

Mindful Technology Use And Sustainable Economic Behavior: A Moderated Mediation Model

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Abstract

Electronic waste is a significant barrier to a sustainable economy and the consumer is among the key players of e-waste snags. Electronic device consumption has seen rapid growth in the recent past. The challenge of a massive upsurge in electronic waste needs to be thoroughly studied from the perspective of consumer behavior to identify an appropriate approach to realize a sustainable economy. The study proposes a moderated-mediation framework to describe, the direct or indirect impact of consumers' consumption (mediated by disposal and moderated by the age of consumer) of electronic devices on mindfulness and inclination to have a sustainable economy. We undertook a quantitative study on 260 survey responses from the youthful users of electronic devices. We applied PLS-SEM methodological approach to test the moderated-mediation model that explains the relation between consumption behavior, mindfulness, and sustainable economy inclination. The findings identify an indirect positive and significant impact of usage on mindfulness and moderated by consumer's age. A significant research outcome indicates that consumers are advocating for a considerable transformation in current e-waste management methods. The research holds significant relevance for sustainable economy researchers and managers who seek to understand the social dimensions of sustainable economy changes, sustainable manufacturing, and consumption.

Keywords: Electronic waste; sustainability; mindfulness; economy; consumption behaviour.

1. INTRODUCTION

Electronic waste is a significant barrier to a sustainable economy. 7.5 percent (4.6 million tons) of total e-waste is generated by electronic devices, with only a 22 percent formal collection and recycling rate (Global E-Waste Monitor, 2024). The consumption of electronic devices has seen rapid growth in the recent past (Bekaroo et al., 2018), anticipating 9 billion smartphone connections and 6.3 billion unique mobile subscribers by 2030 (GSMA, 2023). This is attributed to consumer expectations, social stature, and technological progression (Radi, S. A., & Shokouhyar, S., 2021). The consumer is among the key players in e-waste snags. With the increasing demand for electronic devices, consumers' environmental & health mindfulness, and actions are the important aspects (Parajuly et al. (2019). The consumers play the initiating role where e-waste takes up different routes within the circular /sustainable economy. This includes different ways to use, repair, reuse, remanufacture, and recycle. Primarily, inappropriate e-waste disposal by consumers results in landfills, posing a severe challenge to the environment as well as human health. The challenge of a massive upsurge in e-waste needs to be thoroughly studied from the perspective of

consumer behavior to identify an appropriate approach to realize a sustainable economy.

A circular/sustainable economy is a business economy, which is regenerative by intention and design, contemplating the environmental and economic returns (Ellen Macarthur Foundation, 2013). It is a multifaceted socio-economic system that has consumers among the major players and product design, service design, business models, reverse logistics and policy are the key components (Ellen Macarthur Foundation, 2015). A major chunk of environmental footprints in product life cycles is caused by consumer goods (Koide et al., 2021a, 2021b). The European circular economy plan focuses on closing the material loops and supporting resource reduction, reuse, and recycling to bring enhanced circularity to the production-consumption system and waste management (EU, 2019). E-waste holds a high likelihood for reusability and recovery of valued material (Parajuly and Wenzel (2017), which has a diverse range of electronic devices. A diverse product range and consumers' use & disposal make an interwoven system of sustainable economy with e-waste management. The producers must manage the waste, especially e-waste because the making of

electronic devices includes chemicals responsible for polluting the environment directly due to the release of harmful gases (Rajesh et al., 2022). Currently, consumers' consumption, disposal, and reuse behavior of electronic devices is gaining attention of the researchers and policymakers worldwide. In a socio-economic setup, consumers' familiarity and awareness about the buying and disposal of e-waste constitute a major aspect of health and environmental sustainability. The buying decision of the electronic devices can be determined by factors related to consumer characteristics like gender, age, need, desire to have the latest device, social status, motivation, awareness, and attitude; and factors related to device characteristics such as price, brand reputation, environmental impact, features, and lifespan (Xiong et al., 2020). The frequency of change/buying of electronic devices by consumers, subsequently, results in the piling up of outdated devices or increased disposal or reuse. It is a matter of great concern how the electronic devices get disposed of. This, in turn, depends on the level of awareness of the various disposal platforms (home garbage, certified scrap collector, exchange with a new device, or e-bins), and consumers' disposal behavior owing to their mindfulness towards health and environment sustainability. The majority of the population discard their electronic device in garbage bags at their home, exchange them with new devices, or keep them as backups. They are unaware of e-waste and its management (Zafar & Armughan, 2023). According to the UN Report (2021), e-waste generation will be 120 million tons per year by 2050 as compared to 62 million tons in 2022, which grew by 82 percent from 2010. If the current pattern of generating e-waste continues, each person will produce 12.24 kg of e-waste in 2050 as compared to 7.6 kg in 2021. E-waste is responsible for a loss of more than US\$ 57 billion per annum while disposing of the main raw ingredients such as gold, cobalt, copper, etc. (United Nations University, 2023). Due to limited recycling infrastructure, high costs, and lack of enforcing regulations, less than 20 percent of e-waste is properly recycled and more than 80 percent goes either in landfills or in developing countries where workers are exposed to toxic and dangerous material (WHO, 2023). Harmful chemicals and metals in the air cause respiratory problems, cancer, and birth defects in nearby people (Bakhiyi, B. et al., 2018), alongside the adverse effects on flora and fauna. Every electronic device owned by a consumer has ten times more CO₂ emissions of its weight causing global warming (Singh, N., & Ogunseitan, O. A., 2022). Thus, consumers' mindfulness towards health, the environment, and inclination to have a sustainable economy is the key.

There is growing interest in comprehensive research on sustainable economy (Friant et al., 2021) and substantial literature is available that relates to the indispensable role of consumers in realizing the circular/sustainable economy agenda (Greene, 2024). Developed countries like the Netherlands, Canada, China, and South Korea are promoting circular economy policies but developing countries like India need to take up the task at an extensive mode to understand the impact of consumption behavior on mindfulness and sustainable economy inclination, which is a main constituent of any framework seeking to catalyze a sustainable change. Our research focuses on the concept of a sustainable economy from the viewpoint of mindful consumption and disposal of electronic devices. It is our firm argument that understanding the direct or indirect impact of consumers' consumption of electronic devices on mindfulness and inclination to have a sustainable economy is one of the essential parameters in overcoming obstacles to achieving circular transformation goals. The key research questions (RQs) for the study in hand are:

RQ 1: How does the consumption behavior pertinent to electronic devices consumption, and disposal (e-waste) contribute directly or indirectly to consumer mindfulness and sustainable economy inclination in achieving a sustainable economy?

RQ 2: How does the overall understanding of consumers' buying frequency, buying mode, disposal patterns of electronic devices, and health and environment sustainability awareness contribute to finding possible future policy measures, in developing countries like India, for a sustainable economy?

Hence, this study proposes a moderated-mediation framework to describe, the direct or indirect impact of consumers' consumption (mediated by disposal and moderated by the age of consumer) of electronic devices on mindfulness and inclination to have a sustainable economy. We undertook a quantitative study and applied PLS-SEM to assess the moderated-mediation model that explains the relation between consumption behavior, mindfulness, and sustainable economy inclination. Our research holds significant relevance for sustainable economy researchers and policymakers who seek to understand the social dimensions of sustainable economy changes.

The study is organized as theory and hypotheses building, the methodology, results, and in-depth analysis and discussion, ending with the conclusion.

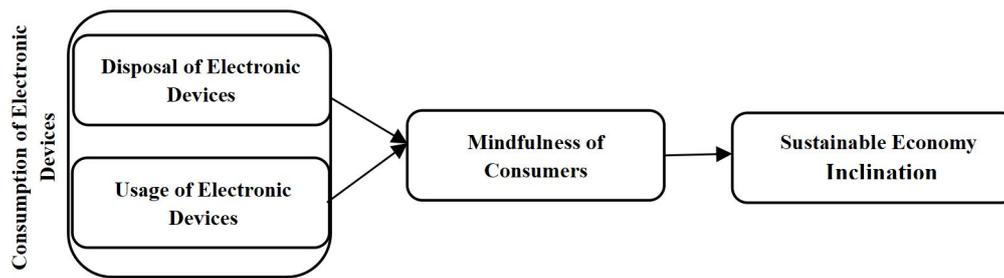


Figure 1: Theoretical Framework Consumption of Electronic Devices, Mindfulness of Consumers, Sustainable Economy Inclination

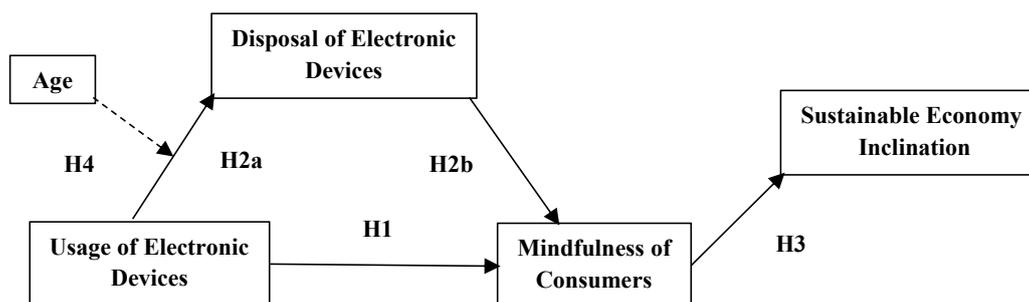


Figure 2: Researchers' Hypothetical Model

Theory and Hypothesis Development

Theoretical support

The theoretical framework for this study is given in Figure 1. The proposed model used the Theory of Planned Behavior (TPB). One of the foremost theories, TPB (Ajzen, 1991) is widely used in analysis techniques along with structural equation modeling (SEM) statistical technique. TPB revolves around the main theme that a plan of doing something leads to a higher likelihood of getting things done, a self-interest motive leading to human behavior. TPB explains intention as a result of three processes vis-à-vis behavioral attitudes, subjective norms, and perceived behavioral control. Many authors have explained consumer behavior towards e-waste in their research. Different aspects of consumers behavior on e-waste like recycling behavior (Liu et al., 2019; Kumar, 2019; Nguyen, 2018; Wang et al., 2019; Papaoikonomou et al., 2020; A.L. Arain et al., 2021), disposal behavior (Nduneseokwu et al., 2017; Shaharudin et al., 2020; Islam et al., 2020), selling behavior (Yuan et al., 2020; Kumar, 2017), hibernating behavior (Kurusu et al., 2020) have been explored by the researchers using TPB theory. The previous literature shows the studies on the impact of different antecedents on different pro-environmental behaviors of consumers. The advancement of TPB i.e. the Theory of Reasoned Action, explains the intentions as the best predictors of behaviors. Therefore, TPB theory explains variables like Usage, and disposal practices as behavioral attitudes, buying decisions and buying influence as subjective norms, health and environment mindfulness, disposal pattern, and

sustainable economy inclination, as perceived behavior in the current study.

The concept of a sustainable/circular economy has gained considerable attention in recent years, with numerous studies examining various aspects of sustainability across different industries. Zambon et al. (2018) stress the importance of integrating economy, landscape, and energy within the viticulture sector to rethink sustainability. Moktadir et al. (2018) found the key factors of sustainable manufacturing in various industries taking circular economy into account. These factors are helpful for the managers to design resource utilization and waste reduction strategies. Whereas, Millar et al. (2019) talked about the challenges related to circular economy and sustainable development in the previous studies. The issues like definition, growth, and implementation of the concept diminishes the true effectiveness of circular economy as a sustainable development tool. Shamsi (2020) highlights that there is a need for management of waste generated by consumed textile. The study underscored the importance of awareness of circular economy especially in the countries like India, leading to increasing investment in the sustainable technologies. Laukkanen et al. (2020) examined that sharing economy business models have the great potential in terms of sustainable value creation, classifying the models prescribing the method for analyzing the potential of sustainable value. Velenturf et al. (2021) described a framework and principles for a sustainable circular economy. The study highlights the significance of optimized usage of resources.

Falcone et al. (2021) explained the value of affordable and clean energy and its role in achieving the sustainable development goals. Veith et al. (2022) explained the drivers of influencing the green economy. The study is based on the responses of Romanian users. Kumar et al. (2022) discussed the application of blockchain technologies to fight with the shortcomings with the implementation of circular economy concept. Brglez et al. (2023) analyzed the relevance of interconnections of circular cities and the circular economy. The study showed light on recent trend in research. Though, the above-mentioned studies highlighted the importance of optimum resource utilization, waste management and technological innovations to increase the effectiveness of sustainable economy. The focus of present study is to understand the impact of the pattern of purchase, use, and dispose on the inclination towards a sustainable economy.

Study Variables

Consumption of Electronic Devices

Usage of electronic devices

Often, shoppers find themselves purchasing new gadgets for certain reasons, while others buy them for entertainment. The major antecedents for the frequent replacement of electronic devices with new ones are the rapid economic growth of a country, the increasing income of consumers, technological innovations, enhanced consumer demand and market for electronic devices, short life cycle, and lesser repairability of electronic devices (Caii, et al., 2020; Arain et al., 2020; Shaikh et al., 2020). A positive trend in increased device utilization was observed as a result of government initiatives in ICT development (Rodrigues et al., 2020). Consequently, the current research considers the usage of electronic devices as an independent variable, which elucidates the purchasing frequency and the mode of purchase (new, used, or refurbished).

Disposal of electronic devices

There are numerous alternatives available to consumers for the disposal of unwanted electronic devices. They are generally afforded a plethora of alternatives. The socio-economic circumstances of the consumer determine the options available, which range from temporary storage at home to disposal in the trash bin/open (Arain et al., 2020; Rodrigues et al., 2020; Wieser and Troger, 2018) or the use of e-bins or authorized scrap collectors (Hamdan and Saidan, 2020). The majority of consumers disposed of their e-waste to informal e-waste collectors and recyclers (Singh et al., 2018). Ramzan et al. (2020) assert that consumers' disposal practices significantly influence their selection of the most recent technology, as well as their intentions regarding health and the environment. Word of mouth considerably

influences the consumer's e-waste disposal behavior, and a substantial number of consumers were unaware of the appropriate disposal location (Gilal et al., 2019). Therefore, the disposal pattern of electronic devices is an independent variable that may serve as a mediator in the current study between the consumption of electronic devices and consumers' mindfulness.

Mindfulness and Sustainable Economy Inclination

A change in human behavior is the key factor which will lead to a sustainable world. It is impossible to achieve a comprehensive sustainable development when talking about waste because it has to take into account the way we consume, manufacture, sustain, and dispose of products and services (Kumar et al., 2021). Therefore, in order to guarantee individual sustainability, a completely different set of human behaviors and social priorities should be instituted (Dayan et al., 2019). Brown and Ryan (2003) give a definition of mindfulness as the advanced awareness and comprehension of one's present experiences or reality. Mindfulness can help individuals take on sustainable habits (Shahbaz and Parker, 2022; Sawyer et al., 2022), inspire changes in consumption (Gupta et al., 2023), and may even lead to an increase in the number of people who vote for a sustainable economy. Thus, the present study takes into account not just the environmental impact of electronic device consumption but also the mindfulness of one's health, as the dependent variable that contributes to the inclination toward a sustainable economy.

Hypotheses Development

Electronic Devices and Sustainable Economy Inclination

The discussion of electronic devices and sustainable economy orientation literature implies the necessity of using technology to care for the environment. Jadro (2017) shows the case of using onboard diagnostic devices to broadly signal fuel economic behaviors in reverse, and that such interventions combining feedback and goal setting can lift fuel efficiency significantly. Biswas et al. (2021) draw attention to the need for energy storage devices that are green and inexpensive for the benefit of society, pointing to the development of the global energy solutions through the use of renewable resources. The power of Generation Z on the environmental issue is also apparent. An article cites a research poll (How Gen Z's Sustainability Concerns Are Influencing Others, 2022) which asserts that this generation chooses the sustainable buying option even if it means a higher price, thus indicating a shift towards ecologically aware consumer behavior. This corresponds to the efforts of the European Commission to boost the activities sustainability through the EU taxonomy (European Commission, 2023) and the financing of sustainable projects

(European Commission, 2023). Moreover, the mixed feelings of consumers regarding the sustainability labels have undergone scrutiny in a concurrent study led by McKinsey and NielsenIQ (McKinsey, 2023) which points out that there is a massive increase in the demand for environmentally and socially responsible products as they are the main factor in the sales growth. Google's sustainability projects (Google Sustainability, n.d.) are indicative of the company's resolve to produce a beneficial environmental effect through the application of technology. The literature thus reviewed, meanwhile, highlights the more and more pronounced sustainability demand across different industries, including but not limited to electronics and ICT (European Commission, 2023), as a part of larger initiatives towards achieving climate-neutral and sustainable economic growth.

Using electronic devices and mindfulness attitude for sustainable economy inclination

The environmental challenge posed by the growing demand for electronic devices throughout the world has led to a corresponding increase in the amount of electronic waste that is generated. Lauwereins (2010) states that through the making of electronic devices 'invisible' and 'autonomous' one can connect everything in a real way. O'Connor et al. (2016) point out the supply chain of materials in the electronics industry as an unsustainable one, thus, suggesting the adoption of innovations in Green Engineering for a circular economy and resolving issues concerning sourcing of materials. Jadro (2017) brings in the example of the use of onboard diagnostic devices that give feedback on driving habits as they relate to fuel efficiency, indicating that technology can motivate people to use the car less and thus, not only save money but also reduce the carbon footprint. The same line of thought is echoed by Benfenati et al. (2019) who examine the use of silk fibroin as an interface in making biocompatible electronic devices for advanced biomedical applications thus proving that eco-friendly materials can be used in more areas of technology than expected. Parvin et al. (2021) analyze e-commerce technology's influence on the upscale of small and medium-size businesses stating that the engagement of electronic devices can increase productivity and speed up business transactions leading to a sustainable economy. In addition, Moraes et al. (2020) focus on the applications of two-dimensional metal oxide nanomaterial in the field of renewable energy, thus establishing that the new materials may play a vital role in the development of energy technologies. Chakraborty et al. (2022) and Srivastav et al. (2023) look into waste reduction and management of electronic wastes through sustainable materials, resource-efficient production and the implementation of circular economy concepts,

respectively. These studies underscore the importance of integrating sustainability principles into electronic device use to promote a more sustainable economy.

In general, these studies indicate the increasing trend of electronic devices usage and imply the necessity to explore the correlation between electronic devices usage and sustainable economy inclination. The literary works treating the subjects of electronic devices and mindfulness as the means to support a green economy highlight the need for Chakraborty et al. (2022) discuss possible solutions and the benefits the sustainable materials and resource-efficient manufacturing processes may bring. Carrasco-Peña et al. (2022) describe using upcycled materials, including polyethylene terephthalate (PET), to produce the substrates of electronic devices that are eco-friendly. Studies focused on eco-friendly behavior and consumption point out the positive impact of tech, such as computers, on sustainability promotion (The Psychology of Sustainable Behavior, 2009). Paavola (2001) underlines the need for changing consumers' habits towards sustainability in the case of electric and electronic products especially. Besides, the research into marketing sustainable fashion (Marketing Sustainable Fashion, 2023) and the cultivation of sustainability consciousness through mindfulness (Cultivating Sustainability Consciousness Through Mindfulness, 2023) point out that the implementation of mindful consumption practices is necessary for the realization of a circular economy. The engagement of brands such as Samsung Electronics in sustainability programs (Samsung Electronics Sustainability Report, 2023) and the rise of the eco-conscious consumers (The Rise of the Eco-Friendly Consumer, 2021) all indicate a growing consciousness about the role of sustainability in the economy. Being aware of the factors that motivate mindful consumption.

Appreciating the behavioral drivers of mindful consumption (Understanding the Behavioral Drivers of Mindful Consumption, 2024) and tackling materialistic values in the quest to a more sustainable economy (The Problematic Role of Materialistic Values in the Pursuit of Sustainability, 2022) is a step in the right direction where electronic devices and mindfulness can be used to achieve a more sustainable economy.

Electronic Devices Recycling and Sustainable Economy Tendency

The discussion of the purchasing and disposal patterns of electronic devices and the transition to a sustainable economy point to the necessity of making the use of sustainability in product consumption and disposal by establishing a sense of sustainability in consumer behavior (5) Sustainability in purchasing electronic devices may

result in the adoption of a more sustainable and inclusive economy as a beneficial trend. (5) The attitude of the consumer towards electronic waste is essential in understanding the buying and disposal habits of the electronics products (6) The consumer wishes to make the environment better and minimize production waste by their buying behaviors (7). Companies like Samsung Electronics are implementing sustainability initiatives, such as waste-decomposing devices in employee lounges, to manage chemicals-related activities from purchasing to disposal. (8) Second-hand shopping is gaining popularity, especially among higher-income individuals, as a sustainable alternative to buying new appliances and electronic devices. (9) In the context of the metaverse, a stable and sustainable economy can lead to the integration of real-world goods into the virtual space, contributing to market growth and sustainability efforts (10).

Therefore, we propose that:

H1: Usage of electronic devices has an impact on the mindfulness of consumers and sustainable economy inclination

H2(H2a, H2b): Disposal of electronic devices mediates the impact of usage of electronic devices on the mindfulness of consumers.

H3: Mindfulness of Consumers impacts sustainable economy inclination.

H4: Age moderates the relationship between the usage of electronic devices and the disposal of electronic devices.

2. RESEARCH METHODOLOGY

Non-probabilistic sampling is implemented in this investigation to implement a descriptive and quantitative methodology. The primary data was obtained from youthful respondents who own and use one or more electronic devices on a regular basis. Close-ended questions on a 1-5 Likert scale were implemented in the survey. The data were

analyzed for reliability, convergent validity, discriminant validity, Fornell Larcker Criteria, HTMT analysis, and hypotheses testing, with 260 responses collected. In order to guarantee its reliability and validity, the authors devised and pretested the questionnaire. Because the research is concentrated on the latent variable of sustainable economy inclination and identifies the directionality of relationships between various variables, PLS-SEM was employed to analyze the data. Detailed information regarding the instrument's components utilized in the investigation is presented in Table 1.

Participants

This study employed a non-probabilistic sampling of a total of 260 participants in the National Capital Region of India, who contributed anonymously and voluntarily (Mean age = 28.5; SD = 1.42). The data collection was controlled in two phases. A pre-screening survey was administered to a pool of convenient samples, aimed to know the potential respondents based on the criterion of possession of one or multiple electronic devices. This methodological approach ensured that only individuals using the electronic devices were administered the survey for the current study. 300 respondents completed the pre-screening survey followed by participation of 260 out of 300 identified respondents, to investigate the research constructs. The final sample of 260 respondents was distributed as 167 males and 93 females and mean age of 28.5 years. There were 120 postgraduates, 30 graduates, and 101 undergraduates with the remaining 9 falling into the other category of educational profile of respondents. All 260 respondents owned electronic devices such as smartphones(158), laptops(77), smartwatches(43) and tablets(22). They also had internet access devices. Table 2 gives summary of the study sample.

Table 1: Constructs and respective items used in the study

Constructs	Items of Instrument of Research
USE	
BUF1	Buying Frequency
BUM1	Buying Mode
DISPOSAL	
DISPO1	Disposal
MINDFULNESS	
MINDF11	awareness of the harmful impact of electronic devices on health
MINDF12	awareness of the harmful impact of electronic devices on the environment
SUSTAINABLE ECONOMY INCLINATION	
SEI_1 SEI_2 SEI_3	importance of awareness programs use of refurbished products mindful/ responsible disposal
BUD1 Buying decision factors	Price

Constructs	Items of Instrument of Research
BUD11 BUD12 BUD13 BUD14 BUD15 BUI1 Buying decision influence BUI11 Own need BUI12 tendency to buy similar products BUI13 desires to spend money BUI14 desires to have the latest device	Brand reputation Environmental impact Product Features Life span

In order to ascertain the attitudes and perceptions of the respondents regarding each construct, which consisted of a total of 19 items, respondents were asked to provide their responses using a five-point Likert scale. The scale ranged from least preferred/important/fully not aware/never (1) to most preferred/important/fully aware/always (5). This scaling method enhances the analytical accuracy of the study by simplifying a straightforward comprehension of the data.

Statistical instrument

The relationships between the components of sustainable economy inclination and the moderated-mediation effects of the age of the user and disposal of electronic devices were identified in the study using SmartPLS4.0 for applying PLS-SEM. PLS-SEM is used for exploratory research analysis. The current study uses a variance-based SEM statistical method (Hair, 2017). PLS-SEM illustrates the relationship between the constructs. PLS-SEM's evaluation is indicated by the measurement model and the structural model. The reliability and validity of the measurement model are verified and the structural model is examined.

Table 2: Characteristics of the study sample

Sample Characteristics			
	Number		Percent
AGE			
15-18	40		15.4
19-21	80		30.8
22-25	55		21.2
26-35	20		7.7
above 35	65		25.0
GENDER			
Male	167		64.2
Female	93		35.8
EDUCATION			
Under-graduate	101		38.8
Graduate	30		11.5
Post-graduate	120		46.2
Other	9		3.5
OCCUPATION			
Student	171		65.8
Employee	53		20.4
Entrepreneur	14		5.4
Other	22		8.5

3. RESULTS

The structural models and measurement models are used to verify the validity and reliability, along with mediation and moderation analyses to comprehend the findings.

Assessment of the measurement model

The reliability and validity were assessed by comparing the Cronbach's alpha (CA) and composite reliability (CR) values within the 0.70 to 0.90 range, which is considered satisfactory by Hair (2017).

Table 1 demonstrates the model's internal consistency reliability, indicating that all factors are appropriate for further analysis. The model is considered to have acceptable convergent validity when the average variance extracted (AVE) is ≥ 0.50 and the indicator loadings are ≥ 0.70 ($p < .05$). This suggests that each construct accurately quantifies

its concept. The outer loadings of the majority of indicators in the four constructs are qualified, with a range of 0.801–0.958, and all loadings are significant in the current study (refer to Table 3). The model has strong convergent validity with AVE greater than 0.50 for all constructs. Also, the value of composite reliability statistics that surpasses 0.7 endorses an acceptable reliability range of 0.72 to 0.95. The findings suggest that constructs are internally consistent and reliable.

Discriminant validity

The diagonal values are indicative of the Fornell-Larcker criterion to assess the discriminant validity of constructs in SEM. The diagonal values in Table 4 are greater than the correlation, which implies that each construct has a robust discriminant validity.

Table 3: Reliability and Convergent Validity of the Model

Constructs	Items	Convergent Validity		Internal Consistency	
		Loadings	Average Variance Extracted	Cronbach's Alpha	Composite Reliability
USE					
BUF1	Buying Frequency	0.883	0.787	0.729	0.729
BUM1	Buying Mode	0.891			
DISPOSAL			-		
DISPO1	Disposal	1			
MINDFULNESS			0.911	0.903	0.906
MINDF11	awareness of the harmful impact of electronic devices on health	0.958			
MINDF12	awareness of the harmful impact of electronic devices on the environment	0.951			
SUSTAINABLE ECONOMY INCLINATION			0.758	0.841	0.869
SEI_1	importance of awareness programs	0.89			
SEI_2	use of refurbished products	0.811			
SEI_3	mindful/ responsible disposal	0.907			
BUD1 Buying decision factors			0.645	0.854	0.877
BUD11	Price	0.825			
BUD12	Brand reputation	0.835			
BUD13	Environmental impact	0.535			
BUD14	Product Features	0.9			
BUD15	Life span	0.867			
BUI1 Buying decision influence			0.293	0.635	0.95
BUI11	Own need	0.967			

BUI12	tendency to buy similar products	-0.226			
BUI13	desires to spend money	-0.327			
BUI14	desires to have the latest device	-0.277			

Discriminant validity is also assessed through heterotrait-monotrait correlation ratios. Constructs with values below the threshold of 0.9 demonstrate acceptable discriminant validity [Table 5]. Furthermore, no instances of multicollinearity were detected between the indicators of the lower-order

constructs and the two dimensions associated with the higher-order construct. Their variance inflation factors (VIF) were 3.5, with the limit of VIF being 5 (Hair, 2017; Ringle et al., 2015) and 10 (Kennedy 2008), as illustrated in Table 6.

Table 4: Fornell Larcker criteria

	Age	BUD1	BUI1	Disposal	Mindfulness	Sus eco inc	Usage
Age	NA						
BUD1	0.025	0.803					
BUI1	0.205	0.268	0.541				
Disposal	0.066	0.311	0.280	NA			
Mindfulness	0.076	0.132	0.115	0.089	0.955		
Sus Eco Inc	0.189	0.545	0.386	0.288	0.139	0.870	
Usage	0.271	0.184	0.207	0.449	-0.077	0.241	0.887

Table 5: Heterotrait-monotrait Ratio (HTMT)

	Age	BUD1	BUI1	Disposal	Mindfulness	Sus eco inc	Use
Age	NA						
BUD1	0.074						
BUI1	0.321	0.224					
Disposal	0.066	0.329	0.154				
Mindfulness	0.080	0.149	0.087	0.094			
Sus Eco Inc	0.190	0.631	0.262	0.307	0.155		
Use	0.317	0.256	0.430	0.526	0.096	0.304	

Table 6: Collinearity VIFs

Age	BUD1	BUI1	DISPO1	MNDF11	SUS ECO INC
1.00	2.05	1.02	1.00	3.10	2.08

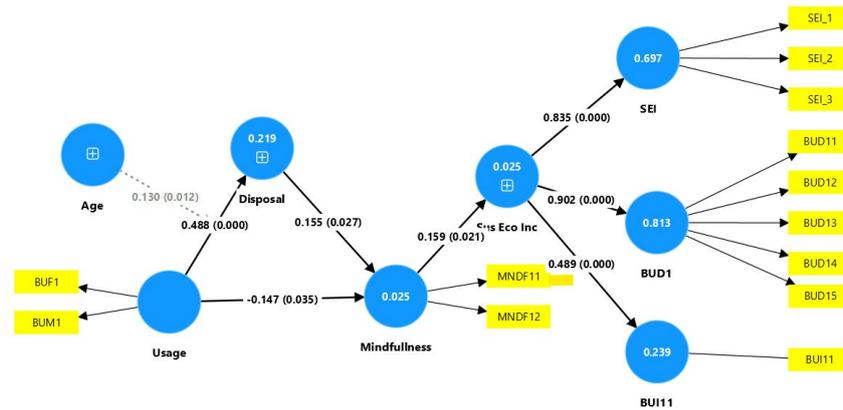


Figure 3: Structural Model

Assessment of the structural model

An in-depth examination of the major effects, moderation effects, mediation effects, and moderated-mediation effects is carried out by the structural model's analysis, which sheds light on the supposed dynamics inside our conceptual model. The current study investigates the direct interaction among variables and the complex interaction of mediating and moderating variables.

The structural model describes the capacity of the model to explain and the assurance of analytical accuracy. The model explains the variation in core characteristics, as reflected in R² values (0.219 for electronic device disposal; 0.025 for mindfulness, and 0.019 for inclination towards a sustainable economy).

The structural model assessment validates the proposal's hypotheses and provides a thorough comprehension of the mechanisms at work.

Table 7: Path coefficients for direct and specific indirect effects

	β	SD	t-statistics	p-values
Disposal -> Mindfulness	0.155*	0.070	2.213	0.027
Mindfulness -> Sus Eco Inc	0.159*	0.069	2.303	0.021
Sus Eco Inc -> BUD1	0.902***	0.017	52.683	0.000
Sus Eco Inc -> BUI11	0.489***	0.073	6.673	0.000
Sus Eco Inc -> SEI	0.835***	0.023	36.096	0.000
Usage -> Disposal	0.488***	0.052	9.419	0.000
Usage -> Mindfulness	-0.147*	0.070	2.113	0.035
(Moderation)Age x Usage -> Disposal	0.130*	0.052	2.500	0.012

Note: n = 260, SD = standard deviation, **p < .05, ***p < .001, Sus Eco Inc = Sustainable Economy Inclination, BUD1 = Buying Decision Factors, BUI11= Buying Decision Influence

The partial least square (PLS) approach was implemented to evaluate the hypotheses in Tables 7, which assessed direct, specific indirect, and total effects. The initial focus of this study was on the collective and direct effects of consumer practices of usage and disposal of electronic devices on mindfulness and sustainable economy inclination. The investigation also investigated the moderating effect of (Usage x Age) on Disposal. The path coefficients indicated that all relationships as highly significant and positive, with the exception of the direct relationship between mindfulness and usage, which is at once significant and negative. Subsequently, these findings verified each of the study's hypotheses. The direct and indirect effects' t-statistics (>1.96) were also highly significant, as their values exceeded the standard value. The results of the analysis of the p-values showed that

nearly all relationships were highly significant, with values lying within the benchmark limit (p < .05). All path coefficients (β) in this analysis are significant, as indicated by Table 7, suggesting that the components had internal links. The disposal of electronic devices is considerably influenced by the usage of electronic devices ($\beta = 0.488$, p < .001), whereas mindfulness is notably affected by disposal ($\beta = 0.155$, p < .05). In contrast, mindfulness is considerably adversely affected by usage ($\beta = -0.147$, p < .05). Moreover, mindfulness significantly influences the propensity for sustainable economies ($\beta = 0.159$, p < .05). The model's explanatory capacity is indicated by the R²(coefficient of determination), measuring the variance described by the endogenous constructs. R² values for disposal, mindfulness, and sustainable economy tendency are given in Table 8. This

indicates that 21.9% of the variance in disposal is explained by the use of electronic gadgets. Whereas awareness and sustainable economy inclination each explain 2.5% of the variance.

f^2 value predicts the capacity of one variable on another within a singular pathway (Hair, 2017; Hair et al., 2019; Shmueli et al., 2019) with a small

(>0.02). Moderate(>0.15) and large(0.35) effect values(Cohen 1977). Table 9 shows a minor influence of mindfulness($f^2 = 0.02$) on sustainable economy tendency and disposal ($f^2 = 0.02$) also has a minor impact on mindfulness. Whereas disposal is moderately affected by usage($f^2 = 0.274$), but mindfulness is not impacted by usage ($f^2 = 0.018$).

Table 8: R² Analysis of Constructs

Construct	R 2	Adjusted R2
Disposal	0.219	0.210
Mindfulness	0.025	0.018
Sustainable Economy Inclination	0.025	0.021

Table 9: F² Analysis

F ²	Standard Effect Size	Analysis Results	F ²
0.02	small	Disposal -> Mindfulness	0.020
0.15	medium	Mindfulness -> Sus eco inc	0.020
0.35	large	Usage -> Disposal	0.274
		Use -> Mindfulness	0.018

Table 10: Q² Analysis of Constructs

	Q ² predict	RMSE	MAE
Disposal	0.867	2.131	1.666
Mindfulness	0.06	3.871	3.748
Sus Eco Inc	0.925	1.062	0.878

Furthermore, Stone-Geisser's Q2 value serves as an essential gauge for assessing the projecting importance of each construct taken in structural model, usually requiring a value beyond 0 (Zheng & Li, 2020). Table 10 demonstrates the acceptable predictive significance of the structural model (Q2 Disposal = 0.867, Q2 Mindfulness = 0.06, Q2 Sustainable Economy Inclination = 0.925). The findings, thus, validate hypotheses H1: Consumer mindfulness and inclination towards a sustainable economy are affected by the utilization of electronic gadgets and H3: The inclination towards a sustainable economy is influenced by consumer mindfulness. Thus, one can say that consumers' usage patterns indicate their perspectives on sustainable economies (Caii et al., 2020; Arain et al., 2020; Shaikh et al., 2020).

Assessment of Moderated Mediating Effect

The mediation is illustrated in Figure 3 shows path coefficients are statistically significant. The transition from usage to consciousness is adverse, indicating that the overall impact (H2a, H2b, H1) will likewise be negative. The mediating effect is significant, as illustrated in Table 11. Thus, the partial mediating function of disposal can be confirmed. Table 6 reveals a partial mediating effect size of 0.078, deemed minor (Hair, 2017). Disposal mediates around 20.78% of the impact of usage on mindfulness (RIT-20.78). The mediating impact is 1.05 times (RID 1.05) more significant than the direct effect of usage on mindfulness. The results support hypothesis H2 (H2a, H2b) and concludes that the disposal patterns of electronic devices mediate the impact of usage on mindfulness. Thus, mindful usage of electronic devices indicates an inclination towards a sustainable economy (Shaharudin et al., 2020; Islam et al., 2020; Nduneseokwu et al., 2017).

Table 11: Indirect Effect

Path	Indirect Effect	Direct Effect	Total Effect	RIT	RID
Usage -> Disposal -> Mindfulness	0.0756	-0.072	0.0036	20.78	1.05

Note: ***p < .05, RIT = Ratio of the indirect and total effect, RID = Ratio of indirect and direct effect, RIT and RID are based on absolute value calculations

Table 7 depicts the moderating effect of consumer age, revealing a positive and highly significant effect (Usage x Age → Disposal) with ($\beta = 0.130$, $t = 2.5$, $p < .05$). The moderation was further examined by basic slope analysis. The mean age lacks any moderating impact (central curve). The steepened curve shows a pronounced positive effect on disposal when the moderating effect (Usage x Age)

was at (+1 SD) (see Fig. 4). Furthermore, the flattened curve shows a diminishing effect on disposal having moderating effect (Usage x Age) at (-1 SD). Hence, there is highly substantial positive moderation (Usage x Age → disposal) supporting hypothesis H4. This indicates more judicious utilization and disposal of electronic gadgets with increasing age (Islam et al., 2020b).

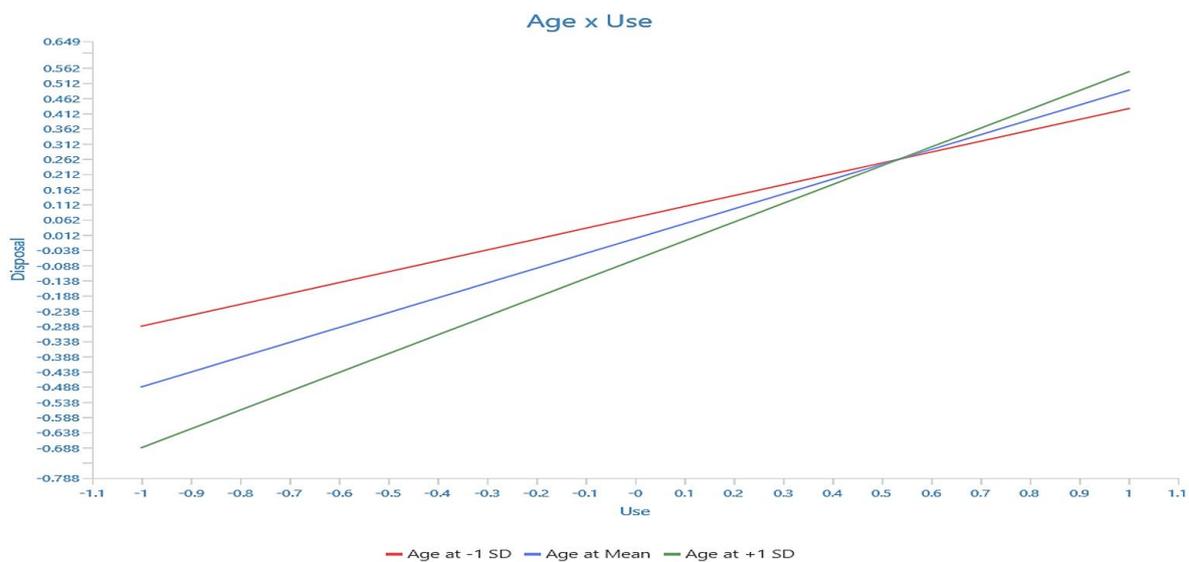


Figure 4: Slope Analysis of Moderation

4. DISCUSSION

The findings of the current study specify a significant relationship between disposal-mediated usage of electronic devices, consumers' attitudes and awareness toward a sustainable economy. Consumers' attention patterns in usage and disposal significantly explain their inclination towards a sustainable economy. Consumers play a crucial role in achieving the circular/sustainable economy strategy (Greene, 2024). The findings also show the direct or indirect impact of consumers' use of electronic devices on their mindfulness and inclination for sustainable economy, which is among the very critical challenges to attain circular economy transformation objectives. Realizing a complete sustainable development separately is not feasible and a new dimension of human behavior and social priorities must be cultivated (Dayan et al., 2019; Kumar et al., 2021). Similarly, the study also evidenced the role of mindfulness for a sustainable economy. The findings are aligned with the existing body of knowledge on mindfulness's role in promoting the adoption of sustainable practices and encouraging consumption behaviors (Shahbaz and Parker, 2022; Sawyer et al., 2022; Gupta et al., 2023). The role of consumer behavior regarding e-waste is explained through the Theory of Planned Behavior (TPB) in this study, which has been widely substantiated in prior literature on e-waste,

including disposal and recycling behaviors of the consumers (Nduneseokwu et al., 2017; Liu et al., 2019; Kumar, 2019; Nguyen, 2018; Wang et al., 2019; Papaoikonomou et al., 2020; A.L. Arain et al., 2021).

Further, a positive and significant moderating effect of age is indicated on the relationship between the usage and disposal of electronic devices. The study also shows the indirect effect of consumption on mindfulness. There is a substantial positive correlation between consumer's age and electronic device usage frequency as well as their disposal patterns (Islam et al., 2020b). The usage impact is mediated by disposal and moderated by age. The impact is large and beneficial. However, the direct effect of usage on mindfulness is significant and negative. Thus, consumers' consciousness of the unfriendly effects of e-waste on health and the environment determines their behavior of reduced or limited usage of electronic devices.

The research highlights the necessity of incorporating sustainability concepts in using electronic devices for a sustainable economy (Chakraborty et al., 2022; Srivastav et al., 2023). The study indicates that promoting a sustainable economy emphasizes the importance of implementing sustainable practices in production and consumption.

Theoretical Contributions

The study's theoretical, practical, and policy consequences are given here.

Theoretical Implications.

The research synthesizes three sustainability theories. One, demonstrating the dynamics of electronic device usage and disposal patterns. Two, awareness of e-waste's impact on health and the environment. Three consumers' inclination towards a sustainable economy. It emphasizes the importance of multiple theoretical perspectives to examine and address sustainability issues related to consumer behavior while purchasing, using and disposing of electronic devices. It also portrays consumers' awareness of disposal methods to moderate the harmful influence of e-waste on the environment. The mediating role of disposal is a key component of the framework. This enhances the understanding of how disposal practices influence sustainability performance.

Managerial Implications

The study encourages electronic companies to adopt and encourage regulated e-waste collection practices. It also recommends manufacturing of refurbished electronic devices and promotes sustainability. E-waste contains materials which can be reused and recovered. By using recycled electronic devices the harmful impact of e-waste can be reduced to a large extent. It also promotes a responsible behaviour among consumers and thus contributes to achieving SDGs.

Limitations and Future Research Directions

The study has a few limitations. One, the study implemented convenience sampling which, though, is cost-effective but it may introduce bias due to the increased level of randomization, causing instability in the selected sample, leading to a biasness (Fraenkel et al., 2023). Two, it is difficult to accept that the sample consisted solely of electronic device users from India. This confines the general applicability of the research findings. It is still uncertain whether similar patterns would apply to individuals in other nations. Three, in this study, certain items, such as BUI1 (0.293), have relatively uncertain loadings. So, it is recommended that future research employ samples from a variety of generations, such as Gen X, Y, Z, and Alpha, to ensure representativeness and diversity of the sample.

5. CONCLUSION

The current research explores the relationship between electronic devices usage, the disposal pattern, awareness of consumers of electronic devices and their inclination towards a sustainable economy. The results reflect the positive and significant impact of disposal patterns on sustainability. Disposal has a moderating effect on

device usage and consumer inclination towards sustainable practices, whereas use of electronic devices is negatively related to awareness. Increasing age reduces the use of electronic devices and improves disposal patterns.

A significant research outcome indicates that users are advocating a significant variation in e-waste management. The study raises concerns demanding the focus of researchers and policymakers on designing formal e-waste collection alternatives. This also includes data security, collection fees, various service options such as online, every house door, and nearness to permanent recycling services. Consumer awareness campaigns are recommended to impart education on e-waste disposal. Attention must be directed to the frequency and content creation on social media for awareness-raising efforts. A regulatory framework necessitates a reduction in informal sector recycling. Therefore, awareness of a sustainable economy is crucial for fostering sustainable behaviour of consumers of electronic devices. The findings possess theoretical, practical, and management recommendations.

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Conflict of Interest

The authors have no competing interests.

Data Availability

The datasets used for the current study are available on reasonable request.

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