



Understanding consumers' perspectives of electronic waste in an emerging economy: a case study of New Delhi, India

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Abstract Obsolete electronics or E-waste has observed significant escalation in the recent years. Young adults, in particular, are one of the largest consumers of electronic equipments in the contemporary world, although research on their perceptions, awareness and disposal behavior of E-waste has been far and few in between. Considering the growth trajectory of E-waste in the emerging economies, a study has been carried out in the capital city of India, New Delhi with 1039 respondents in the age group of 18–22. Contemplating its aggressive generation, obsolete mobile phone was considered as a representative of E-waste. Both purchase and disposal behaviors of mobile phones were evaluated through the lens of theoretical frameworks such as conspicuous consumption and throwaway society. The concepts of planned and premature obsolescence were also explored. A structured questionnaire survey was carried out through a respondent driven snowball sampling method. We observed that the functional need is the foremost consideration while deciding to purchase a new mobile phone within our study sample. Over 49% of our respondents change their mobile phones between 1 and 3 years. This corresponds to the fact that mobile phones are discarded very much within their actual functional lifespan. Overall, it could be concluded that the major attributes of conspicuous consumption and a throwaway society are still not dominant in our study sample. The experiences of India's E-waste have the potential to provide important insights for policy formulation and sustainable

management particularly in other emerging economies and developing countries.

Keywords Electronic waste · New Delhi · Policy · Disposal behavior · Throwaway society · Planned obsolescence

1 Introduction

Obsolete electrical and electronic equipments (EEEs), widely known as electronic waste (E-waste), are experiencing a constant growth during the past two decades. It is an urgent sustainability challenge owing to the environmental pollution and resources depletion that it results in (Zhang et al. 2020). While the recycling of E-waste, especially in an informal setting, often creates air, water, soil and noise pollution, the extraction of metals for production of electronic equipments itself has enormous environmental implications. Nevertheless, there is no denial of the fact that human's increasing reliance on electronic equipments is a major characteristic of a modern society. During and post the Covid-19 crisis, this dependence is expected to increase further due to the new work culture forced upon us by the pandemic. In academia alone, for instance, e-learning apps such as Zoom, Blackboard etc. have been the primary mode of teaching activities since the turn of the year 2020. Skype, Google Meet, Microsoft Teams etc. have found their use as official modes of interactions like never before. Accordingly, it is not unrealistic to predict that our dependence on electronic equipments will increase further in the coming years and so will be the amount of E-waste generated across the globe.

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The unprecedented volume of E-waste generated in the recent time is fueled by several factors. These factors need considerable attention while discussing about sustainable management of E-waste. It is essential to address the crisis both at the producers' and consumers' end. For instance, the ever-changing technologies and the designs of EEEs render it unfeasible or complicated for consumers to upgrade or repair their existing electronic products, forcing them to purchase new products (Arain et al. 2020). Here is a concern that needs urgent consideration from the producers to ensure environmental sustainability. As our reliance on EEEs increases, the planned and premature obsolescence of the same are concerns calling for attention of the producers too considering the current global economic and environmental scenario. Further, consumers are constantly attracted by the introduction of gorgeous designs and smart functions causing a decline of lifespan of their EEEs and an apparent obsolescence directly resulting in a large volume of E-waste (Ibanescu et al. 2018). Limiting the sustainable development of overall human society and seriously threatening human health/safety, the improper disposal of E-waste causes problems ranging from ecological imbalance to resource scarcity and intense environmental pollution (Zhang et al. 2020). Unfortunately, environmental awareness is still very low in most part of the world and it often takes a backseat when consumers decide to purchase new electronic products. As a result, the volume of E-waste intensifies and makes its sustainable management a key challenge (Borthakur 2020).

With developing countries and emerging economies challenged with policy interventions and workplans toward addressing their waste management crisis, E-waste today is not anymore an anxiety for the supposed wealthy nations alone (Borthakur 2020). Both the Global North and the Global South today are confronted with massive volume of E-waste generated and the subsequent management complications. As argued by Pini et al. (2019), "the fact that the acceleration rate of technological development effectively renders certain products obsolete almost as soon as they are purchased have led to an inevitable increase in electrical and electronic waste, which has become a significant problem, particularly in environmental terms". This worrying trend is evident in the electronics sector for several years now. It is a phenomenon that needs addressing both from the producers' and consumers' side. We all must remember that E-waste is a global problem owing to those potential human health and environmental threats and its valuable resource components, making its recycling a necessity both toward addressing the mineral resources scarcity for the electronics industry and decreasing human health and pollution menaces (Zeng et al. 2017).

Comprehending consumers' recycling behavior has the potential to offer specific insights into the stockpile of

E-waste, a decisive parameter in estimation necessitating further consideration (Islam and Huda 2019). This is even more important in the context of emerging economies, for instance, India—a country characterized by an enormous consumer electronics market. Consumers constitute the most dynamic, vital, and deceptive element of E-waste recycling schemes although well-organized infrastructure is essential for the triumph of any E-waste recycling campaign (Kumar 2019). Consumers, as an important stakeholder, decide the success of a recycling initiative through their active participation and engagement. In an urban context, it is imperative to understand the domestic flow of E-waste toward well-organized waste management interventions although situating this flow is complicated owing to its reliance on consumer behavior and dispersed generation (Rodrigues et al. 2020). Further, the fact that a large number of stakeholders are involved in the entire process of E-waste generation to its recycling plus the final disposal (Borthakur 2014) makes the estimation of the flow even more complex.

Several researchers have strived to understand the determinants of consumers' waste disposal and the motivations and barriers related to their recycling behavior (Casey et al. 2019). It has been observed that consumers' unwillingness to take part in formal recycling practices is a great challenge to successful environmentally sound E-waste management (Ramzan et al. 2019). Nevertheless, in the academic literature, there is an absence of adequate understanding concerning consumers' engagement with E-waste management particularly in the emerging economies and their intention to recycle or sell their E-waste (Kumar 2019). Thus, a study in an urban metropolis of an emerging economy has the potential to provide important insights of the consumers' perception of their obsolete electronic equipments and associated disposal behavior.

In this paper, taking hints from the concepts such as conspicuous consumption, throwaway society, and planned obsolescence, we attempt to provide a comprehensive account of E-waste in urban India taking the case of New Delhi, the capital of the country. Carrying out a detailed questionnaire survey in New Delhi through a respondent driven snowball sampling, we endeavour to address queries such as: what are the characteristics of consumers' purchase behavior of electronic equipments, particularly mobile phones? Do planned and premature obsolescence determine the lifespan of an electronic gadget? What are the preferences and patterns of E-waste disposal in the city? What are the main factors influencing consumers' willingness (or rather unwillingness) to participate in E-waste repair and recycling? We are focusing on the age group of 18–22 in the city. The point of innovation of this research has been the fact that, the detailed questionnaire survey conducted with over 1000 respondents in a young

adult populace is probably one of the first attempts to conduct such a study on E-waste awareness and disposal behavior in one of the largest cities in India.

The paper has been divided into the following sections: after the introduction in Sect. 1, Sect. 2 highlights the significance of the study and theoretical framework. Section 3 incorporates the research design and methodology with respect to the survey area, method and questionnaire design. Section 4 illustrates the results of the survey with a detailed discussion followed by conclusion of the study in Sect. 5.

2 Significance of the study and theoretical framework

2.1 Significance and context

Technological progresses in the present-day world have resulted in a considerable increase in the use of mobile technologies (Kuss et al. 2018). In the context of information and communication technology, mobile phone is proven to be the foremost gateway (Subramani Parasuraman et al. 2017). Worldwide, in both developing and developed countries, mobile phone has found keen and widespread adoption as a medium of communication. With over 90 connections for every 100 people, India for instance, has the second largest mobile phone connectivity in the world after China (Basu et al. 2018). Globally, there were over seven billion users in the year 2016 alone with this number of mobile cellular subscriptions persistently rising with every passing year (Subramani Parasuraman et al. 2017). So is the case with internet usage with the percentage amplified worldwide seven-folds between 2000 and 2015 from 6.5 to 43% (Subramani Parasuraman et al. 2017). Kuss et al. (2018) argue that the 'Generation X' (who were born till the early 1980s) and 'Generation Y' (the younger individuals who were born in the mid-1980s and afterward) are observed to be different with respect to their acceptance of smartphone technology, with research suggesting that the younger folks are probably more prone to develop issues as an outcome of their excessive utilization of novel technologies. For instance, social media websites such as Facebook, Twitter or Instagram etc. have increasingly becoming instrumental for the younger generation as means of networking and social presence. Nevertheless, the consumption of these platforms does have a cost. The constant indulgence on scattered information on Facebook, for instance, and the regular demands for socialization could possibly have disadvantageous impacts on academic performance of students (Feng et al. 2019).

Young adults symbolize 'the new generation' in both India and China that contributes extensively to the

consumption growth of electrical and electronic equipments (Kumar 2019). Majority of the global populace in the recent years, particularly university and college-going students, use smartphones, attributable to its broad array of applications (Subramani Parasuraman et al. 2017). Research shows that the age group between 11 and 24 is responsible for 72% of the existing smartphone use (Davey and Davey 2014). Therefore, it is essential that the newer generation recognizes the significance of sustainable and accountable E-waste management and turns out to be an instrument of behavioral and social change in future (Kumar 2019). The fact that the lifespan of mobile phones is getting shorter especially among the young adults calls for more attention in this regard. For instance, although Swiss people in general substitute their mobile phones (meant for both private and business uses) after three years, with an average lifespan of only 1.9 years, the young Swiss are inclined to substitute their mobile phones more frequently (Ohnmacht et al. 2018). As an emerging economy and an aspiring young society, urban Indian youth too could have the tendency to replace their mobile phones than their older compatriots. Accordingly, in this study, we are focusing on the age group of 18–22 in the capital city of New Delhi in India. This generation was born and raised subsequent to the economic liberalization of the country with information and telecommunication devices including mobile phones being an integral part of their lives since a young age (Borthakur and Singh 2020). Therefore, we believe that it will be both significant and interesting to document their purchase and disposal behavior of mobile phones (both feature phones and smartphones) and analyze those through the lens of theoretical foundation such as conspicuous consumption and throwaway society.

2.2 Theoretical framework: conspicuous consumption and throwaway society

Thorstein Veblen, over a century ago, proposed the concept of 'conspicuous consumption'. In his book, *Theory of the Leisure Class* (1899), he coined the term and his work in the book is generally considered as a decisive investigation into the motives and origins of consumption of lavish goods (Saad and Vongas 2009). He puts down the Victorian leisure class for their outlandish profligacy, superciliousness, and their obsession to distinguish themselves from the working-class populations (Gudmunson and Beutler 2012). Conspicuous consumption is intently used as an indication for 'status' and such spending could be recognized as an expression of socioeconomic position (Ryabov 2016; Winkelmann 2012). It largely signifies a consumption pattern which is precisely 'visible' to others and also 'positional' considering the fact that rather than absolute, their consumption is partially relative

(Winkelmann 2012). Further, two insightful observations were made by Veblen about conspicuous consumption (1) He argued that rather than the characteristics of the good itself, one's contentment from consuming conspicuously roots from outsider's response to the wealth being used up and (2) Conspicuous consumption results in producing a considerable quantity of waste (Saad and Vongas 2009). The ground-breaking analysis by Veblen of emulative consumerism and wasteful or extravagant utilization of natural resources is both crucial and timely to environmental sociology owing to the present environmental crisis (Mitchell 2001).

The Veblenian conspicuous consumption in a modern capitalist society corresponds to a behavior prevalent not only among the affluent but also among individuals with lesser means (Ryabov 2016). An essential incentive for conspicuous consumption is the longing for a special social status (Barzoki et al. 2014). As further argued by Barzoki et al. (2014: 154), "That is to say, each individual, in complex metropolitan circumstances, is being watched by many others due to an increase in communication devices and population mobility. Under such circumstances, displaying possessions is the only way for judging one's social status." As our study involves a young urban population in a major Indian metropolis (New Delhi), we aim to analyze such consumption patterns among our response group. Nevertheless, in the contemporary modern world, conspicuous consumption is used by the individuals not only to acquire benefits of social class but also to gain a range of affiliations, put up personal identities, and to pretend or simulate occupational success or experiences (Gudmunson and Beutler 2012). Earlier researches arguing conspicuous consumption to be restricted to the upper class citizens of developed nations have been contested by several empirical works indicating considerable conspicuous spending among the racial minorities and low income populace in the developed world and among the underprivileged in the developing countries with evidences from South Asia (Jaikumar and Sarin 2015). Also, in the modern times, although conspicuous consumption may not be the engine of growth, it may, however, speed up the growth (Rauscher 1997). As a major and emerging economy from South Asia, a study on India's capital city will certainly provide essential indications on the prevalence or absence of conspicuous consumption patterns in the context of purchase and disposal behavior of mobile phone.

Environmental sustainability is challenged by consumerism which is intimately associated with growth-oriented development activities (Wijetunga 2020). As a large and a fast growing economy, protection of India's ecology and environment is a major concern for the country. This concern amplifies with an aspiring society and an upward consumption pattern among its populace with saturation in

no sight. Repairing an out of order product for further reuse is usually considered to be more harmless to the environment than disposing the same and substituting it with a novel manufactured product, of course, except if a more energy efficient replacement of the product is considered (McCullough et al. 2018). However, an international consumer survey reveals that as Gross Domestic Product (GDP) per Capita of a country develops, a transition into a throwaway society starts as in the case of the USA which has long been called the same (McCullough et al. 2018). With emerging economies like India, this pattern is anticipated to be visible in the recent years especially among the affluent urban masses.

Originally in an article published in the American magazine named 'Life', the term 'throwaway society' was first coined on 1 August 1955, so as the term 'planned obsolescence' introduced during the same year in a commercial magazine called 'Business Week' (Makarichi et al. 2018). It was an interesting development considering the fact that both the terms are interconnected since planned obsolescence aids in a throwaway society. However, although a major kind of unsustainable consumption, the existing literature on throwaway consumption has hardly ever assessed the influence of consumerist social principles on individual behavior (Wijetunga 2020). The changeover into a throwaway society is environmentally detrimental (McCullough et al. 2018). It is because such a society is generally characterized by an exceptionally high pattern of consumption and resource wastage, thus creating a massive waste volume that do not merely enlarge with the rising population but also evolve in its characteristics (Makarichi et al. 2018). E-waste is an excellent example of such a waste evolving both with respect to its volume and characteristics over the past two decades.

The effects of conspicuous consumption by the masses and of a throwaway society could be observed in the form of massive waste creation. It is indisputable that the volume of E-waste is increasing in India with every passing year and today, the country is one of the largest generators of E-waste in the world. However, is the amount of E-waste growing because of conspicuous consumption of the general public in the country? As an emerging economy, is urban India increasingly becoming a throwaway society resulting in enormous amount of E-waste generation? Or are there any other hidden yet dominant aspects involved in this regard? Taking hint from the above two theoretical concepts, we attempt to address these queries in this paper.

3 Research design and methodology

3.1 Survey area

The study was carried out in New Delhi, the capital city of India. As one of the largest cities in the country, it is an important economic, political and culture center of India. Owing to the existence of the enormous Indian political system and bureaucracy, New Delhi is a multi-cultural and multi-ethnic cosmopolitan city. According to the latest Census (2011) data available in India, Delhi observed a total population growth of 21.21% since 2001 and has a population size of 16,787,941. The male population is 8,987,326 and female is 7,800,615. The population of Delhi constitutes 1.39% of the total Indian population and records a literacy rate of 86.21%.¹ The demographic profile of the city demonstrates that it could act as an ideal starting point toward analyzing the E-waste management practices in the country especially in terms of consumers' purchase and disposal behavior. Further the high literacy rate could be related to a greater user base of electrical and electronic equipments opted for various purposes. It is a near perfect example of an emerging city in an emerging economy attracting individuals from all sections of the society and all across the country to explore various livelihood and career options. Overall, the city could act as a model for evaluating the E-waste management and policy challenges in the country.

3.2 Questionnaire design

The questionnaire has been designed around three primary research questions as follows:

- RQ 1 What are the major reasons for the growing purchase of mobile phones by the consumers?
- RQ 2 What are the disposal practices opted by the consumers?
- RQ 3 Are consumers aware of prolonging the lives of their mobile phones by repairing those?

Table 1 provides a glimpse of the questionnaire with key questions of the survey.

3.3 Survey method

At the outset, a pilot study was conducted as a pre-survey measure to finalize and validate the designed questionnaire. The pilot study was published in the journal, *Environmental Science and Pollution Research* in May 2020.² The questionnaire was formulated with the help of our previous

research experiences working on E-waste in India for the past more than a decade. The pilot study was conducted with 334 respondents in the city of New Delhi. The study helped us streamline and refine the questionnaire for a much broader respondent audience. Taking clue from the study, a further rationalized structured questionnaire was devised and distributed among purposively selected respondents in New Delhi. This survey was carried out through hard copy distribution of the questionnaires to 2000 respondents. We managed to receive effective responses from 1039 respondents. We opted for a respondent driven snowball sampling. Snowball sampling was selected because it is a well-known, nonprobability sample selection method which aids in locating hidden populaces and is essentially efficient (Johnson 2014). Further, it enhances inclusion, efficacy and identification of hidden populaces by having representatives of the target populace employ subsequent members (Kendall et al. 2008). The respondents in the age group of 18–22 were considered for the purpose of our study and we have considered obsolete mobile phones (both feature phones and smartphones) as the representative of E-waste.

The questionnaire was accompanied compulsorily by an 'Informed Consent Form'. Only with the consent of the respondents we conducted the survey. It was ensured that every single question of the questionnaire was explained in details and doubts clarified before a respondent fills it up. Mostly we gathered together a few respondents, distributed the questionnaire and asked them to fill it up on-spot. This was done to ensure maximum participation. Otherwise, with our previous research experience conducting survey in Indian cities, we realized that a good portion of the questionnaires were not returned back if asked to fill it up at home and submit it the next day. Nevertheless, in some instances, we did have to opt for this option as well. The identity of the respondents remained entirely anonymous and, in the questionnaire, we refrained deliberately from asking the name, address etc. of the respondents. This was done to maintain the privacy of the respondents. In order to ensure honest answers, it was conveyed to the respondents that there is no correct or incorrect response to the questions included in the questionnaire. The respondents also had the option to withdraw from the survey at any point in time and not to answer a query they didn't feel comfortable about. This is the reason that there is not uniform number of responses for each question in the questionnaire. We asked the respondents to submit the informed consent form and the answered questionnaire separately so that the individuals could not be identified personally. Further, questionnaires and the informed consent forms were submitted in a particular place instead of directly handing over to us. Hence, we tried to uphold complete anonymity of the respondents throughout the course of the study. Our

¹ See: <https://www.census2011.co.in/census/state/delhi.html>

² See <https://link.springer.com/article/10.1007/s11356-020-09030-6>

Table 1 Questions related to consumers' purchase and disposal behavior

How frequently do you change your mobile phones?	<ol style="list-style-type: none"> 1. 0–1 year 2. 1–2 years 3. 2–3 years 4. 3–4 years 5. Beyond 4 years
If your mobile phone stops functioning, what is the common and major reason(s) for it?	<ol style="list-style-type: none"> 1. It does not power on 2. Button/buttons stop functioning 3. Problem with the battery 4. Problem with the software 5. Other
What is the major reason(s) for replacement/purchase of a new mobile phone?	<ol style="list-style-type: none"> 1. The old one has become nonfunctional 2. The old one cannot be repaired 3. Considering the cost of repair, it is wiser to buy a new one than repairing the old one 4. The latest models have attractive novel features 5. Carrying the latest model will increase my status in the society 6. All my colleagues/friends are buying the latest models, so do I 7. It no longer meet my needs 8. I was bored with my current mobile phone
What do you usually do with the mobile phone that you no longer use?	<ol style="list-style-type: none"> 1. I keep it stored at home 2. I give it to someone for free (e.g., to my siblings/relatives/others) 3. I sell it to the scrap dealers or 'kawariwalas' at certain cost 4. I leave it at the store when buying a new one 5. I take it to the recycling center 6. I dispose it with normal household/mixed waste
Are you willing to repair your mobile phone instead of purchasing a new one	<ol style="list-style-type: none"> 1. Yes 2. No
What is the hindrance to repairing efforts?	<ol style="list-style-type: none"> 1. I do not know where to take my mobile phone for repairing 2. I think that my phone cannot be repaired 3. I do not bother about repairing as I can easily purchase a new one 4. Considering the cost of repair, it is wiser to buy a new one 5. I do not trust the repaired devices 6. The device does not have a warranty anymore and I am not willing to pay the cost of repairing

research has been carried out with a relatively larger audience. As per our knowledge, it is not common in the Indian E-waste research scenario to conduct a survey with such a large audience.

4 Results and discussion

In the following sections the results and discussion of our study have been presented. The gender-wise distribution of our study sample is provided in Table 2. The research results have been triangulated to ensure validity and reliability of the findings. By combining methods, triangulation strengthens a study. It is primarily the application of

more than one approach to researching a question using numerous data sources, methods, theories and so on (Heale and Forbes 2013). The results of our study have been triangulated using literature survey, expert opinions, the pilot study conducted prior to the current study and similar such studies conducted in diverse socio-economic-political-environmental contexts.

4.1 Purchase behavior of mobile phones

Around 90% of our respondents preferred to answer this question on major reasons for replacement of their old mobile phones or purchase of new ones. In this analysis, we have considered the most prominent reason as

Table 2 Gender-wise distribution of the study sample

	Frequency	Percent
Male	559	53.8
Female	466	44.9
Others	14	1.3
Total	1039	100.0

Table 3 Major reasons for replacement/purchase of mobile phones

	Frequency	Percent
The old one has become nonfunctional	437	42.1
The old one cannot be repaired	174	16.7
Considering the cost of repair, it is wiser to buy a new one than repairing the old one	156	15.0
The latest models have attractive novel features	121	11.6
Carrying the latest model will increase my status in the society	19	1.8
All my colleagues/friends are buying the latest models, so do I	14	1.3
It no longer meets my needs	11	1.1
I was bored with my current mobile phone	4	.4
Total	936	90.1

suggested by the respondents. Over 42% of the respondents said that they purchase or replace a mobile phone when the older one becomes non-functional (see Table 3). So, the functional need is the foremost consideration while deciding to purchase a new phone among our study sample. Complementing this, over 16% of the respondents replace their phones when the older one cannot be repaired. Such attitudes prevalent among the respondents illustrate that the characteristics of a throwaway society are yet to be dominant in the discourse of purchase behavior of electronic

equipments in the city. Although 11.6% of our respondents are attracted to the novel features in a new model of a mobile phone, less than 2% of the respondents believe that carrying the latest model would increase her/his status in the society. Only 1.3% of the respondents purchase new phones influenced by their peers.

As a social phenomenon, conspicuous consumption is intrinsically, yet defiantly, rooted on relatedness and those embracing this attitude look more for 'approval' rather than for 'distinction' (Gudmunson and Beutler 2012). Conspicuousness or conspicuous consumption echoes whether products are consumed or used publicly or privately because glamorous or luxury status goods induce in consumers a sense of distinction and admiration in their respective social networks when consumed in public (Klabi 2020). The very fact that our respondents are not purchasing their mobile phone influenced by their colleagues and friends is proof enough that they are not yet engaged in conspicuous consumptions. Further we compared the frequency of change of mobile phones to the major reasons for disposal in Table 4. The functional aspect of the mobile phone dominates the chart as majority of the consumers who change their mobile phones between 1 and 4 years reasoned non-functioning of the older phone as the primary stimulus for purchasing a new one. Focusing on the consumers and not merely the corporate strategies, Wilson et al. (2017) argued that the retailers and manufacturers could not be considered as the sole stimulus of a throwaway society and depends on the decision-making practices and actions of the consumers too. As 'functionality' of the mobile phones is the most significant consideration of our respondents and their decision-making is influenced by such aspects of functionality, it could be wrapped up that

Table 4 Frequency of change and major reason(s) for replacement/new purchase

		What is the major reason(s) for replacement/purchase of a new mobile phone?								Total
		The old one has become nonfunctional	The old one cannot be repaired	Considering the cost of repair, it is wiser to buy a new one than repairing the old one	The latest models have attractive novel features	Carrying the latest model will increase my status in the society	All my colleagues/friends are buying the latest models, so do I	It no longer meets my needs	I was bored with my current mobile phone	
Frequency of changing mobile phones	0–1 year	28	9	1	16	4	1	1	0	60
	1–2 years	81	35	41	36	1	2	2	2	200
	2–3 years	125	44	50	32	6	3	6	2	268
	3–4 years	89	29	38	18	5	5	1	0	185
	Beyond 4 years	112	57	22	15	3	3	1	0	213
Total		435	174	152	117	19	14	11	4	926

our respondents do not exhibit the typical characteristics of a throwaway society.

4.2 Planned and premature obsolescence

As planned and premature obsolescence have been major concerns in the context of ever-increasing volume of electronic equipments, it is interesting to have a look on the major reasons for malfunctioning of the mobile phones within our study sample. Jeremy Bulow in 1986 defined planned obsolescence as “the production of goods with uneconomically short useful lives so that customers will have to make repeat purchases” (Bulow 1986: 729). In the consumer electronics industry, especially for smartphones, it is a routine economic behavior that companies, in order to integrate novel features and market those attractive features to customers, regularly alter the older product models as technology changes (Rodriguez et al. 2015). The regular launch of the popular iPhones with new features serves as an excellent example here. As described by Madden (2014), in September 2012, Apple released the iPhone 5 with its marketing emphasized on its lightness and thinness as compared to the earlier version. It was a time when lightness and thinness signified a more advanced technology toward ease of portability and technological miniaturization was in trend. Capitalizing on this association, a lighter and slimmer iPhone 5 was marketed with the novel design while creating additional waste volume by obsolescing the earlier Apple accessories (Madden 2014). In fact, Rodriguez et al. (2015) argue that iPhone acts as an outstanding instance of durable goods and consumer electronics that are being manufactured and designed with planned obsolescence in mind. Not only Apple, almost all major mobile phone manufacturers come up with new designs and models at regular intervals resulting in an attractive and lucrative consumer market.

We got the response from 96.5% of the respondents regarding this query on major reasons for malfunctioning

of their mobile phones and 43.7% of them mentioned the problem with the battery as the foremost malfunctioning reason (see Table 5). This reason by far outweighs the second most prevalent cause of fault which is problem with the mobile software. Along with broken screens, bad battery performance is often reported as a major problem predominantly in smartphones (Proske et al. 2016). One of the major limitations, particularly of smartphones, is the short battery lifespan owing to the energy drain which increases while running applications that necessitate rigorous computations on these mobile devices (Tawalbeh et al. 2016). This prompts the consumers to replace their mobile phones while the other functions of the phone are still operating well. During this Covid-19 crisis, when the majority of the works are being carried out virtually, a good battery life of a smartphone or a laptop is proven to be more important than ever. This is particularly true for the student population (which is our primary target group in this study) in a country like India where there is an existing electricity crisis even in the major cities. The teaching activities are mostly gone online during this pandemic and only a good battery life ensures uninterrupted teaching both at the teacher’s and student’s end.

A very basic analysis on the major reasons for malfunctioning of mobile phones with respect to the frequency of change gives an idea of the lasting capacity of batteries. Table 6 shows this relation within our study sample. It could be noted that although negligible during the first one year, the problem with the battery starts emerging between 1 and 3 years and peaks between 2 and 3 years. Over 250 respondents mentioned that they face battery problem during the period between 1 and 3 years. Battery problem with smartphones is a well-known and common issue faced by the users. With our personal experiences too, we could postulate that although smartphones have seen remarkable technological advancements since its inception, the issue with its battery component persists. It is noteworthy here that the French government during 2018–2019 investigated smartphone major Apple for ‘planned obsolescence’ of their iPhone batteries (Hariz 2019). Subsequently, the company apologized and assured to decrease the expenses of battery substitute of iPhones (Hariz 2019). A few customers had long suspected that the company slowed down its older iPhones in order to persuade the customers to upgrade to new models. Once Apple faced the criticism for confessing that it intentionally slows down some aging iPhone models, the company apologized (BBC 2017). Nevertheless, although in the recent years, planned obsolescence has been a widespread allegation to the manufacturers; with the exception of a few isolated cases, proofs are mostly missing (Proske et al. 2016). Are the issues of battery for most smartphone models across companies a part of planned obsolescence or is it a tricky technical

Table 5 Major reasons for malfunctioning of the mobile phones

	Frequency	Percent
It does not power on	129	12.4
Button/buttons stop functioning	148	14.2
Problem with the battery	454	43.7
Problem with the software	210	20.2
Others	62	6.0
Total	1003	96.5
Missing	36	3.5
Total	1039	100.0

Table 6 Frequency of change and major reason(s) for malfunctioning

		If your mobile phone stops functioning, what is the common and major reason(s) for it?					Total
		It does not power on	Button/buttons stop functioning	Problem with the battery	Problem with the software	Others	
Frequency of changing mobile phones	0–1 year	9	16	21	18	1	65
	1–2 years	25	26	101	54	10	216
	2–3 years	35	38	151	38	24	286
	3–4 years	24	28	94	41	11	198
	Beyond 4 years	34	38	81	56	15	224
Total		127	146	448	207	61	989

issue? In order to answer this, further research on the topic is essential. Also, significant research and development activities on both prolonging the battery life and associated challenges are important in order to address this concern. An answer to these queries will especially determine both the upcoming conspicuousness of the urban Indian individuals and the fate of those for or against a throwaway society.

4.3 Lifespan of mobile phones

Table 7 shows the lifespan of the mobile phones within our study sample. Over 98% of our respondents preferred to answer the question on the lifespan of their mobile phones. We observed that 49.5% of our respondents change their mobile phones between 1 and 3 years. This corresponds to the purchase and disposal behavior of mobile phones in many countries in the recent times when mobile phones are discarded very much within their actual functional lifespan. For instance, notwithstanding the fact that mobile phones may have a potential lifespan of over ten years, these phones are usually substituted with a newer one between 12 and 24 months in developed countries even if the phones are still functioning well (Ohnmacht et al. 2018). Including both first use and reuse, the average time of active use of mobile phones in Australia has been estimated

in the range of 2.0–2.6 years similar to the lifespan profile of Japan (Golev et al. 2016). In Hong Kong, the average lifespan of a mobile phone is 23 months which is less than two years (Deng et al. 2017). Such short lifespan are also very much prevalent in most emerging economies such as China, India or Nigeria (Ohnmacht et al. 2018). A study carried out in the Indian city of Bangalore, popularly known as the Silicon Valley of India, estimated that over 46% of the respondents within the study sample replace their mobile phones every 2–3 years and 100% of them replace the same within 4 years (Borthakur and Govind 2019). Overall, it has been observed that most mobile phones still remain in functional stage while they are being substituted after an average user lifespan of two years (Proske et al. 2016).

With repair of mobile phones taking a backseat in the lucrative consumer electronics market, people prefer to purchase new mobile phones instead of repairing the old one. Often the required repairing of a product is expensive owing to the facts such as inadequate accessibility of the replacement parts, glued in batteries and miniaturization as a part of product design among others (Proske et al. 2016). Due to the increasing market competition, the prices of mobile phones are getting lowered and thus, providing the consumers sufficient incentives to purchase new phones. This is reflected by the fact that the second most prominent reason for the purchase/replacement of mobile phones was listed (in Fig. 1) as ‘considering the cost of repair, it is wiser to buy a new one than repairing the old one’. Nevertheless, as could be seen in Fig. 1, the major reason for purchase of mobile phones was listed by majority of the respondents across the useful years categories as, ‘the old one has become non-functional’. This is a positive development and points toward the fact that the consumers are still not engaged in conspicuous consumption and characteristics of a throwaway society is not yet prevalent.

Table 7 Lifespan of mobile phones

	Frequency	Percent
0–1 year	70	6.7
1–2 years	221	21.3
2–3 years	293	28.2
3–4 years	206	19.8
Beyond 4 years	234	22.5
Total	1024	98.6
Missing	15	1.4
Total	1039	100.0

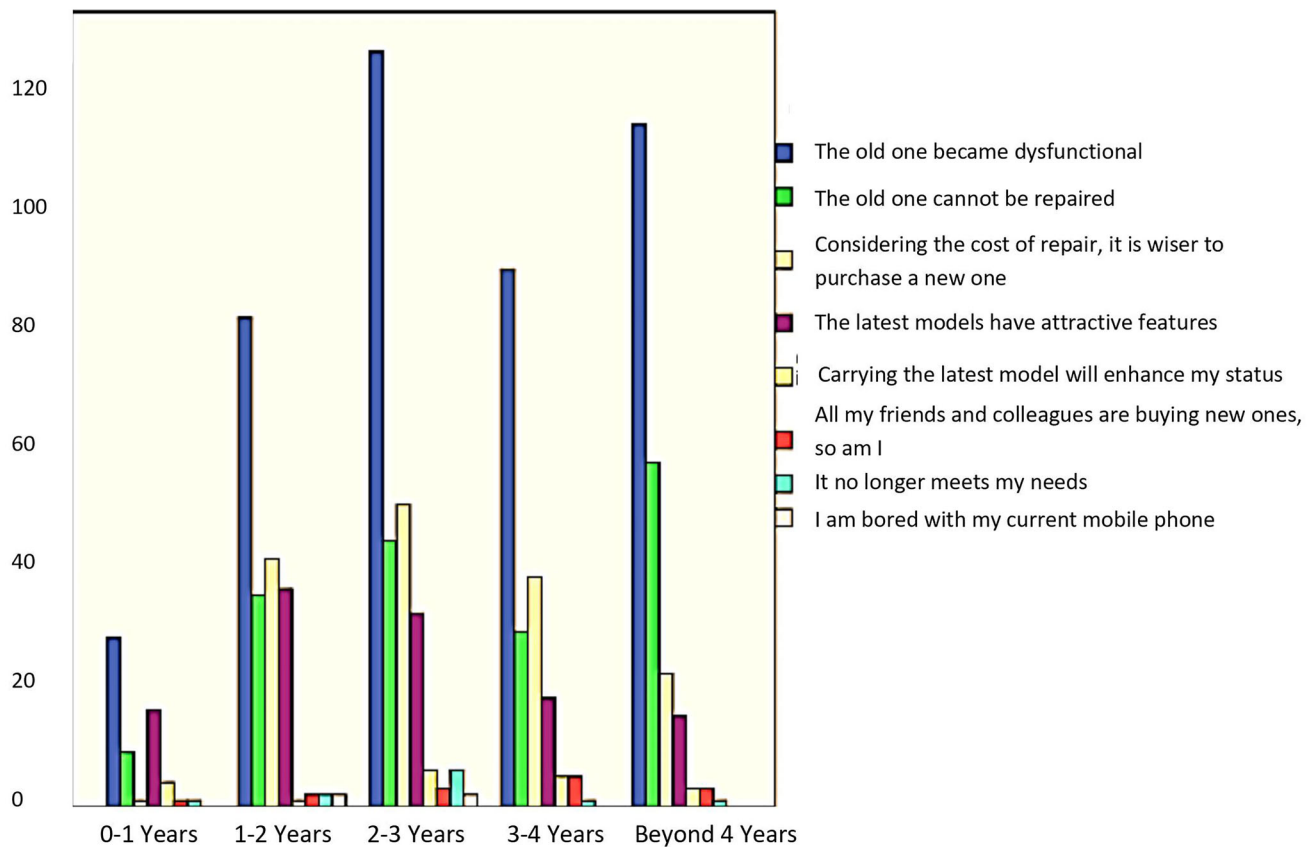


Fig. 1 Major reasons for replacement/purchase of new mobile phones

4.4 E-waste disposal behavior

Table 8 shows the disposal behavior of mobile phones. Overall, 91.5% of the respondents answered this question on their disposal behavior. Majority of the respondents of our study sample, amounting to 46.5%, mentioned that they keep their out-of-use or obsolete mobile phones stored at home. This corresponds to the fact that majority of E-waste in India, including obsolete mobile phones, is stored either due to indecisiveness on how to appropriately manage it or due to an omnipresent idea of E-waste as a ‘commodity’ with some innate value (Borthakur and Govind 2017). While the whole issue of E-waste started getting some research momentum way back in early 2000, Ramachandra and Varghese (2004) estimated that approximately 75% of E-waste in India is stored owing to such ambiguity. This situation remained similar over the years. Considerable amount of E-waste is usually stored at households, educational institutes, public and private sector banks, businesses, information technology companies etc. in major Indian cities including Bangalore and Pune (Borthakur and Govind 2019; Borthakur 2014). Likewise, a study carried out in the city of Chandigarh mentioned that 37.1% of the

respondents in the city store their E-waste without any reason and this storage of obsolete electronics has been established as a major setback in quantification of the waste volume and its recycling (Singh et al. 2018). Our study in New Delhi resonates these already conducted researches on E-waste disposal behavior as we also found that most of the obsolete mobile phones are still stuck in a consumers’ household within our study sample.

The second most prominent disposal behavior (20% respondents) was handing over of their old mobile phones to siblings, relatives or others for free. This behavior too is influenced by the fact that out-of-use electronics are still considered to have some value. Thus, consumers are hesitant to dispose of their mobile phones immediately once they stop using them and prefer to prolong the useful life of those phones instead. Accordingly, electronic equipments, including mobile phones, often find second- and third-users in India. A few respondents (11.2%) mentioned that they sell their obsolete mobile phones to scrap dealers, commonly known as ‘kawariwalas’, at certain price. There has always been a rigorous network of scrap dealers in India. In the country, consumers prefer to sell their obsolete plastics, metals, glasses, old newspapers etc.

Table 8 Disposal behavior of obsolete mobile phones

	Frequency	Percent
I keep it stored at home	483	46.5
I give it to someone for free (e.g., to my siblings/relatives/others)	208	20.0
I sell it to the scrap dealers or 'kawariwalas' at certain cost	116	11.2
I leave it at the store when buying a new one	99	9.5
I take it to the recycling center	39	3.8
I dispose it with normal household/mixed waste	6	.6
Total	951	91.5
Missing	88	8.5
Total	1039	100.0

at certain cost. The scrap dealers often come door-to-door to collect these items and pay the consumers a price for their waste. As repair, refurbishing and reconditioning and component reuse shops are omnipresent in the country (Manomaivibool 2009), such recyclable waste are directed to these business establishments. E-waste, a relatively recent stream of waste, has been incorporated effectively into the existing network of waste collectors and managers in the country. Many consumers, thus, prefer to handover their obsolete mobile phones to the scrap dealers because they get a positive price for the same. We have already argued and established that Indian consumers associate a kind of value to the E-waste.

Overall, the fact that our respondents still attach certain value to their obsolete electronic equipments itself says that it is unlikely for them to engage in conspicuous consumption and part of a throwaway society as of now. Veblen's work on conspicuous consumption conceives that it is a wasteful exhibition and not merely the buildup of assets that bestows status to a person (Neave et al. 2020). This 'wasteful exhibition' is yet to be observed within our study sample because their disposal behaviors in practice essentially divert the potential E-waste from the toxic waste stream for a long time. For instance, we observed that majority of our respondents either store their obsolete mobile phones or give it to their acquaintances for free. These practices extend the life of these mobile phones by keeping them away from immediate discarding.

4.5 Willingness to repair

Table 9 shows the willingness to repair their mobile phones in our study sample. Overall, 97.1% of our respondents preferred to answer this question. We documented that 56.4% of the respondents showed their willingness to repair their mobile phones, while the rest did not wish to repair their phones. This is unlike the result of a study in the city of Bangalore where above 80% of the respondents were willing to repair and recycle their E-waste (Borthakur and Govind 2019). Probably, the negligible price differences between repairing of an old product and purchasing of a new one makes the consumers reluctant toward recycling. As mentioned by a respondent in a survey in Bangalore, there is a difference of merely 400 Indian Rupees (approximately 5 Euros) between purchase of a new camera and repairing of the older one (Borthakur and Govind 2018). This is observed to be true in the case of mobile phones too where 36% of our respondents presumed that their phones cannot be repaired and another 8.6% precisely said that considering the cost of repair, it is wiser to buy a new one (see Table 10). Also, environmental awareness in India is still in its infancy where majority of the consumers are not conscious of environmentally responsible behaviors or tenets of sustainable development. There is a lack of information on repair and recycling centers of any kind of waste in the public domain. Accordingly, 15.5% of our respondents said that they do not know where to take their mobile phone for repairing. Thus, our respondents do acknowledge that there are some obstacles toward taking

Table 9 Willingness to repair mobile phones

		Gender		Total
		Male	Female	
Are you willing to repair your mobile phone	Yes	316	270	586
	No	232	191	423
Total		548	461	1009

Table 10 Major hindrance toward repairing

	Frequency	Percent
I do not know where to take my mobile phone for repairing	161	15.5
I think that my phone cannot be repaired	374	36.0
I do not bother about repairing as I can easily purchase a new one	127	12.2
Considering the cost of repair, it is wiser to buy a new one	89	8.6
I do not trust the repaired devices	9	.9
Total	760	73.1
Missing	279	26.9
Total	1039	100.0

initiatives for repairing. Policymakers must recognize this gap and situate appropriate solution toward solving the same.

5 Conclusions

In the emerging economies, the market for EEEs is both large and lucrative. Countries such as India and China today are not only the largest markets for EEEs but also among largest generators of E-waste too. These countries are characterized by a massive population size which makes them significant for the safeguard of the global environment. E-waste, as a toxic waste stream, asserts its significance in this context. Accordingly, we carried out this research in order to evaluate the purchase and disposal behavior of mobile phones (both feature phones and smartphones) in the capital city of India, New Delhi among respondents in the age group of 18–22. Globally, this age group represents a major mobile phone consumer and India is no exception. Taking clues from the concepts such as conspicuous consumption, throwaway society and planned obsolescence, we attempted to provide a comprehensive account of E-waste in urban India. This study is in continuation with a pilot research we carried out and subsequently published. As pilot studies do have certain limitations particularly in terms of sample size and overall scope/objectives, this research helped us conclude our findings comprehensively.

We observed that the functional need is the foremost consideration while deciding to purchase a new mobile phone within our study sample. Over 42% of the respondents said that they purchase or replace a mobile phone when the older one becomes non-functional. As our respondent's decision-making is influenced by aspects of functionality, it could be concluded that they do not exhibit the typical characteristics of a throwaway society. Also, the very fact that only 1.3% of the respondents purchase new phones influenced by their peers could be proof enough that they are not yet engaged in conspicuous consumptions. Further we evaluated the major reasons for malfunctioning of the mobile phones within our study sample in order to

locate traces of planned and premature obsolescence. Over 43% of the respondents mentioned the problem with the battery as the primary malfunctioning reason. A good battery life is instrumental for uninterrupted working especially in a country like India with a regular electricity crisis even in the major cities. Also, a decent battery of a mobile phone or a laptop is becoming even more important owing to the fact that the current Covid-19 pandemic has enforced a new work culture on us where most of our activities are happening virtually today. We argue that major research and development activities are essential in order to ensure if the issues of battery for most smartphone models across companies are a part of planned obsolescence or a mere tricky technical concern. An answer to these queries will determine both the upcoming conspicuousness of the urban Indian individuals and the fate of those for or against a throwaway society.

Regarding the lifespan of the mobile phones, we observed that 49.5% of our respondents change their phones between 1 and 3 years. This corresponds to the fact that mobile phones are discarded very much within their actual functional lifespan. With repair taking a backseat in the lucrative consumer electronics market, people prefer to purchase new mobile phones instead of repairing the old one. Nevertheless, we documented that 56.4% of the respondents showed their willingness to repair their mobile phones. However, they do acknowledge that there are some obstacles toward taking initiatives for repairing such as inadequate information on repair/recycling centers etc. There is insufficient environmental education and awareness in the country. Both researchers and policymakers must identify such gaps and work toward bridging the same for sustainable E-waste management.

Regarding the disposal behavior, majority of the respondents of our study sample, amounting to over 46%, mentioned that they keep their obsolete mobile phones stored at home. This corresponds to the fact that majority of E-waste in India, including obsolete mobile phones, is stored either due to indecisiveness on how to appropriately manage it or due to an omnipresent idea of E-waste as a 'commodity' with some innate value. E-waste in India

remains a 'wealth' for a long time before turning into 'waste'. Consumers are hesitant to dispose of their mobile phones immediately once they stop using them and prefer to prolong the useful life of those phones instead. Some respondents said that they sell their obsolete mobile phones to scrap dealers at certain price. This is again influenced by the consideration of E-waste as 'wealth' rather than 'waste'. Rather than the 'wasteful exhibition' as suggested by Veblen in conspicuous consumption, our respondents still attach certain value to their obsolete electronic equipments. Their disposal behaviors essentially divert the potential E-waste from the toxic waste stream for a long time. Overall, it could be concluded that the major attributes of conspicuous consumption and a throwaway society are still not dominant in our study sample. However, considering the massive growth of the electronic industry, market for electronics and subsequent E-waste, we must remain vigilant that we do not end up becoming a waste society.

Future scopes: We believe that our research has the potential to act as a fundamental study toward appraising urban Indian consumers' purchase and disposal behavior of electronic goods and gadgets. Such a study in a major Indian metropolis could aid in conducting similar studies particularly in the emerging economies and developing countries. Considering the fact that research on E-waste is still in its infancy in many countries across the globe, our study could provide a few essential hints for researchers willing to explore similar areas. It will indeed be interesting to replicate such a study in the context of a different socio-cultural, economic, environmental and political setup. Such studies will aid in effective policy formulation and implementation as consumers are central stakeholder in any successful E-waste management initiatives.

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Author's contributions The author, Dr. AB, developed the idea of the paper, formulated the questionnaire, and engaged in writing the paper. Dr. PS helped in conducting the survey in New Delhi involving over 1000 respondents.

Availability of data and materials The data will be protected as mentioned in the ethical approval application submitted to KU Leuven, Belgium. The personal data processing meets the requirements of the General Data Protection Regulation (GDPR) as approved by the KU Leuven's ethics approval committee.

Declarations

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

Ethical approval An ethical approval was taken from SOCIAAL-MAATSCHAPPELIJKE ETHISCHE COMMISSIE (SMEC)—SOCIAL AND SOCIETAL ETHICS COMMITTEE at KU Leuven, Belgium (via dossier no. G-2019 09 1740) prior to conducting the study.

Consent to participate The questionnaire was accompanied compulsorily by an 'Informed Consent Form'. Only with the consent of the respondents we conducted the survey.

Consent to publish In the 'Informed Consent Form', approval of the participants was taken for scientific publication of the data. The personal data processing meets the requirements of the General Data Protection Regulation (GDPR) as approved by the KU Leuven's ethics approval committee.

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