, मैं ई–कचरा प्रबंधन प्रथाओं के बारे में जानकारी फैलाने में मदद करना चाहूंगा।			7	7	7	3.5	1.00
23.	मैं ई–कचरा प्रबंधन से संबंधित समाधान उपलब्ध कराने में विभिन्न हितधारकों (स्टेकहोल्डर्स) को सहयोग देना चाहूंगा।			7	7	7	3.5	1.00
24.	यदि मेरे पास ई–कचरा प्रबंधन के लिए उत्पाद और सेवा डिजाइन में सुधार करने का कोई अभिनव विचार है, तो मैं इसे कंपनी के साथ साझा करूंगा।		1	6	7	6	3.5	0.71
25.	यदि मेरे पास ई–कचरे के निपटान और प्रबंधन को बेहतर बनाने के बारे में कोई उपयोगी विचार है, तो मैं उसे कंपनी या समाज के साथ साझा करूंगा।		1	6	7	6	3.5	0.71
26.	एक उपभोक्ता के रूप में, यदि मुझे अवसर मिले तो मैं ई–कचरा प्रबंधन को समर्थन देने के लिए उत्पाद विकास के विभिन्न चरणों में उत्साहपूर्वक विचार प्रस्तुत करूंगा।		1	6	7	6	3.5	0.71

27.	एक उपभोक्ता के रूप में, मैं उन कंपनियों और उत्पादों का समर्थन करूंगा जो ई–कचरा प्रबंधन करते हैं।		1	6	7	6	3.5	0.71
28.	एक उपभोक्ता के रूप में, मैं अपने परिवार, समाज और कार्यस्थल में ई–कचरा प्रथाओं को सफल बनाने के लिए प्रतिबद्ध हूं।			7	7	7	3.5	1.00
29.	मुझे ई–कचरा प्रबंधन के बारे में जानकारी प्राप्त करना बहुत पसंद है।			7	7	7	3.5	1.00
30.	एक उपभोक्ता के रूप में, मैं उस कंपनी की प्रशंसा करता हूं जो ई–कचरा प्रबंधन का अभ्यास करती है।							
31.	एक उपभोक्ता के रूप में, मुझे बेहतर ई–कचरा प्रबंधन के लिए ई–उत्पाद / सेवा डिजाइन और विकास को प्रभावित करने से संतुष्टि मिलती है।			7	7	7	3.5	1.00
32.	एक उपभोक्ता के रूप में, ई–कचरा प्रबंधन प्रथाओं में मेरी भागीदारी मुझे मूल्यवान उपलब्धि की भावना प्रदान करती है।			7	7	7	3.5	1.00
33.	एक उपभोक्ता के रूप में, जब ई–कचरा प्रबंधन से जुड़े हितधारक अपने उत्पादों और सेवाओं को बेहतर बनाने के लिए मुझसे सुझाव मांगते हैं, तो मैं सकारात्मक प्रतिक्रिया देना पसंद करती / करता हूँ।			7	7	7	3.5	1.00
34.	ई–कचरे का प्रबंधन करना मेरी आदत बन गई है।	1		6	7	6	3.5	0.71
35.	मुझे एक आदत के तौर पर ई–कचरा प्रबंधन प्रथाओं में भाग लेना चाहिए।			7	7	7	3.5	1.00
36.	जब मैं कोई इलेक्ट्रॉनिक या इलेक्ट्रिकल उपकरण बदलता हूं, तो मैं पुराने उपकरण के निपटान के बारे में जानकारी ढूंढता हूं।		1	6	7	6	3.5	0.71
37.	मैं बिजली और इलेक्ट्रॉनिक उत्पादों को सामान्य (आम) कूड़ेदान में फेंक देता हूँ।		1	6	7	6	3.5	0.71
38.	मेरे द्वारा नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पाद केवल तभी खरीदे जाते हैं जब पुराने उत्पाद काम करना बंद कर देते हैं ।			7	7	7	3.5	1.00

39.	मैं इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों का निपटान (डिस्पोज) करते समय में पर्यावरण का ध्यान रखती/रखता हूँ।			7	7	7	3.5	**1.00**
40.	सरकार द्वारा शुरू किए गए कानून और नियम मुझे अपने ई–कचरे (वेस्ट) को सुरक्षित रूप से प्रबंधित करने के लिए प्रोत्साहित करते हैं।			7	7	7	3.5	**1.00**
41.	जब मैं नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पाद खरीदता हूं तो मैं यह सुनिश्चित करता हूं कि पुराने उत्पादों का उचित तरीके से निपटान (डिस्पोज) किया जाए।			7	7	7	3.5	**1.00**
42.	इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पाद खरीदते समय उत्पाद का टिकाऊपन एक महत्वपूर्ण कारक है।			7	7	7	3.5	**1.00**
43.	मुझे पता है कि अपने ई–कचरे का प्रबंधन कैसे करना है।			7	7	7	3.5	**1.00**
44.	मेरा मानना है कि मैं अपने ई–कचरे का प्रबंधन करने में सक्षम हूं।			7	7	7	3.5	**1.00**
45.	यह मुख्यतः मुझ पर निर्भर करता है कि मैं अपने ई–कचरे का प्रबंधन कर सकता हूं या नहीं।		1	6	7	6	3.5	**0.71**
								0.90

Source: Authors' own compilation

Table 3: Content Validity Index (CVI) for Hindi Scale Items

Item No.	Items	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7		Expert in Agree-ment (out of 7)	I-CVI	UA
1	मैं अपने ई–कचरे (वेस्ट) को रिसाइकिल करने का इरादा रखती/रखता हूँ।	1	1	1	1	1	1	1		7	1	1
2	मैं अपने ई–कचरे (वेस्ट) को पास के रिसाइकिलिंग स्टेशन पर छोड़ने का इरादा रखतीध्रखता हूँ।	0	1	1	1	1	1	1		7	1	1
3	मैं ई–कचरे (वेस्ट) को रिटेलर या निर्माता को वापस करने का इरादा रखती/रखता हूँ।	0	1	1	1	1	1	1		7	1	1

4	यदि आवश्यक हुआ तो मैं ई–कचरा रीसाइक्लिंग या प्रबंधन शुल्क का भुगतान करने का इरादा रखती/रखता हूँ ।	1	0	1	1	1	1	1		7	1	1
5	मैं अपने ई–कचरे को नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों से बदलने का इरादा रखती/रखता हूँ ।	1	1	0	1	1	1	1		7	1	1
6	मैं अपने इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों के लिए ई–कचरे की मरम्मत (रिपेयर) का इरादा रखती/रखता हूं।	1	1	1	1	1	0	1		6	0.857143	0
7	मैं नवीनीकृत (रिफर्बिश्ड) इलेक्ट्रिकल एवं इलेक्ट्रॉनिक उत्पाद खरीदने का इरादा रखती/रखता हूं।	1	1	1	1	1	0	1		6	0.857143	0
8	मेरा परिवार और दोस्त मुझसे अपेक्षा करता है कि मैं अपने ई–कचरे (वेस्ट) का सुरक्षित प्रबंधन करूँ।	1	1	0	1	0	1	1		5	0.714286	0
9	मेरा कार्यस्थल मुझसे अपेक्षा करता है कि मैं अपने ई–कचरे का सुरक्षित प्रबंधन करूँ।	1	1	1	0	0	1	1		5	0.714286	0
10	मेरे अधिकांश मित्र और सदस्यों सोचते हैं कि ई–कचरे का प्रबंधन करना सही काम है।	1	0	1	1	1	1	1		6	0.857143	0
11	मेरे अधिकांश सहकर्मियों का मानना है कि ई–कचरे का प्रबंधन करना सही काम है।	1	0	1	0	1	1	1		5	0.714286	0
12	यदि मेरे परिवार और मित्र ई–कचरे का उचित प्रबंधन करेंगे, तो मैं भी ऐसा करूँगी/करूँगा!	1	1	1	0	1	0	1		6	0.857143	0
13	मेरी आवासीय सोसायटी मुझे ई–कचरा प्रबंधन प्रथाओं में भाग लेने के लिए प्रभावित करता है।	0	1	1	0	1	1	1		5	0.714286	0
14	ई–कचरा प्रबंधन जिम्मेदारी है।	1	1	1	1	1	1	1		7	1	1
15	ई–कचरा प्रबंधन अच्छा है।	1	1	1	1	1	1	1		7	1	1
16	ई–कचरा प्रबंधन लाभदायक है।	1	1	1	1	1	1	1		7	1	1
17	ई–कचरा प्रबंधन आसान है।	1	1	1	1	1	1	1		7	1	1
18	ई–कचरा प्रबंधन समझदारीपूर्ण है।	1	1	1	1	1	1	1		7	1	1
19	ई–कचरा प्रबंधन लाभदायक है।	1	1	1	1	1	1	1		7	1	1
20	ई–कचरा प्रबंधन संतोषजनक है।	1	1	1	1	1	1	1		7	1	1
21	एक उपभोक्ता के रूप में, मैं ई–कचरा प्रबंधन प्रथाओं में सुधार के लिए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों की डिजाइनिंग और निर्माण प्रक्रिया में भाग लेना चाहूंगा।	1	1	1	1	1	1	1		7	1	1

22	एक उपभोक्ता के रूप में, मैं ई–कचरा प्रबंधन प्रथाओं के बारे में जानकारी फैलाने में मदद करना चाहूंगा।	1	1	1	1	1	1	1		7	1	1
23	मैं ई–कचरा प्रबंधन से संबंधित समाधान उपलब्ध कराने में विभिन्न हितधारकों (स्टेकहोल्डर्स) को सहयोग देना चाहूंगा।	1	1	0	0	1	1	1		5	0.714286	0
24	यदि मेरे पास ई–कचरा प्रबंधन के लिए उत्पाद और सेवा डिजाइन में सुधार करने का कोई अभिनव विचार है, तो मैं इसे कंपनी के साथ साझा करूंगा।	1	1	1	1	0	1	1		6	0.857143	0
25	यदि मेरे पास ई–कचरे के निपटान और प्रबंधन को बेहतर बनाने के बारे में कोई उपयोगी विचार है, तो मैं उसे कंपनी या समाज के साथ साझा करूंगा।	1	1	1	0	1	1	1		6	0.857143	0
26	एक उपभोक्ता के रूप में, यदि मुझे अवसर मिले तो मैं ई–कचरा प्रबंधन को समर्थन देने के लिए उत्पाद विकास के विभिन्न चरणों में उत्साहपूर्वक विचार प्रस्तुत करूंगा।	1	1	1	1	1	1	1		7	1	1
27	एक उपभोक्ता के रूप में, मैं उन कंपनियों और उत्पादों का समर्थन करूंगा जो ई–कचरा प्रबंधन करते हैं।	1	1	1	1	1	1	1		7	1	1
28	एक उपभोक्ता के रूप में, मैं अपने परिवार, समाज और कार्यस्थल में ई–कचरा प्रथाओं को सफल बनाने के लिए प्रतिबद्ध हूं।	1	1	1	1	1	1	1		7	1	1
29	मुझे ई–कचरा प्रबंधन के बारे में जानकारी प्राप्त करना बहुत पसंद है।	1	1	1	1	1	1	1		7	1	1
30	एक उपभोक्ता के रूप में, मैं उस कंपनी की प्रशंसा करता हूं जो ई–कचरा प्रबंधन का अभ्यास करती है।	1	1	1	1	1	1	1		7	1	1
31	एक उपभोक्ता के रूप में, मुझे बेहतर ई–कचरा प्रबंधन के लिए ई–उत्पादध्सेवा डिजाइन और विकास को प्रभावित करने से संतुष्टि मिलती है।	1	1	0	1	1	1	1		6	0.857143	0
32	एक उपभोक्ता के रूप में, ई–कचरा प्रबंधन प्रथाओं में मेरी भागीदारी मुझे मूल्यवान उपलब्धि की भावना प्रदान करती है।	1	1	1	1	1	1	1		7	1	1

33	एक उपभोक्ता के रूप में, जब ई–कचरा प्रबंधन से जुड़े हितधारक अपने उत्पादों और सेवाओं को बेहतर बनाने के लिए मुझसे सुझाव मांगते हैं, तो मैं सकारात्मक प्रतिक्रिया देना पसंद करती/करता हूँ।	1	1	0	1	1	0	1		5	0.714286	0
34	ई–कचरे का प्रबंधन करना मेरी आदत बन गई है।	1	1	1	0	1	1	0		5	0.714286	0
35	मुझे एक आदत के तौर पर ई–कचरा प्रबंधन प्रथाओं में भाग लेना चाहिए।	1	0	1	1	1	1	1		6	0.857143	0
36	जब मैं कोई इलेक्ट्रॉनिक या इलेक्ट्रिकल उपकरण बदलता हूं, तो मैं पुराने उपकरण के निपटान के बारे में जानकारी ढूंढता हूं।	1	1	1	1	1	1	1		7	1	1
37	मैं बिजली और इलेक्ट्रॉनिक उत्पादों को सामान्य (आम) कूड़ेदान में फेंक देता हूँ।	1	1	1	1	1	1	0		6	0.857143	0
38	मेरे द्वारा नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पाद केवल तभी खरीदे जाते हैं जब पुराने उत्पाद काम करना बंद कर देते हैं ।	1	1	0	1	1	0	1		5	0.714286	0
39	मैं इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पादों का निपटान (डिस्पोज) करते समय में पर्यावरण का ध्यान रखती/रखता हूँ।	1	1	1	0	1	1	1		6	0.857143	0
40	सरकार द्वारा शुरू किए गए कानून और नियम मुझे अपने ई–कचरे (वेस्ट) को सुरक्षित रूप से प्रबंधित करने के लिए प्रोत्साहित करते हैं।	1	1	1	1	1	1	0		6	0.857143	0
41	जब मैं नए इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पाद खरीदता हूं तो मैं यह सुनिश्चित करता हूं कि पुराने उत्पादों का उचित तरीके से निपटान (डिस्पोज) किया जाए।	0	1	1	1	1	1	1		6	0.857143	0
42	इलेक्ट्रिकल और इलेक्ट्रॉनिक उत्पाद खरीदते समय उत्पाद का टिकाऊपन एक महत्वपूर्ण कारक है।	1	1	1	1	1	1	1		7	1	1
43	मुझे पता है कि अपने ई–कचरे का प्रबंधन कैसे करना है।	1	1	1	1	1	1	0		7	1	1
44	मेरा मानना है कि मैं अपने ई–कचरे का प्रबंधन करने में सक्षम हूं।	1	0	1	1	1	1	1		7	1	1
45	यह मुख्यतः मुझ पर निर्भर करता है कि मैं अपने ई–कचरे का प्रबंधन कर सकता हूं या नहीं।	1	1	1	1	1	1	1		7	1	1

		41	40	39	37	42	40	41		**S-CVI/ Ave**	**0.9111**	**25**
	Proportion Relevance	0.554054	0.540541	0.527027	0.5	0.567568	0.540541	0.554054	0.541	**S-CVI/ UA (Universal Agree-ment)**		**0.34**

Source: Authors' own compilation

Part 3: Reliability

The reliability analysis was conducted to assess the internal consistency of the constructs measured in the Hindi version of the scale. In the present study, internal consistency was evaluated using data from 450 respondents, following the same methodological approach adopted in the original English version of the Holistic Consumer-Centric and Value Co-Creation Scale for E-Waste Management (Dave K et al., 2025, under peer review) and other scale development studies (Laeequddin et al., 2022). A respondent-to-item ratio of 10:1 was maintained. This help us to ensure how well the items of the scale are consistent to each other. However, for reliability testing, both males and females individuals were included. Only individuals aged 18 and above who could read and write in Hindi were included in the study.

Cronbach's Alpha values for the constructs ranged from 0.455 to 0.906, indicating acceptable to excellent reliability. The construct of Co-Creation (CoC) demonstrated the highest reliability with a Cronbach's Alpha of 0.906 across 13 items, reflecting excellent internal consistency.

Attitude (ATT) demonstrated strong internal consistency (α = 0.846) across seven items. Intention (INT) and Responsible Consumer Behaviour (RCB) also showed good reliability, with Cronbach's alpha values of 0.777 and 0.785, respectively. Subjective Norm exhibited acceptable reliability (α = 0.743) based on six items. In contrast, Perceived Behavioral Control (PBC) recorded a comparatively lower Cronbach's alpha value of 0.562 across three items, placing it at the lower boundary of acceptability. This reduced level of internal consistency may be attributed to the wording or interpretation of specific items within the construct.

For example, the statement "मेरा मानना है कि मैं अपने ई–कचरे का प्रबंधन करने में सक्षम हूं।" contains the term "प्रबंधन," which some participants reported as difficult to understand. Replacing this term with a simpler word such as "संभालने" could improve clarity; however, such modifications risk altering the original conceptual meaning. Moreover, during the back-translation process, this substitution created challenges in preserving conceptual equivalence with the original English version. Despite this issue, the overall reliability results indicate that most constructs in the scale are measured with satisfactory internal consistency, providing a reliable foundation for subsequent analyses.

STATISTICAL ANALYSIS

Descriptive statistics were used to summarize the demographic characteristics of the sample and to examine the distribution of the data. Measures such as means, standard deviations, frequencies, and percentages were computed for all relevant variables. Statistical analyses were performed using SPSS (version 26), while Microsoft Excel was used for data organization and preliminary management.

In addition to the above, Confirmatory Factor Analysis (CFA) and Structural Equation Modeling (SEM) were conducted using Smart_PLS (version 4). These analyses were carried out to assess the validity and reliability of the measurement model and to examine the relationships among the study constructs. The sample size was considered adequate to ensure sufficient statistical power, based on the commonly accepted respondent_to_item ratio of 10:1.

RESULTS

Descriptive Statistics:

The final sample consisted of 450 respondents, of whom 53.6% were male and 46.4% were female, indicating a relatively balanced gender distribution. Most respondents (47.6%) were aged between 18–30 years, followed by 31–40 years (32.0%), 41–50 years (13.3%), 51–60 years (5.6%), and above 60 years (1.6%). The mean age category of the respondents was 1.82 (SD = 0.97), indicating that the sample largely comprised young to middle-aged individuals.

With respect to educational qualification, most participants were graduates (59.8%) or held professional degrees (23.3%), while only a small proportion reported education below the high school level. In terms of occupation, the largest groups were professionals (31.8%) and unemployed respondents (33.6%), followed by those engaged in clerical work (11.3%) and sales or shop-related occupations (9.1%). Socioeconomic status analysis revealed that the majority of respondents belonged to the upper middle class (61.8%), followed by the lower middle class (20.4%) and the upper class (10.9%). Only a limited number of participants were classified under the upper lower (5.8%) or lower class (1.1%) categories. Marital status data showed that 48.9% of the respondents were married, while 49.1% reported being single, with only a small proportion being divorced or separated. Regarding family structure, 55.1% of participants lived in nuclear families, whereas 44.9% resided in joint family settings. Geographically, a slight majority of respondents were from the Delhi–NCR region (53.8%), while the remaining 46.2% were from Uttar Pradesh (Table 4).

Table 4. Socio-Demographic Profile of Respondents (N = 450)

Variable	Category	n (%)
Knowledge Level	Poor Knowledge	256 (56.9%)
	Good Knowledge	194 (43.1%)
Age Group	18–30 years	214 (47.6%)
	31–40 years	144 (32.0%)
	41–50 years	60 (13.3%)
	51–60 years	25 (5.6%)
	60 years and above	7 (1.6%)
Gender	Male	241 (53.6%)
	Female	209 (46.4%)
Education	Illiterate	1 (0.2%)
	Primary School	2 (0.4%)
	Middle School	2 (0.4%)
	High School	35 (7.8%)
	Intermediate/Diploma	36 (8.0%)
	Graduate	269 (59.8%)
	Professional Degree	105 (23.3%)
Occupation	Unemployed	151 (33.6%)
	Elementary Occupation	22 (4.9%)
	Craft and Trade Workers	11 (2.4%)

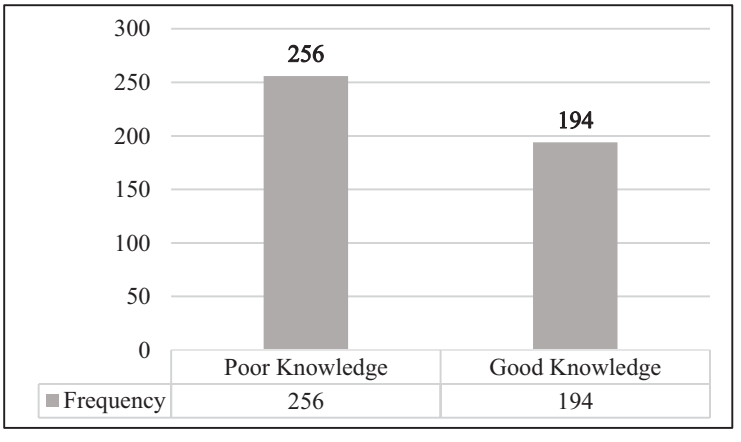
	Skilled Agricultural & Fishery Workers	2 (0.4%)
	Shop/Sales Workers	41 (9.1%)
	Clerk	51 (11.3%)
	Technicians/Associate Professionals	15 (3.3%)
	Professional	143 (31.8%)
	Legislators, Senior Officials, Managers	14 (3.1%)
Marital Status	Single	221 (49.1%)
	Married	220 (48.9%)
	Divorced	5 (1.1%)
	Separated	4 (0.9%)
Family Type	Nuclear	248 (55.1%)
	Joint	202 (44.9%)
Socioeconomic Status	Lower (V)	5 (1.1%)
	Upper Lower (IV)	26 (5.8%)
	Lower Middle (III)	92 (20.4%)
	Upper Middle (II)	278 (61.8%)
	Upper (I)	49 (10.9%)
State	Delhi–NCR	242 (53.8%)
	Uttar Pradesh	208 (46.2%)

Source: Authors' own compilation

Knowledge scores were calculated using participants' responses to seven Likert-scale items measuring awareness related to e-waste. Responses of "Agree" or "Strongly Agree" were coded as 1, representing adequate knowledge, while all other responses were coded as 0. The total knowledge score therefore ranged from 0 to 7. Based on these scores, participants were grouped into two categories: those scoring between 0 and 4 were classified as having poor knowledge, whereas those scoring between 5 and 7 were considered to have good knowledge.

Overall, 56.9% of the respondents were categorized under poor knowledge, while 43.1% demonstrated good levels of knowledge regarding e-waste (Figure 1).

Figure 1: Distribution of Respondents by Knowledge Level on E-Waste



PLS-SEM: The data were analyzed to examine the measurement properties of the study constructs and to test the proposed model. Partial Least Squares Structural Equation Modeling (PLS-SEM) was conducted using SmartPLS (version 4.0).

Factor Loadings and Item Retention: The initial measurement model consisted of 45 items across six constructs: Attitude (ATT), Subjective Norms (SN), Perceived Behavioral Control (PBC), Responsible Consumer Behavior (RCB), Co-creation (CoC), and Intention (INT). An examination of outer loadings indicated that five items (RCB4, RCB5, RCB9, CoC1 and INT1) had loading values below the recommended threshold of 0.60 and were therefore removed from further analysis (Hair et al., 2019). The remaining 40 items showed satisfactory factor loadings, with most values exceeding 0.70, suggesting adequate associations with their respective latent constructs. These results support the retention of the selected items for subsequent assessments of reliability and validity (see Table 5).

Table 5: Outer Loadings of Retained Measurement Items for Each Construct

ITEMS	OUTER LOADINGS
ATT1 <- ATT_Attitude	0.687
ATT2 <- ATT_Attitude	0.732
ATT3 <- ATT_Attitude	0.756
ATT4 <- ATT_Attitude	0.776
ATT5 <- ATT_Attitude	0.701
ATT6 <- ATT_Attitude	0.741
ATT7 <- ATT_Attitude	0.716
CoC1 <- CoC_Co-Creation	0.617
CoC2 <- CoC_Co-Creation	0.630
CoC3 <- CoC_Co-Creation	0.619
CoC4 <- CoC_Co-Creation	0.630
CoC5 <- CoC_Co-Creation	0.631
CoC6 <- CoC_Co-Creation	0.618
CoC7 <- CoC_Co-Creation	0.722
CoC8 <- CoC_Co-Creation	0.626
CoC9 <- CoC_Co-Creation	0.663
CoC10 <- CoC_Co-Creation	0.689
CoC11 <- CoC_Co-Creation	0.696
CoC12 <- CoC_Co-Creation	0.607
CoC_Co-Creation x INT_Intention -> CoC_Co-Creation x INT_Intention	1.000
INT1 <- INT_Intention	0.674
INT2 <- INT_Intention	0.709
INT3 <- INT_Intention	0.691
INT4 <- INT_Intention	0.614

INT5 <- INT_Intention	0.681
INT6 <- INT_Intention	0.687
PBC1 <- PBC_Perceived Behavioral Control	0.688
PBC2 <- PBC_Perceived Behavioral Control	0.794
PBC3 <- PBC_Perceived Behavioral Control	0.742
RCB1 <- RCB_Responsible Consumer Behaviour	0.767
RCB2 <- RCB_Responsible Consumer Behaviour	0.669
RCB3 <- RCB_Responsible Consumer Behaviour	0.771
RCB4 <- RCB_Responsible Consumer Behaviour	0.734
RCB5 <- RCB_Responsible Consumer Behaviour	0.769
RCB6 <- RCB_Responsible Consumer Behaviour	0.716
SN1 <- SN_Subjective Norm	0.814
SN2 <- SN_Subjective Norm	0.811
SN3 <- SN_Subjective Norm	0.782
SN4 <- SN_Subjective Norm	0.729
SN5 <- SN_Subjective Norm	0.672
SN6 <- SN_Subjective Norm	0.622

Source: Authors' own compilation

Convergent and Discriminant Validity: Convergent validity was examined using the Average Variance Extracted (AVE) values, as presented in Tables 6(A), 6(B), and 6(C). Most constructs recorded AVE values above the recommended threshold of 0.50. However, Co-creation (AVE=0.418) and Intention (AVE=0.458) showed slightly lower values. Despite this, Composite Reliability (CR) values for all constructs exceeded 0.70 and Cronbach's alpha values for the majority of constructs were also above 0.70, indicating acceptable levels of internal consistency and reliability.

Although the AVE values for Co-creation and Intention were marginally below the suggested cutoff, both constructs were retained due to their strong theoretical grounding and relevance within the context of responsible e-waste behavior. The 'Intention' construct represents key behavioral tendencies associated with responsible e-waste practices, including willingness to recycle, return products to retailers, pay for proper disposal, repair electronic devices and consider purchasing refurbished products. Similarly, 'Co-creation' reflects the extent to which consumers actively participate in improving e-waste management by sharing information, raising awareness and supporting environmentally responsible initiatives. These dimensions are central to understanding consumer engagement in sustainable e-waste practices. Therefore, despite the slightly lower AVE, the inclusion of these constructs was considered conceptually justified.

Discriminant validity was assessed using the Fornell-Larcker criterion and the Heterotrait-Monotrait (HTMT) ratio. The Fornell-Larcker results indicated adequate discriminant validity, as the square root of the AVE for each construct exceeded its correlations with other constructs. In addition, most HTMT values were below the recommended threshold of 0.85 (Henseler et al., 2015). The highest HTMT value was observed between 'Responsible Consumer Behavior' and 'Perceived Behavioral Control' (HTMT=0.882), slightly above the suggested limit. This result can be explained by the conceptual proximity of the two constructs, as individuals

who perceive greater control over their actions are more likely to engage in responsible e-waste behaviors. Overall, the findings provide sufficient evidence to support the discriminant validity of the measurement model and indicate that the constructs exhibit satisfactory psychometric properties.

Table 6 (A) Reliability and Convergent Validity of Constructs

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
ATT_Attitude	0.856	0.865	0.889	0.533
CoC_Co-Creation	0.874	0.881	0.896	0.418
INT_Intention	0.763	0.764	0.835	0.458
PBC_Perceived Behavioral Control	0.593	0.596	0.786	0.551
RCB_Responsible Consumer Behaviour	0.833	0.833	0.878	0.545
SN_Subjective Norm	0.836	0.851	0.879	0.551

Source: Authors' own compilation

Table 6 (B) Discriminant Validity – Heterotrait-Monotrait Ratio (HTMT)

ITEMS	Heterotrait-monotrait ratio (HTMT)
CoC_Co-Creation <-> ATT_Attitude	0.575
INT_Intention <-> ATT_Attitude	0.510
INT_Intention <-> CoC_Co-Creation	0.648
PBC_Perceived Behavioral Control <-> ATT_Attitude	0.532
PBC_Perceived Behavioral Control <-> CoC_Co-Creation	0.772
PBC_Perceived Behavioral Control <-> INT_Intention	0.601
RCB_Responsible Consumer Behaviour <-> ATT_Attitude	0.510
RCB_Responsible Consumer Behaviour <-> CoC_Co-Creation	0.731
RCB_Responsible Consumer Behaviour <-> INT_Intention	0.487
RCB_Responsible Consumer Behaviour <-> PBC_Perceived Behavioral Control	0.882
SN_Subjective Norm <-> ATT_Attitude	0.398
SN_Subjective Norm <-> CoC_Co-Creation	0.634
SN_Subjective Norm <-> INT_Intention	0.669
SN_Subjective Norm <-> PBC_Perceived Behavioral Control	0.494
SN_Subjective Norm <-> RCB_Responsible Consumer Behaviour	0.492

Source: Authors' own compilation

Table 6 (A) Reliability and Convergent Validity of Constructs

ITEMS	ATT_ Attitude	CoC_Co-Creation	INT_ Intention	PBC_ Perceived Behavioral Control	RCB_ Responsible Consumer Behaviour	SN_ Subjective Norm
ATT_Attitude	0.730					
CoC_Co-Creation	0.518	0.647				
INT_Intention	0.430	0.530	0.676			
PBC_Perceived Behavioral Control	0.400	0.575	0.411	0.743		
RCB_Responsible Consumer Behaviour	0.452	0.649	0.397	0.606	0.739	
SN_Subjective Norm	0.354	0.541	0.552	0.358	0.414	0.742

Source: Authors' own compilation

Collinearity Assessment and Model Fitness: As per the findings, collinearity among the indicators was examined using Variance Inflation Factor (VIF) values. All VIF scores were below the recommended threshold of 3.0, suggesting that multicollinearity was not a concern and that the parameter estimates of the model were not adversely affected. Here, the Model fit was assessed using the Standardized Root Mean Square Residual (SRMR), as reported in Table 7. The SRMR value for the saturated model was 0.075, while the estimated model yielded a value of 0.079. Both values fall within the acceptable range and remain below the suggested cut-off of 0.08 (Hu & Bentler, 1999), indicating a satisfactory fit between the proposed model and the observed data.

Table 7: Model fit summary

	Saturated model	Estimated model
SRMR	0.075	0.079
d_ULS	4.630	5.135
d_G	1.112	1.152
Chi-square	2801.483	2861.946
NFI	0.671	0.664

Source: Authors' own compilation

With respect to the explanatory strength of the model, the R^2 value for Intention was 0.392, while Responsible Consumer Behavior recorded an R^2 value of 0.424. These values indicate a moderate level of explanatory power, which is generally considered acceptable within social science research contexts (Hair et al., 2019). Effect size estimates (f^2) showed that Co-creation exerted a substantial influence on Responsible Consumer Behavior (f^2=0.463), whereas Subjective Norms demonstrated a medium effect on Intention (f^2=0.229).

In contrast, the effects of Attitude (f^2=0.059) and Perceived Behavioral Control (f^2=0.041) on Intention were relatively small, although still meaningful. The interaction between Co-creation and Intention in predicting Responsible Consumer Behavior yielded an f^2 value of 0.000, indicating a negligible interaction effect within the current model. Taken together, these results indicate that the structural model adequately captures the key relationships underlying consumer behavior in the context of e-waste management.

T-Statistics: Hypothesis testing

Table 8 presents the structural relationships among the study constructs, estimated using a bootstrapping procedure with 5,000 resamples. The significance of the hypothesized paths was evaluated based on the path coefficients and their associated t-values and p-values.

The results indicate that Attitude (β=0.213, t=4.716, $p < 0.001$), Subjective Norms (β=0.412, t = 9.438, $p < 0.001$), and Perceived Behavioral Control (β=0.178, t=3.981, $p < 0.001$) have shown statistically significant and positive influence on Intention. The results are consistent with the key assumptions of the Theory of Planned Behavior (TPB), indicating that individuals with more favorable attitudes, stronger social influences and higher perceived control are more likely to develop intentions toward responsible e-waste practices. In this context, Intention showed a marginally significant association with Responsible Consumer Behavior (β=0.074, t=1.700, p=0.089), suggesting that although intention remains a relevant predictor, its independent effect may be limited in the absence of additional facilitating factors. In contrast, Co-creation showed a strong and significant effect on Responsible Consumer Behavior (β=0.609, t=17.336, $p < 0.001$), highlighting the importance of collaborative engagement between consumers and service providers in encouraging sustainable e-waste management practices.

Table 8: Path coefficients and significance levels based on bootstrapping analysis

ITEMS	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
ATT_Attitude -> INT_Intention	0.213	0.214	0.045	4.716	0.000
CoC_Co-Creation ->	0.609	0.612	0.035	17.336	0.000
RCB_Responsible Consumer Behaviour					
CoC_Co-Creation x INT_ Intention -> RCB_Responsible Consumer Behaviour	0.001	0.001	0.024	0.028	0.978
INT_Intention -> RCB_ Responsible Consumer Behaviour	0.074	0.076	0.043	1.700	0.089
PBC_Perceived Behavioral Control -> INT_Intention	0.178	0.182	0.045	3.981	0.000
SN_Subjective Norm -> INT_Intention	0.412	0.414	0.044	9.438	0.000

Source: Authors' own compilation

DISCUSSION

The present study focused on translating and validating a consumer-oriented scale for e-waste management from English to Hindi, using an extended Theory of Planned Behavior (TPB) framework. Effective data collection depends largely on the use of language that respondents can easily understand and relate to. In a multilingual context such as India, the availability of research instruments in regional languages like Hindi is particularly important for ensuring wider participation across different socio-demographic groups. Using

culturally and linguistically adapted tools allows participants to better comprehend the survey items and respond more accurately, thereby improving the overall quality and reliability of the data, especially in settings where proficiency in English may be limited.

In this study, the 'Holistic Consumer-Centric and Value Co-Creation Scale for E-Waste Management' was translated and validated in Hindi to facilitate broader participation among respondents. The translation followed established and standardized procedures to maintain both conceptual integrity and contextual relevance. As noted by Kalgren et al. (2021), cross-cultural scale translation is not a simple word-for-word exercise; rather, it involves balancing fidelity to the original theoretical framework with the need for clarity and comprehensibility for the target population.

Based on cognitive interviews and validity assessments, several refinements were introduced. These included simplifying complex expressions, incorporating gender-neutral language and retaining certain commonly used English terms in cases where suitable Hindi equivalents were either unclear or overly technical. These adjustments were intended to improve participant comprehension while preserving the original meaning of the scale items.

Psychometric evaluation of the Hindi version was carried out using data from 450 participants. The findings indicated satisfactory internal consistency, reliability and structural validity of the scale. Cronbach's alpha and composite reliability values across all constructs were within acceptable ranges, reflecting a strong level of internal consistency. Furthermore, the Average Variance Extracted (AVE) values provided support for convergent validity, indicating that the scale items adequately captured their respective constructs. The structural equation model also showed satisfactory fit, with SRMR values below 0.08. In terms of predictive strength, the R^2 values suggested a moderate level of explanation for both Intention ($R^2 = 0.392$) and Responsible Consumer Behaviour (RCB) ($R^2=0.424$). Taken together, these results indicate that the measurement and structural properties of the scale remain stable in the Hindi version and that the underlying theoretical relationships are applicable within the Hindi-speaking context.

Among the path coefficients, Attitude ($\beta = 0.213$, $p < 0.001$), Subjective Norm ($\beta = 0.412$, $p < 0.001$), and Perceived Behavioral Control ($\beta = 0.178$, $p < 0.001$) significantly predicted Intention. In contrast, Intention showed a relatively weaker association with Responsible Consumer Behaviour ($\beta=0.074$, $p=0.089$), while Co-creation emerged as a strong predictor of Responsible Consumer Behaviour ($\beta=0.609$, $p<0.001$). This pattern indicates that although intention contributes to responsible e-waste behavior, participatory and collaborative engagement through co-creation plays a more influential role in encouraging such practices.

The patterns observed in this study are consistent with the literature published on e-waste awareness in the Indian context. For example, studies by Borthakur and Govind (2015, 2018) and Dwivedy and Mittal (2013) have reported that a large proportion of consumers lack adequate awareness of the risks associated with e-waste and appropriate disposal practices, which in turn influences their willingness to recycle. In the present study findings, participants often described e-waste management using terms such as “responsible,” “sensible,” and “beneficial,” yet noticeable gaps in knowledge were still evident. Respondents with higher levels of awareness were more likely to engage in responsible recycling behaviors, reflecting similar trends reported by Kumar et al. (2017). This suggests that targeted awareness initiatives remain essential for addressing regional and demographic disparities in e-waste understanding. Furthermore, including co-creation as a construct offers a more forward-looking perspective on consumer engagement by shifting attention from passive awareness to active involvement in environmental problem-solving. This perspective is grounded in the concept of value co-creation proposed by C. K. Prahalad and Venkat Ramaswamy (2004), and later extended by Stephen Frow et al. (2011), where consumers are viewed as contributors to value creation rather than mere end users. In this sense, sustainable consumption is shaped not only by individual awareness but also by collective participation in developing practices and innovations aimed at reducing waste.

Extending such frameworks across linguistic and cultural contexts further strengthens the case for using locally adapted research instruments, a position also supported by Kalgren et al. (2021), who emphasize the importance of contextual sensitivity in scale translation.

Finally, the validated Hindi version of the scale helps address an important gap by offering a reliable and context-sensitive instrument for research, public education, awareness initiatives, and policy-related work in the area of e-waste management. Beyond serving as a translated measure, the scale provides a practical means of identifying consumer groups or communities where limitations in awareness and responsible behavior are more prevalent. This allows researchers and practitioners to better locate segments that may require greater attention or support. The scale can also be used in future studies to design targeted interventions, particularly in settings where existing waste management practices remain weak or fragmented. Instead of adopting a generalized, one-size-fits-all approach, the availability of evidence-based insights enables more focused and context-specific actions. In this way, the scale has the potential to contribute to the development of practical and locally relevant solutions, especially in regions facing persistent challenges in e-waste management. Through this, the scale extends beyond the measurement of attitudes and behaviors by offering a means to inform progress toward more sustainable practices. It also aligns with broader global priorities, particularly Sustainable Development Goals 11 and 12, which emphasize sustainable urban development and responsible patterns of consumption and production (United Nations, 2023).

CONCLUSION

The study presents a validated Hindi version of the Holistic Consumer-Centric and Value Co-Creation Scale for e-waste management, providing empirical support for its reliability and validity within the sampled population. The scale offers a structured way to examine how consumers perceive and engage with e-waste related practices, thereby contributing to a deeper understanding of responsible consumer behavior in this context. Further application of the scale across larger and more diverse populations would help strengthen its generalizability and practical relevance. Such efforts may support researchers, educators, and policymakers in developing more inclusive and context-sensitive strategies for improving awareness and participation in e-waste management.

LIMITATION

The findings of the study should be interpreted with certain limitations in mind. The validation of the Hindi version of the scale was carried out using a specific sample, which may not fully represent the diversity of perspectives and behavioral patterns across different regions and cultural contexts in India. Consequently, the findings cannot be generalized to all populations or settings.

Expanding the use of the scale to larger and more diverse samples across multiple geographical areas would help improve its broader relevance. In addition, adapting the scale into other regional languages could further improve its applicability and usefulness in India's multilingual research landscape.

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