IJCEAS

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XV, Issue: 2, Year: 2025, pp.857-887

Consumers' E-Waste Awareness and Sustainable Disposal Behavior: A Comparative Intergenerational Analysis

Mehmet MARANGOZ[1]
Oğuzhan GÜNEŞ[2]

Received:01.07.2025, Accepted: 25.12.2025
10.5281/zenodo.18148043

ABSTRACT

With the advancement of technology and the widespread use of the internet, electronic products have begun to play an important role in our lives. Electronic products, which we encounter in every aspect of our lives, including at home, at work, and in our daily routines, possess significant economic value due to the materials they contain. However, if not disposed of properly, they pose a threat to both the environment and human health. The aim of this study is to examine consumer awareness levels and sustainable disposal behaviors (SDB) regarding electronic waste (e-waste) through an intergenerational comparison. The study aims to determine the effect of e-waste consumer awareness (EWCA) on SDB and its sub-dimensions, as well as to examine these variables within the framework of demographic characteristics (family monthly income and education level) to obtain specific findings. According to the data obtained from the study, it was determined that EWCA has a positive effect on SDB and many of the factors that constitute SDB (reduce, recycle, refuse, repair (5Rs)). Additionally, it was found that EWCA differs according to family monthly income but does not create a significant difference according to education level and generations. Regarding SDB, it was observed that SDB showed statistically significant differences across generations, while no significant differences were found in SDB based on family monthly income and education level. Furthermore, it was determined that reuse differs according to family monthly income and generations, reduction differs according to education level and generations, refusal differs according to family monthly income, and repair differs according to family monthly income and generations. The results indicate that consumers' participation in SDB will increase as a result of their increased awareness of e-waste. Furthermore, the fact that no difference was observed in SDB participation despite an increase in education level highlights the inadequacy of related studies in educational curricula. It is recommended that comprehensive educational programs on the subject be implemented and incentive measures be increased to enhance consumers' awareness of e-waste and encourage their participation in SDB.

[1] Prof. PhD, Mugla Sıtkı Kocman University, Türkiye, mehmetmarangoz@mu.edu.tr, https://orcid.org/0000-0002-1589-2940
[2] Research Assistant, Istanbul Arel University, Türkiye, oguzzhan.guness@gmail.com, https://orcid.org/0000-0002-5260-0695

Keywords: Electronic Waste (e-waste) Consumer Awareness, Sustainable Disposal Behavior (5Rs), Intergenerational Comparison.

JEL Code: M31, S53, S56, D83

1. Introduction

With the advancement of technology and the spread of the internet, electronic devices have become an integral part of our daily lives. Consumers use electronic products in various fields, primarily for communication and transportation purposes. The increase in interaction between people and the ability of consumers to instantly meet their needs in the internet environment has accelerated the acceptance of electronic products by people (Senlikoglu & Kaya, 2025: 2861; Fathi, Ansari, & Ansari, 2022: 3). In addition, the adoption of artificial intelligence and similar advanced technologies by companies has led businesses to prefer electronic products to tasks that require human labor. This situation shows that electronic products are actively used in every aspect of life and that their use will continue to increase in parallel with the development of technology in the coming years (Osibanjo & Nnorom, 2007: 492). The increasing use of electronic products every day also causes some problems. The main issue is how to deal with electronic products that are outdated and/or no longer in use. Consumers can sell, donate, or recycle electronic products that are no longer in use to ensure that they are reused (De Oliveira Neto et al., 2022: 1; Gurler, I. 2011: 35). The process of recycling electronic products that have reached the end of their useful life and reintroducing them to the market involves a specific procedure. The first step in this process is for consumers to be aware of the recycling of electronic products that have reached the end of their useful life. The recycling of electronic products at the end of their useful life, or electronic waste (e-waste), varies between countries, and many developing or underdeveloped countries still lack legal regulations on the matter (Imran et al., 2017: 132).

In a study on the subject (Balde et al., 2024: 26), it was reported that e-waste amounted to 62 million tons in 2012 and reached 96 million tons in 2022. Considering the increasing rate of e-waste growth each year, it is estimated that total annual e-waste production will reach 120 million tons by 2030. While more developed countries are conducting research on the collection and recycling of e-waste, only 8 million tons of the e-waste produced by 2010 could be recycled. Although this figure reached 14 million tons by 2022, it remains significantly insufficient when compared to the rate of e-waste production.

There are numerous studies in the literature that measure consumers' awareness of e-waste (Choi et al., 2024; Adeel et al., 2023; Dhull & Shreshtha, 2021). This study aims to examine the impact of EWCA on SDB in an intergenerational manner, which differs from similar studies in literature. Within this framework, the 3R (reuse, reduce, recycle) model as it currently exists in the literature has been expanded to include the dimensions of “refuse” and “repair” and

it is planned to measure the dimensions that constitute the EWCA and SDB concepts separately to obtain specific findings related to the subject.

2. Electronic Waste (E-Waste) and Its Importance

Waste is not limited to a specific product group but rather encompasses a wide range of items. Electronic waste (e-waste) is defined as waste generated by all electrical and electronic devices that consumers do not intend to reuse (Shahabuddin et al., 2023: 4513). E-waste is increasing day by day with the proliferation of electronic products and their use in many areas. In studies on the subject (Ajekwene et al., 2022: 12; Parajuly & Wenzel, 2017: 2), the diversification of electronic products has been shown to be one of the main factors contributing to the formation of e-waste. Additionally, it has been noted that the lifespan of electronic products has decreased compared to previous years, and it has been emphasized that the decline in product prices has also negatively affected e-waste generation. The high cost of repairing faulty electronic products and the expectation that the product will not perform as well as before after repair also encourage consumers to purchase new electronic products (Borthakur & Govind, 2017: 103).

The increase in electronic products has led to a diversification of e-waste. Chatterjee & Abraham (2017: 212) divided e-waste into three categories in their study. These include electronic appliances used in household tasks (refrigerators, washing machines, etc.), electronic equipment used in information and communication technology (computers, phones, tablets, etc.), and consumer electronics (smartwatches, e-book readers, etc.). Additionally, the study lists the products that contribute most to e-waste generation worldwide such as computers, printers, mobile phones, and computer accessories.

Another factor contributing to the generation of e-waste is the continuous introduction of new electronic products to the market by companies operating within a mass production framework. This situation increases the level of competition in the market and causes prices to fall (Türken & Fırat, 2024: 834). Affordable prices and easy access to products increase consumer demand for electronic products. As a result, the generation of e-waste is accelerating significantly (Nnorom & Osibanjo, 2008: 1473). This situation also causes electronic products to quickly become outdated and be rejected by consumers. Additionally, this shift in consumer behavior has led businesses to adopt a deliberate obsolescence policy, resulting in a shortened lifespan for electronic products. A study on the subject (Perkins et al., 2014: 287) indicates that the lifespan of computers has decreased from four years to two years.

3. The Economic Value of E-Waste

Like all products, electronic products also contain many different components. These components vary depending on the characteristics of the product, but it is known that many electronic products contain valuable materials such as gold, iron, steel, copper, and silver (Kumar, Holuszko, & Espinosa, 2017:

35). A study on the subject (Attia, Soori, & Ghaith, 2021: 236) states that one million mobile phones contain approximately 24 kilograms of gold, 9 tons of copper, 250 kilograms of silver, and 9 kilograms of palladium and that significant economic gains can be made from recycling these products. It is stated that e-waste generated up to 2014 contained approximately 300 tons of gold, with a monetary value of 10.4 billion euros.

Despite the valuable metals contained in e-waste, only 17.4% of it is recycled. Considering that the amount of e-waste increases by an average of 3% to 5% each year, it is clear that a significant amount of material value is being lost (Liu et al., 2023: 1). Additionally, considering that the annual increase in e-waste is three times faster than the increase in household waste, it is estimated that the importance of e-waste will continue to grow in the future (Herat, 2007: 308).

When looking at countries that generate e-waste, it is observed that countries with high economic prosperity and advanced technology (such as the US and EU countries) are at the top of the list. Despite producing a large volume of electronic products, many of these countries are known to be insufficient in implementing legal regulations regarding e-waste recycling or disposal (Patil & Ramakrishna, 2020: 14421). The fact that the global e-waste recycling rate remains low and that these countries are producing more waste every day highlights the need for alternative methods of e-waste disposal. The primary method involves exporting this waste to developing or less developed countries (Sadik, Arefin, & Tabassum, 2017: 1). It is estimated that exports from developed to less developed or developing countries account for approximately 80% of the average annual e-waste production (Kiddee, Naidu, & Wong, 2013: 1237). E-waste generated worldwide each year is exported to Asian countries, primarily China and India. Most of the e-waste is disposed of in landfills or open dumps without undergoing any recycling process. As a result, it can be said that e-waste, which is known to contain high levels of valuable minerals and could significantly contribute to the national economy if recycled, is being disposed of along with household waste (Awasthi & Li, 2017: 434).

4. Problems Caused by E-Waste

The lack of comprehensive legal regulations regarding e-waste disposal and recycling around the world has led to serious environmental problems. E-waste is exported from developed countries to Asia, including Africa. Illegal disposal practices in export countries cause serious damage to the environment and human health. The release of plastics, ceramics, metals, glass, organic flame retardants, and toxic chemicals contained in e-waste into the environment negatively affects both the local environment and the health of people living in the region (Lebbie et al., 2021: 2). The study stated that e-waste generated in 2019 contained 50 tons of mercury and 71 tons of flame retardants (Forti et al. 2020: 15). E-waste mixed with household waste and left in nature pollutes the air and water, as well as poisoning and rendering the soil it meets infertile (Ilbas, 2025: 65). Various health problems arise when people living in the region come into contact with the soil and air (Wu et al., 2014: 557). It is also known that e-waste contaminates drinking water by

mixing with groundwater. The town of Guiyu in China, described as the most polluted place in the world, can be cited as an example of this issue. The illegal dumping of e-waste in this town has rendered the drinking water unusable. Additionally, it has been determined that the rates of premature births and miscarriages in the region are much higher than in other towns in the area. The study states that 70% of children living in the region have dangerous levels of lead in their blood (Sadik, Arefin, & Tabassum, 2017: 2).

Another group affected by the harm caused by e-waste is workers involved in e-waste disposal. Regular monitoring in developed countries and high labor costs lead to e-waste being disposed of in developing or underdeveloped countries. In these countries, the lack of legal regulations or adequate oversight means that necessary precautions are not being taken for workers. The absence of essential protective equipment such as protective clothing, gloves, goggles, and masks for workers involved in e-waste disposal poses significant health risks in the coming years (Dave, Shah, & Tipre, 2016: 2).

A study examining the environmental damage caused by e-waste (Arya et al., 2021: 650) revealed that soil pollution rates in India have increased compared to previous years. This situation is directly proportional to the increase in e-waste, but it also shows that municipalities and local governments are not aware of this issue. A study conducted in China (Song et al., 2012) revealed that e-waste mixed with water causes serious damage to aquatic life. This situation shows that e-waste is not limited to visual pollution or environmental pollution but also has a negative impact on animals. Additionally, another study (Alabi et al., 2012) observed that e-waste coming into contact with soil causes serious damage to the DNA of plants growing in the area and to the health of people interacting with these plants.

Numerous studies have been conducted on the harmful effects of e-waste collection and recycling sites on human health (Igaro et al., 2015; Xu et al., 2015; Liu et al., 2009). These studies reveal the health problems experienced by individuals living in different e-waste collection areas. Studies conducted in Vietnam (Ngo et al., 2021: 541) and China (Xu et al., 2018: 1491) on this subject have indicated that children exposed to environmental problems caused by e-waste may suffer DNA damage, which may increase their risk of cancer in later years. Another study on the subject (Zeng et al., 2016: 408) found that children exposed to harmful substances from e-waste may experience chromosome damage, nervous system, urinary, and reproductive disorders, as well as acute and chronic effects in later years and that the effects of pre-existing diseases and symptoms may also increase. The findings indicate that e-waste causes permanent damage to human health.

5. Consumers' Environmental Awareness and E-Waste Behaviors

The first step that must be taken to combat the problems caused by e-waste is to raise consumer awareness of the issue. It is expected that consumers who are

aware of the issue will make the necessary efforts to combat e-waste in order to benefit the environment and the country's economic development. When examining e-waste within the framework of SDB, it has been observed that people living in different geographical regions contribute to SDB by adopting different methods (Islam, Dias, & Huda, 2021: 5; Borthakur & Govind, 2017: 104-108). China, a major producer and importer of e-waste worldwide, has numerous official and illegal recycling systems. Additionally, it has been determined that citizens of the People's Republic of China are highly aware of the material value of e-waste and, as a result, contribute to SDB by selling their discarded products (Cai et al., 2020: 2396). In a study conducted in Australia on this subject (Golev et al., 2016: 262), it was determined that despite consumers' high level of awareness of e-waste, they hoard their electronic devices. According to the findings, between 2012 and 2014, the proportion of phones hoarded by consumers was equivalent to half of the phones in use.

In a study conducted among students at Adnan Menderes University's Faculty of Engineering in Türkiye on the level of awareness of e-waste, it was determined that young consumers have a low level of awareness. Although the limited scope of the sample does not allow for generalizations about the country, the study provides insight into young consumers' awareness levels regarding e-waste and SDB (Deniz, Aydın, & Kiraz, 2019).

Sweden was the first country to bring the fight against digital pollution to the global agenda. Sweden was a pioneer in raising public awareness of the issue when it brought it to the world's attention in 1990 (Pitron, 2023: 28). Switzerland, which encourages its citizens to be aware of the issue, has been one of the most successful countries in the world in this regard since 1992 with its recycling system. Switzerland, which has a high level of consumer awareness and advanced collection networks regarding e-waste, is one of the leading countries in the world with an annual collection rate of 15 kilograms of e-waste per capita. Additionally, it has been observed that consumers in Switzerland pay fees for e-waste they generate (Duygan & Meylan, 2015: 98).

A study conducted in Ethiopia on EWCA indicated that consumers' awareness of e-waste is very low. Although consumers' low awareness level can be explained by various reasons, the most critical factor is the prevalence of illegal recycling centers. Illegal recycling centers, which have become a significant market in the country, carry out activities such as collecting, sorting, purchasing, selling, and storing e-waste (Ali & Akalu, 2022: 2).

Based on data obtained from different parts of the world, it has been observed that awareness of e-waste and environmental sensitivity are low in developing and underdeveloped countries. One of the main reasons for this situation is the existence of businesses engaged in illegal recycling activities. In many developed countries, although not yet fully widespread, certain legal regulations have been implemented (Patil & Ramakrishna, 2020: 14415-14416). As a result of the situation that has emerged, the view that there is still no structure in place at the desired level for e-waste recycling and SDB worldwide is supported.

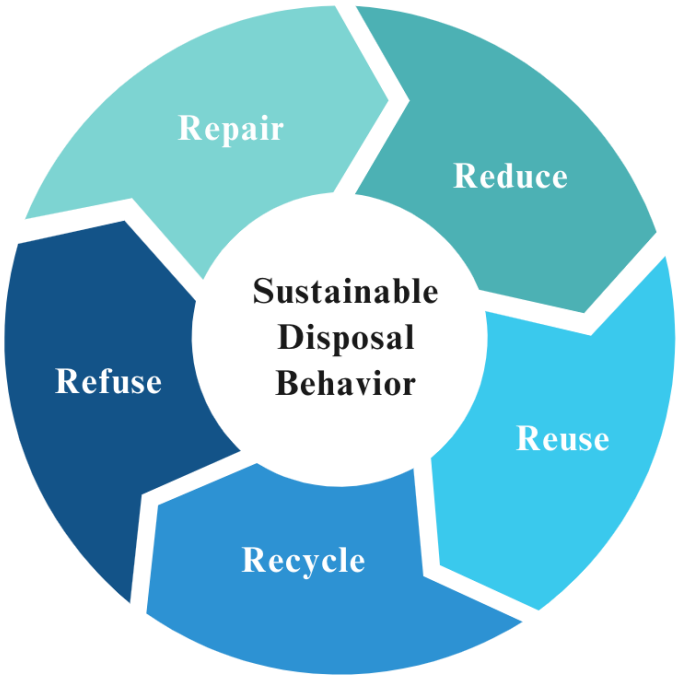
6. Sustainable Disposal Behaviour

Consumer behavior is changing every day in line with developments around the world. This change has led consumers today to feel the need to purchase rather than simply buying according to their needs. This consumption-oriented approach has brought with it waste and the problem of how these products can be recovered after use. Sustainability has emerged with the aim of recycling and reclaiming products. Sustainability is defined as meeting today's needs without compromising the needs of future generations. This situation is not limited to the consumption of products, but also includes production, consumption, and disposal behavior after consumption (Metlioğlu & Yakın, 2021: 1886).

Consumers sometimes dispose of their products when their useful life has ended, and sometimes for other reasons, even before the end of their useful life. Products that have not reached the end of their useful life are sold, donated, or reused to extend their product life cycle, while products that have reached the end of their useful life are recycled to recover their value (Köse & Aydın, 2020: 109; Karaca, 2018: 265). The fact that products are recovered through recycling prevents waste generation, provides financial gain opportunities, and enables the prevention of potential environmental issues. In line with this vision, SDB aims to use products for as long as possible and minimize waste generation (Urmi, Emu, & Khan, 2022: 60). SDB contributes to improving the quality of life for both nature and humans through the benefits it offers (Dao, Downs, & Delauer, 2013: 1).

Numerous studies have been conducted on SDB in the past (Kaur et al., 2022; Ahmadi, 2017; Samiha, 2013). In preliminary studies on the subject, it has been observed that the concepts that constitute SDB are generally accepted as reduce, reuse, and recycle (3R). However, in recent studies (Balwan, Singh, & Kour, 2022: 7; Korsunova, Horn, & Vainio, 2021: 763; Eklová, 2020) it has been concluded that the 3R model is insufficient, and it has been determined that the concepts of refuse and repair should also be included in the SDB model. The expanded SDB model (5R) is outlined below.

Figure 1. Sustainable Disposal Behaviour (SDB) Model (5R)



Source: Korsunova, Horn & Vainio, 2021: 763.

6.1.Reduce

The first concept of the SDB model, reduction, has a very broad structure that encompasses all processes from production to consumption. It advocates for more environmentally friendly and needs-oriented production instead of the low-cost, high-profit approach adopted by manufacturers. It also recommends the use of raw materials that minimize waste and products that can be recycled. This transformation in production aims to facilitate recycling and minimize environmental damage (Karagiannopoulos, Manousakis, & Psomopoulos, 2023: 98).

Consumers play as much of a role as businesses in the generation of waste. For this reason, it is recommended that individuals choose durable products, refrain from purchasing different products before the end of the product's life cycle, and avoid hoarding behavior (Necef, Tama, & Boz, 2020: 68-69). Considering that production increases in parallel with consumption demand, it is necessary to first raise consumer awareness and encourage them to adopt appropriate behaviors to minimize waste generation (Usapein & Chavalparit, 2015: 304).

6.2.Reuse

Consumers can use the products they purchase for multiple purposes. These purposes may sometimes be independent of the product's intended use as promised to consumers. The reuse of products by consumers within the framework of their primary purpose or for purposes other than their primary purpose represents an important aspect of SDB. Although the widespread hoarding among consumers today poses an obstacle to this situation, the reuse of products reduces waste generation and provides significant cost savings (Usapein & Chavalparit, 2015: 304).

One of the key factors that will encourage consumers to reuse existing products is to transform the product. Differentiating the product through design, technology, and other applications based on the fundamental reasons that cause waste can enable consumers to choose it again. This not only prevents products from becoming wasteful and causing environmental problems but also leads to financial savings (Azimi Jibril et al., 2012: 629).

6.3.Recycle

Recycling is defined as the process of reusing products that have reached the end of their useful life or have been discarded for various reasons. Recycling not only results in significant financial savings but also prevents environmental pollution and helps maintain public order. Due to the significant financial resources generated by recycling, many countries, particularly developed ones, offer incentives to citizens and businesses (Hotta et al., 2016). The first step in successfully implementing these incentives is to raise awareness among consumers and businesses about the issue. One of the key factors in the success of recycling is the ability to collect waste properly and on time. In addition to local governments fulfilling their responsibilities, it is expected that those who produce waste will also be aware of the issue and separate household waste from electronic waste to facilitate recycling (Mohammed et al., 2021: 2). In addition, various applications are being implemented to encourage consumers to support waste management. Japan and New Zealand, which support waste management, are implementing various activities on campuses to raise students' awareness about recycling and encourage them to take action. Additionally, Thailand, which imports a large amount of waste from Western countries, is involved in initiatives to create green campuses at its universities (Tangwanichagapong et al., 2017: 204).

6.4.Repair

Nowadays, the decreasing lifespan of electronic products and similar factors have led to a steady increase in the sales of new products. This situation has caused the amount of e-waste to rise steadily. One of the SDB principles is repair, which aims to combat waste generation by repairing products so that they can continue to be used (Pampasit, 2018: 3). The continued use of products that are broken or have reached the end of their useful life after undergoing necessary repairs enables

significant financial savings. Additionally, it can be said that this approach protects public health and prevents potential negative effects on the environment by preventing waste generation (Long et al., 2016: 8).

Compared to purchasing a new product, the repair process saves consumers money. But sometimes, when the right conditions for repair aren't there, the costs can end up being higher than expected. McCollough (2007: 217) found in his study that consumers compare the price of a new product with the repair cost and, considering the risks that may arise after repair, sometimes purchase a new product. The study emphasized that consumers who purchase new products have a higher income level than those who repair their products.

The repair process does not only impose financial costs on consumers. Consumers who are unable to use the product during the repair period make their own decisions taking this situation into account. In addition, the expectation that repaired products will not perform as well as before encourages consumers to purchase new products (Öneme & Bursalıgil, 2022: 25). On the other hand, repair has numerous benefits for SDB. One of these benefits is that the repair process is very low compared to recycling methods. Additionally, requirements such as consumer awareness and support for waste management are not expected for repair. Furthermore, even if a product that has become waste enters the recycling process, it still causes minor harm to the environment and human health. However, the fact that products that continue to be used through repair prevent this harm and do not involve a second process such as remanufacturing in the recycling process serves as a reason for consumers to prefer repair (McCollough, 2009: 620).

6.5.Refuse

The principle of refusal is to make it a mission to discourage consumers from choosing products that are not needed, cannot be recycled, or have a short lifespan. Unlike other SDB principles, refusal aims to prevent the purchase of products that may generate waste. It is known that environmentally harmful substances are used in production today due to their low cost. Consumers are expected to be aware of this and avoid purchasing such products (Kumar, Pali, & Kumar, 2023: 5).

The act of rejection constitutes the first step of SDB. This approach, which rejects the purchase of a product for reasons other than necessity, represents the most important step in the recycling process. Although recycling a product that has become waste provides material benefits, the effort expended, the length of the recycling process, and the environmental damage caused mean that refusal is defined as the most important step in combating waste (Bhattacharjee, 2024: 197).

7. Research Method

In this study, a quantitative method was used to determine the effect of EWCA on SDB and its subdimensions (5R) in terms of intergenerational differences and demographic characteristics. A survey was used as the data

collection method in the study. Participation in the survey was voluntary. The survey was conducted in two different ways: face-to-face and online.

7.1.The Concept of Generations and Generations in Marketing

The division of individuals into generations is essentially based on their birth dates within a specific time frame. Studies have shown that consumers belonging to the same generation share similar characteristics (Csobanka, 2016: 66). This facilitates the classification of consumers and market segmentation studies. Although the generations in question are defined in the literature as X, Y, and Z, researchers disagree on the period represented by these generations (Mahmoud et al., 2021; Bejtkovský, 2016). The fact that generations are positioned in different periods by different researchers is based on the fact that the characteristics of individuals vary within the framework of economic, socio-cultural, political, and environmental conditions. The fact that the participants forming the sample group of this study reside in Türkiye leads to the evaluation of generational classifications specific to Türkiye. Within the framework of the characteristics attributed to generations, it has been observed that Generation X in Türkiye is accepted as having been born between 1960 and 1980, Generation Y between 1981 and 2000, and Generation Z between 2001 and 2010 (Can & Engindeniz, 2023; Ercomert & Güneş, 2021; Bayhan & Karaca, 2020), and the intergenerational comparison part of the study was conducted based on these data.

7.2.Purpose and Significance of the Study

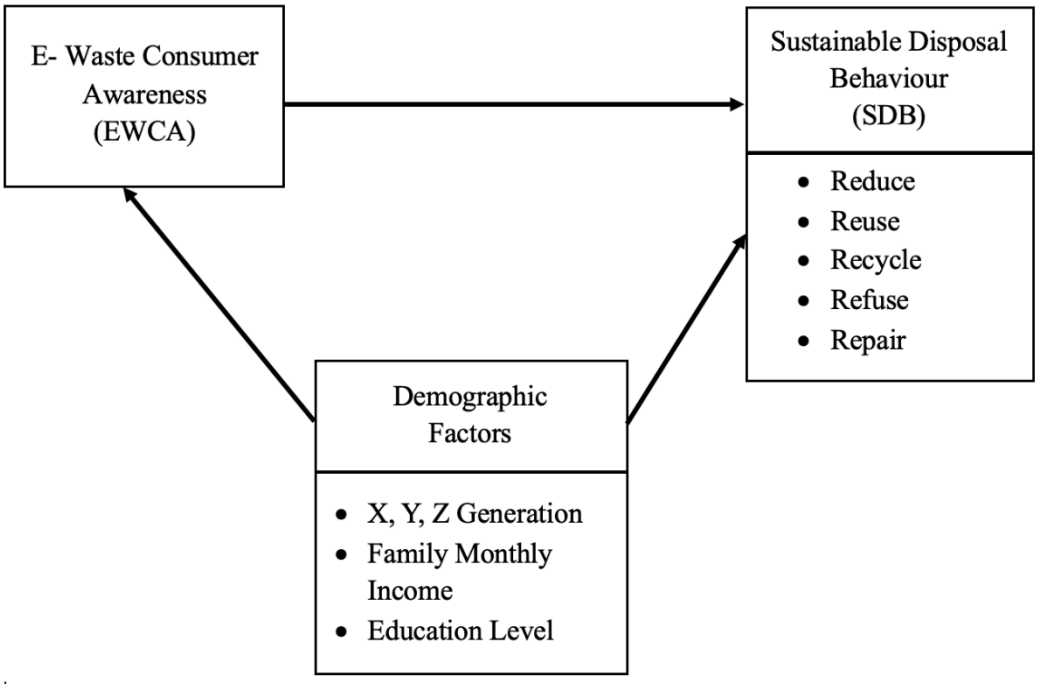
This study aims to determine the effect of consumer awareness, which is considered the first step in the recycling of waste electronic products, on SDB and its sub-dimensions (5R), and to examine EWCA and SDB in terms of intergenerational and demographic characteristics (family monthly income and education level). The results obtained will provide insights into the relationship between generations and electronic products, as well as highlight how awareness levels related to the subject vary across generations. Identifying the differences between generations that have recently been exposed to technology and younger consumers who have grown up immersed in technology and are known to have a higher education level than previous generations enables a multidimensional assessment of the subject.

Numerous studies have been conducted on SDB in the past (Huang et al., 2018; Sakai et al., 2011; Visvanathan, Adhikari, & Ananth, 2007). These studies have been accepted in literature as reuse, reduce, and recycle (3R) in a general framework. This research supports efforts to expand the SDB model and is significant in terms of adding new findings to the literature by comparing the data obtained with previous studies on the subject.

7.3.Research Model and Hypotheses

SDB has been defined in the literature as reduce, reuse, and recycle (3R) (Anua et al., 2022; Paras et al., 2019). However, it has been observed that this model is insufficient today and that studies are being conducted to expand it (Kannan et al., 2024; Balwan, Singh, & Kour, 2022). In this study, SDB is addressed as reduce, reuse, recycle, refuse, and repair. The research model created by the purpose of the study is presented below.

Figure 2. Research Model



A total of 27 hypotheses were formulated to determine the research findings. The main hypotheses of the study are listed below, and analyses were conducted on the sub-hypotheses.

H_1: EWCA has a positive effect on SDB.
H_2: EWCA differs according to monthly family income.
H_3: SDB differs according to monthly family income.
H_4: EWCA differs according to educational level.
H_5: SDB differs according to educational level.
H_6: EWCA differs according to generation
H_7: SDB differs according to generation.

7.4.Development of the Questionnaire Form

The questionnaire developed to collect data for the study consists of three sections. The first section contains questions aimed at determining the demographic characteristics of the participants. The second section of the questionnaire contains

a total of 10 statements aimed at determining EWCA. The third section of the questionnaire contains 25 statements aimed at determining SDB.

The EWCA scale used in the study was adapted to Turkish from the work of Ali & Akalu (2022). The scale statements related to SDB were adapted from the study conducted by Korsunova, Horn, & Vainio (2021). A 5-point Likert scale was used in the survey, and participants were asked to select the option that best reflected their thoughts on the statements in the survey, ranging from "1-Strongly disagree" to "5-Strongly agree".

7.5. Research Population and Sample

With electronic products becoming an integral part of our daily lives, a significant amount of e-waste is generated worldwide each year. The fact that this waste has surpassed household waste in recent years has increased interest in the issue. In line with the aim of this study, the main sample consists of participants living in Türkiye who are over 18 years of age and have previously used electronic products. The sample for the study was defined as individuals over the age of 18 living in Istanbul. Since the research aims to make an intergenerational comparison, all individuals over the age of 18 who have previously used electronic products are included in the study. Participants in the study were selected using the simple random sampling method from among the possible sampling methods. The data was collected between March 10, 2025, and April 16, 2025.

8. Data Analysis

A total of 471 people participated in the study. Seven participants filled out the questionnaire carelessly and randomly, and their responses were excluded from the analysis. A total of 464 valid questionnaires were used in the study, and Cronbach's alpha, structural equation modeling, and one-way analysis of variance (ANOVA) tests were applied to analyze the data.

8.1. Pre-Test and Reliability Analysis

A pre-test was conducted to determine the suitability of the questionnaire form for the study. The pre-test analysis included 128 participants. After obtaining the data, the validity and reliability of the study were determined for each variable, and then exploration factor analysis was applied. Following the analysis, items 1, 8, 9, and 10 in the EWCA variable, the first item in the refuse dimension of the SDB variable, and items 2, 3, 6, 9, and 10 in the reuse dimension of the SDB variable were excluded from the study due to cross-loading in the factor analysis. Following the factor analysis, validity and reliability values were determined for the variables and their sub-dimensions.

After preliminary testing, the final version of the questionnaire was prepared, and fieldwork was conducted. Cronbach's alpha values were calculated

for each dimension of the variables for reliability analysis. The data obtained from the analysis are presented in Table 1 below.

Table 1. Cronbach's Alpha Values of Variables

Variables	**α**
All Work	,921
SDB	,908
EWCA	,817
Recycle	,883
Reduce	,818
Repair	,811
Refuse	,797
Reuse	,774

The analysis revealed that the required reliability ratios **(α>0.70**) were achieved for all dimensions included in the study.

8.2.Findings of Demographic and Explanatory Factor Analysis

The descriptive analysis revealed that 62% of participants were female, 35% were Generation Z consumers aged 18-24, 31% were Generation Y consumers aged 25-44, and 34% were Generation X individuals. Additionally, 20% of the survey participants had an annual income of 0-20,000 TL, 30% had an annual income of 20,001-40,000 TL 000 TL, 30% had an income between 20,001 and 40,000 TL, 25% had an income between 40,001 and 60,000 TL, 10% had an income between 60,001 and 80,000 TL, and 15% had an income of 80,001 TL and above. Additionally, it was determined that 21% of participants had a high school education, 18% had a bachelor's degree, 17% had a middle school education, 15% had an elementary school education, 15% had an associate's degree, and 14% had a postgraduate education.

In the exploratory factor analysis, the EWCA consisting of 6 items, and the SDB consisting of a total of 19 items, and 5 sub-dimensions were studied. The data were tested using the varimax method. Within the framework of the results obtained, it was determined that each factor was grouped under its variable as it appeared on the scale. The findings regarding the analysis results are presented in Table 2.

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XV, Issue: 2, Year: 2025, pp.844-887

Table 2. Exploratory Factor Analysis

Exploratory Factor Analysis Results			
E-WASTE CONSUMER AWARENESS (EWCA)	**Factor Loadings**	**Variance**	**Cronbach Alpha**
I think e-waste is a serious threat to the environment.	0.892	0.133	0.866
I believe that e-waste contains toxic substances.	0.767		
I think e-waste poses a risk to human health.	0.752		
I believe that e-waste is a public problem.	0.700		
I think mismanagement of e-waste poses a risk to people.	0.663		
I know that e-waste contains items of material value.	0.493		
SUSTAINABLE DISPOSAL BEHAVIOR (SDB)			0.838
REPAIR		0.302	0.809
I always try to repair broken electronic products.	0.723		
I can learn how to better repair and fix my electronic products.	0.677		
When my electronic product breaks, I get it repaired.	0.671		
RECYCLE		0.221	0.803
At home, we sort e-waste (plastics, cardboard, glass jars, etc.) for recycling.	0.795		
I recycle the electronic products I buy in the right way so that they can be put back into circulation.	0.770		
I sort garbage and e-waste and put them in the right box.	0.658		
Recycling is a big part of life.	0.406		
REDUCE		0.378	0.732
I can reduce the purchase of products that may generate e-waste.	0.750		
I stopped buying products that may generate e-waste.	0.663		
I avoid buying short-lived electronic products.	0.520		
I may try not to buy electronic products too often.	0.507		
REFUSE		0.502	0.717
I buy electronic products that are valuable to me, so there is no waste.	0.644		
I refuse to buy products that I consider unnecessary and may generate e-waste.	0.576		
I buy electronic products based on whether I really need them or not.	0.481		
REUSE		0.444	0.679
I borrow electronic items from friends.	0.610		
I buy used electronic products.	0.582		
I buy a product made from recycled e-waste.	0.509		
If I only need an electronic product once, I rent it from someone.	0.488		
I donate my used electronic products to charity.	0.488		
KMO: 0.850 **Barlett's Test:** <0.001 **α:** ,848			

8.3.Structural Equation Analysis Findings

Confirmatory factor analysis was applied to test the accuracy of the factors created after the exploratory factor analysis. The reliability (validity) coefficients obtained as a result of this analysis are given in the table below.

Table 3. Fit Values of the Scales

Compliance Criteria	Result	Abbreviation
Degrees of Freedom	267	df
Probability Level	0.000	p
Root Mean Square Error of Approximation	0.079	RMSEA
Comparative Fit Index	0.814	CFI
CMIN/DF	3.908	CMIN/DF

When the fit values of the scales are examined, it is observed that the RMSEA and CMIN/DF values are at the appropriate level. Since the CFI value is very close to the limit, it is considered to be at an acceptable level. In addition, the fact that the p-value is significant shows that the chi-square test result is compatible. As a result, it is determined that the structural equation model is applicable. The analysis findings and hypothesis results of the variables as a result of SEM are presented in Table 4.

Table 4. Structural Equation Model Results

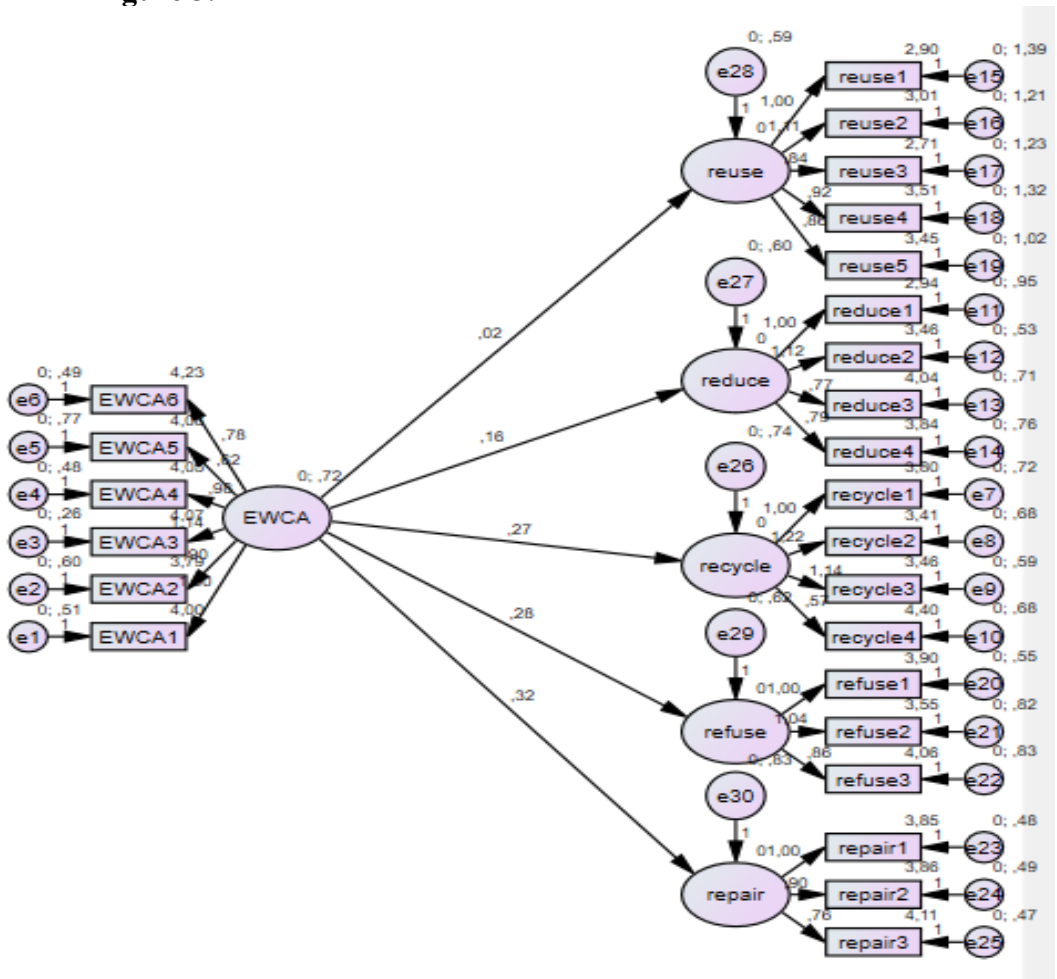
Hypotheses	Coefficient (β)	Standard Error (S.E.)	t	p	Result
EWCA ---> SDB	0.248	0.045	5.526	**<0.001***	**H_1: Accepted.**
EWCA ---> Reduce	0.150	0.054	2.766	**0.006***	**H_{1a}: Accepted.**
EWCA ---> Reuse	0.018	0.056	0.321	0.748	H_{1b}: Rejected.
EWCA ---> Recycle	0.279	0.060	4.693	**<0.001***	**H_{1c}: Accepted.**
EWCA ---> Refuse	0.282	0.059	4.795	**<0.001***	**H_{1d}: Accepted.**
EWCA ---> Repair	0.323	0.064	5.077	**<0.001***	**H_{1e}: Accepted.**

H_{1a}: EWCA has a positive impact on reduce.
H_{1b}: EWCA has a positive impact on reuse.
H_{1c}: EWCA has a positive impact on recycle.
H_{1d}: EWCA has a positive impact on refuse.
H_{1e}: EWCA has a positive impact on repair.

International Journal of Contemporary Economics and Administrative Sciences
ISSN: 1925 – 4423
Volume: XV, Issue: 2, Year: 2025, pp.844-887

According to the data in Table 4, EWCA has a positive effect (p<0.05) on SDB, reduce, recycle, refuse, and repair variables. The significant effect of EWCA on the repair variable is higher than the others (β:0.323). The relationship model between EWCA and the sub-dimensions of SDB is presented in Figure 3 below.

Figure 3. SEM Model



When the structural equation model was analyzed, it was observed that all sub-factors were significant with the factors within their own variables. It has been determined that each of the statements in the questionnaire has an effect on the dimension in which it is included and expresses significance.

8.4.One-Way Analysis of Variance (ANOVA)

Within the scope of the purpose of the study, one-way analysis of variance was applied to determine the intergenerational differences of EWCA and SDB. In addition, the hypotheses questioning that the demographic questions in the questionnaire form (family monthly income and education level) cause a significant

difference on EWCA and SDB variables were also tested with one-way analysis of variance. The findings obtained from the analysis results are presented in Table 5.

Table 5. One-Way Analysis of Variance (ANOVA) Results

Variables	Demographic Factors	N	Ort.	F	P	Hypothesis Result
EWCA	Family Monthly Income	464	69.414	2.893	**0.022***	**H_2: Accepted.**
	Education Level	464	15.584	0.637	0,672	H_4: Rejected.
	Generational Differences	464	31.525	1.297	0.264	H_6: Rejected.
SDB	Family Monthly Income	464	350.243	1.912	0.107	H_3: Rejected.
	Education Level	464	145.370	0.785	0.561	H_5: Rejected.
	Generational Differences	464	960.748	5.453	**<0.001***	**H_7: Accepted.**
Reuse	Family Monthly Income	464	57.785	3.028	**0.018***	**H_{3a}: Accepted.**
	Education Level	464	6.718	0.344	0.886	H_{5a}: Rejected.
	Generational Differences	464	43.801	2.287	**0.045***	**H_{7a}: Accepted.**
Reduce	Family Monthly Income	464	5.849	0.515	0.725	H_{3b}: Rejected.
	Education Level	464	32.234	2.909	**0.013***	**H_{5b}: Accepted.**
	Generational Differences	464	49.344	4.529	**<0.001***	**H_{7b}: Accepted.**
Recycle	Family Monthly Income	464	10.885	0.726	0.575	H_{3c}: Rejected.
	Education Level	464	11.432	0.762	0.762	H_{5c}: Rejected.
	Generational Differences	464	28.912	1.952	0.085	H_{7c}: Rejected.
Refuse	Family Monthly Income	464	21.090	2.716	**0.029***	**H_{3d}: Accepted.**
	Education Level	464	5.034	0.636	0.672	H_{5d}: Rejected.
	Generational Differences	464	16.593	2.132	0.061	H_{7d}: Rejected.
Repair	Family Monthly Income	464	19.370	2.515	**0.041***	**H_{3e}: Accepted.**
	Education Level	464	13.970	1.806	0.110	H_{5e}: Rejected.
	Generational Differences	464	23.164	3.034	**0.010***	**H_{7e}: Accepted.**

H_2: EWCA differs according to family monthly income.
H_{3a}: Participants' reuse behaviors differ according to family monthly income.
H_{3d}: Participants' refusal behaviors differ according to family monthly income.
H_{3e}: Participants' repair behaviors differ according to family monthly income.
H_{5b}: Participants' reduction behaviors differ according to their level of education.
H_7: SDB differs according to generations.
H_{7a}: Participants' reuse behaviors differ according to generations.
H_{7b}: Participants' reduction behaviors differ according to generations.
H_{7e}: Participants' repair behaviors differ according to generations.

After the ANOVA test, it was determined that there was a statistically significant difference on SDB according to intergenerational differences ($p<0.05$),

while family income and education level did not show a significant difference (p>0.05). In addition, it was determined that there was a statistically significant difference in EWCA according to family monthly income. In the analysis of the five sub-dimensions (5R) that make up SDB, it was found that there was a statistically significant difference in reduction according to education level and intergenerational differences, reuse according to family monthly income and intergenerational differences, refusal according to family monthly income, and finally, repair according to family monthly income and intergenerational differences. In addition, H3: SDB according to family monthly income, H3b; H3c: Reduce and recycle behaviors according to family monthly income, H4: EWCA according to education level, H5: SDB according to education level, H5a, H5c, H5d, H5e: Reuse, recycle, refuse and repair behaviors according to education level, H6: EWCA according to generations, H7c, H7d: No difference was found on recycle and refuse behaviors according to generations.

Within the framework of the data obtained, Post Hoc Tukey test was applied in order to determine how the variables that showed statistical significance differed between which groups. Summary data regarding the test findings are shown in Table 6 below.

Table 6. SDB Post Hoc Tukey Test Results

	Generational Differences	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
SDB	18-24 (1)	25-34 (2)	-7.227	1.875	**0.002***
		35-44 (3)	-5.741	1.875	**0.028***
		45-54 (4)	-6.075	1.709	**0.006***
		55-64 (5)	-8.262	2.273	**0.004***
		65 years old and above (6)	-5.257	3.381	0.629

According to the results obtained, it has been observed that consumers in generation x and y are more likely to engage in SDB than generation z consumers.

Table 7. EWCA Post Hoc Tukey Test Results

	Family Monthly Income	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
EWCA	0-20.000 TL (1)	20.001-40.000 TL (2)	-1.491	0.655	0.155
		40.001-60.000 TL (3)	-1.224	0.681	0.376
		60.001-80.000 TL (4)	-2.085	0.895	0.137
		80,001 TL and above (5)	-2.386	0.764	**0.016***

In the analysis conducted on EWCA, it was determined that individuals with a family income of 80,000 TL and above have higher EWCA than consumers with an income of 0-20,000 TL.

Table 8. Reduce Post Hoc Tukey Test Results

Reduce	**Education Level**	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
	High School (3)	Associate Degree (4) Bachelor's degree (5) Postgraduate (6)	0.749 1.394 1.729	0.521 0.497 0.537	0.704 0.059 **0.017***
Reduce	**Generational Differences**	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
	18-24 (1)	25-34 (2) 35-44 (3) 45-54 (4) 55-64 (5) 65 years old and above (6)	-1.333 -0.846 -1.814 -1.554 -1.212	0.466 0.466 0.425 0.565 0.841	0.050 0.457 **0.001*** 0.068 0.701

According to the results obtained, it is seen that high school graduates engage in reduce behavior more than postgraduate graduates. In addition, it was also determined that consumers in the late generation x exhibit more reduction behavior than generation z consumers.

Table 9. Reuse Post Hoc Tukey Test Results

Reuse	**Family Monthly Income**	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
	40.001-60.000 TL (3)	60.001-80.000 TL (4) 80.001 TL and above (5)	2.192 1.470	0.774 0.654	**0.039*** 0.164
Reuse	**Generational Differences**	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
	18-24 (1)	25-34 (2) 35-44 (3) 45-54 (4) 55-64 (5) 65 years old and above (6)	-1.848 -0.695 -0.603 -1.581 -1.434	0.618 0.618 0.564 0.749 1.115	**0.035*** 0.871 0.893 0.284 0.793

Participants with an income between 40.001-60.000 TL were found to show more reuse behaviors than individuals with a family income between 60.001-80.000 TL. In addition, it has also been determined that late millennials between the ages of 25-34 are more likely to engage in reuse behavior than generation z consumers between the ages of 18-24.

Table 10. Refuse Post Hoc Tukey Test Results

	Family Monthly Income	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
Refuse	0-20.000 TL (1)	20.001-40.000 TL (2) 40.001-60.000 TL (3) 60.001-80.000 TL (4) 80.001 TL and above (5)	-0.735 -1.093 -0.418 -0.073	0.373 0.387 0.509 0.435	0.281 **0.040*** 0.924 1.000

When rejection behavior was examined according to family monthly income, it was determined that individuals with a family income of 40.001-60.000 TL showed more rejection behavior than participants with an income of 0-20.000 TL.

Table 11. Repair Post Hoc Tukey Test Results

	Family Monthly Income	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
Repair	0-20.000 TL (1)	20.001-40.000 TL (2) 40.001-60.000 TL (3) 60.001-80.000 TL (4) 80.001 TL and above (5)	-0.941 -1.105 -0.430 -0.560	0.371 0.386 0.507 0.433	0.084 **0.035*** 0.915 0.695
	Generational Differences	**Dimensions**	**X**	**Sd**	**Post-Hoc.**
Repair	18-24 (1)	25-34 (2) 35-44 (3) 45-54 (4) 55-64 (5) 65 years old and above (6)	-1.224 -0.961 -0.868 -1.026 -0.088	0.390 0.390 0.356 0.473 0.704	**0.022*** 0.138 0.145 0.254 1.000

It has been observed that individuals with a family income between 40.001-60.000 TL show more repair behavior than consumers with a family income of 0-20.000 TL. In addition, it was also determined that late millennials exhibit more repair behavior than generation z.

9. Evaluation of Research Findings

The data revealed that EWCA has a positive effect on SDB. The findings obtained are consistent with the studies on the subject in the literature (Ding, Guo, & Xue, 2023; Thukral & Singhal, 2023; Laeequddin, Kareem Abdul, Sahay, & Tiwari, 2022; Wardhana, 2022; Wang, Guo, Wang, 2016). In addition, it was found that EWCA had a positive effect on reduce, recycle, recycle, refuse, and repair, but

had no significant effect on reuse. The obtained results fill an important gap in literature since there is no similar finding in the past.

When EWCA is analyzed within the scope of demographic findings; it is determined that individuals with high family monthly income (80,000 TL and above) have more EWCA compared to individuals with low family monthly income (0-20,000 TL). When the studies on the subject in the literature are examined, it is revealed that the results obtained are like the studies (Pham, Lam, Le Dang, & Pham, 2023; Islam, Dias, & Huda, 2021; Han et al., 2018). As a result of testing the relationship between EWCA and the education level of the participants, it was found that the difference in education level did not create a statistically significant difference on EWCA. The results differ from the studies in the literature (Delcea, Crăciun, Ioanăș, Ferruzzi, & Cotfas, 2020; Dina, Fillaeli, & Jayanti, 2017). In addition, it was determined that EWCA did not differ significantly according to generations. There is no intergenerational study on the subject in literature.

Considering the results of the relationship between demographic characteristics of consumers and SDB, it was found that there was no statistically significant difference in SDB according to family monthly income and education level. This result differs from the studies in the literature (Islam, Dias, & Huda, 2020; Saseanu et al., 2019; Lee & Paik, 2011). Finally, it was determined that there was a statistically significant difference in SDB according to intergenerational differences. These results are consistent with other studies on the subject (Fullerton, McCullough, & Moore, 2019). When the sub-dimensions of SDB were examined in the context of demographic characteristics, it was observed that family monthly income, education level, and intergenerational differences did not create a significant difference on recycling behavior. This result does not conform to the widely accepted view in the literature that individuals with high incomes are well-educated and therefore have awareness (Valenzuela-Levi, 2019; Ferrara & Missios, 2005).

In the relationship between family income and reuse behavior, it was determined that family members with low income were more prone to reuse. This result is consistent with the findings in the literature (Madzaramba & Zanamwe, 2023; McCollough, 2007). In addition, it has been determined that generation y consumers tend to reuse more than generation z consumers. This is in line with the tendency of Generation Z to use the latest model products based on hedonistic consumption and ostentation. The findings have contributed to the relevant literature since they are not the subject of any previous research. It was determined that the difference in education levels did not show a difference in refuse and repair behaviors, including reused behavior. In addition, it is a surprising result that high school graduates show more reduce behavior than participants with postgraduate education. The fact that there is no increase in SDB in parallel with the increase in education level is thought to be due to the lack of convenient access to recycling centers and/or waste bins in the country where the data were collected. It is estimated that the results between education level and SDB behaviors are in contrast with the findings in the literature (Shodiq, Relawatı, & Bakhtıar, 2020; Geng, Liu, & Zhu, 2017) due to this feature. In other findings, it was observed that individuals

with high family income showed more repair and refuse behaviors than low-income participants, but there was no difference on the concept of reduce. While the findings obtained between family income and repair are consistent with the information in the literature (Lane et al., 2024), it has been observed that no previous study has been conducted on the analysis result between family income and refusal behavior. Finally, it was determined that the late generation x in the 45-54 age range engaged in reduced behavior more than the z generation, and the late generation y in the 25-34 age range engaged in repair behavior more than the z generation. The findings fill an important gap in literature.

10.Conclusion and Recommendations

This study aims to examine how EWCA and SDB differ according to intergenerational and demographic characteristics. In addition, determining the effect of EWCA on SDB and its sub-dimensions is also included in the purpose of the study. As a result of the studies conducted in this framework, it was determined that EWCA has a positive effect on SDB and its 4 sub-dimensions (reduce, recycle, refuse, and repair). This situation reveals that significant progress will be made in waste recycling because of increasing consumer awareness. In addition, it is an interesting finding that education and generational differences do not cause a difference on EWCA. This result reveals the insufficiency of trainings to raise awareness on waste management in Türkiye. The fact that there is no change in the awareness of consumers despite the increasing level of education is considered as insufficient studies on the environment and recycling of waste in the education curriculum. In addition, the fact that EWCA has no effect on the recycling dimension is interpreted as the recycling centers and/or waste collection points in the country are not found to be convenient by consumers. The presence of container-type collective waste bins in neighborhoods and streets and the fact that recycling bins are limited to public institutions support this view. In the study, the fact that individuals with high family monthly income (80,000 TL and above) have a high level of EWCA compared to individuals with low income (0-20,000 TL) is explained by the fact that they interact more with electronic products. Considering that an average electronic product today costs more than 20,000 TL, it is estimated that these individuals have very limited access to electronic products. In addition, the determination that the increase in EWCA has a positive effect on SDB in the analysis results supports the idea that the first and most important step in SDB is to increase awareness. For this reason, it is thought that informing consumers about the damage caused by e-waste to the environment and human health will positively affect SDB and pave the way for the preference and demand for green products that are more convenient to recycle.

When SDB is analyzed according to intergenerational differences, it is determined that x and y generation consumers show more SDB than z generation consumers. In addition, the fact that generations x and y have a more positive behavior in reuse, reduce and repair behaviors than generation z leads to the view that generation z does not engage in activities to increase SDB. The fact that there is no difference in SDB and its sub-dimensions (reuse, recycle, repair and refuse)

according to the level of education supports the above view considering that generation z has a high level of education. According to family income, it is thought that the fact that low-income consumers engage in reuse behavior more than high-income consumers is due to their economic purchasing power, and the fact that high-income individuals show more refusal behavior than low-income individuals is due to their higher awareness of the issue.

As a result of the information revealed by the study, it has been revealed that a social awareness-raising study on e-waste and waste management is necessary, especially among young consumers. For this purpose, it is recommended that local and central governments should implement the necessary studies by using mass media (TV, radio, internet, etc.) and social media channels. In addition, it is recommended that courses and projects to raise environmental awareness be added to the curricula of students and that activities to raise social awareness be carried out continuously in channels such as public education centers. In order to encourage consumers to participate in waste management, it is important to use diversified waste bins (glass, plastic, electronics, household, household, batteries, etc.) instead of general waste bins in the neighborhoods atoin order to contribute to the circular economy by abandoning the usual behaviors in society. In addition, the placement of recycling machines in city centers that allow e-waste to be exchanged for its financial equivalent determined by artificial intelligence with an artificial intelligence-supported device can encourage consumers to participate in SDB.

The most important limitations of this study are the consumers over the age of 18 living in Istanbul. The findings on EWCA and SDB were determined through a quantitatively designed questionnaire. To obtain different information on the subject and to determine the depth of the participants' perspectives on the subject, it is recommended to be re-tested comparatively on large masses representing different sample groups such as consumers residing in developed, developing, or underdeveloped countries with semi-structured interview techniques. In order to diversify the theoretical inferences on the subject, it is suggested that SDB and its sub-dimensions be evaluated with other concepts (theory of planned behavior, habit, environmental concern, etc.) that may affect SDB.

REFERENCES

Adeel, S., Nayab, A., Qureshi, M. U., & Channa, K. A. (2023). University Students' Awareness of E-Waste and Its Disposal Practices in Pakistan: A Construction of the Conceptual Framework. *Journal of Material Cycles and Waste Management,* 25(4), 2457-2470.

Ahmadi, M. (2017). Evaluating the Performance of 3Rs Waste Practices: Case Study-Region One Municipality of Tehran. *Adv Recycling Waste Manag*, 2(2), 1-6.

Ajekwene, K. K., Aigbokhan, E., Akindele, O., Yibowei, M. E., Momoh, F. P., & Ugonna, U. K. (2022). Electronic Waste (E-Waste): Sources, Proliferation, Effects & Management in Developing Nations. *IOSR J. Eng*, 12, 12-27.

Alabi, O. A. et al., (2012). Comparative Evaluation of Environmental Contamination and DNA Damage Induced by Electronic-Waste in Nigeria and China. *Science of The Total Environment*, 423, 62-72.

Ali, A. S., & Akalu, Z. K. (2022). E-Waste Awareness and Management Among People Engaged in E-Waste Selling, Collecting, Dismantling, Repairing, and Storing Activities in Addis Ababa, Ethiopia. *Environmental Health Insights*, 16, 1-8.

Anua, S. M. et al., (2022). Reduce, Reuse and Recycle (3R) Awareness Programme to Increase the Knowledge, Attitude and Practice on 3R Among Primary School Students. *International Journal of Academic Research in Business and Social Sciences,* 12(13), 62-74.

Arya, P., Ahlawat, R., & Ahlawat, B. (2023). Application of 5R's of Sustainability in Hotel Industry. *In 2023 International Conference on New Frontiers in Communication, Automation, Management and Security (ICCAMS)* (Vol. 1, pp. 1-5). IEEE.

Arya, S. et al., (2021). Evaluation of Soil Contamination Due to Crude E-Waste Recycling Activities in the Capital City of India. *Process Safety and Environmental Protection,* 152, 641-653.

Attia, Y., Soori, P. K., & Ghaith, F. (2021). Analysis of Households' E-Waste Awareness, Disposal Behavior, and Estimation of Potential Waste Mobile Phones Towards an Effective E-Waste Management System in Dubai. *Toxics,* 9(10), 236.

Awasthi, A. K., & Li, J. (2017). Management of Electrical and Electronic Waste: A Comparative Evaluation of China and India. *Renewable and Sustainable Energy Reviews,* 76, 434-447.

Azimi Jibril, J. D. et al., (2012). 3R's Critical Success Factor in Solid Waste Management System for Higher Educational Institutions. *Procedia-Social and Behavioral Sciences*, 65, 626-631.

Balde, C. P. et al., (2024). The Global E-Waste Monitor 2024. Retrieved from api.globalewaste.org/publications/file/297/Global-E-waste-Monitor-2024.pdf#page=49.99, erişim tarihi: 09.06.2024.

Balwan, W. K., Singh, A., & Kour, S. (2022). 5R's of Zero Waste Management to Save Our Green Planet: A Narrative Review. *European Journal of Biotechnology and Bioscience,* 10(1), 7-11.

Bayhan, H. G., & Karaca, E. (2020). Technological Innovation in Architecture and Engineering Education-An Investigation on Three Generations from Turkey. *International Journal of Educational Technology in Higher Education*, 17(33), 1-22.

Bejtkovský, J. (2016). The Employees of Baby Boomers Generation, Generation X, Generation Y and Generation Z in Selected Czech Corporations as Conceivers of Development and Competitiveness in Their Corporation. *Journal of Competitiveness,* 8(4), 105-123.

Bhattacharjee, S. et al., (2024). Role of Nanotechnology as a Zero Waste Tool. *Environmental Quality Management*, 33(4), 193-209.

Borthakur, A., & Govind, M. (2017). Emerging Trends in Consumers' E-Waste Disposal Behaviour and Awareness: A Worldwide Overview With Special Focus on India. Resources, *Conservation and Recycling*, 117, 102-113.

Cai, K. et al., (2020). Uncovering Residents' Behaviors, Attitudes, and WTP for Recycling E-Waste: A Case Study of Zhuhai City, China. *Environmental Science and Pollution Research,* 27, 2386-2399.

Can, B. A., & Engindeniz, S. (2023). The Effect of Social Media on Prepared Food Consumption of Generation X and Y Consumers: A Case Study for Turkey. *İzmir İktisat Dergisi*, 38(1), 1-18.

Carrara, P., Morandı, W., & Tandoı, E. (2021). Building a Green Development Roadmap Using 5R's and Trız. *Acta Technıca Napocensıs-Series: Applıed Mathematıcs, Mechanıcs, and Engıneerıng*, 64(3), 465-474.

Chatterjee, A., & Abraham, J. (2017). Efficient Management of E-Wastes. *International Journal of Environmental Science and Technology*, 14, 211-222.

Choi, H., Kim, T., Son, H., Kim, D. K., Park, K., & Roh, T. (2024). How Does Consumer Awareness of the Waste of Electrical and Electronic Equipment Affect Reverse Logistics? Extended Triple Bottom Line Approach. *Energy & Environment,* 0958305X241262819.

Csobanka, Z. E. (2016). The Z generation. *Acta Technologica Dubnicae,* 6(2), 63-76.

Dao, H. T. N., Downs, T. J. & Delauer, V. (2013). Sustainable Solid Waste Management in Danang, Vietnam: The 3R (Reduce, Reuse, And Recycle) Approach Focusing on Community Participation. *In Fourteenth International Waste Management and Landfill Symposium,* (30).

Dave, S. R., Shah, M. B., & Tipre, D. R. (2016). E-waste: Metal Pollution Threat or Metal Resource. *J Adv Res Biotech*, 1(2), 1-14.

Delcea, C., Crăciun, L., Ioanăș, C., Ferruzzi, G., & Cotfas, L. A. (2020). Determinants of Individuals' E-Waste Recycling Decision: A Case Study from Romania. *Sustainability,* 12(7), 2753.

Deniz, P. Ö., Aydın, Ç. Y., & Kiraz, E. D. E. (2019). Electronic Waste Awareness Among Students of Engineering Department. *Cukurova Medical Journal*, 44(1), 101-109.

De Oliveira Neto, J. F. et al., (2022). Household Practices Regarding E-Waste Management: A Case Study From Brazil. *Environmental Technology & Innovation,* 28, 102723.

Dhull, R., & Shreshtha, D. M. (2021). Consumer Awareness About E-Waste in Rural and Urban Haryana. *The Journal of Contemporary Issues in Business and Government,* 27(3), 228-234.

Dina, D., Fillaeli, A., & Jayanti, A. A. (2017). Waste-Wise Education: Impact on Zero Waste Awareness and Practices. *Jurnal Pendidikan Matematika dan Sains*, 11(2), 20-27.

Ding, L., Guo, Z., & Xue, Y. (2023). Dump or Recycle? Consumer's Environmental Awareness and Express Package Disposal Based on an Evolutionary Game Model. *Environment, Development and Sustainability,* 25(7), 6963-6986.

Eklová, K. (2020). Sustainability of Buildings: Environmental, Economic and Social Pillars. *Bus. IT*, 2, 2-11.

Ercömert, Ç., & Güneş, S. (2021). Industrial Design Education: A Research on Generation Theories and Change in Turkey. *Design and Technology Education: an International Journal,* 26(3-1), 136-158.

Fathi, B. M., Ansari, A., & Ansari, A. (2022). Threats of Internet-of-Thing on Environmental Sustainability by E-Waste. *Sustainability,* 14(16), 10161.

Ferrara, I., & Missios, P. (2005). Recycling and Waste Diversion Effectiveness: Evidence from Canada. *Environmental and Resource Economics*, 30, 221-238.

Forti, V. et al., (2020) The Global E-Waste Monitor 2020. Retrieved from ewastemonitor.info/wpcontent/uploads/2020/11/GEM_2020_def_july1_low.pdf, erişim tarihi: 25.06.2024.

Fullerton, S., McCullough, T., & Moore, D. L. (2019). Consumer Actions and Attitudes Regarding Initiatives Directed Towards Sustainability: Assessing Gender and Generational Gaps. *Association of Marketing Theory and Practice Proceedings.*

Ganczewski, G., & Jemielniak, D. (2022). Twitter is Garbage: A Thick Big Data Exploration Of# Zerowaste Hashtag on Twitter in Relation to Packaging and Food Packaging Materials. *Packaging Technology and Science*, 35(12), 893-902.

Geng, D., Liu, J., & Zhu, Q. (2017). Motivating Sustainable Consumption Among Chinese Adolescents: An Empirical Examination. *Journal of Cleaner Production*, 141, 315-322.

Golev, A. et al., (2016). Product Flow Analysis Using Trade Statistics and Consumer Survey Data: A Case Study of Mobile Phones in Australia. *Journal of Cleaner Production,* 133, 262-271.

Gurler, I. (2011). The Analysis and Impact of Remanufacturing Industry Practices. *International Journal of Contemporary Economics and Administrative Sciences*, 1(1), 25–39.

Han, Z., Duan, Q., Fei, Y., Zeng, D., Shi, G., Li, H., & Hu, M. (2018). Factors That Influence Public Awareness of Domestic Waste Characteristics and Management in Rural Areas. *Integrated Environmental Assessment and Management*, 14(3), 395-406.

Herat, S. (2007). Sustainable Management of Electronic Waste (E-Waste). *Clean–Soil, Air, Water,* 35(4), 305-310.

Hotta, Y. et al., (2016). Developing 3R Policy Indicators for Asia and the Pacific Region: Experience from Regional 3R Forum in Asia and the Pacific. *Journal of Material Cycles and Waste Management,* 18, 22-37.

Hu, S., & He, J. (2022). The Willingness to Household Waste Disposal Practices of Residents in Rural China. *Journal of Material Cycles and Waste Management*, 24(3), 1124-1133.

Huang, B. et al., (2018). Construction and Demolition Waste Management in China Through the 3R Principle. *Resources, Conservation and Recycling*, 129, 36-44.

Igaro, O. G. et al., (2015). Liver Damage Risk Assessment Study in Workers Occupationally Exposed to E-Waste in Benin City, South-South Nigeria. *Journal of Chemical Health Risks*, 5(3), 155–166.

Ilbas, A. (2025). Türkiye'deki Büyükşehir Belediyelerinin Katı Atık Yönetim Etkinliklerinin Ölçülmesi ve Değerlendirilmesi. *Erciyes Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi*, (70), 65-75.

Imran, M. et al., (2017). E-Waste Flows, Resource Recovery and Improvement of Legal Framework in Pakistan. *Resources, Conservation and Recycling*, 125, 131-138.

Islam, M. T., Dias, P., & Huda, N. (2021). Young Consumers'e-Waste Awareness, Consumption, Disposal, and Recycling Behavior: A Case Study of University Students in Sydney, *Australia. Journal of Cleaner Production*, 282, 1-18.

Islam, M. T., Dias, P., & Huda, N. (2020). Waste Mobile Phones: A Survey and Analysis of the Awareness, Consumption and Disposal Behavior of Consumers in Australia. *Journal of Environmental Management*, 275, 111111.

Kannan, D. et al., (2024). Smart Waste Management 4.0: The Transition from a Systematic Review to an Integrated Framework. *Waste Management*, 174, 1-14.

Karaca, Ş. (2018). Duygusal ve Bilişsel Güdülerin Sürdürülebilir Giysi Tüketim Davranışı Üzerindeki Etkisini İncelemeye Yönelik Bir Çalışma. *Selçuk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi,* (40), 254-268.

Karagiannopoulos, P. S., Manousakis, N. M., & Psomopoulos, C. S. (2023). "3R" Practices Focused on Home Appliances Sector in Terms of Green Consumerism: Principles, Technical Dimensions and Future Challenges. *IEEE Transactions on Consumer Electronics.* 70(1), 96-107.

Kaur, J. et al., (2022). Sustainable Consumption Practices in Indian Households: A Saga of Environment Management Linked to Indian Ethos and Generational Differences. *Society and Business Review*, 17(3), 441-468.

Kiddee, P., Naidu, R., & Wong, M. H. (2013). Electronic Waste Management Approaches: an Overview. *Waste Management*, 33(5), 1237-1250.

Korsunova, A., Horn, S., & Vainio, A. (2021). Understanding Circular Economy in Everyday Life: Perceptions of Young Adults in the Finnish Context. *Sustain. Prod. Consum.* 26, 759–769.

Köse, Ş. G. & Aydın, K. (2020). Sürdürülebilir Moda Perakendeciliği: Tüketici Algıları Üzerine Bir Araştırma. *Istanbul Business Research*, 49(1), 86-116.

Kumar, A., Pali, H. S., & Kumar, M. (2023). A Comprehensive Review on the Production of Alternative Fuel Through Medical Plastic Waste. *Sustainable Energy Technologies and Assessments*, 55, 1-22.

Kumar, A., Holuszko, M., & Espinosa, D. C. R. (2017). E-Waste: An Overview on Generation, Collection, Legislation and Recycling Practices. *Resources, Conservation and Recycling,* 122, 32-42.

Korsunova, A., Horn, S., & Vainio, A. (2021). Understanding Circular Economy in Everyday Life: Perceptions of Young Adults in the Finnish Context. *Sustainable Production and Consumption*, 26, 759-769.

Laeequddin, M., Kareem Abdul, W., Sahay, V., & Tiwari, A. K. (2022). Factors that Influence the Safe Disposal Behavior of E-Waste by Electronics Consumers. *Sustainability,* 14(9), 4981.

Lane, R., Lindsay, J., Arunachalam, D., & Raven, R. (2024). Repair and Maintenance in Australian Households: What Drives This Critical Consumption Work in the Circular Economy? *Consumption and Society*, 1-21.

Lebbie, T. S. et al., (2021). E-waste in Africa: A Serious Threat to the Health of Children. *International Journal of Environmental Research and Public Health*, 18(16), 8488.

Lee, S., & Paik, H. S. (2011). Korean Household Waste Management and Recycling Behavior. *Building and Environment*, 46(5), 1159-1166.

Liu, K. et al., (2023). A Global Perspective on E-Waste Recycling. *Circular Economy,* 2(1), 100028.

Liu, Q. et al., (2009). Chromosomal Aberrations and DNA Damage in Human Populations Exposed to the Processing of Electronics Waste. *Environmental Science and Pollution Research,* 16, 329-338.

Long, E. et al., (2016). Technical Solutions to Improve Global Sustainable Management of Waste Electrical and Electronic Equipment (WEEE) in the EU and China. *Journal of Remanufacturing*, 6(1), 1-27.

Madzaramba, T. H., & Zanamwe, P. (2023). User Perceptions and Acceptance of Treated Greywater Reuse in Low-Income Communities: A Narrative Review. *Journal of Water and Climate Change,* 14(11), 4236-4244.

Mahmoud, A. B., Fuxman, L., Mohr, I., Reisel, W. D., & Grigoriou, N. (2021). "We Aren't Your Reincarnation!" Workplace Motivation Across X, Y And Z Generations. *International Journal of Manpower*, 42(1), 193-209.

McCollough, J. (2007). The Effect of Income Growth on the Mix of Purchases Between Disposable Goods and Reusable Goods. *International Journal of Consumer Studies,* 31(3), 213-219.

McCollough, J. (2009). Factors Impacting the Demand for Repair Services of Household Products: The Disappearing Repair Trades and the Throwaway Society. *International Journal of Consumer Studies*, 33(6), 619-626.

Metlioğlu, H. H., & Yakın, V. (2021). Tekstilde Sürdürülebilirlik: Hızlı Moda Markalarının Sürdürülebilirlik Stratejileri. *OPUS International Journal of Society Researches, 18(Yönetim ve Organizasyon Özel Sayısı),* 1883-1908.

Mohammed, M. et al., (2021). Modeling of 3R (Reduce, Reuse and Recycle) for Sustainable Construction Waste Reduction: A Partial Least Squares Structural Equation Modeling (PLS-SEM*). Sustainability*, 13(19), 1-22.

Mustofa, M. J. (2020). Legal Framework Dealing with Waste Management in Bangladesh: An Analysis and Evaluation. *Southeast University Journal of Arts and Social Sciences,* 3(1), 71-85.

Necef, Ö. K., Tama, D. & Boz, S. (2020). Moda Endüstrisinde Uygulanan Sürdürülebilirlik Stratejilerine Örnekler. *Turkish Journal of Fashion Design and Management,* 2(2), 67-78.

Ngo, H. T. T. et al., (2021). Blood Heavy Metals and DNA Damage Among Children Living in an Informal E-Waste Processing Area in Vietnam. *Human and Ecological Risk Assessment: An International Journal,* 27(2), 541-559.

Nnorom, I. C., & Osibanjo, O. (2008). Electronic Waste (E-Waste): Material Flows and Management Practices in Nigeria. *Waste management*, 28(8), 1472-1479.

Osibanjo, O., & Nnorom, I. C. (2007). The Challenge of Electronic Waste (E-Waste) Management in Developing Countries. *Waste Management & Research*, 25(6), 489-501.

Öneme, A. A. & Bursalıgil, G. (2022). Giyside Görünür Onarım ile Kişiselleştirilmiş Uygulama Denemeleri. *Yedi,* (28), 23-38.

Pampasit, R. (2018). The Waste Management of the Local Administrative Organization in Khao Kho District, Phetchabun Province, Thailand. *In Journal of Physics: Conference Series,* 1028(1), 1-8.

Parajuly, K., & Wenzel, H. (2017). Product Family Approach in E-Waste Management: A Conceptual Framework for Circular Economy. *Sustainability*, 9(5), 768.

Paras, M. K. et al., (2019). The Study of 3Rs–Reuse, Repair, and Redesign at Swedish Recycling Mall. *Industria Textila*, 70(6), 552-556.

Patil, R. A., & Ramakrishna, S. (2020). A Comprehensive Analysis of E-Waste Legislation Worldwide. *Environmental Science and Pollution Research*, 27(13), 14412-14431.

Perkins, D. N. et al., (2014). E-Waste: A Global Hazard. *Annals of Global Health*, 80(4), 286-295.

Pham, T. T., Lam, T. P. M., Le Dang, H., & Pham, N. T. (2023). Consumers' Willingness to Pay an Environmental Fee for E-Waste Recycling in Vietnam: Integrating the Theory of Planned Behaviour and the Norm Activation Model. *Journal of Material Cycles and Waste Management*, 25(5), 2900-2914.

Pitron, G. (2023). *Dijital Cehennem.* (Çev. Tümertekin, A.). İstanbul: Türkiye İş Bankası Kültür Yayınları. (Orijinal Yayın Tarihi, 2021).

Sadik, M. N., Arefin, S. N., & Tabassum, M. (2017). A Survey on Students' Awareness About E-Waste in Bangladesh. *In 2017 2nd International Conference on Electrical & Electronic Engineering (ICEEE)* (pp. 1-4). IEEE.

Sakai, S. I. et al., (2011). International Comparative Study of 3R and Waste Management Policy Developments. *Journal of Material Cycles and Waste Management*, 13, 86-102.

Samiha, B. (2013). The Importance of the 3R Principle of Municipal Solid Waste Management for Achieving Sustainable Development. *Mediterranean Journal of Social Sciences*, 4(3), 129-135.

Saseanu, A. S., Gogonea, R. M., Ghita, S. I., & Zaharia, R. Ş. (2019). The Impact of Education and Residential Environment on Long-Term Waste Management Behavior in the Context of Sustainability. *Sustainability*, 11(14), 3775.

Senlikoglu, G., & Kaya, H. (2025). Dış Ticaret Işletmelerinde Dijital Dönüşüm Uygulamaları Kullanımının Teknoloji Kabul Modeli ile Incelenmesi. *Işletme Araştırmaları Dergisi*, 17(4), 2860-2879.

Shahabuddin, M. et al., (2023). A Review of the Recent Development, Challenges, and Opportunities of Electronic Waste (E-waste). *International Journal of Environmental Science and Technology*, 20(4), 4513-4520.

Shodıq, W. M., Relawatı, R., & Bakhtıar, A. (2020). Education of Rural Society Influences Green Behavior in Disposing Food Packaging. *Quantum Journal of Social Sciences and Humanities,* 1(1), 30-42.

Song, Y. et al., (2012). Thyroid Endocrine Dysregulation and Erythrocyte DNA Damage Associated with PBDE Exposure in Juvenile Crucian Carp Collected from an E-Waste Dismantling Site in Zhejiang Province, China. *Environmental Toxicology and Chemistry,* 31(9), 2047-2051.

Tangwanichagapong, S. et al., (2017). Greening of a Campus Through Waste Management Initiatives: Experience from a Higher Education Institution in Thailand. *International Journal of Sustainability in Higher Education*, 18(2), 203-217.

Thukral, S., Shree, D., & Singhal, S. (2023). Consumer Behaviour Towards Storage, Disposal and Recycling of E-Waste: Systematic Review and Future Research Prospects. *Benchmarking: An International Journal*, 30(3), 1021-1072.

Türken, A. G., & Fırat, A. (2024). Pazarlama Perspektifinden Dijital Bağımlılık Üzerine Kavramsal Bir Değerlendirme. *Çankırı Karatekin Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi,* 14(3), 833-855.

Usapein, P. & Chavalparit, O. (2015). Evaluating the Performance of 3R Options to Reduce Landfill Wastes Using the 3R Indicator (3RI): Case Study of Polyethylene Factories in Thailand. *Journal of Material Cycles and Waste Management,* (17), 303-311.

Valenzuela-Levi, N. (2019). Do the Rich Recycle More? Understanding the Link Between Income Inequality and Separate Waste Collection within Metropolitan Areas. *Journal of Cleaner Production*, 213, 440-450.

Vinkóczi, T., Rácz, É. H., & Koltai, J. P. (2024). Exploratory Analysis of Zero Waste Theory to Examine Consumer Perceptions of Sustainability: A Covariance-Based Structural Equation Modeling (CB-SEM). *Cleaner Waste Systems*, 8, 1-11.

Visvanathan, C., Adhikari, R. & Ananth, A. P. (2007). 3R Practices for Municipal Solid Waste Management in Asia. *Linnaeus Eco-Tech*, 11-22.

Wang, Z., Guo, D., & Wang, X. (2016). Determinants of Residents' E-Waste Recycling Behaviour Intentions: Evidence from China. *Journal of Cleaner Production,* 137, 850-860.

Wardhana, D. Y. (2022). Environmental Awareness, Sustainable Consumption and Green Behavior Amongst University Students. *Review of Integrative Business and Economics Research,* 11, 242-252.

Wu, C. et al., (2014). Spatial Characteristics of Cadmium in Topsoils in a Typical E-Waste Recycling Area in Southeast China and its Potential Threat to Shallow Groundwater. *Science of the Total Environment*, 472, 556-561.

Xu, X. et al., (2018). Blood Concentrations of Lead, Cadmium, Mercury and Their Association with Biomarkers of DNA Oxidative Damage in Preschool Children Living in an E-Waste Recycling Area. *Environmental Geochemistry and Health*, 40, 1481-1494.

Xu, X. et al., (2015). E-Waste Environmental Contamination and Harm to Public Health in China. *Front Med* 9(2): 220–228.

Zeng, X. et al., (2016). Children with Health Impairments by Heavy Metals in an E-Waste Recycling Area. *Chemosphere*, 148, 408-415.