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Electronic Waste Behaviour among Young Consumers[*]

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Abstract

Theoretical background: Today's societies generate more and more household waste due to continuous industrial progress and increasing consumption. One special, fastest-growing type of household waste is electronic waste. It often contains multiple substances that pose a hazard to people and the environment. Apparently, electronic waste is not always recycled. Storing end-of-life electronics at home or disposing of them with other household waste, whereby the substances they contain cannot be recycled, are not uncommon behaviours. Users significantly impact the volume of generated and properly managed electronic waste.
Purpose of the article: The purpose of the article is to identify young consumer behaviour regarding electronic waste in the Polish market. The age group surveyed is special because of the highest tendency among other age groups to use electronic devices, its large role in shaping social opinion and its influence on market trends. It was pursued through an analysis of their awareness and attitudes. We investigated surveyed consumer willingness to accept higher costs of electrical and electronic equipment and limited functionality to achieve a smaller environmental footprint. We further determined consumer-perceived availability of information about the negative impact of electronic waste, how it is managed, and the frequency and causes of its disposal. The last analysed area was the surveyed consumers' preferences regarding electronic waste collection and management systems.
Research methods: The study employed a survey method. The original questionnaire consisted of 20 questions. The first five were classification questions, while the other fifteen focused on the study objective. The questions employed nominal, ordinal, and interval scales, including the Likert scale. The CAWI (computer-assisted web interview) survey involved 380 respondents who were conveniently sampled young consumers.
Main findings: The study revealed that surveyed consumers exhibited good electronic waste awareness, which, alas, does not affect their environmental attitudes. The respondents were more willing to accept reduced functionality of electronics (8.7%) than higher costs (8.3%) to achieve a better environmental footprint. As much as 73% of the respondents did not agree with the statement that they felt well informed about the potential adverse environmental impact of electrical and electronic equipment when buying it. When online stores were concerned, the percentage was slightly lower but still high at 66%. The most common reason for disposing of equipment is the end of service life, except for mobile phones and powerbanks, which the respondents replaced when new models were available. The respondents believed take-back systems (29%) and scheduled bulky waste collection (29%) to be the most user-friendly forms of electronic waste disposal.

Introduction

Advancing technology, particularly Information and Communications Technology (ICT), drives the prevalence of various types of electronic devices. This trend is true for households and businesses both. The digital transformation, emergence of social media, and universal Internet access significantly shaped how consumers behave and businesses operate, including regarding the equipment necessary to use these services. The fourth industrial revolution is a period characterized by the dynamic development of modern technologies based on electronic equipment (Nieradka, 2019).

Increasingly stimulated economic development, investments, and innovations depend on using – constantly improved and refined – electrical equipment (Zhong et al., 2022). These factors drive the growth in waste electrical and electronic equipment volumes and exacerbate environmental pollution (Zeng et al., 2022). According to Directive 2012/19/EU of the European Parliament and of the Council, waste electrical and electronic equipment means electrical or electronic equipment which is waste within the meaning of Article 3 of Directive 2008/98/EC, including all components, sub-assemblies, and consumables which are part of the product at the time of discarding. Therefore, the notion of electric waste or e-waste covers electronic products no longer fit for use and are discarded by the owners or recycled. The 2022 global electronic waste production estimate is 62 trillion kg, which is 7.8 kg per person on average. Only 22.3% of it was properly collected and recycled (Baldé et al., 2024). The adverse environmental impact of electronic waste is often worse than that of municipal waste. On the one hand, it contains multiple hazardous substances, such as lead, chromium, and other heavy metal compounds (Regel-Rosocka, 2018). On the other hand, when managed properly, electronic waste may be a valuable source of rare elements and substitute scarce minerals with high recycling potential (Lahtela et al., 2022).

In light of the above, the article aims to identify consumer behaviour regarding electronic waste. Focusing the survey on young consumers is interesting for several reasons. First of all, it is this age group that uses electronic devices most frequently (Zhang et al., 2019). Additionally, it is this age group that will dominate the consumer market in the coming decades. Young consumers have a significant role in creating social opinions and market trends. They have always been actively involved in environmental organisations and activities (Gavinet, 2020). Therefore, researching this particular group will allow us not only to analyse current behaviour, but also to forecast future social changes that may occur on the market.

Constant monitoring and observation of consumer habits in this regard are necessary to investigate the problem and instigate actions towards minimising adverse outcomes of electronic waste. Consumer attitudes are critical for effective waste sorting (Tian et al., 2022). In addition, implementing a sound electronic waste recycling policy may help curb climate change ramifications and provide an alternative source of scarce mineral resources for many industries (Anandh et al., 2021). Sustainable

consumption encompasses the use of natural resources, goods and services in a conscious, responsible manner, at various levels. This may also include awareness of minimizing the production of electronic waste (Jarczok-Guzy, 2023).

Literature review

Electronic waste is researched intensively virtually all over the world. Most publications focused on such countries as China, the United States, India, and the United Kingdom (Anandh et al., 2021). The most researched electronic waste types in descending order are phones, computers, refrigerators, and TV sets (Anandh et al., 2021). The growing interest in this topic stems from the exacerbation of the problem of electronic waste, as its share in the stream of unmanaged waste continues to rise. Figure 1 shows data for four European states that are the largest producers of electronic waste. The volume of e-waste has been growing regularly in recent years beyond any doubt.

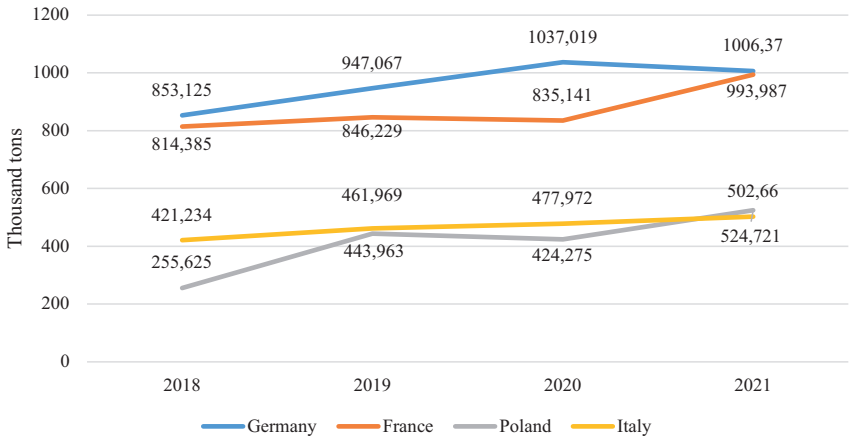

Figure 1. Volumes of electrical and electronic equipment collected in European Union member states that generated the most waste as of 2021

Source: (Eurostat, 2024).

Zhong et al. (2022) carried out interesting research on waste collection. They classified consumers into three groups with two surveys. The types (economical, environment-friendly, and general or indifferent) differed significantly regarding attitudes towards electronic waste. Having classified consumers, the authors determined that a correctly adapted waste collection system – a points system in this case – may guide consumer behaviour. In particular, it can incentivise consumers towards more environmentally-friendly practices (Zhong et al., 2022). Another apt conclusion of the study is that the waste collection system should be diversified to accommodate various types of consumers.

The country's level of development also significantly affects the electronic waste policy. This statement is corroborated by Shahrasbi et al. (2021). According to these authors, the financial aspect is the primal factor for engaging consumers in recycling schemes in developing countries. The environmental domain is of lesser importance. In contrast, consumers in developed countries pay more heed to the social and environmental dimensions. Policy-makers should consider these observations when working on long-term strategies for electronic waste collection systems (Shahrasbi et al., 2021).

A study by Casey et al. (2019) demonstrated that small waste electrical and electronic equipment (such as chargers, phones, and shavers) may be particularly problematic because it is rarely recycled immediately. After the end of its life, this type of equipment is usually purposefully stored or left lying around the house. The main reason is the small size of the devices. Even when an incentive appears to throw it away, it is not always recycled. The waste can end up in a landfill, which is highly damaging to the system and environment. This very precise and thorough study shows the complexity and intricacy of the process. Another particularly problematic issue with small waste electrical and electronic equipment is that it is hard to define the moment in time when the product becomes a piece of waste. Consequently, consumers very often treat the product as something that might still come in handy even though it has not been used for a long time (Casey et al., 2019). Similar results were reported by Nowakowski (2016). He confirmed that chargers and mobile phones are the most commonly retained types of small waste electrical and electronic equipment. Large waste equipment that is often stored by consumers includes saws, drill machines, and computers. Most of the equipment will be kept at home, given to relatives or sold to scrap collectors (de Oliveira Neto et al., 2022). This will result in a shortage of electro-waste for processing at recycling facilities (Fadlil et al., 2022).

Awareness is another important aspect of consumer behaviour. Song et al. (2012) indicated that 33% of respondents were unaware of the potential consequences of electronic waste. Only a group of around 25% were fully aware of all threats linked to the generation of electronic waste. This confirms the limited knowledge of the public concerning electronic waste (Song et al., 2012). The low level of awareness concerning electronic waste was confirmed in a group of engineering students, whose awareness of electronic waste recycling and regulations was established as low. Moreover, no statistically significant difference was found in responses from first- and fifth-year students, which is intriguing (Deniz et al., 2019). Young consumers are more aware. They have concerns about environmental and social impacts. They tend to have a more environmentally-friendly attitude than older generations (Mason et al., 2022). The literature review above leads to the first research question, RQ1: What is the level of awareness and attitudes of young consumers towards electronic waste?

The issue of costs of electronic waste management is an important part of the management system as well. A study by Song et al. (2012) demonstrated that an

advanced recycling fee was the most popular. It involves increasing the product price by the recycling cost. This approach is employed in most countries, and its public acceptance is 74% (Song et al., 2012). The authors further demonstrated that people with higher education and greater income are more willing to pay the price of electronic waste management (Song et al., 2012). In contrast, research by Shaikh et al. (2020) revealed no similar association with consumer income.

An in-depth analysis in a study by Shaikh et al. (2020) demonstrated that about 60% of consumers were willing to pay about 10% of the product price to ensure proper and safe disposal (Shaikh et al., 2020). Nixon et al. (2009) found that consumer beliefs regarding environmental protection are statistically significant and affect user willingness to pay for electronic waste management.

A survey by Ananno et al. (2021) showed that about 62% of respondents were unwilling to pay any electronic waste recycling fee. The highest level of willingness to pay was found among consumers aged 25–35 (Ananno et al., 2021). These publications give rise to the first hypothesis H1: Young consumers are willing to make purchasing decisions that take into account the higher cost and functional limitations of electrical and electronic equipment in exchange for their lower negative environmental impact.

Consumer behaviour regarding electronic waste is significantly affected by the amount of information available to them and access to information relevant to the behaviour. Appropriate information dissemination significantly impacts behaviour and attitudes (Muthukumari et al., 2024). Prakash et al. (2024) confirmed that the availability of consumer information, knowledge, and convenience were the primary factors of e-waste recycling intentions among consumers. Therefore, the role of proper availability of consumer information to electrical and electronic equipment users seems to be one of the primary components of future attitudes and behaviour. Consumers intend to buy environmentally-friendly devices, so they need to know how to tell them apart and where to look for that information (Tian et al., 2022). The same applies to e-waste segregation and take-back. Therefore, the second hypothesis is H2: Young consumers, when purchasing electrical and electronic equipment, are properly informed about the negative environmental impact of electronic waste and possible methods of dealing with used equipment.

Government policy also significantly affects consumer behaviour regarding electronic waste (Zhong et al., 2022). The official instruments include fees and deposit-refund systems. Wang et al. (2022) looked for a good model of electronic waste collection policy through a four-party evolutionary game model involving the government, consumers, the collector, and the recycler. The results of this theoretical effort demonstrated that incentives do not always ensure the desired level of engagement in electronic waste collection and recycling. Interestingly, a regulatory policy with strict monitoring and punishment may ensure engagement of parties in electronic waste recycling (Wang et al., 2022).

Qu et al. (2022) conducted similar research and analysed an online electronic waste collection system. An increase in consumer preferences towards online recycling enhances recycling rate and profitability. These are valuable insights for planning future and improving current electronic waste collection systems. According to Tian et al. (2022), proper consumer information about the environmental benefits of waste segregation is vital for motivating consumers to recycle. In addition, government bodies play a crucial role in effective policy deployment through the promotion of recycling, even in the form of out-of-home advertising or such incentives as merchandise prizes. The study suggests that the policy should be broad in scope and consumer-focused. Shaikh et al. (2020) established that most consumers identify the government as the responsible stakeholder regarding electronic waste management organisation and accountability.

According to Song et al. (2012), the most common causes of electronic waste disposal depended on the type of equipment. Still, the primary cause for all types under the study (monitors, laptops, TV sets, washing machines, refrigerators, and air conditioners) was the end of life: about 40%. The second most common cause for such electronics like desktop PCs, TV sets, and washing machines was the lack of sophisticated functions. When it comes to laptops, refrigerators, and air conditioners, the second most frequent reason was instability and improper operation. It shows that consumer behaviour regarding electronic waste management varies. Hence, the following research question is posed to identify the behaviours of the Polish population, RQ2: What are the frequency and causes behind young consumers' decisions to disposal or replace electrical and electronic equipment?

Research shows that the most popular methods of disposing of household electronic waste are retrieval by the retailer (32%), discard into a refuse bin (25%), sale to a recycling company (19%), and storage at home (13%) (Song et al., 2012). The problem of excessive electronic waste storage at home was also discussed by Shaikh et al. (2020). The system and organisation of waste management are pivotal for the effectiveness of the process. It should respond to consumer preferences to the maximum extent by design. Therefore, the article poses the following research question, RQ3: What are young consumers' preferences regarding the available forms of collection and disposal of electronic waste and their willingness to use particular solutions in practice? The literature review provides background for a research programme targeting consumer behaviour regarding electronic waste. The design is presented in Figure 2.

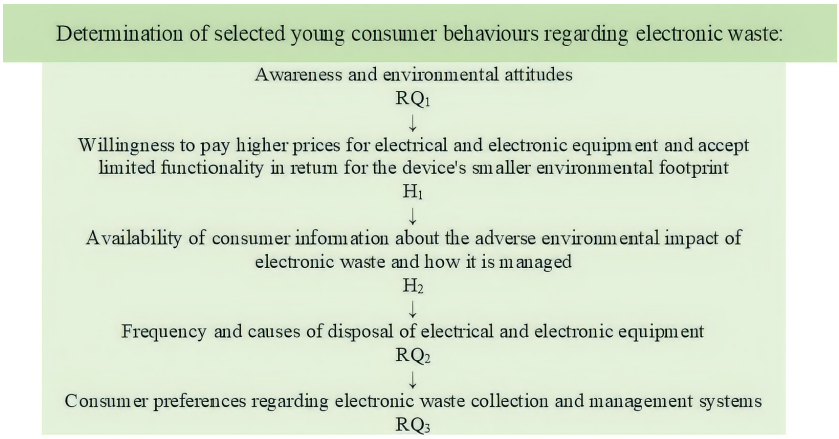

Figure 2. Theoretical model of the investigation into young consumer behaviour regarding electronic waste

Source: Authors' own study.

Research methods

The objective was pursued, hypotheses verified, and research questions answered through a survey. The study was based on an original survey questionnaire of 20 questions. The first five were classification questions, and fifteen pursued the research objective. The questions employed nominal, ordinal, and interval scales, including the Likert scale. Eleven questions were closed questions with one or more answers. Four questions were semi-open: the respondents could give original answers in addition to the response options. During the analysis of the collected results, the number of original answers was found to be small and not subjected to statistical analysis.

Before administering the questionnaire to the respondents, we made several trials, whereby selected respondents filled in the questionnaire witnessed by a pollster. This pilot study was carried out on students at the Krakow University of Economics. The trials aimed to empirically test and verify whether the questionnaire was clear and unambiguous for the respondents. The CAWI (computer-assisted web interview) questionnaire was a Google Form disseminated electronically. The response collection followed the principles of convenience sampling, which the literature considers a source of reliable data (Cheah & Phau, 2011). A similar data acquisition method to investigate electronic waste behaviour was employed by such researchers as Ananno et al. (2021). The survey and the entire research process followed the principles of anonymity and voluntary participation. The survey period is February–September 2023.

The results were analysed using variable frequency distribution methods. The independence of the features was tested with the non-parametric chi-square test. The association of the investigated variables was determined with Cramér's *V*. The analysis was conducted in Statistica 13.1 (StatSoft Polska).

The survey yielded 380 correctly completed questionnaires. Most of the sample were women (58.2%), while men constituted 41.8%. The largest group was made up of residents of cities with over 500 thousand inhabitants (46.1%). The second largest group were rural residents (27.4%). The detailed profile of the sample is shown in Table 1.

Table 1. Profile of the sample

Specification		Structure	
		Number	Percentage
Sex	female	221	58.2
	male	159	41.8
Residence	rural area	104	27.4
	town with up to 500,000 residents	101	26.6
	city with over 500,000 residents	175	46.1
Education	year 1	199	52.4
	year 2	79	20.8
	year 3 and over	102	26.8
Technical profile	yes	112	29.5
	no	268	70.5
Economic activity status	inactive	227	59.7
	active	153	40.3
Total		380	100.0

Source: Authors' own study.

Results

The objective was first pursued with an assessment of the respondents' awareness. At this stage, we analysed surveyed consumer knowledge about the notion of electronic waste. The results are shown in Figure 3. The respondents could choose from among several proposed statements. Only answers A and C in Figure 3 were correct.

As shown in Figure 3, about 75% of the respondents were able to define electronic waste correctly. As regards residence, the highest level of knowledge was identified among residents of towns of up to 500 thousand people, and in terms of the year of study, first-year students fared the best. The other data reflecting the knowledge of the notion of electronic waste in detail are shown in Figure 3.

The next component of consumer awareness evaluation was to identify consumer attitudes towards electronic waste. The respondents voiced their opinions on electronic waste behaviours using a Likert scale. The results are shown in Figure 4. The first three of them assessed awareness and the last three assessed the attitudes of the respondents.

These results suggest that the respondents exhibited high awareness. It is evident from the high percentage of answers agreeing with the statements proposed in the questionnaire. However, attitudes turned out to be much less environmentally friendly. This is reflected in the high percentage of answers that disagree with the attitudes

described in the questionnaire. The study shows that about 67% of the respondents were unwilling to spend more time making sure the product is environmentally friendly. Also, 49% disagreed with the effort to verify whether or not the equipment they buy has a negative environmental impact. The presented data offer no footing for a conclusion that the respondents exhibit environmentally-friendly attitudes in the electrical and electronic equipment market. In connection with the above data, the first research question was answered.

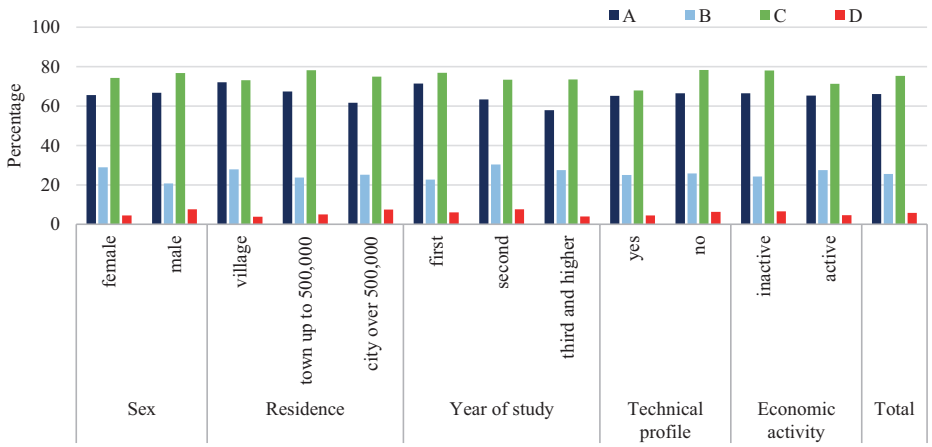

Figure 3. Respondents' knowledge about the notion of electronic waste by selected sociodemographic characteristics

Note: A – electronic equipment or its parts discarded by the end user with no intention to use them again, B – electronic equipment or its parts discarded by the end user with the intention to use them again, C – waste group covering end-of-life electrical and electronic equipment, D – waste group covering end-of-life electronic equipment only.

Source: Authors' own study.

Similarly high awareness in the study was obtained by Trinh and Giao (2023), who conducted their study in Vietnam. On the other hand, much better results for the study of pro-environmental behaviour were obtained by de Oliveira Neto et al. (2022) who highlighted that an individual's pro-environmental behaviour is influenced by cultural aspects and demographic factors such as gender and age. In turn, this study was conducted in Brazil. As can be seen, the location of the research influences the level of consumer awareness and behaviour.

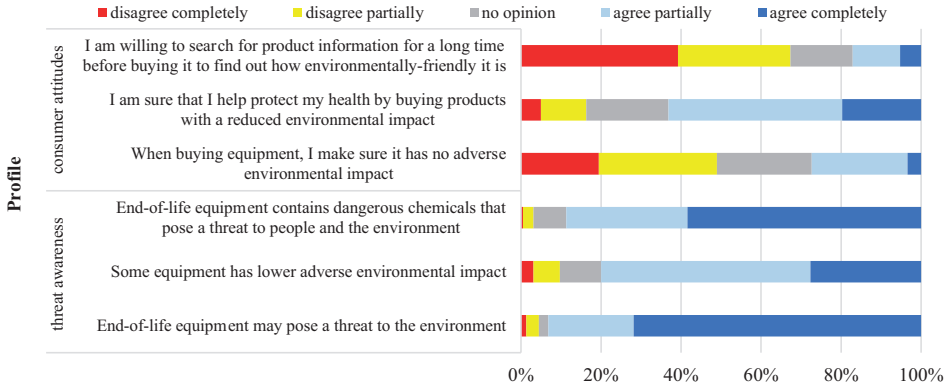

Figure 4. Respondents' awareness and attitudes regarding the notion of electronic waste by selected sociodemographic characteristics

Source: Authors' own study.

The next research stage was to assess the consumer willingness to pay higher prices for electronics for them to be made of more environmentally-friendly materials and their willingness to accept some functional limitations to reduce the product's footprint. In both cases, the consumers declared their behaviour on an interval scale to express their opinions regarding a mobile phone, PC/laptop, MP3 player, earphones, smartwatch, powerbank, and tablet. Their answers are summarised in Figure 5.

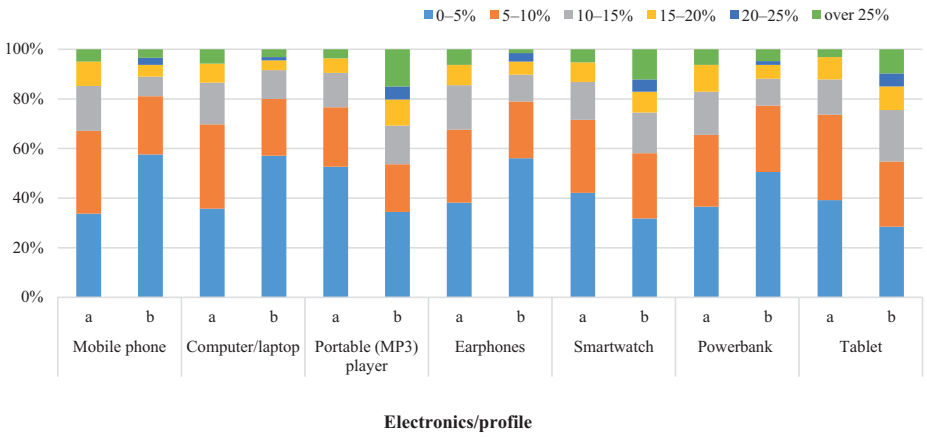

Figure 5. The results of surveyed consumer willingness to pay higher prices for electronic equipment and accept limited functionality in return for the device's smaller environmental footprint

Note: a – up to how much more would you be willing to pay for the electronic devices listed below for them to be more expensive but made from materials that cause no adverse impact on the natural environment?; b – up to what extent would you be willing to accept the functional limitations of the devices listed below in exchange for their design and materials causing lesser environmental harm?

Source: Authors' own study.

The results show that the respondents exhibited little to no willingness to accept higher financial costs of electrical and electronic equipment that would be more environmentally friendly. Figure 5 shows that the respondents most often declared acceptance for a 0–5% increase in price. The most often selected devices that could be more expensive in exchange for better environmental characteristics were powerbanks, mobile phones, and earphones. Note that the mean answer did not exceed an additional cost of 10% in any case. The acceptance of higher costs for environmentally-friendly features was the lowest for portable music players.

The surveyed consumers were unwilling to accept the functional limitations of electronics, resulting in more environmentally-friendly designs and materials. The dominant responses for all the devices were those of the lowest interval (0–5%) of functional limitations, such as smaller memory storage, worse sound quality, and smaller battery capacity. The respondents detested functional limitations in computers (laptops), earphones, and mobile phones the most. On the other hand, they would most readily accept functional limitations in portable music players and smartwatches from among all the devices.

A comparison of the two elements constituting electronic waste consumer behaviour demonstrates that the respondents are statistically more willing to accept functional limitations in electronic devices (8.7%) than a higher purchase cost (8.3%) in exchange for a smaller environmental footprint of the equipment. Still, the difference is insignificant. In light of the above, considering the analysed results, hypothesis H1: Young consumers are willing to make purchasing decisions that take into account the higher cost and functional limitations of electrical and electronic equipment in exchange for their lower negative environmental impact should be accepted.

The next focus of the behavioural study was to analyse how well-informed the consumers are about the adverse impact of the electronic equipment they buy on the environment and how end-of-life equipment is managed. It is a critical aspect of electrical and electronic equipment purchase and use. It drives other consumer attitudes and behaviours to a significant extent. We asked the respondents to assess how well-informed they were at the moment of purchase using a five-point Likert scale. The level of consumer information availability was evaluated for online and brick-and-mortar stores separately. The results are shown in Figure 6.

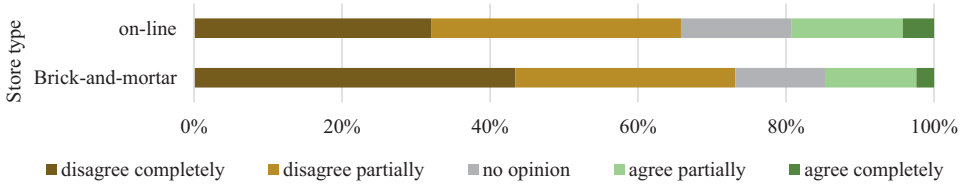

Figure 6. Results of opinions regarding access to information about the adverse environmental impact of equipment by point of sale

Source: Authors' own study.

As the data show, the respondents evaluated the availability of consumer information about the adverse environmental impact of equipment when buying electrical and electronic equipment as very low. Surprisingly, the surveyed consumers considered the availability of information in brick-and-mortar stores worse. As many as 73% of surveyed customers of brick-and-mortar stores disagreed that they felt well-informed about the potential adverse environmental impact of devices. In the case of online stores, the percentage is slightly lower but still high at 66%. The data are far from optimistic because poor availability of consumer information or inability to access environmental information about electrical and electronic equipment may hinder the moulding of appropriate surveyed consumer attitudes and awareness. It may also hamper the selection of electrical and electronic equipment with a lower environmental impact. In view of the results obtained, it must be assumed that the consumers surveyed are not properly informed about the negative impact of electronic waste on the environment and how to manage it. Therefore, hypothesis H2: Young consumers, when purchasing electrical and electronic equipment, are properly informed about the negative environmental impact of electronic waste and possible methods of dealing with used equipment, should be rejected.

Next, we investigated consumer knowledge of electronic waste management. Figure 7 presents data from the empirical research. They reflect respondents' declarations concerning their knowledge about proper methods of disposing of electronic waste under the waste collection system in place.

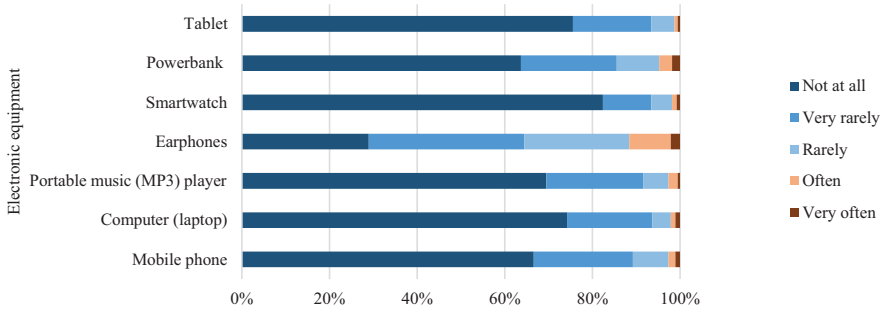

Figure 7. Frequency of disposal of electrical and electronic equipment

Source: Authors' own study.

The least disposed of devices were smartwatches and tablets. The respondents declared they threw them away the least. It may be because of their durability, slower technological advances, or relative lack of new functions. It is the other way around with mobile phones. The most frequently discarded devices are earphones and powerbanks. These devices were most frequently indicated as being thrown away often and very often. We asked the consumers to specify the most common cause of discarding electrical and electronic equipment so that we could gain a better understanding of their motives. The results are shown in Figure 8.

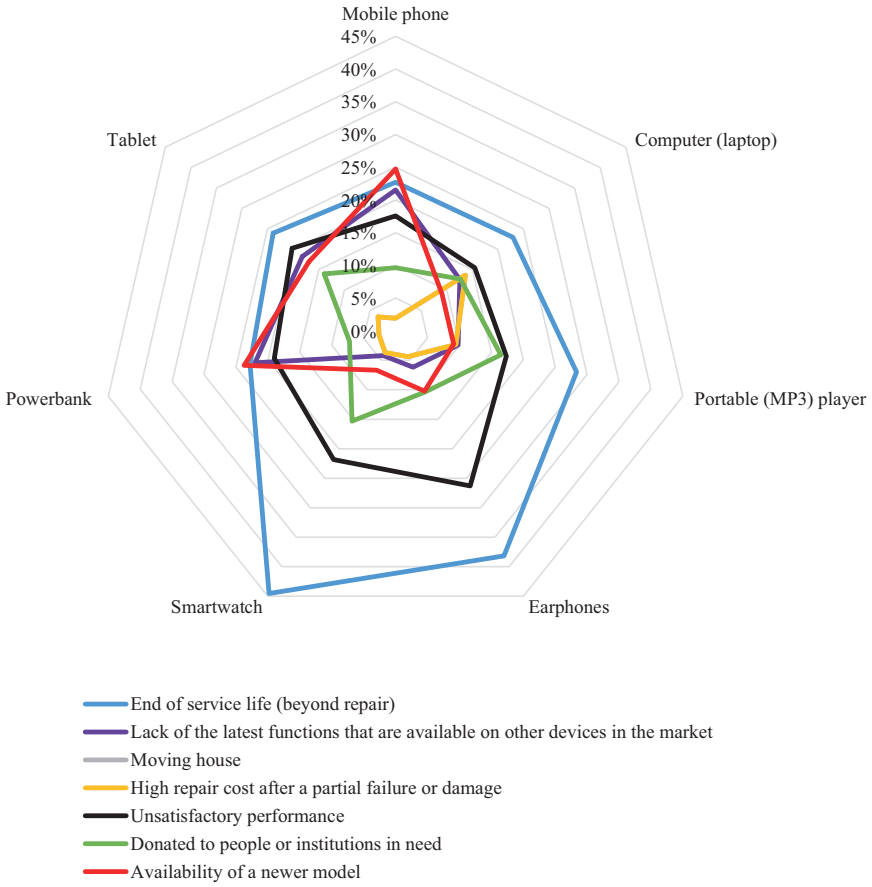

Figure 8. The most common reasons for discarding devices by type

Source: Authors' own study.

The investigation of the most common reasons leading to electronic waste generation revealed that the main cause for discarding equipment was its end of useful life. It is the most common answer statistically. The second most popular reason was unsatisfactory performance, and the third was a newer model.

As Figure 8 shows, the end-of-service life is the number one cause of electronic waste generation for computers (laptops), portable music players, earphones, smartwatches, and tablets. In the case of telephones and powerbanks, the respondents most often chose the availability of a new device model.

The next research stage focused on consumer preferences regarding electronic waste collection and management systems. The first question of this stage was who should pay for waste electrical and electronic equipment management according to the respondents. The collected data are presented in Figure 9.

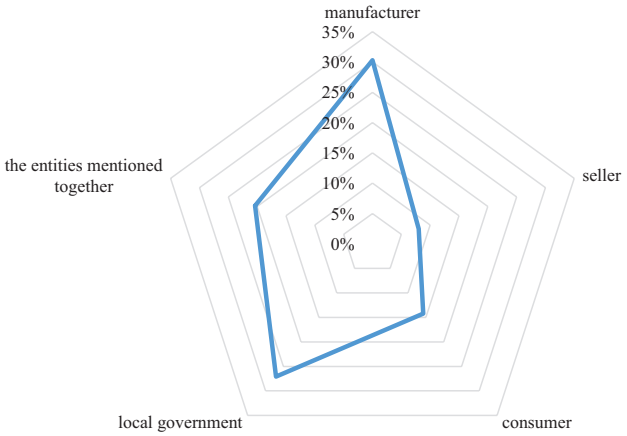

Figure 9. Respondents' opinions concerning who should pay for electronic waste management

Source: Authors' own study.

The opinions tended to cluster around manufacturers (30%) and local governments (27%). These were the most often selected answers. About 20% of the respondents leaned towards splitting the costs. Mere 14% believed that electronic waste management should be the sole responsibility of users, i.e. consumers. We determined percentage intervals of costs the respondents would be willing to cover to identify their willingness to participate in electronic waste recycling scheme costs more precisely. The answers are shown in Figure 10.

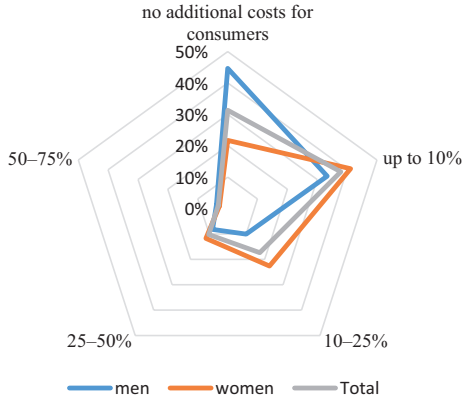

Figure 10. Acceptable recycling costs for surveyed consumers

Source: Authors' own study.

The most popular answer was not more than 10% of recycling cost. This answer was selected by about 38% of the respondents. The second-most popular option was zero consumer cost. It was the preference of 31% of the respondents. The data

obtained corresponds to the results of the work of Cai et al. (2020). Their study also determined that the number of consumers willing to pay the cost of recycling electronic devices is very low. The study by Arain et al. (2020) conducted among students found that free disposal was the most important factor in consumers deciding to recycle their electronic waste.

We conducted an independence test to improve the analysis of surveyed consumer participation in electronic waste recycling costs. The test shows that the acceptable cost of electronic waste recycling to be borne by the respondents depended only on sex (Table 2). Values of the contingency coefficient or Cramér's *V* indicate a moderate strength of association.

Table 2. Results of the chi-squared test for electronic waste recycling cost

Specification	Sociodemographic characteristics*				
	sex	residence	year of study	education	economic activity
Chi-square value	26.923	3.250	6.901	1.639	6.618
p-value	0.000	0.918	0.547	0.802	0.157
Cramér's *V*	0.266	-	-	-	-

* characteristics categories as per Table 1

Source: Authors' own study.

The results of the independence test show that men are less willing to pay for electronic waste recycling. Women more often declared willingness to participate in the costs. A similar study was conducted by Yin et al. (2014). Their work found a higher level of acceptance to pay for recycling costs, but this study only looked at mobile phones, which are cheaper to recycle than other devices. Perhaps this is the reason for the difference in the results obtained.

Another relevant aspect of the e-waste management system is identifying the most accessible and convenient methods for collecting electrical and electronic equipment. This is why we chose to learn about the respondents' opinions in this regard. The data are shown in Figure 11. According to the survey, most respondents believed take-back systems (29%) and scheduled bulky waste collection (29%) to be the most user-friendly forms of disposing of electronic waste. The third most popular method of collecting waste electrical and electronic equipment is additional containers at every block of flats or house (27%). There are no significant differences in preferences among the options.

Therefore, there is no single leading method of collecting electronic waste preferred by the respondents. The two remaining options involving higher fees or deposits were much less popular. Numerous studies have shown that convenience is a significant factor influencing consumer decisions to recycle e-waste (Anderson & Lee, 2025; DiGiacomo et al., 2018). The impact of convenience is significant, so identifying preferences in this area is very important. A high level of convenience for recycling will drive the recycling process.

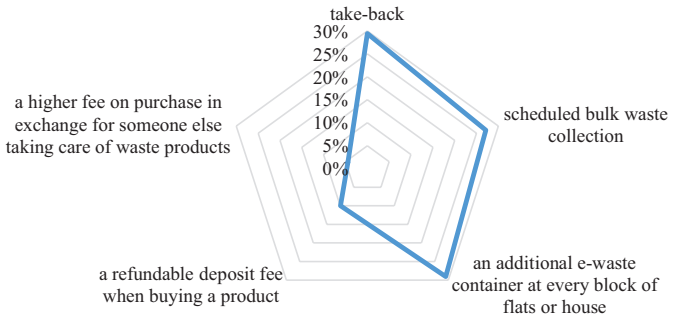

Figure 11. The most convenient method of electronic waste collection

Source: Authors' own study.

Discussion

The purpose of the article is to identify consumer behaviour regarding electronic waste. The problem is often discussed in international literature, although not so much by Polish authors. This makes the present study a valuable source of insight into consumer behaviour in the critical and thriving market. Our results and analyses offer a picture of surveyed consumer behaviour regarding electronic waste. Most surveyed consumers define and understand the notion of electronic waste correctly. Also, their awareness is relatively sufficient. What is more alarming is that the surveyed consumer attitudes we identified were far from what might be called environmentally friendly. A large share of the respondents declared no willingness to search for product information for an extended time to determine whether it is environmentally friendly. Similarly, approx. 50% of them were disinclined to check the impact of the electrical or electronic equipment they buy on the environment.

The awareness level in the present survey was higher than in the research by Song et al. (2012) or Deniz et al. (2019). Regrettably, this good result is not reflected in consumer attitudes, which can be translated into specific behaviour.

Although the surveyed consumers are willing to pay higher prices for electrical and electronic equipment and accept limited functionalities, the declared scope of their commitment was usually between 0 and 5%. It is not a high value, and it reflects the surveyed consumer attitudes identified in the first part of the study to some extent. These results are slightly below those of Shaikh et al. (2020), where respondents were usually willing to pay about 10% more for electrical and electronic equipment to ensure its proper and safe disposal. A study by Shaikh et al. (2020) evaluated respondent willingness and was similar to this one but employed a different scale and instructions, so the two are not comparable. Still, both can give a general insight into the investigated environmental behaviour. An inadequate recycling system and its excessive costs are the biggest barriers for consumers in the process of properly

handing in their waste and choosing legitimate recyclers. Similar conclusions were reached by He and Sun (2021) in their study.

The identification of the availability of information for consumers yielded many conclusions. The study shows that surveyed consumers are not adequately informed about the characteristics of electrical and electronic equipment they buy. In their opinion, brick-and-mortar stores offer poorer access to information about product environmental footprint than online stores. It is alarming. However, one has to keep in mind that young consumers prefer the multimedia environment of online stores and perhaps consider it better regarding access to information. Access to information is critical when discarding equipment and when the method of disposal is decided: whether it is collected as per the recycling system or joins other household waste at a landfill. On average, the respondents' knowledge is the best in this regard for mobile phones and computers. It is the worst when it comes to earphones and smartwatches. This aspect is particularly important, making the low results alarming. Proper consumer information significantly affects buyer's attitudes and behaviour (Muthukumari et al., 2024). Similarly, research by Islam et al. (2022) found that more than 50% of the participants in the study did not know where to return used batteries. Such a low level of information is bound to result in very little waste being handed in properly. Therefore, it seems vital to take action to improve the availability of consumer information concerning the environmental footprint of individual types (models) of devices in Poland.

The study also revealed the frequency of discarding electrical and electronic equipment and its most common causes. The most common reason the respondents gave was the end of service life. It is a promising outlook. Combined with European Union-level efforts towards legal requirements for extending equipment service life, it may help limit electronic waste volumes. Still, some devices (mobile phones and powerbanks) are thrown away when a newer model is available, according to the respondents. It is alarming and yet typical of today's consumer society. In contrast, Song et al. (2012) demonstrated in a similar study in China that the respondents indicated end of service life as the main reason for discarding all types of equipment the authors analysed. Those respondents much less frequently threw away devices because a newer model was marketed.

The last stage of our research identified the most preferred methods of electronic waste collection and transfer into the waste management system. It is a critical point in the process because, if done efficiently, it allows a full stream of waste to be recycled quickly. The study identified three primary methods preferred by surveyed consumers and indicated by the respondents the most: take-back systems, scheduled bulky waste collection, and additional containers at every block of flats or house. It is vital to make these disposal methods available to limit electronic waste storage at home, as found by Casey et al. (2019) and Shaikh et al. (2020).

Conclusions

Electronic waste young consumer behaviour is a critical aspect of the waste management system that needs to be diagnosed before the system is designed to work effectively. Effectiveness is defined mostly by the volume of recycled waste that is restored to the market in one form or another. It is completely in line with the idea of circular economy, which is believed to be the best possible economy model. The current climate crisis requires more time and effort to slow the process down and eventually reverse it. All electronic waste research contributes to it. Particularly if they concern young people who, on the one hand, are very keen to use electronic devices and, on the other, will have an increasing influence on shaping the market offer of these products as time goes on.

The work behind this article significantly aids the identification of surveyed Polish consumer behaviour regarding electronic waste and provides reliable and current knowledge in this regard. We identified in the sample some issues, such as insufficient information and the availability of information about the potential adverse environmental impact of electronics during purchase. Therefore, it is unreasonable to expect of surveyed consumers to make extraordinary efforts without access to information. Today, potential buyers can compare electrical and electronic equipment but only regarding power consumption. It is not easy to access information about chemicals used during production, production process sustainability, or the device's expected service life. A lack of these data can affect environmental attitudes and hinder consumer engagement. The conclusions of this study are important because in just a few decades, current young consumers will represent a greater influence on the market of the future. This time can be used to adapt the system appropriately to the expectations of these specific consumers.

Designing and implementing an effective waste management system are challenges, even for wealthy and developed countries. The conclusions of the present study show, however, that the system should be diversified in terms of electronic waste collection methods. Regrettably, as in most studies, the surveyed respondents to our survey also believe the government should be responsible for waste electrical and electronic equipment policy and management. Young consumers are unwilling to pay for the service. The simpler and more accessible the system is to consumers, the higher the collection and recycling rate of electronic waste.

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