Behavioral reasoning theory (BRT) perspectives on E-waste recycling and management

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ABSTRACT

Each year, millions of tons of electronic waste (or e-waste) are generated worldwide, thus, fueling concerns among scholars, practitioners, policymakers, and governments about e-waste recycling and management. The past few years have witnessed a growing interest among scholars to examine the behavioral issues concerning e-waste recycling. However, most of the existing studies have focused on adopting e-waste recycling and related innovations. It is already known that 'reasons for' and 'reasons against' the adoption of any innovation are quantitatively different. The current study bridges this gap by utilizing a novel consumer behavior framework called behavioral reasoning theory (BRT) to study e-waste recycling attitudes and intentions. The study examined the relative influence of 'reasons for' and 'reasons against' in predicting attitude and intentions within the context of e-waste recycling by using a single framework. The developed model was tested using structural equation modeling with 774 Japanese consumers. The study also examined the moderating role of environmental assessment and environmental concerns in influencing the studied associations. The results suggest that 'reasons for' was positively associated with attitude and intentions. The consumer values shared negative associations only with 'reasons against.' The study findings offer interesting insights for service providers, policymakers, and governments.

1. Introduction

The rapid advancement of technology and the growing needs of consumers have resulted in increased consumption of natural resources, which has, in turn, led to the equally rapid growth of electronic waste (e-waste) worldwide (Mmereki et al., 2016). E-waste consists of the electronic and electrical equipment, sub-assemblies, and components that have been discarded by their owners (Dias et al., 2019). A relatively recent study suggested that e-waste was growing annually at the rate of 4–5% (Islam et al., 2016) and has become one of the major pollution problems because of the threats posed to the environment and human health (Dias et al., 2018). One of the primary reasons for this is the scarcity of proper recycling technology for processing the massive volumes of e-waste generated annually (Dias et al., 2018; Jujun et al., 2014). The e-waste contains hazardous and toxic materials that can harm the environment and human health and well-being (Echegaray and Hansstein, 2017).

In 2014, 41.8 million metric tons of e-waste were generated worldwide (Wang et al., 2016). Furthermore, this massive volume of e-waste was expected to exceed 50 million metric tons in 2018 alone (Peng et al., 2018) and close to 52.2 million by 2021 (Nguyen et al., 2018). This growing volume of e-waste worldwide calls for serious consideration of ways to deal with the problem.

Scholars have highlighted the economic and business aspects of e-waste recycling because the processing of e-waste can be profitable since it contains precious metals that can be recovered and reused by employing the proper techniques (Dias et al., 2018). Furthermore, e-waste recycling can also eliminate the need to produce virgin materials (Baxter et al., 2016). The objective of e-waste recycling is to efficiently recover valuable metals, safely dispose of toxic and hazardous substances so that they do not pose any risk to human health and environment, and create sustainable businesses (Schluep et al. et al., 2009). Recycling also has a social impact as it generates employment opportunities, and companies are encouraged to engage in the recycling business (Schluep et al., 2009).

Despite the fact that e-waste recycling has various environmental and societal benefits, consumers often engage in illegal and open dumping of non-functional parts as well as residues of e-waste (United Nations University, 2017). Some of the possible reasons for illegal or the open dumping of e-waste are a lack of awareness, the convenience of the action, monetary incentives, weak laws and regulations, and the non-availability of recycling sites (United Nations University, 2017). Scholars suggest that it is important that people are motivated to engage in e-waste recycling for proper e-waste management (Echegaray and Hansstein, 2017). Consequently, it is important to understand the consumer attitudes, beliefs, and behavioral issues related to e-waste recycling to ensure success (Kumar, 2019; Liu et al., 2019; Wang et al., 2018; Borthakur and Govind, 2017).

Most of the existing studies focused on understanding the reasons for engaging in e-waste recycling (Nduneseokwu et al., 2017; Wang et al., 2018). In other words, prior literature has mainly focused on motives or facilitators towards engaging in e-waste recycling, while the equally important inhibitors or barriers that contribute to the consumer resistance towards engaging in e-waste recycling are rarely studied. Claudy et al. (2015) and Sahu et al. (2020) suggested that scholars should focus on understanding both sets of factors, namely facilitators (acceptance) as well as inhibitors (resistance) to any innovation, action, or behavior. This is because acceptance and resistance are quantitatively different, so they influence consumer decision-making in different ways. Zhong and Huang (2016) have emphasized that the consumer's unwillingness towards e-waste recycling was a major challenge that requires urgent scientific attention. To the best of our understanding, no prior empirical study has, within a single framework, examined the relative influence of the many factors contributing to the adoption and resistance towards e-waste recycling.

The current study bridges this gap by utilizing the behavioral reasoning theory (BRT) for understanding consumers' intentions to participate in e-waste recycling. The research model developed by using BRT was evaluated using an online cross-sectional survey of 774 Japanese consumers. BRT enables scholars to examine the relative influence of both 'reasons for' (related to acceptance) and 'reasons against' (contributes to resistance) regarding participation in e-waste recycling. BRT is an emerging consumer behavior theory that provides a comprehensive overview of the different behavioral aspects concerning consumer intentions (Sahu et al., 2020). BRT suggests the associations between reasons (drive and restrict) and values (representing norms and beliefs) as well as attitude and intentions to use a given innovation (Westaby, 2005). The current study findings are of special relevance to scholars, policymakers, service providers, and practitioners engaged in e-waste recycling and management.

The present research examined Japanese consumers' e-waste recycling behavior because, in recent years, the continuous production and increased consumption of electronic products has resulted in the exponential generation of e-waste in Japan (The

Japan Times, 2015). The dramatic increase in the amount of e-waste generated in Japan makes it the third-largest e-waste producer in the world after China and the US (Richter, 2017). Japan produced 2.2 million metric tons of e-waste in 2013, but only 24%—30% of the generated e-waste was recycled (The Japan Times (2015). According to a recent report, nearly 650,000 tons of small electronics and household appliances are discarded in Japan every year, of which only 100,000 tons are recycled (BBC News, 2016). E-waste in Japan is collected by retailers from consumers and then shipped to the selected recycling centers. Manufacturers are responsible for setting up their recycling facilities. Moreover, it is also possible that the consumers can directly take their e-waste to the recycling center or their nearby municipality (Borthakur and Govind, 2018).

The current study is structured as follows: Section 2 presents the review of relevant literature on e-waste recycling and management and BRT's theoretical framework. In Section 3, the theoretical framework and the different hypotheses are developed and discussed. Section 4 presents the research methodology, and Section 5 covers the study results. The discussion in light of the prior literature is presented in Section 6. The different theoretical and practical implications, and the limitations and directions for future research are discussed.

2. Background literature

2.1. E-waste recycling and management

E-waste recycling and management are a part of a broad spectrum of initiatives referred to as waste management, with consumer awareness being one of the major driving forces behind it waste management. Consequently, scholars are increasingly interested in a better understanding of the critical issues related to consumer intentions and their related behavior. The review of the prior literature on e-waste recycling indicates that scholars have examined different behavioral factors that influenced their e-waste recycling behavior. This included demographics (e.g., age, monthly income, and educational status) (Song et al., 2012; Yin et al., 2014) attitude (Liu et al., 2019) environmental awareness (Liu et al., 2019; Nixon and Saphores, 2007; Sun et al., 2015) environmental concerns (Dwivedy and Mittal, 2013; Nnorom et al., 2009) convenience (Peng et al., 2018; Ylä-Mella et al., 2015; Zhang et al., 2019) recycling habit (Wang et al., 2011) social influence (Kumar, 2019) behavioral control (Kumar, 2019) and incentives (Peng et al., 2018; Zhang et al., 2019).

The prior literature has also shed light on the cultural aspects related to e-waste recycling; for example, a study showed that Indians either donated or stored their old mobile phones at home (Dixit and Vaish, 2013). Similarly, the Chinese population was found to store e-waste at home (Chi et al., 2014). Ylä-Mella et al. (2015) observed similar behavior among the residents of Finland and suggested that 55% of respondents have two or more old mobile phones stored at home. Kumar (2019), in their cross-cultural study on young Indian and Chinese adults, reported that in both countries, young adults often dispose of their e-waste in the informal sector. This is due to the informal sector's monetary offerings and door-to-door collection facility (Kumar, 2019).

Several electrical and electronic equipment manufacturers have established centers for the collection of obsolete electronic equipment from consumers (Agrawal et al., 2015; Bovea et al., 2017). This is one strategy to address the problem of e-waste management, as the collected products can either be repaired and reused or recycled and disposed in a proper manner (Agrawal et al., 2015; Bovea et al., 2017). However, despite the availability of recycling centers, consumers often do not use them and instead either sell the old electrical and electronic equipment in second-hand stores or dump

them in open spaces (Dixit and Vaish, 2013; United Nations University, 2017). This suggests that manufacturers must understand the driving forces and barriers due to which consumers do not engage in e-waste recycling. The present study has tried to address this need and gap in the literature.

2.2. Behavioral reasoning theory (BRT)

Scholars argue that it is becoming increasingly important for firms to better understand why, when, and whether consumers will accept an innovation (Sahu et al., 2020). Different theoretical frameworks are available to this end, which can enable scholars and practitioners to understand the adoption of any innovation. Some of the common examples include the diffusion of innovation theory (DOI), the technology acceptance model (TAM), the theory of reasoned action (TRA), and the theory of planned behavior (TPB). However, most of these frameworks are criticized since these focused mainly on the acceptance related factors while consumer resistance is mostly ignored (Claudy et al., 2015; Sahu et al., 2020).

The prior literature has already shown that new products and services suffer from a high failure rate because of a lack of focus on understanding the multiple reasons behind consumer resistance or the hindrances to their acceptance (Antioco and Kleijnen, 2010). The situation is no different in e-waste recycling since most prior studies focused on understanding the positive factors that influence the intentions to recycle e-waste. Consequently, knowledge of consumers' willingness to engage in e-waste recycling is sparse, making it a growing concern among policymakers for the problem to be investigated as soon as possible. In keeping with such a demand, scholars also agree that there is an urgent need to identify, develop, and use newer behavioral models which can provide a more comprehensive picture of the factors that influence the adoption of and the resistance to innovations (Claudy et al., 2015; Kleijnen et al., 2009).

BRT is a theoretical framework that enables scholars and practitioners to investigate the relative influence of both the 'reasons for' and 'reasons against' the intentions towards any innovation (Westaby, 2005; Sahu et al., 2020). BRT is different from the acceptance frameworks because the latter only takes into account the 'reasons for' engaging in any innovation (Sahu et al., 2020). Scholars have suggested that 'reasons for' resisting any innovation was not necessarily the opposite of the 'reasons for' accepting that innovation (Claudy et al., 2015; Kleijnen et al., 2009; Sahu et al., 2020). For example, the health benefits of recycling e-waste could be 'reasons for' engaging in recycling. The high cost and inconvenience could be the possible reasons people tended to resist the recycling of e-waste. Hence, the holistic comprehension of consumer behavior cannot be obtained without an examination of both the 'reasons for' and the 'reasons against.'

In this regard, BRT not only allows scholars to distinguish between the 'reasons for' and the 'reasons against,' but it also helps in evaluating the influence of these factors on the consumers' intentions and behavior by using a single decision-making framework (Sahu et al., 2020). Consequently, BRT offers a comprehensive explanation of behavior when compared to other theories by including context-specific reasons that help people in justifying their actions (Westaby, 2005). Furthermore, BRT presents important empirical linkages between values, beliefs, reasons (for and against), attitude, and behavioral intentions. Because of the reasons above, recent studies have empirically shown that BRT can explain the higher percentage of variance in user intentions compared to other acceptance models (Claudy et al., 2015; Westaby et al., 2010). Scholars have utilized BRT for investigating consumer behavior in different areas, such as organic food (Tandon et al., 2020), alcohol over-consumption (Norman et al., 2012), resistive or favorable

consumer perceptions towards innovations (Claudy et al., 2015, 2013), managerial decision-making (Westaby et al., 2010), and also in case of the adoption of mobile banking (Gupta and Arora, 2017).

3. Framework and hypotheses

The current study has utilized BRT as a baseline theory for developing a research framework on understanding e-waste recycling behavior (see Fig. 1). BRT has four main components, namely, behavioral intentions, attitude, reasons (both for and against), and values. Behavioral intentions can be understood as the tendency of the consumer to engage in an action, task, or behavior (Kim et al., 2018). In comparison, attitude is defined as the degree of assessment of the positive or negative outcome of the behavior, e.g., if an attitude is positive towards a given behavior, then it is more likely that the individual will intend to engage in the behavior, and on the contrary, a negative assessment of the outcome will likely translate into non-engagement (Kumar, 2019; Sahu et al., 2020).

BRT postulates that reasoning takes center stage in consumers' mental processing behavior (Claudy et al., 2015). Westaby (2005) reported that reasons were the major predictors of attitude towards behavioral intention, consistent with the theory of explanation-based decision making and reasons theory. Reasoning theories hypothesize that if people have strong 'reasons for' or against engaging in the behavior, this helps them justify their actions. Furthermore, this also activates other factors that relate to behavioral intention. BRT categorizes "reasons" into two opposing sub-dimensions - 'reasons for' and 'reasons against' which are also represented as facilitators (adoption) and inhibitors (resistance), or pros and cons in the prior literature (Westaby, 2005). In light of this, reasons cover a wide range of context-specific factors that can help in improving the understanding of behavioral intentions (Westaby, 2005; Sahu et al., 2020).

Values are thought to be significant in shaping a person's attitude (Dreezens et al., 2005) and can be understood as abstract cognitions that provide a way for life (Austin and Vancouver, 1996). Furthermore, deeply held values are believed to affect people's behavior (Dillon and Gayford, 1997). Due to this, BRT has considered value as an important component.

The different hypothesized associations in the current research model are shown in Fig. 1 (Westaby, 2005). The 'reasons for,' 'reasons against,' and value are measured as second-order measures. The 'reasons for' were measured using personal and environmental benefits while the "reasons against" were examined using risk, usage, image, and value barriers. The value was measured using a single order measure named environmental concerns (see Table 1).

3.1. Attitude and intentions

The earlier literature suggests that a positive attitude was significantly associated with the willingness to engage in a given behavior (Tandon et al., 2020). Furthermore, it was seen that attitudes positively influenced consumer intentions (Basha and Lal, 2019; Claudy et al., 2015, 2013; Tandon et al., 2020). For example, Claudy et al. (2015) reported that consumers' attitude towards micro wind turbine usage and car-sharing positively influenced their adoption intentions. Tandon et al. (2020) found that consumers' attitude towards organic food has a positive influence on purchase intention. Similarly, positive consumers' attitude towards e-waste recycling is likely to be associated with increased intentions to recycle e-waste. Therefore, in the present study, we hypothesized:

H1. Attitude towards e-waste recycling shares a positive association with e-waste recycling intentions
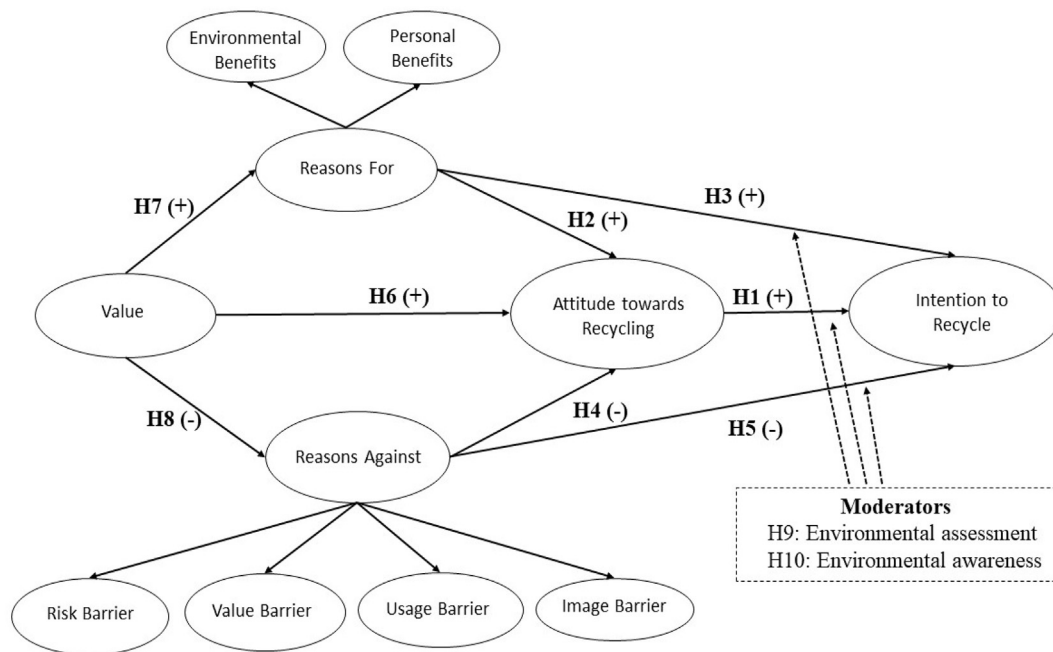
Fig. 1. Our research model.

Table 1
Factor loadings of the measurement and structural models.

Study Measures (Reference)		Measurement items	CFA	SEM
*Reasons for (RF)	Personal Benefits (Claudy et al., 2015)	PB1: Using e-waste recycling reduces the health hazards from electronic wastes	.79	.80
		PB2: Using e-waste reduces the chances of accidental damage at home	.57	.56
	Environmental Benefits (Claudy et al., 2015)	EB1: Using proper e-waste recycling protects the environment from toxic chemicals	.82	.82
		EB2: Using e-waste recycling reduces the risk of polluting the environment	.88	.88
		EB3: Using e-waste recycling cuts down the emission of greenhouse gases	.73	.72
*Reasons against (RA)	Risk Barrier (Kaur et al., 2020)	RB1: I fear that after the transfer of my electronic device for recycling, the stored information may be misused	.85	.85
		RB2: I fear that my electronic device may be misused by the collection center	.80	.80
	Value Barrier (Laukkanen, 2016; Wang et al., 2016)	VB1: I feel that the traffic expenses of e-waste recycling are high	.75	.66
		VB2: I feel that the handling charges of e-waste recycling are high	.70	.74
	Image Barrier (Kaur et al., 2020)	IB1: In my opinion, e-waste recycling is often too complicated to be useful	.77	.77
		IB2: I have an image that e-waste recycling is difficult to adopt	.64	.64
	Usage Barrier (Tandon et al., 2020)	UB1: In my opinion, it is not easy to find information on e-waste recycling	.85	.85
		UB2: In my opinion, it is not easy to find an e-waste collection center	.89	.89
Value (VAL)	Environmental Concerns (Tarrant and Cordell, 1997)	EC1: I have read newsletters, magazines or other publications written by environmental groups	.65	.65
		EC2: I have signed a petition in support of protecting the environment	.84	.84
		EC3: I have given money to an environmental group	.78	.78
		EC4: I have boycotted or avoided buying the products of a company because I felt that the company was harming the environment	.66	.66
Attitude (ATT) (Wang et al., 2016)		ATT1: E-waste recycling is good	.82	.81
		ATT2: E-waste recycling is beneficial	.81	.81
Intentions (INT) (Holland et al., 2006)		INT1: I am willing to speak to my friends about appropriate modes of disposing of electronic appliance	.73	.71
		INT2: I'm willing to spend some time taking my old electronic appliances to be recycled	.75	.77

Note. *Second-order measures, CFA = Confirmatory Factor Analysis, SEM = Structural Equation Modeling.

3.2. 'Reasons for' and 'reasons against.'

3.2.1. 'Reasons for,' attitude and intentions

With regard to a particular behavior, it was observed that the 'reasons for' acted as the motivators or facilitators that could instigate positive perceptions among consumers. The current study considers 'reasons for' to be composed of personal and environmental benefits because the extant literature on e-waste recycling emphasized the importance of these two variables (Botelho et al., 2016; Dwivedy and Mittal, 2013).

Personal benefits refer to the economic or non-economic gain accruing to the consumers if they participated in e-waste recycling. The economic benefit is the most commonly studied factor, which is also regarded as the major driver for changing consumer intentions (Botelho et al., 2016; Dwivedy and Mittal, 2013). The possibility of getting money on the return of obsolete products makes economic benefits a noticeable factor (Borthakur and Govind, 2018; Dixit and Badgaiyan, 2016). However, the prior research also considered a personal benefit as being non-economic, such as the reduced health hazard that consumers experience if

they participate in recycling. Due to this, the current study proposes that personal benefits are one of the important 'reasons for' engaging in e-waste recycling.

Environmental benefits refer to energy conservation, reduction in pollution, and the extended life of the product, among other things (Manaktola and Jauhari, 2007). E-waste recycling results in the recovery of valuable metals and the proper disposal of hazardous materials, both of which bring environmental benefits (Baxter et al., 2016). E-waste recycling eliminates the need for the production of virgin metals and, thus, reduces the environmental burden through safe disposal (Baxter et al., 2016). Scholars argue that the environmental benefit is neither the primary motivation nor the benefit perceived by the consumer (Manaktola and Jauhari, 2007). Nevertheless, Zhang et al. (2018) reported that consumers cared about environmental benefits and were willing to make choices in favor of the environment. Moreover, the aspect relating to environmental benefits became prominent in the case of e-waste recycling. Therefore, to assess the perceived importance of the environmental benefits for consumers with regards to e-waste recycling, environmental benefits were considered to be the second component comprising the 'reasons for' dimension of our framework.

The prior literature suggested that 'reasons for' was an important measure that influenced consumer's behavior in different contexts (Claudy et al., 2015; Westaby et al., 2010; Sahu et al., 2020; Tandon et al., 2020). For example, the 'reasons for' consuming organic food was positively associated with consumer attitude and intentions (Tandon et al., 2020). Due to this, the 'reasons for' towards e-waste recycling are likely to be associated with a positive attitude and intentions towards e-waste recycling. Therefore, in the present study, we hypothesized that:

H2. 'Reasons for' share a positive association with the attitude towards e-waste recycling

H3. 'Reasons for' share a positive association with intentions towards e-waste recycling

3.2.2. 'Reasons against, attitude and intentions

The 'reasons against' are collectively referred to as the resistors that have the power to create negative perceptions among individuals towards engaging in a given behavior (Sahu et al., 2020). The prior literature utilized the popular psychological innovation resistance theory (IRT) (Ram and Sheth, 1989; Kaur et al., 2020; Talwar et al., 2020) to examine the 'reasons against' component of the BRT model (Tandon et al., 2020). IRT suggests that the 'reasons against' or the barriers to engagement in a given task or behavior can be of five types - usage, value, risk, image, and tradition (Ram and Sheth, 1989). The pilot study with ten consumers suggested that the barrier of tradition was not a concern in that society (see Section 4.1 for details on the pilot study). Therefore, the current study considered only four barriers - risk, value, usage, and image.

Risk barrier. The consumers usually consider the different risks in a given activity. The perceptions about the risks act as a significant barrier in determining consumer behavior (Kaur et al., 2020; Talwar et al., 2020). The risk barrier shared a significant negative association with intentions towards the use of mobile payment systems (Kaur et al., 2020). Laptops, mobile phones, and cameras are some of the electronic equipment containing a consumer's personal information and confidential data (Liu et al., 2019; Tan et al., 2018), which can be recovered from obsolete products (Kumar, 2019). Thus, the theft of such personal information creates a risk barrier in the case of e-waste recycling. Consequently, the risk barrier act as an important component of 'reasons against' behavior. In the present study, the risk barrier was measured in terms of the fear associated with the misuse of the stored information by the recycling center.

The value barrier is mostly associated with the perceived monetary value gained by the consumer (Talwar et al., 2020). Talwar et al. (2020) reported that the value barrier shared a significant negative association with the purchase intentions in context to online travel agencies. Similarly, Kushwah et al. (2019a) highlighted that the value barrier negatively influences consumers' organic food consumption intention. Due to this, if the consumers perceive that engaging in formal e-waste recycling process will bring an extra cost, then their willingness to engage in the recycling process may be negatively affected (Dwivedy and Mittal, 2013; Wang et al., 2016). Furthermore, Wang et al. (2016) reported that the cost of e-waste recycling, when borne by the consumer, had a negative association with the intentions to recycle. Given this fact, people may prefer to dispose of their e-waste through informal channels or with ordinary garbage or to store it at home. These factors suggest that the value barrier is one of the most important components of 'reasons against' in our framework.

Usage barrier. Scholars have suggested that innovations that contradict the consumers' usual routine, values, and traditions suffer as a result of these persons not having positive adoption intentions (Kaur et al., 2020; Lian and Yen, 2014; Talwar et al., 2020). The inconvenience of practicing or using innovation impacts its usage and thus becomes a barrier. Similarly, an increase in the complexity of the task also decreases people's willingness to perform it (Taylor and Todd, 1995). Kaur et al. (2020) confirm the negative association of usage barriers with intention in a mobile payment solution. In the context of e-waste recycling, improving the convenience of recycling positively affects people's behavioral intention (Kochan et al., 2016; Liu et al., 2019; Zhang et al., 2019). The present study considered the usage barrier in terms of the consumers' perceived inconvenience of recycling and accessing to information on e-waste recycling. Due to this, it is an important component of the 'reasons against.'

Image barrier. Scholars emphasized that psychological factors were responsible for creating image barriers that arise when consumers have negative perceptions of the product, process, brand, or repercussions of the innovation (Kaur et al., 2020; Lian and Yen, 2014; Talwar et al., 2020). Some of the factors highlighted by researchers as contributing to image barriers relative to online shopping included poor delivery service, time-consuming, and complexity (Rudolph et al., 2004). Similarly, e-waste recycling might also be affected by factors that create a negative image, such as people's willingness to take the time for recycling and the perceived difficulty in performing the task (Wang et al., 2016). For example, people may perceive that a considerable amount of time is required to take the electronic product from their home to the collection center or stand in the queue at the collection center. Similarly, the perceived difficulty is defined as the consumers' perception that considerable efforts might be required in shipping or transporting the bulky electronic products (e.g., refrigerators or washing machines) from home to recycling centers. Both of these may be perceived as image barriers. Given the importance of image barriers, it was considered for inclusion in the 'reasons against' component of BRT.

The prior research has empirically shown that 'reasons against' was negatively associated with consumer attitudes and intentions (Claudy et al., 2015). For example, negative association was found in context to the car-sharing solutions (Claudy et al., 2015) as well as the purchasing of organic food (Tandon et al., 2020). Due to this, the similar negative associations are likely to be shared in context to the e-waste recycling.

H4. 'Reasons against' share a negative association with the attitude towards e-waste recycling

H5. 'Reasons against' share a negative association with the intentions towards e-waste recycling

3.3. Value and attitude

Value plays a significant role in an individual's decision-making in their personal and professional life. The prior literature confirmed that consumer value had a significant influence on attitude (Claudy et al., 2015). Seminal literature on value and attitude also suggested that there exists a relationship between values-attitude-behavior and that causality moves from values to attitude to behavior (Dreezens et al., 2005; Thøgersen and Ölander, 2002). Furthermore, as mentioned earlier, 'reasons for' share a positive and 'reasons against' a negative association with attitude (Claudy et al., 2015; Tandon et al., 2020). Due to this, it is likely that consumer value also shares a similar association with the 'reasons for' and 'reasons against' components of BRT.

The present study has utilized the environmental concerns towards e-waste recycling as the BRT model's consumer value. The environmental concerns are defined as the extent to which consumers are bothered about the degradation of the environment (Park and Lin, 2018). Ellen et al. (1991) defined environmental concerns as the consumers' perception of the extent to which their efforts can help in mitigating environmental problems. Prior literature has suggested that environmental concerns share a positive association with attitude, intentions, and willingness to engage in a pro-environmental behavior. Trivedi et al. (2018) suggested that ecological concerns (consumer awareness of the environmental problems) shared a positive association with attitude. Dienes (2015) reported that environmental concerns regarding climate had a significant positive impact on pro-environmental intentions and on the people's willingness to pay for climate change mitigation. Similarly, Kushwah et al. (2019a) and Kushwah et al. (2019b) suggest that people with greater environmental concerns are more likely to have a pro-environmental intention. Moreover, in the context of e-waste recycling, Dwivedy and Mittal (2013) found environmental concerns had a positive impact on consumers' willingness to engage in e-waste recycling. However, to the best of our knowledge, no prior study has examined the association between consumer value, 'reasons for,' and 'reasons against' engaging in e-waste recycling. However, based on the prior extended literature on environmental concerns, it is likely that value (measured using environmental concerns) shares a positive association with attitude and 'reasons for' as well as the negative association with 'reasons against' engaging in e-waste recycling. Due to this, we hypothesized that:

H6. Value (environmental concerns) shares a positive association with the attitude towards e-waste recycling

H7. Value (environmental concerns) shares a positive association with 'reasons for' towards e-waste recycling

H8. Value (environmental concerns) shares a negative association with 'reasons against' e-waste recycling

3.4. Moderating effect: environmental assessment and environmental awareness

The moderating role of environmental assessment and awareness in influencing the associations between 'reasons for,' 'reasons against,' attitude, and intentions to engage in e-waste recycling was examined. Environmental assessment refers to consumers' perceptions of the change in the e-waste management situation during the last ten years (Echegaray and Hansstein, 2017). On the contrary, environmental awareness refers to consumers' perceptions regarding the negative effects of the improper management of e-waste as well as possessing knowledge regarding the proper disposal of e-waste (Echegaray and Hansstein, 2017). Scholars

suggested that consumers were more likely to get involved in e-waste management practices when they saw the environmental conditions deteriorating (Echegaray and Hansstein, 2017). The environmental situation assessment could also influence the strength of the association between the antecedents and the consumers' intentions to engage in e-waste recycling. On the other hand, Nguyen et al. (2018) and Wang et al. (2018) suggested that environmental awareness was a prominent factor that has affected recycling intentions as well as the success of the e-waste management system. Based on this discussion, the study hypothesized that:

H9. Environmental assessment positively moderates the associations between reasons, attitude with intentions to engage in e-waste recycling

H10. Environmental awareness positively moderates the associations between reasons, attitude with intentions to engage in e-waste recycling

4. Method

4.1. Data collection and survey development

The proposed research hypotheses were evaluated using an online cross-sectional survey with 774 Japanese consumers (51.6% females) with ages ranging from 30 to 59 years (mean age = 44.56 years and SD = 8.24 years). The demographic profile of the participants is provided in Table 2. The majority of the study respondents had over 4 million yens (~37,000 USD) as their home income and over 2 million yens (~18,600 USD) as personal income. A leading online survey marketing firm (Macromill Inc.) collected the data for this study (Taima and Asami, 2020). The firm has over two million registered users in Japan that represent different socio-demographics covering the representative population of Japan (Kumagai and Nagasawa, 2019). This firm is regularly engaged in collecting survey data for academics, government, and business (Kumagai and Nagasawa, 2019). The data collection followed a random sampling technique to recruit the participants from the available pool, living in Japan. Ethical guidelines and codes of conduct were also followed as per Japan Marketing Research Association (JMRA) (Kumagai and Nagasawa, 2019). The survey process continued until the data from the desired age group, and gender in the desired quantity was collected. Only the completely filled survey questionnaire was collected. Hence there was no missing data.

The study measures and associated measurement items considered in the BRT model were drawn from the existing literature (see Table 1). The study utilized the two measures i.e. environmental assessment and environmental awareness as moderators to get a better understanding of consumer behavior with regards to e-waste recycling. The environmental assessment was measured using a single item, and environmental awareness was accessed using four items (Echegaray and Hansstein, 2017). The extracted measures and items were adapted to fit the e-waste recycling context in Japan. Four experts in Japanese culture and survey development reviewed the instrument after it was developed and suggested minor changes relative to language and the choice of words. All the survey items were translated from English to Japanese by two qualified translators following forward and backward translation. The final translation was evaluated and revised by two research professionals acting as third parties. The survey was checked multiple times to avoid any inconsistencies in terms of the translation. The final version of the online survey was evaluated using a pilot study with 10 consumers (6 male, 4 female) representing the target user group. In the pilot study, the

Table 2
Demographic profile of the participants.

Variable	Category	Frequency (percentage %)
Gender	Male	375 (48.4%)
	Female	399 (51.6%)
Age (in years)	30 to 35	138 (17.9%)
	36 to 40	117 (15.1%)
	41 to 45	159 (20.6%)
	46 to 50	148 (19.1%)
	51 to 55	120 (15.5%)
	55 to 60	92 (11.8%)
Home Income (in Japanese Yen)*	Less than 2 million	34 (4.4%)
	Between 2 and 4 million	130 (16.8%)
	Between 4 and 6 million	159 (20.5%)
	More than 6 million	340 (43.9%)
Personal Income (in Japanese Yen)*	Less than 2 million	243 (31.4%)
	Between 2 and 4 million	160 (20.7%)
	Between 4 and 6 million	119 (15.4%)
	More than 6 million	150 (19.4%)

Note. Missing data were present.

participants were asked to read and evaluate the different survey questions and suggest if any of the questions were unclear, confusing, or do not make sense. Based on pilot study results, minor changes in the language of the survey questions were undertaken. All of the study measures were evaluated using a five-point Likert scale ranging from strongly disagree (1) to strongly agree (5).

4.2. Data analysis

The data analysis was carried out using SPSS 24.0 and AMOS 24.0., two popular statistical tools. The two-step approach was adopted for data analysis (Anderson and Gerbing, 1988). In the first step, confirmatory factor analysis (CFA) was performed, and the different model fit indices were examined concerning the measurement model. Also, the different forms of instrument validity and reliability were examined concerning the different study measures. In the second step, the structural model was accessed using structural equation modeling (SEM), and all the proposed research hypotheses were evaluated. Finally, the moderation analysis was conducted to examine the validity of hypotheses H9 and H10. The Model 1 in process macro in SPSS was utilized for performing the moderation analysis. The common method bias was examined using Harman's single factor test.

5. Results

5.1. Common method bias

The present study has undertaken different steps to ensure that common method bias did not pose a significant problem to the study design and results. These steps include: First, the study respondents were clearly informed that their participation is anonymous in nature, there are no right or wrong answers, and they should attempt all the questions honestly. This step is important because scholars have emphasized the need to reduce participant apprehensions and increase the likelihood of respondents' honest answers toward the survey (Podsakoff et al., 2003; Halder et al., 2020). Second, survey participation often suffers from various social desirability bias, where the participants are inclined towards social norms and intend to portray their good image (Bondy and Talwar, 2011). Scholars emphasize that online surveys reduce the social desirability bias to some extent (Bondy and Talwar, 2011). Third, Harman's single factor test was employed to examine the presence of common method bias (Podsakoff et al., 2003). The results suggest that 39.13% of the variance is explained by a single

factor below the threshold value of 50%, hence confirming that the common method bias is not a concern for the study.

5.2. Measurement model, validity and reliability

The prior literature recommended the threshold values for the good model fit indices as: Comparative Fit Index (CFI) $\geq$ 0.92, Tucker-Lewis Index (TLI) $\geq$ 0.92, Normed Fit Index (NFI) $\geq$ 0.90, Root Mean Square Error of Approximation (RMSEA) $\leq$ 0.08, Chi-square ratio degrees of freedom ($\chi 2/df$) $\leq$ 3.0 (Anderson and Gerbing, 1988). The measurement model returned a good model fit as $\chi 2/df$ = 2.42, *CFI* = 0.96, *NFI* = 0.93, *TLI* = 0.95, *RMSEA* = 0.04.

The different forms of instrument validity and reliability were examined in the context of the study measures. The content validity of the study measures was ensured by drawing the items from the existing literature on e-waste recycling and management and consumer behavior. On the other hand, face validity was examined through a pilot study (10 consumers), which improved the validity of the study measures.

The current study undertook different statistical tests for ensuring internal reliability and the convergent and discriminant validity of the study measures. The factor loadings for all the measurement items were above 0.50, the average variance explained (AVE) for study measures were greater than 0.50, and their composite reliability (CR) values greater than 0.70 (see Table 3). This suggests that the study measures possessed sufficient convergent validity (Hair et al., 2010).

The CR values were above the recommended threshold of 0.70, which suggested that the study possessed sufficient internal reliability. Similarly, the study measures had sufficient discriminant validity because the AVE values for the study were greater than their corresponding maximum shared variance and average shared variance (Fornell and Larcker, 1981). Furthermore, the correlations among the study measures were less than 0.80.

Table 3
Validity and reliability analysis.

	CR	AVE	MSV	ASV	ATT	RF	RA	INT	VAL
ATT	.80	.66	0.56	.19	.81				
RF	.81	.68	0.56	.20	.75	.83			
RA	.80	.53	0.07	.03	-.10	-.08	.72		
INT	.71	.55	0.21	.17	.43	.46	-.26	.74	
VAL	.82	.54	0.20	.06	.04	.06	-.20	.45	.74

Note: Composite reliability = CR, Average variance extracted = AVE, Maximum shared variance = MSV, Average shared variance = ASV, Attitude = ATT, Reasons for = RF, Reasons Against = RA, Intentions = INT, Value = VAL.

5.3. Structural model

The structural model also returned good model fit ($\chi 2/df$ = 2.86, CFI = 0.95, NFI = 0.92, TLI = 0.94, RMSEA = 0.05) (Anderson and Gerbing, 1988). The structural model supported the following hypotheses: H1 (β = 0.24, p < .001), H2 (β = 0.75, p < .001), H3 (β = 0.22, p < .001), H5 (β = -0.27, p < .001) and H8 (β = -0.23, p < .001) (see Table 4). On the other hand, customer values shared no association with attitude (H6: β = −0.003, p > .05) and 'reasons for' (H7: β = 0.08, p > .05). Additionally, the 'reasons against' measure shared no association with attitude (H4: β = −0.04, p > .05). The structural model explained 27.4% variance in intentions towards e-waste recycling and 56.1% variance in attitude towards e-waste recycling. Furthermore, the model explained a 1% variance in the 'reasons for' and 5.2% variance in the 'reasons against' (see Fig. 2).

5.4. Moderation analysis

The moderation analysis results suggest that environment assessment positively moderated the association between 'reasons for' and intentions (see Table 5). Upon further probing, it was found that consumers scoring high on environmental assessment differed significantly from consumers who were less concerned for the environment (see Fig. 3). The environmental assessment did not moderate the association between the 'reasons against' and intentions, and attitude and intentions (see Table 5). On the other hand, environmental awareness positively moderated the relationship of intentions and 'reasons for' (see Fig. 4), 'reasons against' and intentions (see Fig. 5) as well as between attitude and intentions (see Fig. 6). Upon probing the conditional effects at the different values of the moderator, the consumers showing a low level of environmental awareness significantly differed from consumers with medium or high levels of awareness for all three associations (see Figs. 4–6).

6. Discussion

Electronic waste management is a growing matter of concern worldwide due to its adverse impacts on the environment and well-being of society. The present study aims to investigate the consumer's intentions to participate in e-waste recycling. The study has utilized a popular consumer behavior framework titled behavioral reasoning theory (BRT) as a theoretical lens. The developed research model investigates the association between value, reasons (for and against), and attitude towards e-waste recycling. In addition to this, the association between reasons (for and against) and intentions was also examined. The study utilized structural equation modeling (SEM) to access the developed research model with 774 Japanese consumers. The study results suggest that, out of the eight proposed hypotheses, five are supported (i.e., H1, H2, H3, H5, and H8).

The results show that the H1, which examined the association between consumers' attitudes and intentions towards e-waste

Table 4
The results of the hypotheses testing.

Hypothesis	Path	B	p	Support
H1	ATT → INT	.24	<0.001	Yes
H2	RF → ATT	.75	<0.001	Yes
H3	RF → INT	.22	<0.001	Yes
H4	RA → ATT	-.04	>0.05	No
H5	RA → INT	-.27	<0.01	Yes
H6	VAL → ATT	-.003	>0.05	No
H7	VAL → RF	.08	>0.05	No
H8	VAL → RA	-.23	<0.001	Yes

recycling, is supported. This finding was consistent with most of the prior studies (Basha and Lal, 2019; Claudy et al., 2015; Tandon et al., 2020). The study finding suggested that a positive attitude towards e-waste recycling resulted in positive intentions to engage in e-waste recycling.

H2 and H3 examined the positive association between 'reasons for' and attitude and intentions. The results supported both these hypotheses, which is again consistent with prior extended literature. Earlier studies using BRT confirmed that the 'reasons for' was positively associated with attitude, intentions, and behavior, in general (Claudy et al., 2015; Westaby et al., 2010; Tandon et al., 2020). The 'reasons for' measure consisted of personal benefits and environmental benefits, and these sub-measures were found to be positively associated with intentions (Botelho et al., 2016; Zhang et al., 2018). The study findings suggested that personal and environmental benefits motivated people to have a favorable attitude towards e-waste recycling and, ultimately, to engage in related actions. The associated health and environmental benefits triggered a positive attitude and user intentions (Wang et al., 2019). The degradation of the environment is a matter of concern, and it has also received sufficient attention across different social media platforms (Närvänen et al., 2018). The recent news about red skies in Indonesia and the Amazon forest fires are raising several environmental concerns as they pose various health hazards (Hughes, 2019; BBC News, 2019). These things are out of the individual's control, but practicing sound e-waste management is at the consumers' discretion (Dixit and Badgaiyan, 2016). The possibility of gaining various personal and environmental benefits from following e-waste recycling practices should motivate consumers to engage in such practices.

H4 and H5 examined the negative association between 'reasons against' and attitude as well as 'reasons against' and intentions. The study findings only supported H5 suggesting a negative association between 'reasons against' and user intentions, which was also consistent with the extant literature (Claudy et al., 2015; Gupta and Arora, 2017). The study finding on H4 is consistent with Claudy et al. (2015) as they also found an insignificant association in context to micro wind turbines. The current study results suggest 'reasons against' did not play an influential role at the time of development of consumer attitude, which is basically a positive or negative evaluation of the act, task, or behavior. However, the 'reasons against' becomes dominant when they move closer to the intentions to engage in e-waste recycling. It should also be noticed that BRT is a context-specific theory, and scholars have also emphasized that the associations shared between 'reasons,' attitude and intentions might differ according to the context (Claudy et al., 2015).

H6, H7, and H8 examined the associations between consumer value and attitude as well as value, 'reasons for,' and 'reasons against.' The consumer value was measured using the environmental concerns. Among these three hypotheses only H8 was supported, which suggested a negative association between value and 'reasons against.' The findings concerning H6 were consistent with the prior studies suggesting an insignificant association between value and attitude (Claudy et al., 2015; Gupta and Arora, 2017). H7 was not supported, suggesting a non-significant association between 'reasons for,' and value, which in fact contradicted the claims of prior studies (Claudy et al., 2015; Gupta and Arora, 2017; Tandon et al., 2020). The possible reasons could be: (a) that the chosen value, environmental concern, is culture specific and so this may not be influential in the Japanese culture; (b) the prior BRT literature considered different values such as health consciousness in case of organic food purchase (Tandon et al., 2020), perceived value compatibility and openness to change in case of car-sharing solutions (Claudy et al., 2015). Due to this, the contexts were also different. BRT is a context-specific theory, and scholars have

Fig. 2. The results of the structural model testing.

Table 5
Moderation analysis.

Environment Assessment						
	B	T	P	LLCI	ULCI	Moderation?
RF → INT	.19	2.15	.03	.0162	.3644	Yes
RA → INT	.09	.87	.38	-.1070	.2784	No
ATT → INT	.10	1.15	.25	-.0675	.2600	No
Environmental Awareness						
RF → INT	.47	6.34	.00	.3222	.6110	Yes
RA → INT	.24	2.41	.02	.0435	.4268	Yes
ATT → INT	.26	4.00	.00	.1346	.3937	Yes
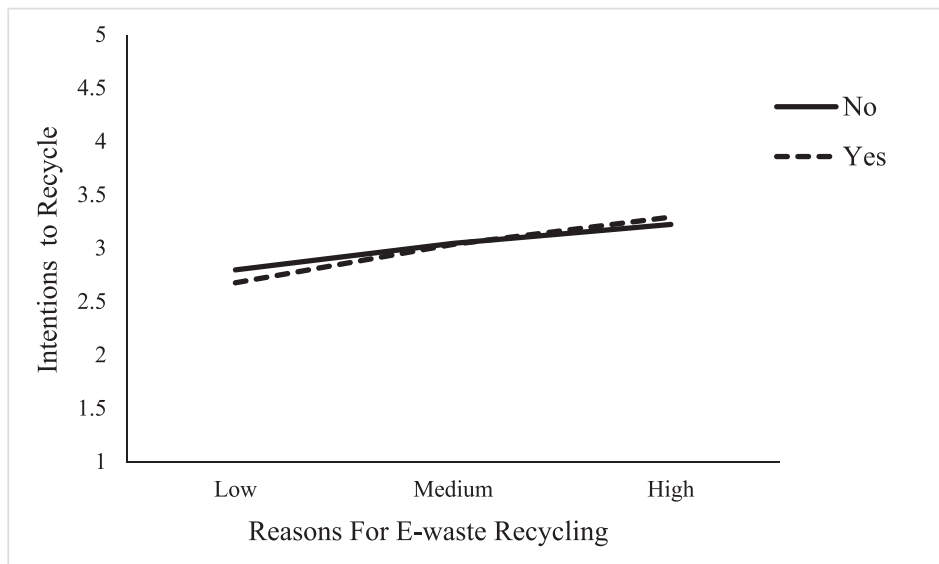
Fig. 3. Moderating influence of environmental assessment.

emphasized that the associations might differ in different contexts (Claudy et al., 2015).

H9 and H10 examined the moderating influence of environmental assessment and awareness on the associations between
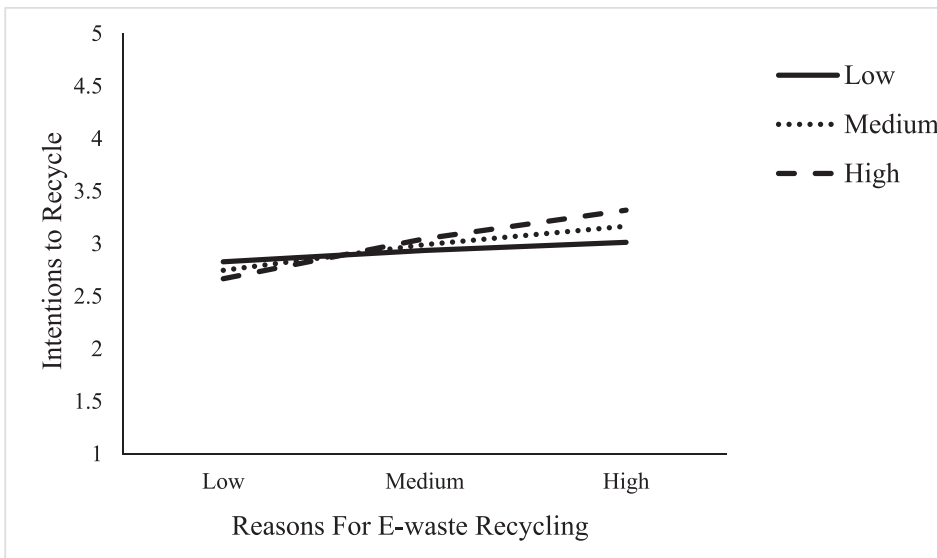
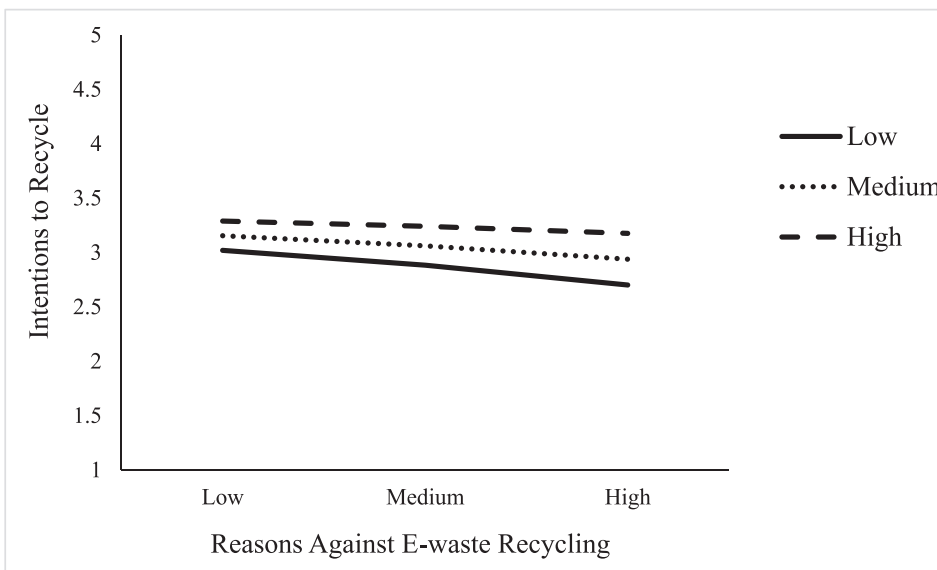**Fig. 4.** Moderating influence of environmental awareness.

Fig. 5. Moderating influence of environmental awareness.

'reasons for,' 'reasons against,' and attitudes with use intentions. H9 was partially confirmed, while H10 was fully confirmed. The prior literature suggested that environment assessment had a significant impact on e-waste management practices, e.g., Echegaray and Hansstein (2017) found that consumers were likely to participate in e-waste management when they saw that environmental conditions were deteriorating. Similarly, environmental awareness had a significant influence on the success of e-waste management (Nguyen et al., 2018; Wang et al., 2019). The study findings showed that both environment assessment and awareness could significantly influence the associations shared between reasons, attitudes, and intention to use e-waste recycling.

6.1. Theoretical implications

The current findings have significantly contributed to the existing literature on e-waste recycling and management. This study offers three main theoretical implications. First, the study findings provide a more detailed understanding of the relative influence of facilitators and inhibitors (i.e., 'reasons for' and 'reasons against') in influencing the attitude and intentions towards e-waste recycling. This was necessary since most of the prior studies focused on the factors that influenced the adoption and acceptance of e-waste recycling. In comparison, only little was known about the possible inhibitors that kept individuals away from engaging in e-waste recycling.

Second, the present study has significantly extended the theoretical foundations of the existing literature on the topic due to two main reasons: (a) the current study is the first empirical study utilizing the behavioral reasoning theory (BRT) to study the e-waste recycling; (b) the present study has examined the moderating role of two interesting, timely, and essential yet ignored variables, namely environmental awareness and environmental assessment. Due to these reasons, the current study has significantly contributed to the research stream of e-waste recycling.
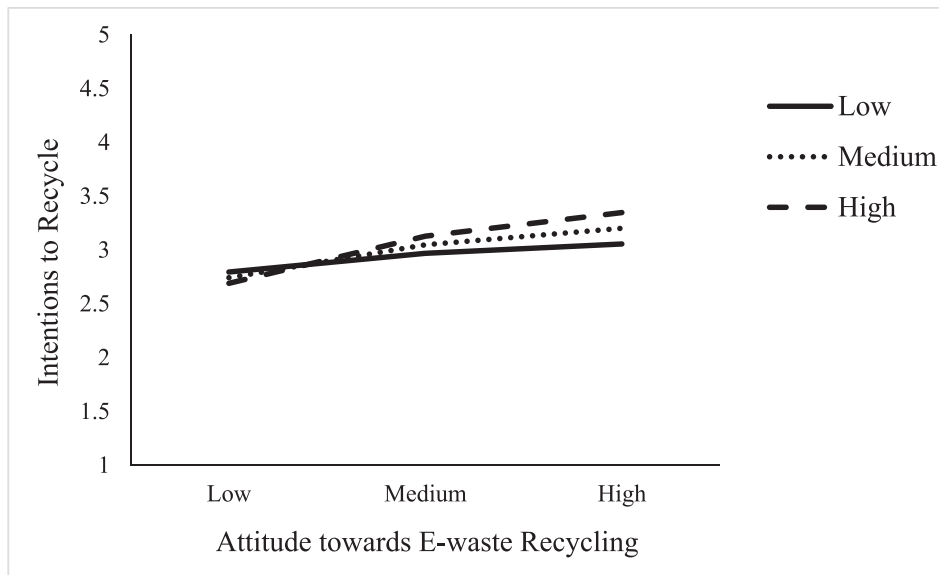
Fig. 6. Moderating influence of environmental awareness.

Third, the findings provide crucial insights into Japanese consumer behavior and perceptions regarding their tendency to engage in proper e-waste disposal practices. Japan ranks third in terms of e-waste production (Richter, 2017), but there is still a limited understanding of the Japanese consumers' perceptions relative to e-waste disposal. These findings should motivate other scholars to conduct similar studies among different cultural and geographical groups to enrich the understanding of the topic.

6.2. Practical implications

The study offers two major practical implications. First, the findings could be useful for the electronics manufacturers and recyclers, e.g., they can now better understand the factors that inhibit and facilitate consumers to participate in the proper disposal of e-waste. For example, our results demonstrate that 'reasons for' shares a positive association with attitude and intentions to recycle and is composed of personal and environmental benefits (see section 3.2.1). Similarly, 'reasons against' composed of different barriers are negatively associated with intentions to recycle. Hence, the service providers can highlight the personal (such as health and economic) and environmental benefits of e-waste recycling in their marketing and communication strategies. Similarly, they can address the barriers due to which consumers tend to resist participating in e-waste recycling.

Second, the study findings are of relevance to governments and policymakers. With the knowledge gained from the study (i.e., influential role of 'reasons for' and 'reasons against'), they could develop dedicated strategies to motivate and assist consumers in participating in e-waste recycling. For example, they could: (a) work towards making the e-waste recycling more convenient, e.g., make it easy for consumers to find information on e-waste recycling and e-waste collection centers (usage barrier), (b) provide explicit information regarding the possible privacy and security concerns involved in the recycling process (risk barrier). This is especially important because when people are disposing of smart devices, such as phones and tablets and laptops, they are usually concerned about the possible theft of their personal information and its misuse. (c) reduce the cost levied on e-waste recycling (cost of transport and handling charges) (value barrier). (d)

communicate clearly to consumers that e-waste recycling is not difficult, and it is not complicated through marketing campaigns (image barrier). These strategies would ensure higher acceptance and lower resistance to e-waste recycling practices.

6.3. Limitations and future work

The current study has two main limitations, which should be addressed in future studies. First, the current study lacks generalizability due to the considered research context as it examined e-waste recycling among Japanese consumers. Future research should focus on validating the findings of the current study with consumers from other countries. As mentioned before, Japan is reported as being one of the worst affected countries in terms of effective e-waste management. Due to this, the current study provided insightful perspectives from the consumers of such a heavily affected country. However, the study findings might differ in the case of consumers living in other countries where this problem is less severe. Second, the study design is based on the cross-sectional data, prone to the bias of social desirability. Due to this, future research should validate the possibility of any such bias by considering other available research designs, e.g., longitudinal and experimental studies. In addition to this, we recommend three directions of future research on this subject: (a) examine the different ways to motivate consumers to engage in e-waste recycling (e.g., the role of economic incentives), (b) study the negative implications of e-waste dumping on the environment and the society, and (c) investigating how consumers perceive the recyclability and repairability of electronic appliances and how they associate such characteristics with the manufacturers and retailers.

CRediT authorship contribution statement

Amandeep Dhir: Writing - original draft, Writing - review & editing, participated in the, Conceptualization, design, Methodology, data collection and, Data curation, wrote the first draft of the manuscript, participated in data, Formal analysis, modeling and, Validation, All authors participated in reviewing and editing of the final draft as well as the revision. **Nitin Koshta:** Writing - original draft, Writing - review & editing, participated in the,

Conceptualization, design, Methodology, data collection and, Data curation, wrote the first draft of the manuscript, participated in data, Formal analysis, modeling and, Validation, All authors participated in reviewing and editing of the final draft as well as the revision. **Raman Kumar Goyal:** Writing - review & editing, participated in the, Conceptualization, design, Methodology, data collection and, Data curation, participated in the literature review, All authors participated in reviewing and editing of the final draft as well as the revision. **Mototaka Sakashita:** Writing - original draft, Writing - review & editing, participated in the, Conceptualization, design, Methodology, data collection and, Data curation, wrote the first draft of the manuscript, participated in data, Formal analysis, modeling and, Validation, carried the, Project administration, and, Supervision, All authors participated in reviewing and editing of the final draft as well as the revision. **Mohammad Almotairi:** Writing - original draft, Writing - review & editing, Data curation, Validation, Project administration, Supervision, participated in the literature review. participated in data analysis, modeling and validation. carried the project administration and supervision. All authors participated in reviewing and editing of the final draft as well as the revision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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