12-2022

Closing the Loop: An Examination of Consumer Attitudes and Motivation for Sustainable Behaviors

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CLOSING THE LOOP: AN EXAMINATION OF CONSUMER ATTITUDES AND MOTIVATION FOR SUSTAINABLE BEHAVIORS

A Dissertation

Submitted to the Graduate Faculty of the
University of South Alabama
in partial fulfillment of the
requirements for the degree of

Doctor of Philosophy

in

Business Administration, Marketing

by
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December 2022

To Julia Claire and Charlotte Ruby:

may you always stay curious, never stop learning, and
remember that you are capable of anything you put your heart and head into.

ACKNOWLEDGEMENTS

The completion of this dissertation marks the end of a long journey, and one that would not have been possible without the support of a number of people. They say that it takes a village to accomplish a feat like this, and I couldn't be more grateful for my village. To Chris Henderson- my rock and my unwavering support. You push me to be the best version of myself and have never let me give up, even though I certainly tried many times. I'm thankful to have you in my corner and I can say without a doubt that you are the reason I've made it to the end of this journey. Thank you for being my partner, through and through. To my parents, Brett and Joyce Duplessis, thank you for your never-ending encouragement, support, and prayers. From helping with the girls, to dropping off dinner for us, and even taking road-trips to Mobile with me- you've been here every step of the way and I truly could not have done this without you. Thank you for teaching me what hard work looks like. To Julia and Charlotte- you are the reason I do what I do. Thank you for your patience and understanding during this journey. For all of my family's love and support, I am eternally grateful.

To the friends who have been here to offer encouragement and lend a listening ear- "thank you" just isn't enough. Elizabeth Duhon- you are my biggest cheerleader and you never fail to build me up and remind me of my strength and my worth. You're the definition of a true friend and I'm blessed to have had your support on this journey.

Heather Ford, my sidekick since day 1 on this earth, thank you for supporting me in every way possible. I appreciate you more than you know. Kendra Crotwell- your infectious joy and constant encouragement are a real treasure. Here's to more free time and Pokeno nights together! Amanda Ledet- I'll never be able to fully express how thankful I am that this program brought us together. You are one of the most thoughtful and genuine people that I've had the pleasure of getting to know, and I'm proud to call you my friend. To Cohort 7- I can't imagine a better group of folks to go through this process with. The coffee dates, study sessions, and all the highs and lows- we did it all together and I'll forever be grateful for this journey we were placed on.

I would also like to extend my gratitude to my dissertation committee and academic mentors. Dr. Matt Howard, the chair of my committee, thank you for investing in your students the way you do. I am thankful for the opportunity to have participated in research both alongside you and under your supervision. To Dr. Tyler Morgan- thank you for taking the time to invest in this project and help steer the work in directions that I am certain have made this project much more valuable. To Dr. Joe Hair- I could have never imagined the ways in which meeting you would impact my life. You are larger than life and I'm not sure you even recognize the impact you have on those around you. From wine and music nights with our cohort in your kitchen to continually being there to push and guide us through the program- you are the teacher, mentor, and friend that every PhD student could only be so lucky to have.

Thank you to my village- WE did it!

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LIST OF ABBREVIATIONS

AVE	Average Variance Extracted
CB-SEM	Composite-Based Structural Equation Modeling
CCA	Confirmatory Composite Analysis
CEDs	Consumer Electronic Devices
CFA	Confirmatory Factor Analysis
CLSCs	Closed Loop Supply Chains
CMB	Common Method Bias
CSC	Consciousness for Sustainable Consumption
DV	Dependent Variable
EEE	Electrical and Electronic Equipment
ERI	E-Waste Recycling Intention
HTMT	Heterotrait-Monotrait
IR	Innovation Resistance
IRT	Innovation Resistance Theory
IV	Independent Variable
MTE	Motivation Towards the Environment
PLS-SEM	Partial Least Squares Structural Equation Modeling
SDT	Self-Determination Theory
SPI	Sustainable Purchase Intentions
VC	Value Consciousness
VIF	Variance Inflation Factor

ABSTRACT

Henderson, Jennifer D., Ph.D., University of South Alabama, December 2022. Closing the Loop: An Examination of Consumer Attitudes and Motivation for Sustainable Behaviors. Chair of Committee: Matt C. Howard, Ph.D.

Smartphones and related electronic devices are a recently growing area of ethical, environmental, and social responsibility concern. Specifically, these products generate large quantities of electronic waste (e-waste) and are increasingly produced under questionable working conditions. These social and environmental impacts can potentially be mitigated through the adoption of sustainable consumer behaviors, such as e-waste recycling and purchasing sustainably- produced devices. However, although we are years into the modern sustainability movement, there still exists an attitude-behaviors gap where many consumers report that they are concerned about environmental and social responsibility issues, but they fail to translate these concerns into consumption behaviors. This manuscript examines the factors that should drive consumers to purchase electronic devices that have been manufactured by sustainable processes as well as engage in e-waste recycling behaviors. The study explores the relationship between consumers' attitudes and beliefs towards sustainability and their overall motivation to engage in sustainable behaviors. Partial least squares structural equation modeling (PLS-SEM) is used to investigate the direct, mediated, and moderated relationships among the variables studied using data from 343 respondents in the United States. Results suggest that consumers' awareness and consciousness for sustainable consumption does positively influence motivation to engage in sustainable consumption behaviors.

CHAPTER I

INTRODUCTION

Rapid technological innovation coupled with widespread consumption of electronic equipment has substantially influenced society's reliance on consumer electronic devices (CEDs). More than 5 billion people worldwide have mobile phones, and consumer spending on electronic devices (mobile phones, tablets, personal computers, etc.) is projected to surpass $2 trillion by 2023 (Statista, 2021). With such widespread adoption of technology comes the inevitable issue, however, of how to effectively manage end-of-use devices. Consumers today dispose of enormous quantities of old computers, monitors, smartphones, and other electronic components, usually within two or three years after buying them. Most of these devices end up in landfills instead of being recycled (Alena & Libor, 2012). Electronic waste (e-waste) is, therefore, one of the fastest-growing forms of pollution worldwide and has garnered much attention in the last decade. Indeed, the quantity of dumped computers, telephones, televisions, and appliances doubled between 2009 and 2014, to 42 million tons per year globally (Wang et al., 2016), and continues to increase rapidly (Hsu et al. 2019).

Many consumer electronics supply chains are now realizing a life-cycle approach to products that integrates end-of-life products back into the business model is needed (Guide et al., 2003). In short, integrated life-cycle activities are an essential component of closed-loop supply chains (CLSCs), including processes such as: obtaining end-of-life

products from end-users, refurbishing and remanufacturing products in the most economical and environmentally friendly manner, and remarketing products to create and exploit markets for remanufactured goods (Guide et al., 2003).

The success of such closed-loop supply chain initiatives is dependent, however, upon buy-in from consumers to both return old or unused devices and purchase new devices (re)manufactured via sustainable processes. The overall purpose of this research, therefore, is to examine consumers' attitudes and intentions towards engaging in environmentally and socially responsible sustainable consumer behaviors, such as participating in electronics recycling and take-back programs. Additionally, it will examine consumer intentions to purchase devices that have been manufactured using such programs and processes. Because sustainable and closed-loop electronics supply chains are reliant on consumer participation in such initiatives, it is essential that consumers' attitudes, beliefs, and motivations be understood (Hosta & Zabkar, 2021). To gain a better understanding of the role consumers play in supporting or inhibiting closed loop consumer electronics supply chain efforts, the research questions guiding this study are:

RQ1 - What is the relationship between a consumer's sustainable attitudes and beliefs and their intent to engage in sustainable consumer behaviors?

RQ2 - What role does motivation play in sustainable consumption and disposal behaviors for consumers?

RQ3 - What barriers exist for sustainable consumer electronics consumption and disposal for consumers?

While we are years into the modern sustainability movement, an attitude-behavior gap continues to exist where many consumers report they are concerned about environmental and social responsibility issues but fail to translate these concerns into sustainable consumer behaviors (Juvan & Dolnicar, 2014; Terlau & Hirsch, 2015; Wiederhold & Martinez, 2018). To date, the literature has primarily examined sustainable consumer behaviors in a fragmented manner – either focusing on attitudes and beliefs as antecedents of sustainable behaviors (Balderjahn et al. 2013; Van Doorn & Verhoef, 2015; Sudbury-Riley & Kohlbacher, 2016) or strictly on motivation to engage in sustainable behaviors (Geng et al., 2017; Khan & Hameed, 2019; Kumar & Yadav, 2021). This study, however, will examine not only consumers' attitudes and behaviors towards sustainability, but also their motivation to engage in sustainable consumption behaviors, as well as the relationship between attitudes and behaviors and motivation.

While attitudes, beliefs, and motivation are useful in understanding sustainable consumer behaviors, it would be remiss not to examine factors that potentially act as impediments to such sustainable behaviors. Prior studies have shown, for example, that consumers neglect to engage in behaviors such as electronics recycling due to lack of knowledge regarding recycling options (Clark, 2010), inconvenience (Kaur et al., 2020), or perceptions of risk involved in the process (Zhang et al., 2020). Furthermore, despite claiming to be sustainable-minded, research shows consumers tend to be price-sensitive when it comes to buying green or sustainably made products (Mandese, 1991). Given these considerations, an additional focus of the current research is to identify potential barriers to those behaviors and how they can be overcome.

The current manuscript therefore has three primary contributions. First, it examines the relationship between consumers' sustainable attitudes and beliefs, and their motivation to engage in sustainable consumer behaviors. Next, it relies on innovation resistance theory to explore the potential barriers impeding sustainable electronics consumption and disposal. Finally, it validates the self-determination theoretical framework chosen to model consumer behavior motivation. Namely, by demonstrating a relationship between consumers' personal beliefs surrounding sustainable consumption and their motivation to engage in sustainable behaviors, researchers and practitioners can devote appropriate attention to bridging the attitudes-behaviors gap plaguing sustainable consumption. Together, these contributions not only enable a deeper understanding of the theories surrounding sustainable behaviors, but they also provide several directions for future research and immediate implications for practice.

CHAPTER II

LITERATURE REVIEW AND HYPOTHESES

In this chapter, we examine and propose constructs for the current study by means of an expansive review of previous research in consumer behavior, sustainability, and supply chain management. The first section will consist of a brief review of the overarching foundations of closed-loop supply chain research. The following sections will further introduce the research constructs associated with electronics closed-loop supply chain effectiveness, including E-Waste Recycling Intention, Sustainable Purchase Intentions, Consciousness for Sustainable Consumption (CSC), Motivations Toward the Environment, Value Consciousness, and Innovation Resistance.

2.1 Closed-Loop Supply Chains (CLSCs)

Supply chains in the most classic form have focused on the forward flow of processes and goods needed to fulfill customers' requests. These coordinated networks are comprised of manufacturers, producers, transportation providers, warehousers, and retailers aligned to bring products or services to market (Lambert et al., 1998). For purposes of recapturing value or properly disposing of materials, reverse logistics processes are often incorporated into supply chains. Reverse logistics processes involve

managing the flow of information, materials, inventory, and finished goods from the point of consumption to the point of origin (Rogers & Tibben-Lembke, 2001).

When considered in combination, forward and reverse supply chains represent a closed-loop supply chain. Closed-loop supply chain networks are designed to maximize the value created from product recovery and remanufacturing, either by reusing the entire product and/or some of its components (Qiang et al., 2013). Reverse and closed-loop supply chains are not new, although the products being remanufactured have changed throughout the years. For example, automotive parts have been reused and remanufactured since the 1920s (Guide et al., 2003). However, a comprehensive review of reverse logistics and closed-loop supply chain literature demonstrates the primary scope of research has been one that is operational in nature, focusing on aspects such as inventory modeling, production planning, network design, and reverse distribution (Govindan et al., 2015). While these processes are critical to CLSCs, the role of the consumer in closed loop supply chains is relatively recent and warrants further research.

Most recently, closed loop supply chains are being viewed as tools for addressing environmental problems and recapturing value for the firm. By encouraging consumers to return old devices, for example, which will then be put back into the supply chain by means of recycling and disassembling, consumer electronics supply chains can minimize or even eliminate negative impacts on the environment (Souza, 2013; Islam & Huda, 2018). As such, consumer participation in such sustainable initiatives is a substantial area of concern for today's electronics supply chains (Ni et al., 2021).

2.2 E-Waste Recycling Intention

Electronic waste (e-waste) describes the various forms of electrical and electronic equipment (EEE) that are no longer of value to users and often discarded as waste without intention of re-use (Kumar et al., 2017). E-waste is a steadily growing concern, as rapid technological advancements lead to more frequent adoption and subsequent disposal of devices. According to Guiltinan (2009), the planned obsolescence business model that guides technological manufacturing today is built on the premises of limited repair (non-reparable component parts), limited functional life design (short shelf life), and functional enhancements primarily available only through upgrades (new devices). As a result, e-waste from products such as cell phones and laptops is growing worldwide and in need of a redesigned and extended recycling process. In 2016, 44.7 million tons of e-waste were generated worldwide, with quantities projected to surpass 57.2 million tons just 5 years later in 2021 (Hsu et al. 2019; WEEE Forum 2021). Such waste poses a significant waste to both humans and the environment, as it is often dumped in landfills instead of being appropriately recycled. According to the United Nations Environment Program (UNEP), only 20% of electronics waste worldwide is appropriately recycled (Nijman, 2019).

The behavior of consumers is one of the major pillars in the design of any successful e-waste management system (Dwivedy & Mittal, 2013). However, there has been little research conducted to investigate consumer motivational factors influencing sustainable e-waste behavior (Fan et al., 2021). According to Dixit & Badgaiyan (2016), the primary focus of e-waste research has been from a perspective of assessing societal impact of e-waste (Umair et al., 2015) or evaluating recovery of metals from e-waste

(Jujun et al., 2014), overall neglecting the consumer as the initial point in the closed loop supply chain. While there have been few studies that focus on consumers' intention to recycle e-waste (Saphores et al., 2006; Nixon et al., 2009; Wang et al., 2011; Dixit & Vaish, 2015), there is an overall void of studies focusing on consumer motivation and attitudes towards participating in such activities. This research aims to extend the current literature by addressing the need to analyze consumers' motivation for engaging in e-waste recycling behaviors.

2.3 Sustainable Purchase Intention

Data regarding consumer purchase intentions is often used to make production decisions concerning both new and existing products, and the marketing programs that support them (Morwitz et al., 2007). Thus, extensive research regarding consumers' likelihood to purchase exists in the marketing literature. Relevant and commonly referenced factors that influence the likelihood to purchase include product knowledge (Brucks, 1985; Park et al.,1994; Chiou, 1998), brand preference (Mitchell & Boustani, 1994, Chaudhuri & Holbrook, 2001; Wu & Lo, 2008), and price (Chang & Wildt, 1994; Chandon et el., 2000). Although the likelihood to purchase literature is substantial, studies examining purchase intentions specifically for electrical and electronic equipment have been rare, specifically in regard to green or sustainably minded consumers (Young et al., 2010).

Research has indicated that purchasing for technology-based products involves different aspects that distinguish it from low involvement product purchasing (such as that for household products or food items). According to Young et al.'s (2010) green consumer behavior study, when purchasing electronic products, three primary factors

facilitate the purchase of green products: green labels, specialist information, and the availability of green products. Green labels or information sources touting the products' benefits reduce cognitive effort for consumers, especially those who were under time pressure. The presence of a specialist to guide the consumer through the purchasing process was also likely to enhance the likelihood of purchasing sustainably made electrical and electronic equipment (EEE) products. This is especially beneficial in the case of high-involvement technology purchases which tend to include more risk (Young et al., 2010). Finally, the availability of green products in mainstream retail outlets influences the overall likelihood to purchase green technology products. Thus, manufacturers and marketers alike must keep in mind that consumers are unlikely to compromise on traditional product attributes, including availability (Ginsberg & Bloom, 2004).

Carvalho et al.'s (2015) study extended previous knowledge on drivers of sustainable purchase intentions (SPI), utilizing a triple bottom line perspective of people, planet, and profit for psychometrically validated scale development. Prior sustainable purchase intention measures primarily relied on single (Bredhal, 2001) or few-item (Lee 2008) scales asking respondents: 'I would intend to' with respect to sustainable purchase intentions. Carvalho et al. (2015) provide an integrated view of sustainable purchase intentions that serve to better explain consumers' sustainable purchase intentions, while providing a comprehensive construct to measure SPI. The current study utilizes the comprehensive, multi-item SPI scale to measure consumers' EEE purchase intentions in relation to their consciousness for sustainable consumption.

2.4 Consciousness for Sustainable Consumption

When determining potential drivers for sustainable consumer behaviors, it is important to understand consumers' underlying attitudes and beliefs toward those sustainable behaviors (e.g., recycling, limiting energy consumption, reducing waste, and promoting fair treatment of workers). Consciousness for sustainable consumption is operationalized in this study by weighing consumers' personal beliefs with their relative importance to the three sustainability dimensions. The term sustainability is defined in varying ways but is often centered around a "triple bottom line" approach surrounding implications for people, planets, and profit (Elkington, 2004). This approach involves assessing both business and personal responsibilities based not only on economic drivers, but also assessing the social and environmental impacts of actions as well (Sheth, et al., 2011). In other words, sustainability is often referenced in terms of meeting the needs of the present without compromising the ability of future generations to meet their own needs for the environment, society, and the economy. These three principles are used as a guide to both understand and influence one's behaviors and decision making from a multidimensional approach.

First, the environmental integrity principle ensures human activities do not erode the earth's land, air, and water resources (Bansal, 2005). Environmentally-focused sustainability efforts such as recycling and the reduction of greenhouse gas emissions aim to either maintain or improve the state of the natural environment in which we live. The social dimension encourages individuals and organizations to consider their impact on society and addresses issues such as community relations, fair wages, safe working conditions, and charitable contributions, to name a few. This means socially responsible

consumers will base their consumption on a desire to minimize harm and maximize benefits to society. Finally, the economic prosperity principle involves the creation and distribution of goods and services in ways that will help to raise the standard of living around the world (Bansal, 2005). Economic prosperity in sustainability promotes a reasonable quality of life through the actions of organizations and individuals in society (Holliday et al., 2002). In the past decade or so, people have increasingly acknowledged the importance to actively pursue sustainable development (Kahle et al., 2013).

A major challenge for today's sustainability efforts is how to effectively handle large volumes of consumer electronics devices that are no longer used or needed due to rapid new product introduction, planned obsolescence, and increased consumption (Kumar & Bhaskar, 2016). Within the core concept of sustainability lies a three-dimensional framework that captures environmental, social, and economic variables used to evaluate an individual's overall sustainable attitudes and behaviors (Balderjahn et al., 2013). This three-dimensional framework is applied in the current study to determine consumers' overall level for sustainable consumption as it relates to overall consumption and disposal behaviors.

The environmental dimension for identifying sustainable consumption examines consumer attitudes and values for five primary factors: recycling, packaging, resources and energy, local production, and climate. The underlying assumption is consumer consciousness for environmentally friendly consumption is a core indicator of overall sustainable consumption and disposal (Balderjahn et al., 2013). The primary area of environmental concern regarding EEE devices is e-waste; specifically, the amount of e-waste and how to responsibly and economically manage it. As an example, of the 42

million tons of e-waste dumped annually in 2014, the United States generated the largest amount, almost 12 million tons (Wang et al., 2016).

Used electronics contain substantial amounts of hazardous materials, such as mercury, lead, cadmium, and polychlorinated biphenyls. When e-waste is disposed of without proper management or controls in place, there are negative impacts on both the environment and human health. For example, landfills have the potential to transport toxic substances into groundwater, while incineration processes can emit toxic gases into the atmosphere (Kahhat et al, 2008). Significant concentrations of toxic substances such as blood, serum, hair, human milk, and urine have been found in individuals who have lived in areas where e-wastes are being disposed (Kiddee et al., 2013). These toxins, such as lead, mercury, selenium, and arsenic, have been linked to cancer, allergic reactions, and brain damage (Puckett and Smith, 2002). Awareness of such harmful environmental implications could likely motivate sustainable consumer behaviors.

The social dimension examines one's behaviors that attempt to help or benefit another individual or group of individuals. The implication is consumption and disposal activities are conducted in ways to minimize or eliminate any harmful impacts on society. But evidence indicates otherwise (Balderjahn et al., 2013). The sourcing and manufacturing of EEE devices have been plagued with controversy over the past decade. Rapid global demand for electronics has led to intense working conditions at manufacturing facilities abroad, where longer hours and increased work pressure are the norm. For example, at least 18 young rural immigrant workers attempted suicide in 2010 at Foxconn facilities in China, where more than 50% of the world’s electronic devices are produced (Ngai et al., 2016). Poor and unfair working conditions, along with unattainable

production targets, were to blame for these incidents. In another example of unsafe working conditions, cobalt, an essential component in lithium-ion batteries, is produced in the Democratic Republic of the Congo. Not only is cobalt a scarce mineral, but it is often mined in unsafe working conditions utilizing illegal child labor (Holmes, 2019). Transparency and awareness into such social issues surrounding electronics manufacturing are essential for driving future sustainable consumption efforts. That is, as consumers develop a better understanding of the societal and environmental impacts of their consumption behaviors, their purchasing and recycling intentions may be positively impacted.

The economic dimension of the sustainability framework evaluates the consciousness of caring for one's long-term economic well-being. Because of the negative consequences of overconsumption for the environment and society, economically conscious consumers increasingly try to cut down on harmful forms of consumption (Quelch & Jocz, 2009). However, this economic rationale of sustainability does not accommodate the consumer's choice of purchasing products with sustainable attributes. A more comprehensive approach to economic sustainability posits that if individuals want to buy sustainably, they will evaluate the overall necessity of the item in question and purchase sustainable products where possible (Balderjahn et al., 2013).

In the case of consumer electronic devices such as smartphones, sustainably produced devices have not been an option for consumers up to this point. Given the closed-loop direction firms are moving towards in the future, however, sustainable devices are likely to be an option for consumers to consider in their future purchasing journeys. As such, this research employs the CSC scale (Balderjahn et al., 2013) to

measure the intention to consume in such a way that improves one's environmental, social, and economic aspects of quality of life. Thus, the following hypotheses are proposed:

Hypothesis 1: There is a positive relationship between one's consciousness for sustainable consumption and their intent to recycle end-of-use electronics.

Hypothesis 2: There is a positive relationship between one's consciousness for sustainable consumption and their intent to purchase sustainably-made electronics.

2.5 Motivation Towards the Environment

The means to better understanding consumption behaviors may be found in the underlying motivations driving such behaviors. Consumption is a purposeful behavior performed as a means to some end (Barbopoulos & Johansson, 2017). When it comes to sustainable consumption behaviors, however, research has shown people are relatively inactive with respect to environmentally-friendly consumption and disposal (Shevchenko et al., 2019; Phulwani et al., 2020). To better understand environmental behaviors, Pelletier et al. (1998) followed a motivational approach to develop the Motivation Towards the Environment (MTES) scale. By applying Self-Determination Theory (SDT), Deci and Ryan (1985; 1991) the authors developed environmental subscales that correspond to the different forms of motivation. A review of SDT follows.

2.5.1 Self-Determination Theory

Self-determination theory is a general theory of human motivation that has frequently been applied to domains such as education (Standage et al., 2005), healthcare (Williams & Deci, 1996), and sports (Ntoumanis, 2001). Self-determination theory distinguishes among three primary forms of motivation: intrinsic motivation, extrinsic motivation, and amotivation (Deci & Ryan, 1991, 2000). According to Deci and Ryan (1991), intrinsic motivation is defined as the innate tendency to engage in an activity for the purpose of pleasure and satisfaction derived from the activity. Thus, a consumer who is intrinsically motivated is acting out of personal choice and interest.

Extrinsic motivation describes the practice of engaging in activities due to motivation by external means. With extrinsic motivation, the goal is to bring about positive consequences or avoid negative ones (Pelletier et al., 1998). According to SDT, extrinsic motivation is broken down into 4 motivational subtypes: external regulation, introjected regulation, identified regulation, and integrated regulation, each of which exist on a self-determination continuum. External regulation is the least autonomous form of extrinsic regulation, where one performs an activity or engages in a behavior to satisfy external demands or avoid punishment. Behaviors motivated by introjected regulation are driven by the individuals' sense of obligation, and are often accompanied by feelings of guilt, anxiety, or pressure (Villacorta et al., 2003). With identified regulation, an individual performs an activity by personal choice, as these actions are often believed to be aligned with one's values, goals, and identity (Pelletier et al., 1998). Integrated regulation takes place when a behavior has become assimilated by the person as part of their core self (Villacorta et al., 2003).

Lastly, SDT recognizes amotivation as experiencing a lack of control, where actions are mechanical and meaningless (Deci & Ryan, 2000). Individuals experiencing amotivation are unable to see the consequences of their actions, and as a result, unable to feel a sense of purpose or reward with respect to those behaviors.

The MTES scale (Pelletier et al., 1998) consists of subscales that measure an individual's level of intrinsic, extrinsic, and amotivation for environmental behaviors. Prior applications of the MTES to sustainability research have indicated that environmental attitudes and beliefs are positively related to self-determined motivational types, while non-self-determined motives are negatively associated with environmental attitudes and beliefs (Tabernero & Hernandez, 2011; Promberger & Marteau, 2013). This study will contribute to these findings by further examining the relationship between consumers' consciousness for sustainable consumption and their motivation towards the environment. Thus, the following hypotheses are proposed:

Hypothesis 3: Consciousness for sustainable consumption is positively related to one's motivation towards the environment.

Hypothesis 4: A consumer's motivation towards the environment is positively related to their sustainable purchase intention.

Hypothesis 5: A consumer's motivation towards the environment is positively related to their intention to recycle end-of-use electronics.

Hypothesis 6: A consumer's motivation towards the environment mediates the relationship between their consciousness for sustainable consumption and their intent to purchase sustainably-made electronics.

Hypothesis 7: A consumer's motivation towards the environment mediates the relationship between their consciousness for sustainable consumption and their intent to recycle end-of-use electronics.

2.6 Value Consciousness

Prior literature suggests consumers are price-sensitive when it comes to 'buying green' (Mandese, 1991). Consumers unwilling to pay a higher price or place a primary focus on a product's price during the decision-making process have been referred to as 'value conscious', 'price conscious', 'price oriented', etc. (Rihn et al., 2018). The level of price consciousness for these consumers is highly likely to influence their overall purchasing behaviors.

Green products often carry a higher price than do conventional alternatives (Olson, 2013). However, recent studies have shown that price itself is not necessarily a constraint to green buying, as long as consumers have a reason to accept the higher prices. That is, if the consumer perceives value in the green product, price is less likely to impact purchasing decisions. As such, value represents a consumer's perception of the trade-off between perceived benefits and sacrifice (Lovelock, 2000). Research has shown that consumers with environmental concerns are often less sensitive to price (Olson, 2013; Tanner & Wolfing, 2003) and are willing to accept trade-offs between environmental benefits and higher prices (Laroche et al., 2001). However, reduced performance and/or quality of the device can limit the overall appeal to consumers (Olson, 2013; Hazen et al., 2017). Thus, the following hypotheses are proposed:

Hypothesis 8: Value consciousness moderates the relationship between consciousness for sustainable consumption and intention to purchase sustainably such that the relationship is weaker when consumers are more value conscious.

Hypothesis 9: Value consciousness moderates the relationship between motivation towards the environment and intention to purchase sustainably such that the relationship is weaker when consumers are more value conscious.

2.7 Innovation Resistance

Many existing studies on e-waste have focused on understanding reasons why consumers engage in e-waste recycling behaviors (Wang et al., 2018). However, equally important are barriers that contribute to e-waste recycling resistance. Sahu et al. (2020) suggest these factors be studied together, simultaneously examining intentions for engaging in e-waste recycling and barriers inhibiting such sustainable behavior. Drawing on innovation resistance theory (IRT) (Ram, 1987; Ram & Sheth, 1989), this research will examine the reasons for not engaging in e-waste recycling behaviors. IRT aids in recognizing the reasons for resistance towards an innovation. Innovation resistance is defined as "the resistance offered by consumers to an innovation, either because it poses potential challenges from a satisfactory status quo or because it conflicts with their belief structure" (Ram & Sheth, 1989). Ram and Sheth (1989) suggest that an innovation may create a high degree of change in consumers' daily lives and disrupt their established routines. Specifically, the study will consider four primary kinds of disruptions and barriers to recycling: risk, value, usage, and image (Kaur et al., 2020).

Risk barriers are those that refer to the amount of risk associated with an innovation (Ram & Sheth, 1989). In this sense, risk represents consumers' perceptions of

risk, not the actual risk involved in an innovation. Literature has found that risk barriers have a negative impact on users' adoption intentions and behaviors (Kaur et al., 2020). In this case of this study, users may fear the risk of personal information being collected or misused after recycling electronics, for example.

Value barriers are those defined as the value delivered by the innovation compared to its performance-to-price ratio (Ram & Sheth, 1989). Value barriers can resemble the idea of perceived usefulness of the innovation. Literature has demonstrated that value barriers can negatively impact innovation adoption (Kim et al., 2021). In the case of e-waste recycling, consumers may perceive that the associated costs are too high and may resist from recycling.

Usage barriers represent any obstructions caused by the innovation, primarily in the context of new innovation compared with existing systems (Ram & Sheth, 1989). Usage barriers can represent the effort required to partake in a process, or changes required to one's existing routine and habits. Studies have shown that usage barriers can have a negative association with consumers' willingness and intent to adopt innovations and innovative processes (Kaur et al., 2020). In the e-waste recycling context, perceived convenience or ease of use is suggested to impact behavioral intent to recycle.

Image barriers represent the consumers' perceptions about how complicated or easy the innovation is to learn and embrace (Kim at el., 2021). Scarcity of information to consumers or perceived time and difficulty involved in learning about new processes can lead to high image barriers for adoption. For example, when consumers perceive that it is difficult or a waste of time to bring their end-of-life devices to a recycling facility, they may refrain from doing so (Sajid & Zakkariya, 2022). These important facets of

innovation resistance together will provide insight into consumers risk aversion, as well as perceptions of convenience, value and usefulness of recycling e-waste. Thus, the following hypotheses are proposed:

Hypothesis 10: Innovation resistance moderates the relationship between consciousness for sustainable consumption and intention to recycle e-waste such that the relationship is weaker when consumers express higher innovation resistance.

Hypothesis 11: Innovation resistance moderates the relationship between motivation towards the environment and intention to recycle e-waste such that the relationship is weaker when consumers express higher innovation resistance.

2.8 Theoretical Contribution

Through the lens of self-determination theory (Deci & Ryan, 2000), we argue that consumers who possess a higher level of consciousness for sustainable consumption (e.g., concern and awareness for social, environmental, and economic issues) are more motivated to engage in environmental and socially responsible consumer behaviors surrounding electronics consumption and disposal. We also contribute to innovation resistance theory (Ram & Sheth, 1989) literature by identifying possible barriers to engaging in sustainable consumption behaviors such as e-waste recycling. As shown in Figure 1 below, we examine the relationship between factors driving sustainable consumption behaviors (consciousness for sustainable consumption and motivation) and factors moderating such behaviors (value consciousness and innovation resistance). Overall, this research investigates the impact of motivation and sustainable consumption on outcomes impacting closed-loop supply chain effectiveness and contributes to

advancing consumer behavior and supply chain sustainability research and practice. These proposed relationships are visually represented in the theoretical model in Figure 1.

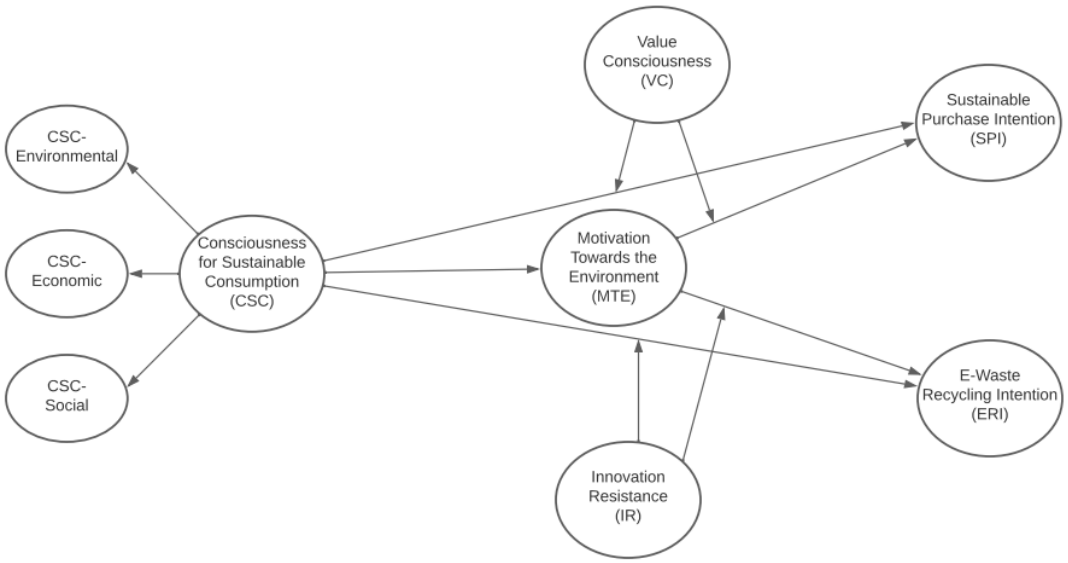

Figure 1. Theoretical Model of Consciousness for Sustainable Consumption Behavior.

CHAPTER III

METHODS

3.1 Study Design

A cross-sectional design was used to examine the relationships between attitudes and beliefs surrounding sustainable consumption, motivation, and intention to engage in sustainable electronics consumption and disposal behaviors. An online survey instrument was administered to a Prolific survey panel comprised of users of consumer electronic devices. Prolific maintains an established panel of informed respondents and data from this source has been used by thousands of researchers in prior studies (Palan & Schitter, 2018; Eyal et al., 2021). Participants were compensated once their completed survey was returned.

Screening questions were utilized to ensure respondents met the required criteria. Namely participants were to be at least 18 years of age and proficient in the English language. Participants were also asked whether they currently possess at least one consumer electronic device. Two attention checks were included in the survey instrument as a means of maintaining integrity of responses (Oppenheimer et al., 2009; Berinsky et al., 2014). For example, one question read: “Research has suggested that instructional manipulation checks be used in surveys to improve data quality and ensure attention is

being given to the questions being asked. For this question, select option 5- 'Strongly Agree'". No participant failed either of the attention checks. To ensure an appropriate sample size for the model, guidelines were followed to achieve the statistical power required to obtain meaningful solutions from the application of partial least squares structural equation modeling (PLS-SEM) (Bido et al., 2014; Hair et al., 2022).

Because this study relied on a single instrument to collect self-reported data, common method bias (CMB) can pose a threat to the validity of the study's results. For this reason, the survey instrument was designed and delivered following guidelines of Podsakoff et al. (2012) to minimize potential bias. For example, proximal spacing was utilized to separate independent, dependent, moderating, and mediating variables. Harman's single-factor test was also applied post hoc in SPSS to assess common method bias (Podsakoff & Organ, 1986) and a single-factor did not emerge. However, recent criticisms of the insensitivity of Harman's one factor test (Gorrell et al., 2011; Howard & Henderson, 2022), suggest that this measure is a poor indicator of common method bias. Thus, collinearity assessments reported in section 4.3 will serve to further indicate that common method bias is not present.

A pilot test was conducted with a small group of participants (n=45). For the final survey a total of 350 responses were received. Removing responses containing straight line responses, outliers or substantial missing data resulted in a final sample size of 343 responses. The final sample was comprised of 159 (46%) males, 178 (52%) females, and 6 (2%) individuals who identified as other or preferred not to disclose. The mean age was 43 years and 238 (70%) respondents were Caucasian, 51 (15%) were African American, 26 (7%) were Asian, 21 (6%) were Hispanic/Latino, and 7 (2%) were other nationalities.

3.2 Measures

All measures were administered on Likert-type scales with a varying number of response options (e.g. 1 – 7 or 0 – 10) and endpoint adjectives of *Strongly Disagree* and *Strongly Agree*). Established scale statements were adapted to ensure all relevant topics are assessed and the language is consistent with the contemporary meaning. In the following paragraphs the established constructs used in this research are briefly described. The complete survey instrument is shown in the appendix.

Consciousness for Sustainable Consumption. Balderjahn et al.'s (2013) 16-item scale was used to measure the participants' personal beliefs and values regarding sustainable consumption. Examples of the items are "It is very important for me personally that products can be disposed of in an environmentally friendly manner" and "It is very important to me that, during the manufacturing of a product, workers are treated fairly or are fairly compensated". Consciousness for sustainable consumption was modeled as a higher order construct with three subcomponents: environmental, economic, and social consciousness. The Cronbach's alpha for Consciousness for Sustainable Consumption was .92.

Motivation Towards the Environment. Pelletier et al.'s (1998) 25-item scale was used to measure the participants' motivation towards environmentally-friendly behaviors. Examples of the items are "I do things for the environment for the pleasure of contributing to the environment" and "I do things for the environment for the recognition I get for it from others". The Cronbach's alpha for Motivation Towards the Environment was .96.

Innovation Resistance. Adaptations from Ram and Sheth's (1989) resistance to innovations scale was used to measure participants' hesitancies and perceived barriers to electronics waste recycling. Examples of the 8 items include "I fear that after the transfer of my electronic device for recycling, the stored information may be misused" and "In my opinion, it is not easy to find information on e-waste recycling". The Cronbach's alpha for Innovation Resistance was .85.

Value Consciousness. Lichtenstein et al.'s (1990) 5-item value consciousness scale was used to measure participants' value consciousness when purchasing sustainably-made products. Examples of the items include "I am very concerned about low prices, but I am equally concerned about product quality" and "When I buy products, I like to be sure that I am getting my money's worth". The Cronbach's alpha for Value Consciousness was .81.

Sustainable Purchase Intention. Carvalho et al.'s (2015) 11-item sustainable purchase intention scale was adapted to measure participants' intention to purchase electrical and electronic devices manufactured via sustainable processes. Examples of the items include "I would consume products such as sustainably-made electronic devices (smartphones, PCs, etc) if I trusted their certification and source of raw materials" and "I would consume products such as sustainably-made electronic devices (smartphones, PCs, etc) if they had better visibility in store". The Cronbach's alpha for Sustainable Purchase Intention was .91.

E-waste Recycling Intention. E-waste recycling intentions were measured using 6 items adapted from Russell et al. (2017) and Zhang et al. (2015). Examples of the items include "I am interested in electronic waste recycling initiatives" and "I will give my old

devices and machines to recycling firms". The Cronbach's alpha for E-Waste Recycling Intention was .82.

CHAPTER IV

RESULTS

Partial least squares structural equation modeling was performed using the SmartPLS 3 software package to examine the measurement and structural models (Ringle et al., 2015). PLS-SEM enables researchers to examine the direct, indirect, and moderated relationships between variables, and the statistical objective of PLS-SEM is to maximize the variance explained in the dependent variables (Hair et al., 2020; Hair & Sarstedt, 2020). In this study, the recommended method for assessing PLS-SEM results, confirmatory composite analysis (CCA), was performed (Hair et al., 2020; Hair, J.F, 2021). As suggested when performing CCA with reflectively-measured constructs, a process evaluating item loadings and their significance, composite reliability, convergent validity (using AVE- average variance extracted), discriminant validity (HTMT), and nomological and predictive validity was performed (Hair et al., 2020).

4.1 Analysis

A detailed discussion of the results of the analysis appears in the following sections. Table 1 includes descriptive statistics, means, standard deviations, and correlations for all variables. The highest correlation is the relationship between one's motivation towards the environment (mediator) and their intent to recycle e-waste (DV; r = 0.71). Another quite strong correlation is between one's consciousness for sustainable

consumption (IV) and motivation towards the environment (mediator; r = .69). These observations indicate motivation to engage in sustainable behaviors is a meaningful concept to study further.

Table 1. *Means, Standard Deviations, and Correlations for Study Variables.*

Variable	Mean	SD	1	2	3	4	5
1. Consciousness for Sustainable Consumption	5.64	0.99					
2. Motivation Towards the Environment	5.20	1.20	0.69***				
3. Sustainable Purchase Intention	5.22	1.07	0.38***	0.36***			
4. E-Waste Recycling Intention	5.49	1.21	0.55***	0.71***	0.29***		
5. Innovation Resistance	4.04	1.37	-0.04	-0.12*	0.04	-0.20***	
6. Value Consciousness	6.26	0.80	0.19***	0.15**	0.23***	0.14*	0.06

Notes: N=343.

*p < .05.

**p < .01.

***p < .0

4.2 Measurement Model Evaluation – PLS-SEM

First, the measurement model was assessed by evaluating and confirming the outer model. Confirming composite measurement models (CCA) using PLS-SEM is a process similar to that of assessing measurement models using a CB-SEM confirmatory factor analysis (CFA) (Hair et al., 2020). The following steps were performed to execute the CCA: estimating the model's outer loadings and significance, checking indicator reliability, assessing Cronbach's alpha reliability and composite reliability, verifying convergent validity by calculating the AVE from the indicators, examining discriminant validity between the composite constructs, evaluating nomological validity, and assessing predictive validity (Hair et al., 2020).

In performing the CCA step one, several items did not meet the recommended indicator loading criteria of .708 or above (Hair et al., 2017). Specifically, of the 69 items evaluated, 56 were retained. As shown in Table 2, the items removed for consciousness for sustainable consumption were ECON5 (.641), ECON6 (.568), and ECON7 (.602). One item was removed from both the e-waste recycling intention (ERI5: .549) and the value consciousness (VC1: .493) scales. Four items were removed from the innovation resistance scale: IR1 (.421), IR2 (.484), IR3 (.479) and IR4 (.573). Eight of the twenty-four items on the motivation towards the environment scale were removed due to low loadings. These items (ER1-ER4) and AMO1-AMO4) were associated with negative feelings or emotions towards pro-environmental behaviors, as opposed to the positively worded items found in the remainder of the scale.

Several other items below .708 were retained because it is permissible to keep items that load between .40 and .70 that are statistically significant and important to the

meaning of the latent construct (Hair et al., 2019; Hair et al., 2022). All items retained in the model were significant, $p < .001$. Table 2 displays the individual items, their initial loadings, significance and whether they were retained or removed (indented and italicized). Table 3 represents the final items included in the study, after removal of the items with low loadings.

Table 2. *Outer Model Analysis: Initial Item Loadings and Statistical Significance. This table shows how survey items relate to constructs.*

Variable	Loading *p-value*	Variable	Loading *p-value*	Variable	Loading *p-value*
CSC		**MTE**		**ERI**	
CSCENV1	0.893***	MTES_IM1	0.709***	ERI1	0.852***
CSCENV2	0.935***	MTES_IM2	0.840***	ERI2	0.872***
CSCENV3	0.952***	MTES_IM3	0.864***	ERI3	0.885***
CSCENV4	0.952***	MTES_IM4	0.857***	ERI4	0.617***
CSCSOC1	0.947***	MTES_INTEG1	0.817***	*ERI5*	*0.549****
CSCSOC2	0.927***	MTES_INTEG2	0.782***	**IR**	
CSCSOC3	0.942***	MTES_INTEG3	0.841***	*IR1*	*0.421**
CSCSOC4	0.963***	MTES_INTEG4	0.797***	*IR2*	*0.484***
CSCSOC5	0.960***	MTES_IDEN1	0.737***	*IR3*	*0.479***
CSCECON1	0.810***	MTES_IDEN2	0.850***	*IR4*	*0.573****
CSCECON2	0.770***	MTES_IDEN3	0.780***	IR5	0.867***
CSCECON3	0.743***	MTES_IDEN4	0.759***	IR6	0.859***
CSCECON4	0.766***	MTES_INTRO1	0.828***	IR7	0.774***
CSCECON5	*0.641****	MTES_INTRO2	0.782***	IR8	0.786***
CSCECON6	*0.568****	MTES_INTRO3	0.779***	**VC**	
CSCECON7	*0.602****	MTES_INTRO4	0.715***	*VC1*	*0.493****
SPI		*MTES_ER1*	*0.317****	VC2	0.858***
SPI1	0.697***	*MTES_ER2*	*0.142**	VC3	0.774***
SPI2	0.784***	*MTES_ER3*	*0.091*^{ns}	VC4	0.815***
SPI3	0.749***	*MTES_ER4*	*0.104*^{ns}	VC5	0.791***
SPI4	0.731***	*MTESAMO_1R*	*0.368****		
SPI5	0.782***	*MTESAMO_2R*	*0.482****		
SPI6	0.743***	*MTESAMO_3R*	*0.497****		
SPI7	0.708***	*MTESAMO_4R*	*0.497****		
SPI8	0.760***				
SPI9	0.634***				
SPI10	0.685***				
SPI11	0.758***		*** p<.001, ** p<.01, * p<.05, ^{ns} = not significant		

CR = Composite Reliability; AVE = Average Variance Extracted; HTMT = Heterotrait-Monotrait; CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness.

Table 3. *Outer Model Analysis: Final item Loadings and Statistical Significance. This table shows how survey items relate to constructs.*

Variable	Loading *p-value*	Variable	Loading *p-value*	Variable	Loading *p-value*
CSC		**MTE**		**ERI**	
CSCENV1	0.893***	MTES_IM1	0.709***	ERI1	0.852***
CSCENV2	0.935***	MTES_IM2	0.840***	ERI2	0.872***
CSCENV3	0.952***	MTES_IM3	0.864***	ERI3	0.885***
CSCENV4	0.952***	MTES_IM4	0.857***	ERI4	0.617***
CSCSOC1	0.947***	MTES_INTEG1	0.817***		
CSCSOC2	0.927***	MTES_INTEG2	0.782***	**IR**	
CSCSOC3	0.942***	MTES_INTEG3	0.841***	IR5	0.867***
CSCSOC4	0.963***	MTES_INTEG4	0.797***	IR6	0.859***
CSCSOC5	0.960***	MTES_IDEN1	0.737***	IR7	0.774***
CSCECON1	0.810***	MTES_IDEN2	0.850***	IR8	0.786***
CSCECON2	0.770***	MTES_IDEN3	0.780***	**VC**	
CSCECON3	0.743***	MTES_IDEN4	0.759***	VC2	0.858***
CSCECON4	0.766***	MTES_INTRO1	0.828***	VC3	0.774***
		MTES_INTRO2	0.782***	VC4	0.815***
SPI		MTES_INTRO3	0.779***	VC5	0.791***
SPI1	0.697***	MTES_INTRO4	0.715***		
SPI2	0.784***				
SPI3	0.749***				
SPI4	0.731***				
SPI5	0.782***				
SPI6	0.743***				
SPI7	0.708***				
SPI8	0.760***				
SPI9	0.634***				
SPI10	0.685***				
SPI11	0.758***				

*** $p<.001$, ** $p<.01$, * $p<.05$, ^{ns} = not significant

CR = Composite Reliability; AVE = Average Variance Extracted; HTMT = Heterotrait-Monotrait; CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness.

Next, the reliability of the measurement model was assessed. Results for this analysis are shown in Table 4. All constructs were above the recommended levels of .70 for composite reliability. Therefore, all requirements for measurement model reliability were well above recommended minimum guidelines (Hair et al., 2017). Next, the construct convergent validity was evaluated based on the sizes of the average variance extracted (AVE). The AVEs for all constructs were well above the minimum recommended level of .50, thus providing support for convergent validity (Hair et al., 2017). For the next CCA step, discriminant validity between constructs was assessed according to the heterotrait-monotrait (HTMT) ratios. All HTMT ratios were below the recommended level of 0.85. Additionally, all upper level confidence intervals (95%) did not include a 0 or a 1 (Henseler et al., 2015). Thus, discriminant validity among the constructs were confirmed.

Table 4. *Reliability, Convergent, and Discriminant Validity for Study Variables.*

	Variable	CR	AVE	HTMT	2	3	4	5
1.	CSC	.929	.525					
2.	ERI	.893	.680	.644				
3.	IR	.907	.709	.119	.177			
4.	MTE	.967	.645	.723	.800	.171		
5.	SPI	.927	.535	.413	.400	.095	.391	
6.	VC	.887	.663	.255	.233	.079	.170	.260

CR = Composite Reliability; AVE = Average Variance Extracted; HTMT = Heterotrait-Monotrait; CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness.

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The two remaining steps of CCA involve the evaluation of nomological and predictive validity (Hair et al., 2020). For nomological validity, correlations of constructs both within the model and outside of the model can be used to confirm both theoretical and empirical consistency (Hair et al., 2019). Specifically, the nomological validity of each construct can be established by demonstrating a consistent strength of relationships between one or more constructs from well-developed theoretical research streams. Within previous literature, seminal articles such as Pelletier et al. (1998), Young et al., (2010), Balderjahn et al., (2013) and more were used to develop the conceptual model. The nomological validity of the constructs found in this study are supported by these studies and other prior sustainability and reverse logistics literature.

4.3 Structural Model Evaluation- PLS-SEM

The next step of CCA involves assessing the structural model. The purpose of this step is to evaluate the relations of the exogenous and endogenous constructs in the study (Hair et al., 2021). The following aspects were examined to evaluate the structural model results: multicollinearity issues, path coefficients and significance, R^2 for dependent variables, in-sample f^2 effect size, and out-of-sample prediction using PLS predict (Hair et al., 2020).

First, the structural model was evaluated to determine if multicollinearity was present among the independent constructs as measured by the VIF statistic. As shown in Table 5, VIF values between the constructs were less than the 3.0 threshold. This indicates multicollinearity should not be an issue when evaluating the structural model (Hair et al., 2021).

Table 5. *Variance Inflation Factor (VIF) Statistics for Predictor Variables.*

	Variable	1	2	3	4	5	6
1.	CSC		1.985		1.000	2.016	
2.	ERI						
3.	IR		1.081				
4.	MTE		2.071			2.015	
5.	SPI						
6.	VC					1.054	

CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness.

Next, the path coefficients and significance levels for the hypothesized relationships were analyzed. The path coefficients represent the strength of each independent variable (construct) predicting the dependent variable (construct). In this step, the beta coefficients and significance levels for hypothesized direct and indirect relationships were examined using PLS bootstrapping to generate these metrics as well as bias-corrected confidence intervals (Hair et al., 2022).

4.3.1 Direct Relationships

For the full model, the hypothesized direct relationships were analyzed first. The three direct relationships from the exogenous construct consciousness for sustainable consumption were assessed. The three relationships include the positive relationships with sustainable purchase intentions, e-waste recycling intention, and motivation towards the environment. The results indicate that all three relationships are positive and significant, supporting H1, H2, and H3. Next, two other direct relationships were analyzed that are from the endogenous construct motivation towards the environment. These two relationships include the hypothesized positive relationships with sustainable

purchase intention and e-waste recycling intention. The results for these two relationships are positive and significant, supporting H4 and H5. Table 6 shows the results of the analysis of the five hypothesized direct relationships.

Table 6. *Path Coefficients, T Statistics, and P Values for Direct Effects of the Hypothesized Relationships shown in Figure 1.*

	Hypothesized Relationship	Path Coefficients	T Statistics	P Values	Significant (<.05)
H1.	CSC→ ERI	.161	3.138	.001	Yes
H2.	CSC→ SPI	.222	2.933	.003	Yes
H3.	CSC→ MTE	.703	21.499	.000	Yes
H4.	MTE→ SPI	.188	2.227	.027	Yes
H5.	MTE→ ERI	.601	11.843	.000	Yes

CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness.

4.3.2 Indirect Relationships – Mediation

Next, the indirect mediated effects were assessed in terms of the coefficient sizes and significance levels via 10,000 samples with bootstrapping. This process facilitates obtaining solutions for more complex models with smaller sample sizes by employing randomly drawn observations to create multiple subsamples of the original data to analyze the model and calculate relationship statistical significance (Hair et al., 2017; Hair et al., 2019, Hair et al., 2021). This method also facilitates the assessment of complex direct and indirect relationships. Mediation examines the progression in the relationship between the exogenous variable/construct to an interim endogenous variable and then to the ultimate endogenous outcome variable (Hair et al., 2017).

Evaluation of mediation in this study followed the PLS-SEM assessment approach recommended by Sarstedt et al. (2020), which is superior to other approaches such as PROCESS. Results indicated motivation towards the environment partially mediates the relationship between consciousness for sustainable consumption and e-waste recycling intention, as well as between consciousness for sustainable consumption and sustainable purchase intentions. These findings provide support for both H5 and H6, suggesting motivation toward the environment is an important factor in facilitating sustainable consumer outcomes (purchasing and recycling intentions). Evaluation metrics for the indirect mediated relationships are shown in Table 7.

Table 7. *Path Coefficients, T Statistics, and P Values for Indirect Mediation Effects of the Hypothesized Relationships shown in Figure 1*

	Hypothesized Relationship	Path Coefficients	T Statistics	P Values	Significant (<.05)
H6.	CSC→ MTE→ ERI	.422	10.314	.000	Yes
H7.	CSC→ MTE→ SPI	.132	2.206	.027	Yes

CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention

4.3.3 Other Types of Relationships – Moderation

Potential moderating relationships proposed in Chapter 2 were assessed next. This involved analyzing the path coefficients and statistical significance of the moderating effects of value consciousness and innovation resistance variables. Specifically, value consciousness was hypothesized to moderate the relationship between consciousness for sustainable consumption and sustainable purchase intention, as well as the relationship

between motivation towards the environment and sustainable purchase intention. Likewise, innovation resistance was hypothesized to moderate the relationship between consciousness for sustainable consumption and e-waste recycling intention, as well as the relationship between motivation towards the environment and e-waste recycling intention. None of the moderating effects for our full model were significant, so H8, H9, H10, and H11 were not supported. Results for all hypothesized moderated relationships for the full model are shown in Table 8.

Table 8. *Path Coefficients, T Statistics, and P Values for Indirect Moderation Effects of the Hypothesized Relationships shown in Figure 1*

	Hypothesized Relationship	Path Coefficients	T Statistics	P Values	Significant (<.05)
H8.	VC*CSC → SPI	-.023	.243	.808	No
H9.	VC* MTE→ SPI	.107	1.110	.267	No
H10.	IR*CSC→ ERI	.031	.382	.702	No
H11.	IR*MTE→ ERI	.008	.102	.919	No

CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; IR = Innovation Resistance; VC = Value Consciousness

4.3.4 In-Sample Explanatory Power and Out-of-Sample Prediction

A common measure used to assess the explanatory power of a structural model is the coefficient of determination, or R^2. The R^2 measures in-sample explanatory power for endogenous constructs (Hair et al., 2020; Hair & Sarstedt, 2021b). As such, the R^2 value represents the amount of variance in a dependent variable that is explained by the independent variables based on an in-sample approach. R^2 values range from 0 to 1, with higher values representing higher predictive ability of the structural model. While acceptable R^2 values depend on the context of the research, an R^2 between 0.25 and 0.50

is generally considered a weak effect, a value between 0.50 and 0.75 is considered a moderate effect, and a value above 0.75 is considered substantial (Hair et al., 2011; Hair et al., 2021).

Table 9 displays the R^2 values for the endogenous variables in the structural model. Two of the variables (SPI and CSC-ECON) demonstrate weak explanatory power within the model. However, the remaining six dimensions have R^2 values ranging from 0.494 to 0.818, indicating overall moderate effects. The adjusted R^2 values indicate very little change in the values when adjusting for the number of predictor variables, indicating the model is not overfitted (Hair et al., 2018; Hair et al., 2019). It should also be noted that R^2 values were not substantially impacted by the inclusion or removal of items with low-loadings as mentioned above in section 4.2.

Table 9. *Coefficients of Determination for Consciousness for Sustainable Consumption, Motivation Towards the Environment, E-Waste Recycling Intention, and Sustainable Purchase Intention*

Construct	R^2	R^2 Adjusted
Consciousness for Sustainable Consumption (HOC)		
CSC- Economic Dimension	0.228	0.225
CSC- Environmental Dimension	0.736	0.735
CSC- Social Dimension	0.818	0.818
Motivation Towards the Environment	0.494	0.492
E-Waste Recycling Intention	0.546	0.539
Sustainable Purchase Intention	0.217	0.205

The next analysis performed in the structural model was the *f*2 statistic. The *f*2 provides a means to determine the effect size of a driver construct on a specific dependent construct. Guidelines for assessing are values of 0.02, 0.15, and 0.35,

respectively, represent small, medium, and large effects of an exogenous latent variable on an endogenous latent variable (Cohen, 1988; Hair et al., 2019). Effect size values of less than 0.02 indicate that there is no effect. Table 10 shows the effect sizes for all exogenous variables on each endogenous variable studied. All proposed relationships meet minimum effect size guidelines except the proposed moderation hypotheses.

Table 10. *f^2 Effect Sizes for all Exogenous Variables on each Endogenous Variable Studied*

Path	f^2 Effect Size	Effect Size Level
CSC → ERI	0.029	Small
CSC → SPI	0.031	Small
CSC → MTE	0.975	Large
MTE→ SPI	0.022	Small
MTE→ ERI	0.384	Large
VC*CSC→ SPI	0.000	NE
VC*MTE→ SPI	0.007	NE
IR*CSC→ ERI	0.002	NE
IR*MTE→ ERI	0.000	NE

CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness; NE = No Effect.

The final steps of the CCA assessment process are to analyze out-of-sample prediction using Q^2 and the PLSpredict option in SmartPLS. In sample prediction has the potential to overestimate the predictive abilities of the model, leading to overfitting of the model. The first step performed to assess out-of-sample prediction was to review the Q^2 metric for endogenous constructs. The Q^2 value is obtained by using the blindfolding procedure which omits data points and estimates the parameters with the remaining data

points (Chin, 1998; Tenenhaus et al., 2005; Henseler et al., 2009). According to Hair et al. (2017), a Q^2 value greater than zero (0) signifies the theoretical model has predictive relevance for the chosen endogenous construct. Using an omission distance of 10, all of the endogenous variables within the full model return values greater than 0. Thus, the full model shown in Figure 2 establishes moderate predictive relevance according to the Q^2 value.

PLSpredict's out-of-sample assessment processes provide a more accurate representation of the ability of a structural model to infer from the sample data to a larger population (Shmueli et al., 2019; Hair et al., 2020; Hair & Sarstedt, 2021a; Manley et al., 2021). PLSpredict evaluates out-of-sample prediction using a training and hold-out sampling procedure. The procedure applied in this study specified 10 folds and 10 iterations for each fold. The Q^2 predict values were all above 0, demonstrating good predictive relevance. The PLS-SEM root mean square error (RMSE) was also compared with the linear model RMSE. Error for the PLS-SEM model (the proposed model) was less than that for the linear model, indicating little error for the model.

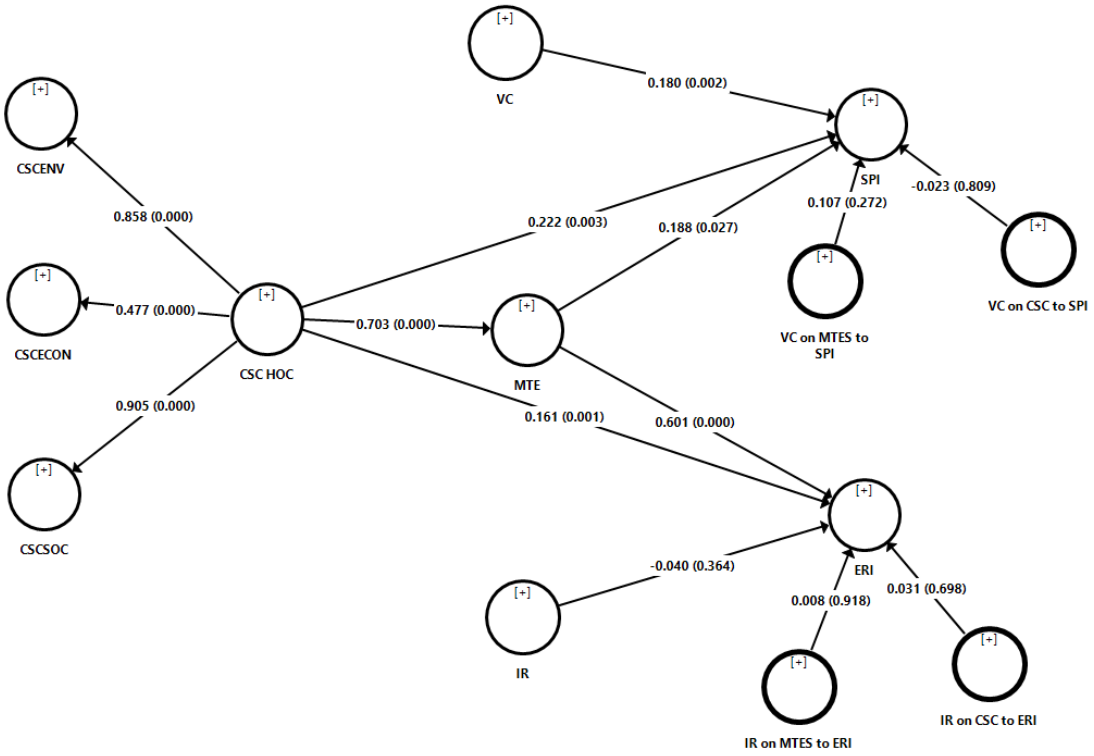

Figure 2. Path Coefficients and Significance Values. *Model of MTE Mediating the Relationship Between Consciousness for Sustainable Consumption and Sustainable Behavior Outcomes; Including the Moderating Roles of Value Consciousness and Innovation Resistance.* CSC = Consciousness for Sustainable Consumption; ERI = E-Waste Recycling Intention; IR = Innovation Resistance; MTE = Motivation Towards the Environment; SPI = Sustainable Purchase Intention; VC = Value Consciousness.

CHAPTER V

DISCUSSION

This chapter summarizes the findings of the study and is organized in four sections. First, a summary discussion of the results is presented. Next, the theoretical and managerial implications of the research are discussed. In the third section of this chapter, study limitations are discussed, along with recommendations for future research. Finally, the last section of this chapter contains overall observations and conclusions regarding this research.

5.1 Summary of the Results

The goal of this research was to analyze consumers' attitudes and beliefs towards sustainable behaviors that impact closed-loop supply chains. Based on this objective, a survey was conducted to obtain responses from 350 participants to examine potential relationships between attitudes and beliefs surrounding sustainable consumption, environmental motivation, and intention to engage in sustainable electronics consumption and disposal behaviors.

The results above outline five significant direct relationships and two significant indirect mediating relationships. For the direct relationships, we found that consumers' consciousness for sustainable consumption is significantly and positively related to e-

waste recycling intentions, sustainable purchase intentions, and overall motivations towards the environment. Consumers' motivation towards the environment was found to impact e-waste recycling intentions and sustainable purchase intentions positively and significantly.

Regarding indirect relationships, motivation towards the environment showed a mediating role between consciousness for sustainable consumption and sustainable behavior intentions. Specifically, the presence of motivations towards the environment were found to strengthen consumers' intentions to engage in sustainable purchasing behaviors as well as e-waste recycling behaviors. There were no significant moderating relationships. These overall findings will be discussed and expanded further in the remaining sections.

5.2 Theoretical and Managerial Implications

This research contributes to academic literature in three primary ways. The first contribution is the finding that consciousness for sustainable consumption is significantly and positively related to motivation towards the environment. Numerous studies have explored consumer motivation to engage in sustainable consumer behaviors (Ellen at al., 1991; Loock et al., 2013; Shafiei & Maleksaeidi, 2020). Nonetheless, there remains a need for further exploration that assesses awareness and consciousness for sustainable consumption as a driver of sustainable consumption motivation (Buerke et al., 2017; Pekkanen et al., 2018). The results of this study indicate that consumer consciousness and sustainability-focused beliefs have a direct positive impact on motivation for sustainable behavior. In other words, as consumers report that environmental and social awareness are important to them, they are more likely to demonstrate motivation to engage in

sustainable behaviors. Likewise, results of this study show that this sustainable motivation significantly impacts e-waste recycling behaviors and intentions to purchase sustainably. Future studies should, in turn, investigate ways to bring attention and awareness to modern sustainability challenges, in hopes of impacting consumers' consciousness for these issues. For instance, Hansmann (2010) emphasizes the role that the media plays in raising public awareness for sustainable development. Looking forward, media reporting should present sustainability challenges as mentioned in this study in an accessible and interesting manner.

In addition, this study contributes to existing self-determination theory literature by laying the foundation for researchers to better understand the relationship between consumers' awareness of resource consumption consequences and the varying types of motivation for engaging in sustainable behaviors. By expanding the current theoretical foundations of these relationships to examine the relationship between CSC and MTE, we aim to identify means of shortening the attitudes-behaviors gap where many consumers say they are sustainable-minded but fail to translate those attitudes to behaviors. Previous research has demonstrated that intrinsic, self-determined forms of motivation, when compared to non-self-determined forms, are generally related to a higher frequency of sustainable consumer behavior (Baxter & Pelletier, 2020). These prior findings should be further evaluated to draw attention to self-determined forms of motivation, those stemming from one's personal values, awareness, consciousness. While the current study did not explicitly distinguish between the types of motivation reported by consumers, the strength of the relationship between CSC and MTE suggests that more attention is warranted this area.

The third contribution is the finding that there is no moderating effect of value consciousness on intention to purchase, or of innovation resistance on intent to recycle. This is unexpected since prior research has suggested otherwise. In the case of value consciousness, perhaps consumers' internal values and beliefs outweigh their reluctance to spend more money on products, assuming that products can be proven to have been manufactured in ways that align with their core values. As noted previously, research has shown that consumers with environmental concerns are often less sensitive to price and are willing to accept trade-offs between environmental benefits and higher prices (Laroche et al., 2001). The brand or corporation releasing the product should also be considered as potentially impacting purchase intention. In the case of high-involvement goods (consumer electronics), there is generally an element of trust, established quality, and performance that is expected from brands such as Apple. In this sense, value consciousness may not impact purchase decisions when purchasing from an established brand (Rao & Monroe, 1989; Keller, 1998). In the case of innovation resistance, respondents indicated that barriers such as time, effort, costs, and risks wouldn't impact their intention to recycle e-waste. This is again another interesting finding. While prior studies have shown evidence that barriers were weakened when environmental awareness was high (Sajid & Zakkariya, 2022), it is surprising that there was no evidence of the barriers moderating recycling outcomes in this study. Attention should be given to determining what the new barriers might be for e-waste recycling, given these findings.

5.3 Limitations and Future Research

As demonstrated previously, this study contributes new knowledge to sustainable consumption literature regarding consumer motivation. There are several limitations, however, to be noted. First, it is important to recognize that because this study was conducted in the United States alone, results may not prove generalizable to other countries. Future research should consider how various geographic areas including economic and cultural phenomena, are likely to impact the conceptual and empirical results of the relationship examined in this research.

Also, this study relied on a single administration of the research instrument to collect self-reported data, which introduces the possibility of common method bias. If present, common method bias has the potential to increase or decrease observed correlations between the independent and dependent variables (Podsakoff et al., 2003; 2012). In this study, there may be some reporting issues on whether the respondents admit to not showing concern about environmental or social issues, even though anonymity was fully explained to all participants. As the study relied on self-reports, social desirability may also have been a distorting factor influencing the results. Nevertheless, anonymous online survey panels as utilized in this study have proven to yield considerably lower social desirability biases than non-anonymous or face-to-face surveys (Dodou & de Winter 2014).

While moderation was not found for the variables included in this study, further consideration should be given to other factors that may impact purchase and recycling intentions. For example, participation in these sustainable behaviors may vary by age/generation, geographic location, or socioeconomic status. Political ideology has also

been identified as a factor impacting sustainable consumer behaviors. Specifically, differences have been noted between conservatives and liberals in terms of openness for new experiences, tolerance for uncertainty, and resistance to change (Watkins et al. 2016). An additional area of focus has been recently identified is surrounding psychological ownership of smartphones and digital technologies (Kirk & Swain, 2018). As consumers see their digital devices as extensions of their being, they may be hesitant to give up or donate them, even once they have reached the end of their useful life. These areas should be explored as researchers aim to better understand how to increase sustainable consumption and disposal behaviors.

5.4 Conclusions

With over 50 million tons of electronics waste now being generated annually, it has never been more important to understand consumers' motivations for mitigating the harmful impacts of e-waste on the environment and society. The conceptual and empirical results presented within this study can be used to help guide future explorations of consumer opinions and behaviors, especially as they relate to consumer electronics purchases and electronics waste. Emphasis should be placed on the role of motivation in future studies since this concept aligns with consumers' attitudes and beliefs for engaging in sustainable behaviors. Additionally, the surprising findings that value consciousness and innovation resistance do not impact sustainable consumer behaviors should be highlighted. Future research should, in turn, explore additional barriers to engaging in sustainable behaviors, as this study has shown traditional barriers such as price and

privacy concerns may no longer be as influential as once suspected. Overall, the goal is to increase consumers' participation in sustainable consumption behaviors, as this is a critical piece of closing the loop for today's supply chains.

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APPENDICES

Appendix A

IRB Approval to Conduct Research

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INSTITUTIONAL REVIEW BOARD
February 28, 2022

Principal Investigator:	Jennifer Henderson		
IRB # and Title:	IRB PROTOCOL: 22-020 [1863902-1] CLOSING THE LOOP: AN EXAMINATION OF CONSUMER ATTITUDES AND MOTIVATION FOR SUSTAINABLE BEHAVIORS		
Status:	APPROVED	Review Type:	Exempt Review
Approval Date:	February 28,2022	Submission Type:	New Project
Initial Approval:	February 28,2022	Expiration Date:	
Review Category:	45 CFR 46.104 (d)(2): Research that only includes interaction involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior (including visual or auditory recording): i. Information obtained is recorded by the investigator in such a manner that the identity of human subjects cannot be readily ascertained, directly or through identifiers linked to the subjects		

This panel, operating under the authority of the DHHS Office for Human Research and Protection, assurance number FWA 00001602, and IRB #00000286 or #00011574, has reviewed the submitted materials for the following:

1. *Protection of the rights and the welfare of human subjects involved.*
2. *The methods used to secure and the appropriateness of informed consent.*
3. *The risk and potential benefits to the subject.*

The regulations require that the investigator not initiate any changes in the research without prior IRB approval, except where necessary to eliminate immediate hazards to the human subjects, and that **all problems involving risks and adverse events be reported to the IRB immediately!**

Subsequent supporting documents that have been approved will be stamped with an IRB approval and expiration date (if applicable) on every page. Copies of the supporting documents must be utilized with the current IRB approval stamp unless consent has been waived.

Notes:

Appendix B

Codebook for data collection

SURVEY

Items on a 1 to 7 scale with anchors of Strongly Disagree (1) to Strongly Agree (7).

Consciousness for Sustainable Consumption (CSC)		
It is very important for me personally that (during the manufacturing of a product)...		
ENV	ENV1	It is made from recycled materials.
	ENV2	It can be disposed of in an environmentally friendly manner.
	ENV3	It is packaged in an environmentally friendly manner.
	ENV4	It is produced in an environmentally friendly manner.
SOC	SOC1	Workers' human rights are adhered to.
	SOC2	No illegal child labor is involved.
	SOC3	Workers are not discriminated against.
	SOC4	Workers are not abused.
	SOC5	Workers are treated fairly and are fairly compensated.
Even if I can financially afford a product, it is important for me personally that...		
ECON	ECON1	I/you really need this product?
	ECON2	It is a useful product?
	ECON3	I/you absolutely require this product?
	ECON4	I/you don't become over indebted in the long term?
	ECON5	The expenses don't unduly burden my/your financial situation?
	ECON6	I/you don't have to forego future purchases?
	ECON7	I/you don't have to take money from emergency financial reserves?

Items on a 1 to 7 scale with anchors of Strongly Disagree (1) to Strongly Agree (7). **Motivation Towards the Environment (MTES)**		
Why would you be motivated to do things for the environment (ex: recycle, reduce plastic use, buy secondhand, donate old items, etc)?		
IM	IM1	Pleasure in mastering new ways to help
	IM2	Pleasure in improving the quality of the environment
	IM3	Pleasure when doing things for the environment
	IM4	Pleasure in contributing to the environment
INTEG	INTEG1	An integral part of my life
	INTEG2	Seems that taking care of myself and environment are inseparable
	INTEG3	Part of the way I've chosen to live
	INTEG4	Has become a fundamental part of who I am
IDEN	IDEN1	Is a sensible thing to do
	IDEN2	A way I have chosen to contribute
	IDEN3	Is a reasonable thing to do
	IDEN4	A good idea to do something about the environment
INTRO	INTRO1	I'd regret not doing something
	INTRO2	Would feel guilty if I didn't
	INTRO3	Would feel bad if I didn't do anything
	INTRO4	Would feed ashamed if I didn't
ER	ER1	Other people will be upset if I don't
	ER2	For the recognition I get from others
	ER3	Because my friends insist that I do
	ER4	To avoid being criticized
AMO	AMO1	I wonder why; the situation isn't improving
	AMO2	Don't know; have the impression I am wasting time

	AMO3	Don’t know; can’t see how my efforts are helping
	AMO4	Don’t know; can’t see what I’m getting out of it

Items on a 1 to 7 scale with anchors of Strongly Disagree (1) to Strongly Agree (7).

Innovation Resistance (IR) *E-waste is a popular, informal name for electronic products nearing the end of their "useful life." When it comes to recycling electronic devices that I no longer use or need:*		
IR	IR1	I fear that after the transfer of my electronic devices for recycling, the stored information may be misused.
	IR2	I fear that my electronic devices may be misused by the collection center.
	IR3	I feel that the traffic expenses of e-waste recycling are high.
	IR4	I feel that the handling charges of e-waste recycling are high.
	IR5	In my opinion, e-waste recycling is often too complicated to be useful.
	IR6	I have an image that e-waste recycling is difficult to adopt.
	IR7	In my opinion, it is not easy to find information on e-waste recycling.
	IR8	In my opinion, it is not easy to find an e-waste collection center.

Items on a 1 to 7 scale with anchors of Strongly Disagree (1) to Strongly Agree (7).

Value Consciousness (VC) *Please answer the following questions, considering your general purchasing habits and values.*		
VC	VC1	I am very concerned about low prices, but I am equally concerned about product quality.
	VC2	When shopping, I compare the prices of different brands to be sure I get the best value for the money.
	VC3	When shopping, I always try to maximize the quality I get for the money spent.
	VC4	When I shop, I like to be sure that I am getting my money’s worth.
	VC5	I generally shop around for lower prices on products, but they still must meet certain quality requirements before I will buy them.

Items on a 1 to 7 scale with anchors of Strongly Disagree (1) to Strongly Agree (7).

Sustainable Purchase Intention (SPI)		
I would purchase remanufactured or sustainably-made electronic devices (smartphones, PCs, etc) if:		
SPI	SPI1	They were cheaper.
	SPI2	They were available in more stores.
	SPI3	They were available closer to home.
	SPI4	I trusted their certification and source of materials.
	SPI5	They had better visibility in store.
	SPI6	I better understood their benefits.
	SPI7	I better understood what is written on the packaging.
	SPI8	I knew the brands better.
	SPI9	They offered more trial opportunities.
	SPI10	I have had a better consumer experience in the past.
	SPI11	My day-to-day brand also offered this type of product.

Items on a 1 to 7 scale with anchors of Strongly Disagree (1) to Strongly Agree (7). **E-Waste Recycling Intention (ERI)** *E-waste is a popular, informal name for electronic products nearing the end of their "useful life." When it comes to recycling electronic devices that I no longer use or need:*		
ERI	ERI1	I am interested in electronic waste recycling initiatives.
	ERI2	In the future, I will donate my old devices and machines to recycling firms.
	ERI3	I am generally eager to recycle electronic devices in the future if it is convenient.
	ERI4	I am willing to trade-in my old devices in exchange for credit on new device purchases.
	ERI5	I have recycled electronic devices in the past.
	ERI6	I prefer to retain old electronics devices to use as backup or for friends and family to use.

Attention Check Questions		
ATT	ATT1	Research has suggested that instructional manipulation checks be used in surveys to improve data quality and ensure attention is being given to the questions being asked. For this question, select option 5- 'Strongly Agree'.
		○ 1- Strongly disagree ○ 2- Disagree ○ 3- Neither agree not disagree ○ 4- Agree ○ 5- Strongly agree
ATT	ATT2	Please indicate your agreement with the following statement:
		To demonstrate that you have read this question and followed the instructions, select "7- Strongly Agree
		1- Strongly disagree ○ 2 ○ 3 ○ 4- Neither agree nor disagree ○ 5 ○ 6 ○ 7- Strongly Agree ○

Tech Usage Question		
TU	TU1	Freeform text box to accept numerical input:
		How many consumer electronic devices do you personally own? Consider only those within your possession, not in your overall household. Desktop computers Laptop computers Output devices (monitors, printers, speakers, etc) Input devices (keyboards, mice, scanners, etc.) Tablets Smartphones Wearable devices (fitness trackers, smartwatches, etc.) Televisions Gaming devices Digital cameras and recording devices Other

BIOGRAPHICAL SKETCH

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Publications and Presentations:

Henderson, J. "The Future of Electronics Consumption and the Role of the Sustainable Consumer" Association for Marketing Theory and Practice Conference, 2020.
Howard, M., & Henderson, J., "A review of exploratory factor analysis in tourism and hospitality research: identifying current practices and avenues for improvement". Journal of Business Research, 2022.
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