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**A TERVEZETT ELAVULÁS KÜLÖNBÖZŐ ASPEKTUSAI ÉS AZ
ÁLTALA BEFOLYÁSOLT TERÜLETEK**

**THE DIFFERENT ASPECTS AND AFFECTED AREAS OF
PLANNED OBSOLESCENCE**

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Abstract

Planned obsolescence expresses those activities that incite the need and urge in customers to purchase a new product sooner than it would be necessary, through the means of non-durable product design, using software-based methods in order to impair product functionality and marketing strategies. Planned obsolescence can be viewed as a necessary force in the economy, or as a harmful process for our planet, that misuses the limited amount of resources and thus should not be upheld any longer. This research aims to give a clear and comprehensive perspective on the 'two-faced coin' that is planned obsolescence, through analysing literature on the different aspects of the concept and through conducting empirical research of mixed methodology to better understand the consumer side of the phenomenon. The findings of this research include the different methods of the application of planned obsolescence, the role of consumers in this process, and the environmental impact and future implications of planned obsolescence. The empirical research confirmed that consumers believe that manufacturers practice planned obsolescence and they mostly associate negative feelings with this concept. Consumers demonstrate conscious behaviour regarding the handling product and show willingness to prolong their lifetime through repair, however numerous barriers, that have relations to planned obsolescence makes this harder. With my research, I conclude that consumer behaviour can be and is exploited by companies. Still, consumers accept this as reality, as they feel powerless about it. Planned obsolescence has many benefits for the economy, but its detrimental nature toward the environment cannot be sustained anymore. There is a need to move forward toward more sustainable economic models, that would also address the issues that planned obsolescence would leave behind.

Introduction

Planned obsolescence is a highly relevant topic that is an integral part of today's consumer society. Manufacturers have great control over the useful lifetime of their products, and it has been proved various times, that they are willing to take advantage of the trust of consumers and limit the lifetime of products intentionally to boost sales and inquire higher profits. Planned obsolescence is a two-faced coin, that has proved to be beneficial for the economy, but has obvious drawbacks and negative impacts on the environment and consumers. Although this phenomenon has been part of our economic system for over 100 years, its viability in the 21st century must be questioned, because of environmental, sustainability and ethical issues

Literature is abundant on this topic, as many authors examine the different sectors and aspects of planned obsolescence, however, there are few research papers, that analyse the concept as a whole. The goal of this research is to give a comprehensive overview of the different aspects and affected areas of planned obsolescence, which could prove beneficial for those concerned with this concept, both on the side of demand and supply. Due to the complexity of the topic, I find it highly necessary to examine and introduce it from different standpoints and to understand its role in our economy and society.

By the end of my research, I wish to find answers to the following research questions:

- How viable is the concept of planned obsolescence today?
- How can manufacturers practice planned obsolescence?
- What is the role of consumers in this cyclic process?
- How does planned obsolescence affect the environment?

I believe these questions tackle the main ideas and aspects of this complex topic. By finding the answers to these questions, I believe I will be able to present a comprehensive picture of this process and understand the main ideas and connections related to it.

As a means of presenting the functionality of the process, an approach was chosen, that takes the two different actors of the process into account: firms and manufacturers – consumers. From the firms' perspective, the different methods, and strategies of implementing planned obsolescence, and on the other hand, the role of consumers in the process, as well as their reactions and feelings are explored. This approach allows me to separate the concepts and analyse them from their respective standpoints, while also leaving place for connections between the two sides.

To conduct my research and structure my research paper, I have chosen an approach that would allow me to present this process logically. As the process dates back to the 19th century, before

the main body, the paper gives a brief overview of the phenomenon's history, which is necessary to understand its relevance and role in our lives. The main body of the paper discusses the different aspects of the methods of planned obsolescence and their respective subcategories. This part presents how the process functions through literature review and real-life examples. After the presentation of the different obsolescence types, the side of consumers is briefly introduced through a literature review. In continuation, the benefits of planned obsolescence are argued, as well as a positive type of obsolescence. After the main body, the environmental impact of the process is presented from different points. This chapter broadens the concept's effects and role in the economy and society. As a final part of the literature review, the current and future issues of planned obsolescence are briefly discussed to further confirm its relevance. The literature review is followed by empirical research which further examines the consumer side of planned obsolescence. *Figure 1.* shows the conceptual framework of this paper, with the different topics explored and their connections and relations with each other.

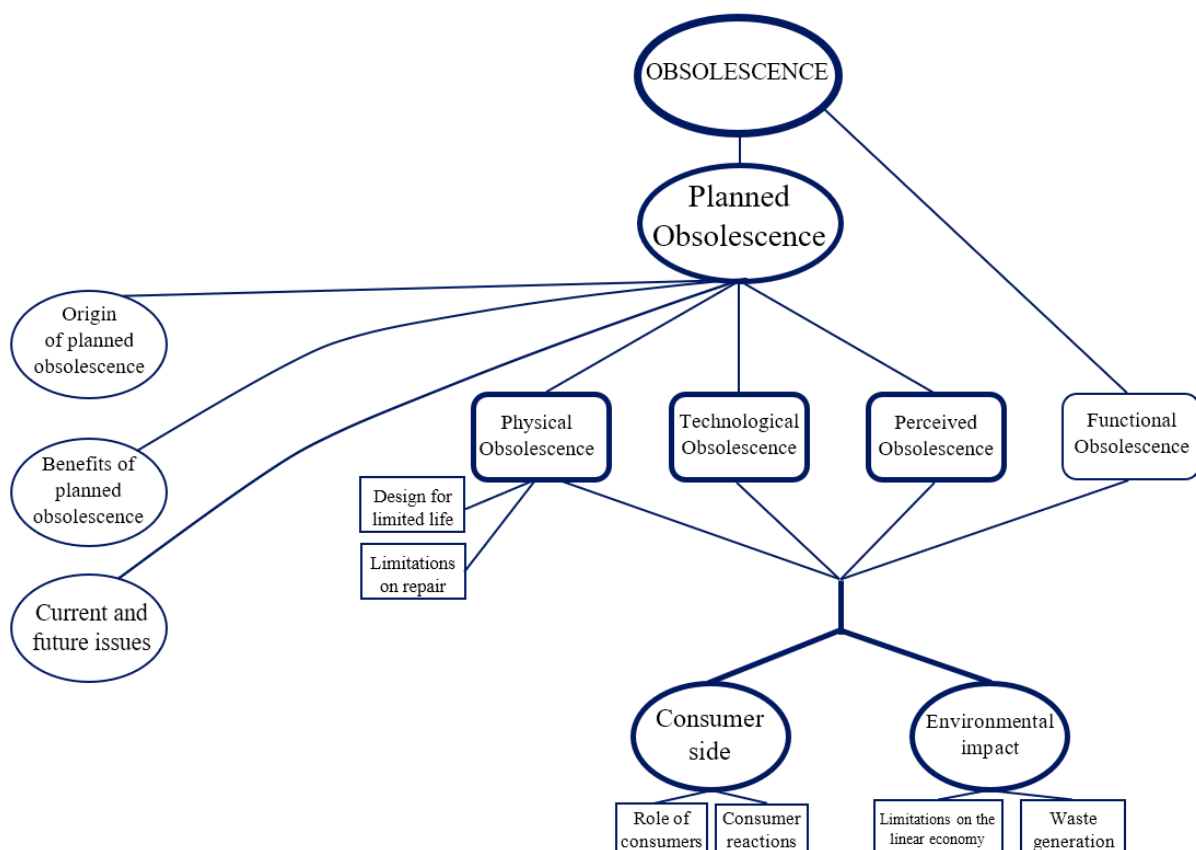


Figure 1. The conceptual framework of this research paper

To acquire the related professional sources for conducting my literature review, I have mainly used the following databases: Business Source Premier, Google Scholar, JSTOR, and Science Direct. I have also used Statista to acquire statistical data and various online articles and forums to explore people's experiences and standpoints. To find the appropriate papers on both the manufacturer and consumer side, I have used the search engines of the databases in a systematic manner using related keywords. Some of the most notable keywords include: 'planned obsolescence', 'Phoebus cartel', 'physical obsolescence', 'technological obsolescence', 'perceived obsolescence', 'planned obsolescence AND Apple', 'obsolescence AND software', 'planned obsolescence AND environment', 'planned obsolescence AND benefits', 'planned obsolescence AND consumers', 'right to repair', 'climate change'. I have looked for papers, that discuss the different perspectives of the practice and effects of planned obsolescence. For the literature review, peer-reviewed articles were used from different academic journals. Along with these documents some online forums and articles were also used for the literature review.

The following authors, among many others, and their papers proved to be significant contributors to the exploration of this topic: Packard (1960); Maitre-Ekern and Dalhammar (2016); Satyro et al. (2018); Kuppelwieser et al. (2019); Karakuş Umar and Beyaz (2021); Malinauskaite and Erdem (2021).

For the empirical research, which examined the consumer side of planned obsolescence, I have decided to use a mixed methodology of quantitative and qualitative features. This way I can utilise the numerical insight of quantitative data and the detailed and less apparent information from qualitative data. This combination allows me to present a better contextualised image of the topic of planned obsolescence. The application on a mixed methodology is also beneficial in the case of this paper, because research like this has not been done on the consumer side of this topic and thus certain aspects of this perspective mostly remains unrevealed. Through the quantitative research, in the form of an online survey, a general idea is provided about suppositions and behaviour, while the qualitative research, which was done in the form of a focus group interview, gives assistance in understanding the underlying reasons for choices and behaviour and the related opinions and feelings.

This research paper may contribute to the current literature and the socio-economic well-being. First of all, owing to the comprehensive nature of the paper, a proper overall image is presented, which gives a thorough understanding of this process and the connections between its affected areas. There are few papers in literature, that explore this topic in such a way, and none, that go into such length exploring the methods of planned obsolescence. Furthermore, the empirical research might prove useful for manufacturers in the national (Hungarian) sphere, as consumer

behaviour and concerns are presented, that can help firms in improving their services to better reflect consumer needs.

This paper also contributes with added value to already present research papers. The detailed exploration of Apple's repair strategy, in the subsection of 'Limitations in repair', provides a concrete example of the possible application of planned obsolescence strategies, which is based on the knowledge and viewpoint acquainted from literature. Moreover, the empirical research can be considered unique, as I could not find other research, that would explore consumer behaviour and reactions in relation to planned obsolescence in a Hungarian environment.

1. The origin of planned obsolescence

The concept of making more revenue through inciting repeat purchases from customers using different methods is not a new concept. In fact, it dates back to at least the 19th century. Turbin (2002) discusses the first appearance of the usage of planned obsolescence in the form of disposable shirt collars. 'Legend has it that the detachable collar was invented in 1827 by Hannah Lord Montague, wife of a Troy, New York, businessman, to solve a common household problem: an entire shirt had to be laundered when only its collar was soiled.' (Turbin, 2002, p. 480.) The first 'collar factories' were set up in the 1840s but planned obsolescence didn't rise to prominence until the first half of the 20th century. Malinauskaite and Erdem (2021, p. 722) argue, that the release of the Cadillac Touring Edition in 1912 was the first significant step of planned obsolescence on a national level, due to the addition of the new electric starter, 'which made all previous cars obsolete', although this could be viewed as a process of technological advancement, rather than a strategical use of planned obsolescence. The process continued in the automobile industry, but the first organised, intercompany manifestation of this business strategy appeared in the 1920s in the lightbulb industry, in the form of the Phoebus Cartel (1925-1939). Various lightbulb producers came together and formed a cartel in which they agreed to limit the lifetime of bulbs from 2000-2500 to 1000 hours, inciting more frequent purchases and a significant increase in sales.

Other notable appearances of planned obsolescence in the 1900s include the strategy of DuPont¹, which consisted in producing 'fast-wearing nylon stockings, which were easily torn or stretched, leading to a high number of sales throughout the 1950s and beyond' (Malinauskaite and Erdem, 2021, p. 722) self-disabling ink cartridges below a pre-specified ink level or after a certain number of prints, making it necessary to purchase a new device, despite them being in

¹ E. I. du Pont de Nemours and Company

perfect, working condition, due to the replacement of cartridges being more expensive than purchasing a printer; and the introduction of disposable razors by Gillette, which had thin metal blades (Maitre-Ekern and Dalhammar, 2016).

In the first half of the 20th century, the world saw the Great Depression (1929-1939), the worst economic crisis of the industrialised world so far. Bernard London believed, that planned obsolescence could be the way out of the depression. The first mention of the term 'planned obsolescence' occurred in his paper "Ending the Depression through Planned Obsolescence", written in 1932. He explains in his paper, that in this time period people 'disobeyed the law of obsolescence' and used and kept their material possessions for a much longer period than it was expected by statisticians. He proposed the usage of planned obsolescence to put an end to this issue and boost the economy.

‘Briefly stated, the essence of my plan for accomplishing these much-to-be-desired-ends is to chart the obsolescence of capital and consumption goods at the time of their production. I would have the Government assign a lease of life to ... all products of manufacture, mining and agriculture, when they are first created, and they would be sold and used within the term of their existence definitely known by the consumer. After the allotted time had expired, these things would be legally “dead” and would be controlled by the duly appointed governmental agency and destroyed if there is widespread unemployment. New products would constantly be pouring forth from the factories and marketplaces, to take the place of the obsolete, and the wheels of industry would be kept going and employment regularized and assured for the masses.’ (London, 1932 p. 2.)

Those holding onto their obsolete products would be sanctioned, and repeat purchases would be incited in several markets, allowing the government to collect more tax revenue from the much more frequent transactions. 90 years after the proposition of London, planned obsolescence is still an essential part of our economic system. Various types of obsolescence strategies are utilised in order to shorten product lifetime and compatibility, in order to encourage consumers to purchase newer products. The textile industry, fashion, mobile phones, electronic devices, cars, industrial equipment, software, and many more are all affected by planned obsolescence.

Nevertheless, contrasting the standpoint of the era of the 1930s, today it is more and more evident that such a system cannot be sustained. In 1932, the main focus was on the revitalization of the economy, while sustainability and resource depletion were totally disregarded, as these

concepts were not pressing issues in those times. However, nowadays these concepts cannot be ignored. One of the greatest problems to be solved in the 21st century is sustainability. The question must be asked: Is planned obsolescence still a viable concept more than 100 years after its conception, taking into consideration all the fields affected by it, such as the economy, consumer exploitation, waste generation, environmental impact, resource depletion, etc, or is it time for the economy to move on from the linear economic system? A new circular formula and exploring new possibilities for innovation, technological development, and durable product design, lasting for 'a lifetime', a concept that was (although not completely, but) dismissed almost a century ago seems to be a system, that could replace the current one.

2. Obsolescence

Planned obsolescence can be defined as a business strategy, in which manufacturers and producers purposefully limit the durability, lifespan, and software compatibility of products, while also influencing demand and using marketing methods to incite the need in consumers to purchase new products. This phenomenon is used to keep demand high, increase sales and acquire higher profit. The usage of this strategy can be justified by its role in boosting the economy and keeping a constantly increasing tendency in technological development, however, there are counterarguments to its relevance, mainly its detrimental impact on the environment.

The phenomenon of planned obsolescence is highly complex. It affects society and the economy in various ways and as such its viability, usefulness and detrimental nature can be interpreted differently from each perspective. Planned obsolescence is a two-faced coin, which can bring benefits to manufacturers, consumers, and technology as well, while at the same time it can also undermine customers and 'fraud' them, result unbeneficial for certain firms and contribute to one of the greatest issues of the 21st century: the climate crisis and environmental detriment.

If investigated from different perspectives, the concept gains very different meanings, and its role in the economy and society can be interpreted in various ways. Karakuş Umar and Beyaz (2021) conducted research, in which they made interviews with experts in the fields of economics, business, mathematics, sociology, and engineering. Both the results of these interviews and the literature review of the authors resulted in the same finding as stated before: planned obsolescence can be interpreted in various ways, depending on the standpoint of the examination, but the two main viewpoints are that of economic and technological contribution to growth contra environmental pollution and the waste of resources.

Nowadays planned obsolescence is practiced in different methods, creating different categories and subcategories of the phenomenon. Based on definitions and concepts used in previous literature (Packard, 1960; Satyro et al., 2018; Kuppelwieser et al., 2019; Karakuş Umar and Beyaz, 2021; Malinauskaite and Erdem, 2021) this paper will classify planned obsolescence into three main categories: physical obsolescence, technological obsolescence, and perceived obsolescence. In the coming subchapters, these categories and their respective subcategories will be further elaborated on, by examining previous research papers and documentaries, conducting small-scale interviews, examining product design and repairability, and analysing historical happenings that defined the consumerist characteristics of planned obsolescence.

2.1. Physical Obsolescence

Physical obsolescence refers to cases when the reason for a product becoming obsolete is in relation to its physical attributions, like materials, durability, and repairability. Manufacturers and producers utilise this technique to limit the life of their products which in turn forces customers to replace that product and make a new purchase before it would be necessary otherwise.

To better distinguish the different methods related to this issue and to better see how this said goal is planned to be reached, physical obsolescence can be further divided into 2 subcategories, based on the classification used in previous literature: design for limited life and design for limited repair. (Satyro et al., 2018; Malinauskaite and Erdem, 2021; Makov and Fitzpatrick, 2021)

2.1.1 Design for limited life²

The product, straight from the conception and designing phase to manufacturing is created in a way, that limits its lifetime. This is achieved through implementing non-durable components, made of substandard materials, like plastic or weak metal sheets that wear out, deteriorate or brake easily after a limited amount of time, sooner than other materials would. Moreover, many products are designed with self-deteriorating mechanisms, like purposefully assembling the products in a way, that allows friction to happen between the components, wearing them out. This can result in the product totally or partially losing its functionality, encouraging repair or replacement.

² Satyro et al., 2018

The design for limited life strategy of planned obsolescence can be associated with different sectors, most prominently: (I.) Fashion, (II.) Industry and (III.) Electrical or electronic equipment (EEE).

(I.) Limited life in fashion

The obsolescence related to fashion is intertwined and partly a result of fast fashion. Producers realised, that by decreasing the durability of clothing items, consumers will be forced to repair their products or purchase new ones. This practice can be traced back to the 19th and early 20th centuries. Turbin (2002) discusses the first appearance of the usage of planned obsolescence in the form of disposable shirt collars in the 19th century. A bit later, in the 1900s, DuPont³ utilised this strategy by creating 'fast-wearing nylon stockings, which were easily torn or stretched, leading to a high number of sales throughout the 1950s and beyond' (Malinauskaite and Erdem, 2021, p. 722). These early appearances of planned obsolescence however were not driven by fast fashion, but in reality, by practical reasons. Fast fashion has become prominent in the last few decades. 'Fast fashion is a design, manufacturing, and marketing method focused on rapidly producing high volumes of clothing.' (Stanton, 2018, para. 2) By adopting this new view of manufacturing clothing items, the prices of clothes have dropped and so did the quality.

Before fast fashion, producers were creating clothes for 4 seasons, now we see 11-15 clothing seasons a year with around 52 (weekly) micro-seasons (Stanton, 2018; Brown, 2021). Customer demand has adapted to the fast-changing fashion first adopted by companies like Zara and H&M, and now it acts as a reinforcing power in the market, keeping it ever-flowing. Companies use marketing strategies to reinforce this physical obsolescence with perceived obsolescence, showing different new clothing trends to convince customers that their current items are obsolete, as a new fashion wave has emerged. These inexpensive, non-durable clothes can now reach consumers, even those at lower wage rates. But on the flip side, these clothing items are not meant to last. The low price comes at the cost of low durability. 'Fast fashion garment production leverages trend replication and low-quality materials (like synthetic fabrics) to bring inexpensive styles to the end consumer.' (Stanton, 2018, para. 2) Due to this, these products have a limited timeframe of adequate functionality, before they lose their colour, stretch out, tear, etc. thus forcing customers to purchase new items.

³ E. I. du Pont de Nemours and Company

(II.) Limited life in the industry

Cars, industrial products, and different branches of the industry are also affected by implementing strategies to limit life or incite the need for spare part replacement or repair, showing, that the existence of planned obsolescence is widespread across many branches of production and manufacturing. This will be presented through some examples, that display how manufacturers have the capability to induce obsolescence in the industry.

The 1.8T engine of Volkswagen was created with numerous design flaws, that acted as a self-deteriorating mechanism. Its oil sump was undersized, leading to blockages or burned-out turbos and engines; a plastic impeller was placed within the water pump, which has a life cycle of 60000-90000 miles, due to the impeller being more prone to breaking and wear and tear. Implementing minor design flaws like these will lead to issues, that often require skilled maintenance in order to avoid further complications and damage (Anon, 2018⁴; Trey, 2021).

The infamous BMW swirl flaps, which are small components of the BMW diesel M47TU & M57TU engines are actually quite beneficial and hold different advantages, such as better fuel-air ratio, less emission of exhaust gases, and improved fuel economy (Anon, 2021)⁵. However, these tiny spare parts provide a great example of limited life. The flaps were poorly designed from a material standpoint as they were notably prone to wear and tear and the screws holding them were known to come loose. The damaged or loosened flaps could cause serious damage to the car's engine. 'When a swirl flap fails, the debris drops down into the engine, either sticking in the valve port and jamming it open, causing the piston to collide with the valve, or falls into the cylinder itself causing the piston, valves, and head to become damaged.' (Grosvenor Motor Company, n.d.) The damaged engines often needed replacement or serious repair, both resulting in high costs for owners. BMW later on intended to implement more durable flaps, however, the design was still not adequate, so they moved on from using the component. Intentional or just a simple design flaw is not to be determined now, however, this example clearly demonstrates how manufacturers can induce obsolescence through minor design-related decisions even in seemingly minor components.

⁴ <https://www.trianglecarcare.com/automotive-planned-obsolescence/>

⁵ <https://dkuperformance.co.uk/pros-and-cons-of-swirl-flaps-for-bmw/>

Another example is the assembling of CNC tool-holders for CNC machining centers in one of the leading providers in the building automation sector.⁶ In one of the company's departments, assembly workers work on manufacturing static and mobile tool holders. Mobile tool-holders allowed tools to move. Certain kinds of these tool-holders needed some form of axle-link, in a vertical and horizontal axis. At the department, this was done by implementing gears, that had to be secured through latch-binding, which is a stable mechanical connection. A milling of the same size is cut into both the axle and the gear and then a latch with the depth of the size of the two millings is placed in there, providing a physical bond between the axle and the gear, so they cannot rotate separately. This way they only move together and unless excessive force is applied this bond can last forever. However, there were cases when instead of using a latch to secure the components, an industrial adhesive⁷ was applied. This adhesive is really strong and effective, but due to the constant forces and pressure being present and with the continuously moving gears, this securing might not last as long. Moreover, the operating temperatures, the temperature fluctuation, and the greasing, that is needed for the mechanisms are all unfavourable for the adhesive. So, it seems that applying an adhesive instead of a mechanical bond limits the life of the product and might lead to severe damage, as if the adhesive gets loose, the gear will be able to rotate by itself and will have room to wiggle, which can impair the product internally.

(III.) Limited life in EEE

In the same way as in other products, obsolescence is designed into EEE in the manufacturing phase. In order to shorten the lifespan of EEE, manufacturers deliberately insert fragile components into these products, that wear over time and impair their functionality.

In the 2012 documentary, 'Planned Obsolescence: Why Electronics Don't Last Long', ENDEVR tries to investigate the methods of obsolescence applied in electronic products, like televisions and cell phones. Their investigation led to the finding, that 50-85% of issues related to LG and Samsung televisions in 4 regions of France came from problems with the capacitors located on the electronic card. In the documentary, a small electronic repair store in Paris is also shown, where capacitor issues are one of the most common problems. They revealed that they changed 5-10 capacitors daily, for the price of 21€ compared to the 200-300€ repair offer of the mother

⁶ This information was provided in a small-scale interview by one of the manufacturing technicians of a leading international company in the sector of building automation. The name of the company and the employee are to remain anonymous.

⁷This adhesive is not restricted to industrial use and can be purchased by individuals as well.

company. The lifespan of capacitors is affected by heat, and it was revealed, that in the case of Samsung electronic cards, the capacitors were right next to a radiator, directly exposed to the heat emitted from it, limiting their life. The same issue appeared in other parts of Europe and the US as well, affecting 7,5 million Americans. The case led to a lawsuit, which was settled, and Samsung offered free repairs and compensation to those who already got their devices repaired. One of the electronic experts at the repair shop in Paris revealed that in later models the capacitors were moved further from the heat source, however, new capacitors were designed that couldn't be bought on the market and the parts couldn't be replaced by repair shops and new devices would have to be purchased in case of capacitor failure.

Another common issue in electronic products is batteries. Lithium-ion batteries, that 'are widely applied in portable electronic devices, power grids, and electric vehicles (EVs) for their outstanding characteristics such as high energy density, low cost, and long cycle life.' (Zhao, Zhang, and Wang, 2022 p. 1.) Their performance, however, deteriorates with use and with each recharging. Recharging impacts the batteries depending on different specific factors, like current battery percentage or time spent on the charger, so improper handling of this can lead to shorter lifespans. Complication, however, comes after the expiration of the batteries, as replacing them nowadays seems problematic. The issue of battery replacement will be further explored in the next sub-section related to product repair.

After conducting a small-scale interview with a long-time technician at one of the major international telecommunication companies I have found further examples of liabilities in EEE. Both set-top boxes and routers, that provide tv and internet services to customers, are connected to external networks and the electrical network as well and thus can be exposed to voltage overloads from different directions, which can be caused by lightning strikes or even system restarts after power outages. These devices are vulnerable to such impulses and can be damaged by them, leading to the need for repair or replacement. In the case of the device being related to a service of the provider, there are no direct costs, although these costs can be implemented in the initial prices, but in the case of a personal device, the costs burden the owner. These issues are very common, and technicians encounter them even on a daily basis, especially after thunderstorms. Television devices also have other internal design flaws. According to the technician, they regularly encounter issues with tv sets, where the glue holding the LED light inside the screen gets loose, letting go of the lights, leading to visible white spots where the lights touch the screen.

2.1.2 Limitations on repair

Another type of physical obsolescence is restricting product repair. The replacement of the product is achieved by limiting the consumer's possibilities to repair their products or discouraging them, making the process not worth the while or the money.

Various methods can be used to limit the possibilities of product repair, like 'restricting the availability of spare parts or stopping their production after the expiration of the legal guarantee; creating incompatibilities with similar parts of more recent models; and preventing disassembly by using specific tools or gluing parts together.' (Maitre-Ekern and Dalhammar, 2016, p.380) Samsung utilised one of these methods, as explained in 'Planned Obsolescence: Why Electronics Don't Last Long, 2012'. After the exposed issue of the capacitors, explained in section 2.1.1/(III), Samsung moved the capacitors further away from the radiators in later models, however, they also implemented a new design of capacitors, which was not available for purchase on the market, terminating the possibility for repair shops to repair the circuit boards in case of this issue, forcing customers to replace their devices.

One of the first elements of EEE to fail and the most common source of fault leading to product replacement is the battery (Maitre-Ekern and Dalhammar, 2016; Troeger, Wieser and Hübner, 2017), which, in reality, is the 'heart' of the device, the source of its power. Without it, the device cannot function, and a deteriorating battery leads to a decrease in the quality of the product. According to iFixit⁸, 'iPhone batteries are rated to hold 80% of their capacity for up to 500 charge cycles, which lasts roughly 18-24 months for most users.' For average users, this means about 18-24 months of fully functional lifespan for their products, after which the phone will need more frequent charges and its performance will deteriorate. (Smith, 2021⁹; Apple, n.d.¹⁰)

There are different factors making it harder to repair electronic products by replacing the faulty battery. Up until the early 2010s, it was more common for smartphones to have removable back panels and easily removable batteries, however, with the release of the first iPhone, which came with a sealed back and a fixed battery, the trend has become less and less popular for aesthetic and technical reasons as well. (Maitre-Ekern and Dalhammar, 2016; Morales, 2022) One of the

⁸iFixit is one of the leading providers of repair manuals for a wide range of electronic devices. It's 'a collaborative effort spanning thousands of fixers, repair-seekers, and translators.' They offer detailed free repair guides and sell tools and spare parts for products, making it possible for owners to repair their products

⁹ iPhone 13 Battery Replacement guide – iFixit

<https://www.ifixit.com/Guide/iPhone+13+Battery+Replacement/145896>

¹⁰ Battery Service and Recycling – Apple

<https://www.apple.com/batteries/service-and-recycling/>

technical reasons usually mentioned is dust and water protection, yet liquid damage is still not covered by Apple's warranty. (Apple Support, 2022) It seems manufacturers made it harder and harder to remove and replace batteries in a DIY manner. Batteries have been welded, glued, or screwed in into the inner parts of the device, in certain cases even with special, modified types of screws, making it even harder for everyday users to access the batteries. One of the owners of iFixit described the irreplaceable battery as a 'premature death clock', that allows Apple to sell more devices and achieve higher profits. (Planned Obsolescence: Why Electronics Don't Last Long, 2012) In modern models, the batteries of iPhones and Android phones are built into the device and numerous components have to be carefully and precisely removed to access the battery, which is (on many occasions) further fixed with adhesive strips, that must be removed to remove the battery. Using manuals like those offered by iFixit, everyday people also have the possibility to repair their cell phones and replace certain components, however, it certainly proves to be difficult and requires numerous special tools. Moreover, as soon as the phone or other electronic device is opened up by the owner, on most occasions, the warranty is immediately voided.

Another way to restrict people's accessibility to repair is through making repairing the product timewise and economically unappealing. I am going to present this strategy by conducting my own research by examining the warranty and repair policies of Apple, one of the Big Five American information technology companies. For this research I am going to use the official website of Apple and investigate the different warranty types; the issues included and not included in them; the deductible fees of certain issues; and the obsolescence policies.

Apple's repair strategy is quite layered, so customers must take many things into consideration when handling issues with their cell phones. Apple offers three types of warranties to their customers: *Apple Care*, *Apple Care+*, and *Apple Care+ with Theft and Loss*.

Apple Care is the basic 1-year warranty that comes with the purchase of any of their products, and 90 days of free phone support. In this one-year period, Apple 'warrants the Apple-branded hardware product and Apple-branded accessories contained in the original packaging against defects in materials and workmanship when used in accordance with Apple's user manuals, technical specifications, and other Apple Product published guidelines.' (Apple Legal, 2022) It is important to note, that according to the official warranty description provided by Apple, this warranty does not apply, among others, to:

- ‘Consumable parts, such as *batteries* or protective coatings that *are designed to diminish over time*, unless failure has occurred due to a defect in materials or workmanship’
 - This means, that one of the most frequent issues of EEE, the battery (Maitre-Ekern and Dalhammar, 2016; Troeger, Wieser and Hübner, 2017) is not included in the 1-year warranty, although it is also worth mentioning, that batteries usually last longer than this period anyways. (Smith, 2021¹¹; Apple, n.d.¹²)
- Aesthetic damage, not caused by manufacturing defects
 - Including scratches and damaged plastic ports
- Liquid contact
- ‘Damage caused by ... anyone who is not a representative of Apple or an Apple Authorized Service Provider’
 - This further encourages customers to seek official Apple repair services, instead of cheaper, third-party repair services or DIY self-repair.

Apple Care+ includes everything offered by the base Apple Care plus ‘an extra year of warranty coverage (an extra two years for Macs), two years of free phone support (one year extra for Macs), and accidental damage coverage (except for the Apple TV).’ (Lloyd, 2018) Moreover, it covers battery service, free of charge, if the component retains less than 80% of its original capacity and up to two ‘incidents of accidental damage’, for certain service fees, available at the ‘AppleCare+ for iPhone Terms and Conditions¹³’ page on the Apple website. In the case of iPhones, these fees are the following:

- Screen-Only Damage: US\$29
- Back Glass-Only Damage (not available on iPhone SE and iPhone models released prior to iPhone 12): US\$29
- All Other Damage: US\$99

These fees are more customer friendly than the prices, that customers are to pay in case of repair out of the warranty period, however, Apple Care+ comes with a fixed subscription-based term

¹¹ iPhone 13 Battery Replacement guide – iFixit
<https://www.ifixit.com/Guide/iPhone+13+Battery+Replacement/145896>

¹² Battery Service and Recycling – Apple
<https://www.apple.com/batteries/service-and-recycling/>

¹³ <https://www.apple.com/legal/sales-support/applecare/applecareplus/us/>

plan. In the case of the newest iPhone models, Apple Care+ comes with a monthly fee of \$9.99 or \$199 in case of a 2-year subscription. (Apple, 2019)

For the newest iPhone models (iPhone 13 Pro and iPhone 13 Pro Max), out-of-warranty screen repairs cost \$279 and \$329, out-of-warranty battery replacement costs \$69, and out-of-warranty repair costs for 'other damage' in the US are \$549 and \$599, respectively. (Apple.com, 2019) For comparison, the prices of these two models, if ordered from the official Apple store are \$999-\$1499 in the case of 'iPhone 13 Pro' and \$1099-\$1599 in the case of 'iPhone 13 Pro Max'. (Apple, n.d.) For better visualisation, the previously mentioned price-related data is presented in *Table 1*.

Table 1. Fees and prices related to iPhone 13 Pro & iPhone 13 Pro Max maintenance with Apple Care+ with warranty and out of warranty				
	iPhone 13 Pro		iPhone 13 Pro max	
Device	\$999-\$1499		\$1099-\$1599	
Apple Care+	\$9.99/month or \$199/2 years		\$9.99/month or \$199/2 years	
Service	<i>Warranty</i>	<i>Out of warranty</i>	<i>Warranty</i>	<i>Out of warranty</i>
<i>Screen damage</i>	\$29	\$279	\$29	\$329
<i>Battery replacement</i>	No cost	\$69	No cost	\$69
<i>Other damage</i>	\$99	\$549	\$99	\$599

Table 1. 'Fees and prices related to iPhone 13 Pro & iPhone 13 Pro Max maintenance with Apple Care+ with warranty and out of warranty'

Sources: 'AppleCare+ for iPhone Terms and Conditions'¹⁴; (Apple, 2019); (Apple.com, 2019); (Apple, n.d.)

'*Apple Care+ with Theft and Loss*' is the third warranty possibility, that customers can opt for. This warranty includes the benefits of Apple Care+ and 'up to two incidents of theft or loss coverage every 12 months.' (Apple, 2019) This is also a subscription-based service. In the case of the previously examined devices (iPhone 13 Pro & iPhone 13 Pro Max) the subscription fee of Apple Care+ with Theft and Loss is \$13.49 monthly or \$269 in case of a 2-year subscription. On top of that, customers also have to pay a deductible in case of living with the Theft and Loss coverage. The fee, that customers are subject to pay is \$149.

This data showcases, how customers are forced to spend hundreds of dollars on their already expensive devices in order to feel secured about the safety of their electric equipment.

¹⁴ <https://www.apple.com/legal/sales-support/applecare/applecareplus/us/>

Reasonable customers will many times opt for the extra security offered by Apple Care services. Screen damage is one of the more frequent issues that mobile phone users might encounter. An iPhone owner, who after purchasing the device made a 2-year subscription (which is economically more appealing than a monthly subscription and reasonable considering phone lifespans) is supposed to pay \$228 in total in case of a screen damage repair during the 2-year period. This might be over 1/5 of the device's original value, which may significantly depreciate after 2 years. Based on the statistics from the 2019-2020 period, provided by cell phone trade-in site BankMyCell, which tracked almost 300 phone's resale values hourly, iPhones on average depreciated by 45,46% from their original sale value. (Turner, 2020) A different statistic provided by Musicmagpie in 2021, using their own trade-in data to showcase the trade-in values of the most popular mobile devices for 36 months from their launch date showed that iPhone devices depreciated by 60% on average from their initial value. (www.musicmagpie.co.uk, 2021)

This data shows that certain repairs, even within the warranty services, can cost more than half of the device's current value. Looking at a supporting example: an iPhone 13 Pro, which was bought at the initial price of \$999 falls out of the user's hand and its screen gets damaged. This issue occurred 20-24 months after the initial purchase of the device, but the customer got a 2-year Apple Care+ warranty for \$199 to cover possible future issues. The customer gets the device's screen repaired for the reduced price of \$29. The total cost of the owner this way sums up to \$288, however over this period, the device has lost (let's say) 50% of its original value, now being around \$500. Now the warranty and the repair cost more than 57,6% of the device's current value. Without the warranty, the same issue would cost \$279, a price very close to the one previously discussed.

Many examples can be made, less and more extreme, for different situations, however, the point is, that many customers don't feel comfortable paying high fees, such as that in the example, so instead of the trouble and costs that arise from repair, they opt to invest that money into a new device. 'The large investment in time and the costs which were to be expected to accrue from a repair are common reasons why a replacement purchase was chosen, rather than repair.' (Troeger, Wieser and Hübner, 2017 p. 9.)

Moreover, Apple categorises its devices based on their age. The *Vintage* category includes devices, that Apple stopped distributing more than 5 and less than 7 years ago, while those devices that have not been distributed for sale for more than 7 years are categorised as *Obsolete*. 'Apple discontinues all hardware service for obsolete products, with the sole exception of Mac

notebooks that are eligible for an additional battery-only repair period. Service providers cannot order parts for obsolete products.’ (Apple, 2019)

Although not recent incidents, but still worth mentioning to see the mindset of Apple employees revolving around repair, I will describe the cases of the 2003 iPod scandal, a video titled, 'iPod's Dirty Secret'¹⁵, created by Casey Neistat that went viral in the early 2000s and the case of the iPhone 4 showed in the 2012 documentary, 'Planned Obsolescence: Why Electronics Don't Last Long'. 'iPod's Dirty Secret' included a phone call with the Apple Care service and support line, where the caller described that his 18-month-old iPod had a dead battery. Taking into consideration the warranty time and the costs affiliated with the repair, the Apple Care servicer declared that the caller 'might as well get a new one.' (Neistat, 2014) A similar case happened in the ENDEVR documentary, where the Apple store employee, comparing the price of a new device and that of a battery replacement, proclaimed that he would personally opt for getting a new device.

Moreover, a step in the right direction, Apple now offers repair manuals and a rentable repair kit for their devices, available for customers to be able to repair their electronic equipment. Now for a price of \$49, phone owners can rent an Apple self-repair toolkit, that contains the necessary, specific tools to make DIY repairs. The parts are also available for purchase, with a total cost of around \$1200. For this reason, for the time of the rental, a hold of around \$1200 is put on the renter's credit card, as a form of security, to make sure the toolkit gets returned on time. On top of the rental fee, customers also have to order the spare parts for extra cost. Rental is a lot more adequate for everyday users, however, for individual repair stores, these Apple-approved tools can prove useful. Apple's new approach towards the 'right to repair' is a good indication for the future of the movement. After years of restricting repair for repair stores and ordinary users, Apple now allows 'Independent Repair Program,' which allows repair shops to enter into a certification process and contract with Apple to get access to authentic Apple tools and manuals.' (Bursztynsky, 2021)¹⁶ However, the current effort of Apple is still debatable. Their toolkit is professional, and it provides very specific tools, but its nature as a practical DIY kit is questionable.

¹⁵ (Neistat, 2014) - <https://www.youtube.com/watch?v=SuTcavAzopg&t=1s>

¹⁶ <https://www.cnbc.com/2021/11/17/apple-self-service-repair-program-will-let-you-buy-parts-for-iphone-or-mac.html>

To put things into perspective, I will make a brief comparison between the Apple repair kit, which is shipped for a battery replacement, and the iFixit battery replacement kit.



Figure 2. iFixit iOpener Toolkit
Image source: (iFixit Store Europe,
n.d.)

<https://eustore.ifixit.com/products/iopener?variant=32254690394193>



Figure 3. iPhone 13 Tool Kit

Image source:
<https://selfservicerepair.com/order>

The iFixit iOpener is available for purchase for the price of \$19.99. It contains 11 components, that can fit in one hand. This is everything, that iFixit deems necessary for everyday DIY repairers to change a phone's battery, with the help of the manual guides and video guides.

On the other hand, the repair kit offered by Apple comes at a rental fee of \$49 with a credit hold of around \$1200. The customer has 7 days of ownership of the kit. In the case of an iPhone 13 battery replacement, the kit comes in 2 cases, that 'when stacked on top of each other, measure 20 inches wide and 47 inches high. One case weighs 43 pounds and the other weighs 36 pounds.' (Apple – Tool Kit Rental¹⁷) The cases come with 16 tools in total, some of which are sizeable. The tools offered by this kit are more targeted and specific for the intended purpose.

¹⁷ <https://selfservicerepair.com/tool-kit-rental>

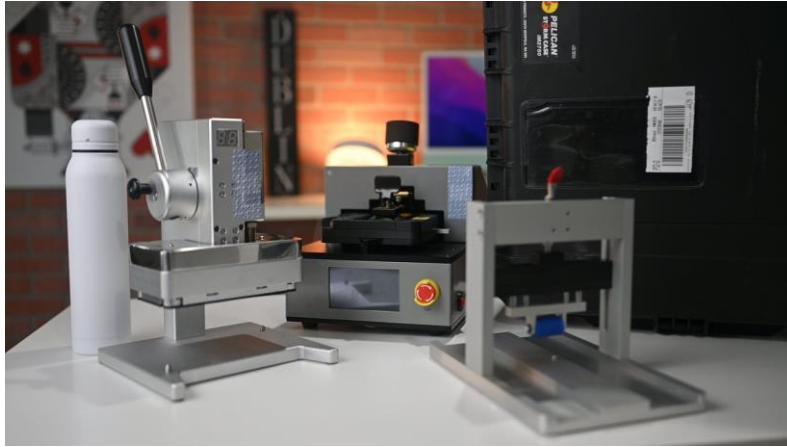


Figure 4. Apple Self Repair Toolkit's larger tools: Display Press, Heating Tool, Battery Press (AppleInsider, 2022)

Image source: <https://appleinsider.com/articles/22/04/30/apples-self-repair-program-toolkit---hands-on-with-whats-inside>

iFixit acknowledged and gave credit for Apple's efforts towards a more repair-friendly model and believes that the company is moving in the right direction, however, they also stated, that the Apple repair toolkit does not seem to be tailored for average people, even comparing it to a 'mini factory'. They believe, there's more work to be done, and they will help to push these efforts forward. (Goldheart, 2022)

As means of providing a slight insight into the state of certain brands in repairability, I will use the website of iFixit, which provides a list¹⁸ of phone devices rated by their repairability on a scale of 1-10. As of this research, the bottom 10 devices on the list (that are also the devices with 2 points or less) consist of the brands of Microsoft, Samsung, Nexus, HTC, iPhone, Motorola, and Essential. It is important to highlight that some of these devices are considerably older than others. If we look at only more recent models (from 2017), Essential, Motorola, Samsung, and Microsoft would be part of the list. The ratings of all these devices come down to unnecessary restrictions in the devices' design that significantly increase the difficulty of repairs. These reasons include: glued or soldered-in components, poorly rooted cables, buried batteries, intense adhesives, components susceptible to wear and tear, etc. (www.ifixit.com, n.d.)

¹⁸ <https://www.ifixit.com/smartphone-repairability?sort=score>

2.1.3 Other types of physical obsolescence

Other types of physical obsolescence include having to change functionality components in products, such as the ink cartridges in printers. The cartridges often prove to be more expensive, than the printer itself and may have restrictions, such as no possibility to refill them or only being able to do so with specific inks. Furthermore, printers may be programmed to block printing at a certain level of ink, even though it would still be enough to print more. (Soke, 2020) Another example would be the case of compatibility issues of school textbooks, or similar products that get yearly or periodical rereleases in form of new editions with no significant change of content, just little tweaks, which might include the changes of page numbers, often time causing owners to replace the product instead of purchasing second-hand copies, due to them seemingly being outdated. (Soke, 2020)

2.2 Technological Obsolescence

“The only big companies that succeed will be those that obsolete their own products before someone else does”

(Bill Gates, Founder of Microsoft, 2006) (Rajagopal, Erkoyuncu and Roy, 2014)

Technological obsolescence is a branch of planned obsolescence, that relies on software-based methods to influence the functionality of products to shorten their real lifespan or to affect their usefulness in order to make them obsolete. This branch includes different strategies, like ending software update compatibility and decaying functionality with further updates.

Not many research papers have been written, that put emphasis and focus on this specific branch of planned obsolescence, however through analysing the available papers, that articulate this phenomenon and through presenting some of the incidents of the last 5-10 years, that relate to this issue, I intend to elaborate on how technological obsolescence affects our products and drives customers to discard their devices.

Based on the literature review, technological obsolescence can be achieved through (but not limited to) the following methods:

- The current software receives no further support (end of support) (Merola, 2006; Sandborn, 2007; Rajagopal, Erkoyuncu and Roy, 2014)
 - Although the software may still be perfectly operational, this way there is no guaranteed support against malware and security breaches. (Satyro et al., 2018)

- Introducing non-compatible software updates (Malinauskaite and Erdem, 2021)
 - After a certain period, devices, like phones and tablets are not compatible with the newest operation system software updates and remain at an earlier update version.
 - This in time will lead to incompatibility issues, like applications and services not being available anymore.
- Hardware is not strong enough for software update (Sandborn, 2007; Satyro et al.,2018)
 - Although the device might be still in perfect condition, due to its dated hardware (which usually is not replaceable), the product is not useful anymore and customers are forced to purchase a more recent model.
- Encoded functionality limitation
 - Using encoding to limit backward compatibility of applications and programs, despite it being possible (Miao, 2010).
 - Chips enforcing a premature programmed stoppage of the device after a certain amount of time/number of functional cycles or at a pre-determined resource level, even though the device and available resources would still be able to function (See subsection 2.1.3) (Engel, 2015; Soke, 2020).
- Not allowing repair ‘by using digital locks or copyrighted software’ (Malinauskaite and Erdem, 2021 p. 731.)
- Software updates slowing devices
 - ‘Intentionally degrade the performance of older devices’ (Makov and Fitzpatrick, 2021 p. 6.)
- Planned obsolescence attack by aging networks-on-chip
 - Zhao et al. (2021) describe an enhanced planned obsolescence strategy: a controlled aging of NoC-bases many-core chips, with warranty times in mind. The aging is slower during the warranty period, after which it gets accelerated. ‘By manipulating the routing algorithm that influences the lifetime distribution of the NoC nodes’ (Zhao et al., 2021 p. 1.) the manufacturers could increase their profit margins by more than 50% according to experimental models.

To better understand the relevance of the issue, I am going to present some examples of the application of technological obsolescence in order of chronological incidence to see the progress of this phenomenon over the years and with the changes in technology.

Miao (2010) presents two different cases related to Microsoft's Tying strategy related to software from the early 2000s. He highlighted that 'Microsoft applications bundled in a new system are often unavailable to users of old systems, who therefore must upgrade their systems in order to use these applications.' (Miao, 2010, p. 583.) In the first example he presented the case of the Windows security software, Windows Defender, which as minimum system requirements needed operations systems 'Windows XP Service Pack 2 or later, or Windows Server 2003 Service Pack 1 or later.' (web.archive.org, 2006). However, as presented in Miao (2010), after accessing and removing a line of code, that was responsible for verifying the current Windows software version, users in fact could install the security software to an earlier Windows version, Windows 2000.

A second example presented by Miao (2010), which shows the possibilities that companies have in limiting software, that in turn might be used for increasing their profit margins is the case of a third-party software competing with the official Windows software. He highlighted how RealPlayer, a third-party media player app and main competitor of Windows Media Player (WMP) in the 2000's 'consistently support[ed] more versions of the Windows OS than Microsoft's own WMP' (Miao, 2010) throughout different versions of the two software. Microsoft, explaining its bundling strategies claimed, that 'its own applications can best utilize the operating system.' (Miao, 2010 p. 585.) It is important to highlight, that in the paper Miao (2010) states, that the research model of the paper is limited, and he does not claim to fully explain the behaviour presented, but proposes, that apart from the technical aspects of the upgrading strategies, economic motives might have also played a role in these cases.

Maitre-Ekern and Dalhammar (2016) show an example of technology-induced obsolescence in the form of incompatibility. They bring the example of Apple's iPhone 5 (released: September 21, 2012) (Apple Newsroom, 2012), which came with a new type of charger. Due to this, in case customers wanted to use their phones with older accessories, they were forced to purchase adapters. (Cowley, 2012) At the time Apple charged £15 for a charger cable and £30 for an adapter. (Wrenn, 2012) Apple also implemented its in-house strategy to exclude competition by putting a chip in the new chargers, which ensured that non-Apple cables would not work. This example once again can have technical explanations, as this change to a smaller and thinner charger allowed Apple to design the new iPhone model to be even thinner and more appealing to customers, however, it certainly also proved to be a good business model, that provided Apple with extra revenue.

Satyro et al. (2018) present numerous examples of products designed with planned obsolescence mechanisms, one of which is categorised as 'design for restricted technological update'. The incident presented in the paper is also related to Apple products: iPhone 5, iPhone 5c, and iPad 4 (32-bit). The proposed issue was the fact, that the new iOS 11 (released: September 19, 2017) had bigger hardware requirements than the previous iOS system, requiring a 64-bit processor, while the previously mentioned models ran with 32-bit processors. Owners of these models did not have the possibility to replace the processors with better ones, so their models were obsolete to newer software updates and functions.

One of the biggest cases revolving around planned obsolescence was Apple's 'Batterygate' scandal. In late 2016, there was an increasing number of reports of iPhone 6 and iPhone 6S devices unexpectedly shutting down after decreasing to 30% of battery charge, as a self-protecting mechanism, to preserve the battery. (Tandon, 2022) After shutting down, the phones had to be plugged in to restart, proving very inconvenient for users. In response to this issue, in January 2017, Apple releases a new iOS update, iOS 10.2.1, which incorporated performance management features, that 'considered a combination of the device temperature, battery state of charge, and battery impedance, and slowed down the performance of devices with depleted batteries by automatically shifting them to a state similar to battery safe mode' (Makov and Fitzpatrick, 2021 p. 6.) and it also incorporated a new message to the battery info menu, that stated 'your battery needs service' for batteries that were notably worn-out as a form of greater transparency. (Panzarino, 2017) It was revealed, that mainly older, more depleted, or worn-out batteries were affected by the shutdowns, as these batteries couldn't handle the sudden spikes of activity, which could have been results of different factors, like application requirements, outside temperature, battery mileage or battery damage (Panzarino, 2017). The modifications bundled with the iOS patch tampered with the functionality of the phones, as reportedly iPhones with depleted batteries had their performance slowed down. Critics and the general public responded with allegations against Apple, claiming the tech giant was purposefully throttling with the devices intending to drum up sales. Apple's official response to the case denied any purposeful harm done to customers:

"We have never – and would never – do anything to intentionally shorten the life of any Apple product or degrade the user experience to drive customer upgrades. Our goal has always been to create products that our customers love, and making iPhones last as long as possible is an important part of that." (Moon, 2022, para. 4)

Apple stated that the iOS update made it possible to restart the phones that have shut down without the need to plug them in and also, they achieved a significant, 70-80% decrease in the number of devices shutting down. (Panzarino, 2017). According to the company, the changes were made to preserve battery life (Clayton, 2020). With the iOS update, iOS 11.3, Apple also provided the possibility to disable performance management. (Apple Newsroom, 2018) Later on, Apple also offered battery replacement discounts (Romm, 2020).

Millions of users were affected by these issues and 33 US states were accusing Apple of purposefully tampering with devices in order to boost sales. A multi-year case ensued, that ended in 2020. Different complaints were filed against Apple in the US and Europe for 'intentionally decelerating its older smartphone models through software updates which led to a permanent slowdown of the system. Consumers were not well informed regarding the iOS operating system updates, namely 10.2.1 and 11.2, on their phone's performance, and therefore or new models.' (Malinauskaite and Erdem, 2021 p. 742.) Apple reached settlements in 2020, agreeing to pay \$500 million in compensation to customers in form of (a minimum of) \$25 for each affected customer, who applied for compensation (Gecit, 2020; Romm, 2020). Furthermore, Apple had to pay \$113 million to settle the allegations made by the 33 US states (Clayton, 2020; Romm, 2020).

In 2018 there was another investigation related to planned obsolescence. The Italian government started investigations against Apple and Samsung with the suspicion of planned obsolescence. The government was interested in determining if the companies were purposefully using software updates to impair the functionality of their customers' devices by slowing them down. They were also proposing that the two companies might not provide customers with the necessary information regarding the consequences of software upgrades on their devices (Gartenberg, 2018). Malinauskaite and Erdem (2021) describe how both Apple and Samsung customers were induced to system updates that were not designed for their devices. In the case of Apple, the users of iPhone 6, iPhone 6+, and iPhone 6S+ experienced impaired functionality after installing the new operating system, designed for the iPhone 7. Customers who owned the Samsung Galaxy Note 4 model faced a similar issue after being led to install an operating system for the Galaxy Note 7. Samsung handsets experienced serious battery performance issues, the devices became virtually unusable, and customers had no possibilities to return to a previous software version, leading to the devices becoming obsolete. 'Italy's Competition Authority has fined Apple and Samsung €10 million and €5 million, which are the maximum allowed under Italy's Competition Code, respectively for inducing users to

install software updates which it says, "significantly reduced" the performance of their products.' (Vinocur, 2018, para. 1)

To provide a recent example of software-based obsolescence I have looked into the repairability of recent devices. I will present two cases, where software was responsible for blocking third-party repair. I am going to do this by presenting two videos created by a content creator named Hugh Jeffreys¹⁹, a dedicated Right to repair advocate, who specialises in restoring and modifying electronics.

The first example is related to Apple's iPhone 13, a device released in 2021. The experiment conducted by Jeffreys consists of purchasing two identical models of the iPhone 13 device and then switching the logic boards between the two phones 'to simulate changing every part inside the phone.' (Jeffreys, 2021, 3:36). After changing the two components, it will be clear which functions are still available and which ones are limited by software. After launching the models, following the interchanging of the logic boards, the device showed various messages, stating, that certain parts could not be verified as genuine Apple components. Features like 'Battery health', 'Face ID', 'Auto brightness', and 'True tone', which is responsible for automatically balancing the colour temperature of the display with the surroundings. Furthermore, the front camera was also affected, as the portrait and cinematic modes were not functioning properly or not functioning at all, even locking up the camera app. Both devices experienced the same issues and the issues still remained after restoring the phone to iOS 15.0. Instead, the camera became even more unstable and broken. After reassembling the devices with their respective components, all features returned, and the issues were fixed. In an attempt to dig deeper into the individual errors, Jeffreys tried replacing only certain components to see what errors arise. After replacing the front cameras, but keeping all other components as original, 'Face ID' was once again unavailable, and the camera was still dysfunctional. After attempting a display replacement with different methods, trying various combinations between original (the phone's own) and other (from a different phone) display panels sensor cables, 'Face ID' 'True tone', 'Auto brightness' were all unusable and the front camera still had the same issues. Seemingly and as concluded by the original creator of the video, these devices were manufactured in a way that makes it virtually impossible for third-party or DIY repairers to repair their devices without losing certain functions, as the different components of the phones are likely bound to each other by software and thus only function properly with their original factory components, or if

¹⁹ <https://www.youtube.com/c/HughJeffreys/featured>

the software locks are properly eliminated, which Apple repair stores are most probably capable of.

The second experiment of Jeffreys involved the Samsung Galaxy A51, which was first released in late 2019. The test was conducted with the same principles in mind: replacing certain components between two identical models to see if the functionality of the devices is impaired in any way due to software blocks. Jeffreys (2021) simulated a common repair, a display replacement by exchanging the motherboards and the fingerprint sensors between the two phones. After assembling the phones and turning them on, the fingerprint sensors proved to be unfunctional. As a more specific test, after reassembling the phones with their original components, Jeffreys changed up the fingerprint readers. This way, the sensor seemed to work, however, there were some odd functionality issues. Adding a new fingerprint to the system displayed required calibration in the system, and Jeffreys was able to unlock the phone using fingerprints that were not previously programmed into the phone. Replacing the USB-C charging boards and the cameras did not cause any malfunctions, showing that they are not affected by software locks. Reassembling the devices with all their original components returned them to their original functioning states. Similarly to the iPhone 13 model, seemingly Samsung has also used some sort of software pairing in their devices, binding certain components to the original phone and restricting their replacement without losing functions.

Interestingly, the Samsung Galaxy S20 model, first released only about 2 months after the A51, did not have issues like this. Replacing the motherboards, simulating a camera replacement, the cameras, and the charging were perfectly functional, despite rumours. (Jeffreys, 2020)

These examples prove, that manufacturers have the technical possibility and are willing to use software to limit repairability and thus enforce technological obsolescence on the devices of their customers. These actions contradict the increasing ‘Right to repair’ trends and sustainability. It is important to highlight, that after continuous complaints, Apple released a new iOS update, that removed the software restrictions related to the Face ID, allowing customers to replace their screens without functional sacrifices. This announcement followed the announcement of Apple ‘in which the company confirmed that, for the first time, it will provide genuine iPhone and Mac parts to users interested in repairing the devices themselves.’ (Espósito, 2021, para. 4) This change of events might relate to the increasing attention that governments pay to repair rights of customers and to the fact that there is an increasing tendency in the legislation being introduced, that would enforce companies to make repairs better available for their users. (Owen, 2021) Whether Apple would change issues like this by

themselves, without them being exposed to the general public by individual repairers is debatable.

2.3 Perceived Obsolescence

The third branch of obsolescence that is discussed in this paper is 'perceived obsolescence'. Apart from physical weaknesses, built-in liabilities, limited repair, technological incompatibilities, and software blocks, manufacturers and producers have something else to enforce obsolescence, incite further purchases, and drive up sales: us, the customers.

The essence of perceived obsolescence lies in psychology. It happens when customers are convinced that their product is no longer useful or valuable so the customer should purchase a newer version of the product to enjoy the full value and be more fashionable. Advertisement, marketing, and fashion trends all closely relate to perceived obsolescence as these are the driving forces of the phenomenon. Instead of relying on physical or technological liabilities, perceived obsolescence is based on the urge in customers to acquire something 'a little newer, a little better, a little sooner than is necessary' (Adamson and Gordon, 2003, cited in Kuppelwieser et al. p. 2, 2019). These driving forces are mostly based on aesthetic, stylistic fashionable changes, that themselves do not provide any practical benefits, but act as a symbol of status. Oftentimes these stylistic changes occur periodically, with new product releases, that might also offer technical or functional upgrades, however, the changes in the product's style and appearance make it easily distinguishable from the previous model, which allows them to more easily transmit the message towards customers, that their old products are part of the past and are undesirable, compared to the new models. (Malinauskaite and Erdem, 2021)

Packard (1960) already discussed how perceived obsolescence (also referred to as 'psychological obsolescence') can be used to manipulate customers into making regular and frequent purchases. Our society revolves around consumption and the ever-changing fashion trends are socially accepted and expected making it possible to 'create obsolescence-in-the-mind merely by shifting to another style. ... Designer George Nelson bluntly summed up the challenge of producing the appearance of change when he stated, in *Industrial Design*: "Design . . . is an attempt to make a contribution through change. When no contribution is made or can be made, the only process available for giving the illusion of change is 'styling.' In a society so totally committed to change as our own, the illusion must be provided for the customers if the reality is not available." (Packard, 1960 p. 46.)

To better understand the concept of perceived obsolescence it is important to look into the roots of the concept, which most dominantly lies in the change of rules in the automotive industry, starting in the 1920s. The Ford Model T was released in 1908. It was the first mass-produced car widely available for the middle-class, mostly thanks to its low manufacturing costs and its low price. Henry Ford's vision was to create a single, technologically outstanding car, that most people would be able to afford, so after the completion of the Model T, they stopped designing other cars and solely focused on this model, improving it over the years. (Tarján, n.d.)

"I will build a motor car for the great multitude. It will be large enough for the family but small enough for the individual to run and care for. It will be constructed of the best materials, by the best men to be hired, after the simplest designs that modern engineering can devise. But it will be so low in price that no man making a good salary will be unable to own one-- and enjoy with his family the blessing of hours of pleasure in God's great open spaces."

- Henry Ford
(Ford and Crowther, 1922)

Tarján (n.d.) states that at the Ford company they had a minimalist approach to handling their cars. Any improvements and repairs that were made, were due to strictly technical and functional reasons. A perfect example of this was the colour of the Model T. After a significant increase in demand for cars, Ford, in order to make the manufacturing process faster, started to use a new type of 'baked enamel paint', that notably decreased the time to paint and dry the car and also the costs related to it, however, the paint was only available in black. Due to this, cars manufactured by Ford were only available in black for a long period of time. (Hoover, 2021)

"Any customer can have a car painted any colour that he wants so long as it is black."

- Henry Ford
(Ford and Crowther, 1922)

The car was simple and puritan. These conditions show that before the late 1920s, cars were viewed as machines of service, which is also stated in (Whiteley, 1987). This however changed as demand started to shift and more importantly started to be shifted by manufacturers. After almost 20 years as the industry leader, the 1920s brought an end to the reign of the Model T, out of which 15 million cars were sold until 1927. (Tarján, n.d.)

Whiteley (1987) and (Tarján, n.d.) describe the transition of cars from a service used for travelling into possessions of pride and prestige in the late 1920s. The Model T started to slowly

become obsolete as new trends emerged in the automotive industry, which changed the fundamental rules of how business was done before. Style and the 'eye appeal' became significant factors in the industry, as, after two decades, people started to seek exclusivity, and they had higher demands. Manufacturers were happy to reinforce these needs and wants coming from the customer demand and thus started the constant and continual restyling of cars to boost sales. A prime example was the introduction of different colours into car design. As described in Hoover (2021), General Motors (GM), the main competitor of Ford, started to experiment with new types of paints for cars. GM, now under the control of the DuPont company, invented a new type of paint in 1923, the Duco paint, which was superior in durability and strongness to the baked enamel and it also came in different colours. Contrary to the technical viewpoint of Ford, GM started to capitalise on the eye appeal and soon started to release cars in different colours. GM started to utilise perceived obsolescence in the form of annual releases of cars in different colours, which in reality was an aesthetic differentiation from other cars, which acted as a form of symbol of status. This was utilised to make the 'old' Model T look outdated, as well as their own, previous GM car models, a strategy that was encouraging yearly car replacement. (Muller and Lebedev, 2021)



Ford Model T

DuPont – GM 1924 Oakland True Blue

Figure 5. The Ford Model T, released in 1908 (only available in black for years), and the coloured 1924 Oakland True Blue

Source: Hoover (2021) - <https://americanbusinesshistory.org/why-cars-dont-have-to-be-black/>

Whitely (1987) describes how planned obsolescence solidified itself as an integral part of the system in the coming decades. The 'Sears Roebuck' company had their Coldspot refrigerator redesigned in 1935, making them sales leaders in the industry. After this, they had annual redesigns of the product in 1936, 1937, and 1938, which provided little real improvement, but

were easily distinguishable and provided the sense of progress desired by customers. By the 1950s, the traits of the consumer society were clearly visible, both in actions of manufacturers and in the attitude of customers. Harley J. Earl, leader of GM made a statement in 1955, that proves, that the use of obsolescence was already commonplace in the period: 'our job is to hasten obsolescence. In 1934 the average car ownership span was five years; now it is two years. When it is one year, we will have a perfect score'. (Whitely, 1987 p. 7.) Design was carefully shifted periodically. Manufacturers had to make sure to keep the pace of redesign steady; not too slow nor too rapid. That was essential in prolonging the period in which desirable sales could be acquired but also making sure that customers felt unsatisfied by their current models, longing for a trendier one, and not disgraced. 1-3-yearly cycles became dominant in redesigning products to incite sales. In the 50s new car body types were created, and although new car models offered new accessories and gadgets, it was the visual differences that were obvious to customers, and they represented a form of social status. This shows, how functional and perceived obsolescence can be intertwined. New accessories, features, and additional functionalities can create a sense of lost value in one's current product and thus might perceive this product as more obsolete, despite it functioning properly. Furthermore, the new product, due to its technical superiority might also possess a higher social value, which might induce the replacement.

Packard (1960) describes how in the late 1950s and 1960, the home-builder industry started to follow in the footsteps of the automotive industry by purposefully inciting obsolescence with constant restyling. 'In 1960, Consumer Reports quoted a Westinghouse official on the need of a "new look" every year in order to assist sales. Complete redesign each year, he said, would be too costly. "But changes only in decorative trim will satisfy the dealer, please the customer, and effectively 'obsolete' the previous year's model.'" (Packard, 1960 p. 76.) As people did not have sufficient money to purchase a new home, different branches of the home-furnishing industry started to encourage people to reinvent their homes by acquiring new furniture of fresh design through trade-ins. Packard (1960) showcases how different home-furnishing branches, such as *furniture, beds, sewing machines, floor coverings, and bathroom scalings*, all had plans for how to execute aesthetic changes that would enforce perceived obsolescence. The strategy was promoting and supplying certain product designs for a determined period of time (around 2-5 years) after which a new style would emerge and take over promotion. If perceived obsolescence is executed well, the supply would create the demand and thus create an ever-going cycle of consumption. The goal was to always present easily distinguishable new styles,

that would make the old ones outdated. 'By giving a product a fashionable appearance, the designer was virtually guaranteeing it would look old fashioned in two or three years, and so was building-in style obsolescence.' (Whiteley, 1987 p. 3.)

In current times, fashion is highly affected by perceived obsolescence. In an era of consumerism and fast fashion, physical obsolescence is highly reinforced by perceived obsolescence, as mentioned in subsection 2.1.1 (I). In order for people to stay fashionable, trendy, and up-to-date, they have the incentive to purchase the brand new, freshly released products of the clothing industry. Even though many times, the clothing items owned by the consumers are still in good condition, they replace them, and many times dispose of them. This is the result of the manipulative nature of trend-creation and promotion and also of the consumer society, in which many people experience peer pressure due to the basic human social need of fitting in. 'Adorno and Horkheimer, accordingly, argued that every consumer could be manipulated by the culture industry to buy certain goods even if they did not need them.' (Malinauskaite and Erdem, 2021 p. 723.).

Nowadays perceived obsolescence has been perfectly solidified as a business strategy. It still functions to this day through the implementation of various intricate methods. Most people in modern countries are exposed to an immense amount of advertisements on a daily basis. Advertisements have infiltrated most places of our lives, from public places to our homes, until now, with a little exaggeration, we are surrounded by ads 24/7. *Table 2.* presents some of the platforms used to provide customers with advertisement.

Table 2. Exposure to advertisements		
Advertisement	Sensory system	Presence
Billboards, flyers, posters	Visual	• Street • Public transport
Advertisement in press	Visual	• Anywhere (magazines)
Radio announcement	Audial	• Home • Workplace • Public transport • Car
Television commercials	Audio-visual	• Home • Cinema
Internet ads	Audio-visual	• Anywhere • (phones & computers)

Own editing

These commercials and ads are used by companies to influence consumers' behaviour through marketing strategies. Marketing is a branch of the business industry, that is built around analysing, understanding, and influencing the behaviour of customers. Psychology is essential

in understanding existing customer instincts and behaviour, which then can be utilised in creating successful advertisement campaigns for products and services. Professional marketing employees and advertisement creators usually have a great understanding of this branch of psychology and thus can utilise universal trigger points and convey the right message in their commercials to influence the consumer in a favourable way for the goal of their company.

Commercials have changed a great deal over the years. Over the last 2 decades, the internet became a very prominent platform to reach customers. We are targeted by advertisements in search engines, social media sites, video streaming pages, and music broadcast sites as well. People are carrying their mobile phones everywhere, so now people can be exposed to ads anywhere, anytime. Thanks to algorithms, bigdata, and artificial intelligence, advertisers can now use specifically targeted advertisements, based on people's behaviour and habits on the internet, making sure, that ads arrive at the right audience and only the adequate audience.

Moreover, Malinauskaite and Erdem (2021), through a literature review present how consumers can be misdirected due to the complexity of the information available to them when considering a purchase decision, leading to a market failure, called 'confusopoly', which might cause customers to make irrational decisions.

There are two psychological concepts related to perceived obsolescence that have been argued in literature: 'The mental cost of product replacement' (Makov and Fitzpatrick, 2021) and Consumer responses to new product announcements. (Kuppelwieser et al., 2019) The following papers provide more insight into how perceived obsolescence can be implemented in modern times, in the consumer society, and moreover, connections can be made with the advertisement strategies previously discussed.

Makov and Fitzpatrick (2021) discuss how customers are actually conscious when it comes to product replacement and strive not to be unnecessarily wasteful, so when it comes to the two-sided decision of retiring an old product and purchasing a new one, they search for a justification, which makes the replacement reasonable. Physical and functional wear-and-tear and damages provide an easy alibi for replacing a product, however as described in Makov and Fitzpatrick (2021), Heath and Fennema (1996) and Okada (2001) stated, that upon purchasing a product, the consumer creates a mental account book, in which they keep track of the initial price and value of the product, as well as the depreciation of said value with the passing of time, eventually arriving to a date, where they believe they got their money's worth. With newer product releases, like for example in the cases of smartphones, the expectation of customers

might increase, and thus the value perception in their own product might decrease. (Proske and Jaeger-Erben, 2019, discussed in Makov and Fitzpatrick, 2021) Advertisements can further influence and feed this false sense of deterioration with the promotion of the new product and by dropping the promotion of the older one. People have the desire and are consciously reinforced to desire something ‘a little newer, a little better, a little sooner than is necessary’ (Adamson and Gordon, 2003, cited in Kuppelwieser et al. p. 2, 2019).

The experiment conducted by Kuppelwieser et al. (2019) describes how customers' product replacement habits are influenced by the announcement of new products. Their experiment, consisting of three different simulated scenarios of mobile phone replacement cycles demonstrated, that the length of a substitution period and the announcement of a new product have an influence 'on both consumers' value perceptions and their willingness to buy.' (Kuppelwieser et al., 2019) It was found, that shorter replacement cycles reduce the value, that consumers attribute to their current products, and their willingness to purchase as well. On the other hand, longer substitution periods affected the value perception and willingness to buy positively. The important point to take away from this experiment is that without any physical or functional changes in a product, companies can influence customers' perception of the value of their product, solely by announcing a new substitute product. This strategy can be utilised with the 'mental account-book', previously mentioned. If the diminishing marginal value of the customers' current product is synchronised well with product release dates and reinforced by advertisement campaigns, companies can have a noteworthy influence on the customers' purchasing behaviour and their demand.

With this information in mind, it is worth taking a look into the product release cycles of some of the major smartphone and automobile companies²⁰: Samsung, Apple, Huawei, Audi, Volkswagen, Toyota and Ford. Examining the release dates of the models offered by these companies, it becomes clear, that new models have been mostly released in 1–5-year periods, however, with time, the product release cycles have become shorter and shorter. Nowadays, in

²⁰ <https://screenrant.com/samsung-galaxy-phones-chronological-order/>
<https://www.samsungsfour.com/mobiles/samsung-galaxy-smartphones-complete-model-list-released-year.html>
<https://www.iphonelife.com/content/evolution-iphone-every-model-2007-2016>
<https://screenrant.com/iphone-apple-release-chronological-order-smartphone/>
<https://www.techradar.com/news/a-history-of-every-huawei-flagship-phone>
<https://www.gsmarena.com/huawei-phones-58.php>
<https://www.cars.com/research/audi/>
<https://www.autoevolution.com/volkswagen/>
<https://www.supercars.net/blog/all-brands/ford/ford-model-list/>
<https://www.ranker.com/list/full-list-of-toyota-models/reference>
<https://www.autoevolution.com/toyota/>

the mobile phone market, it has become commonplace to release new models annually, while in the automotive industry the usual release period is 1-2 years.

2.4 Consumer side

‘Individuals struggle for “power”, but what power is determines the nature of this struggle. As in the subject of our study, “power” in consumption culture is about being able to consume more. In that case, it will be the desire to “consume more” that directs the actions of individuals.’

Source: Karakuş Umar and Beyaz (2021) p. 184.

Although the different methods of planned obsolescence are practiced by manufacturers, it is important to keep in mind that the economy and the market are essentially driven by demand, or in other words, kept in motion by consumer needs. Based on basic, traditional economic concepts and theories, it can be stated that all rational consumers have wants and needs that they want satisfied and choose goods that provide them with the maximum utility. (Malinauskaite and Erdem, 2021) Manufacturers and producers try to work on satisfying this demand, however ‘producers are not merely responding to consumer demand but are deliberately influencing market conditions.’ (Malinauskaite and Erdem, 2021 p.726)

We live in a society, that, based on its general consumerist traits and the behaviour related to it, is oftentimes defined as a ‘consumer society’ or a ‘throw-away society’, where purchases are not only dictated by essential needs, but by cultural influences as well. Hellmann and Luedicke (2018) describe how consumers only put value in products and services, that serve their self-interest and oftentimes base their own self-worth and social value and status on their belongings. This compulsion for social conformity and the attribution of social values to goods is now an important factor in society’s consumerist attitudes. People want innovation, people want to be fashionable, people want to stand out, etc. Packard (1960) also pointed this out, stating that individual happiness was at the foremost focus of society. In order to keep up with the ever-changing fashion, social expectations, and peer pressure, consumers feel compelled to acquire new products. Nowadays everyone is a consumer, and everything has become consumption (Hellmann, and Luedicke, 2018). Customers are under constant manipulation from producers and are influenced through many platforms and methods, that induce planned obsolescence, however ultimately, in many cases, these acquisitions serve and satisfy the needs of said customers and the decision, in the end, is made by them. Whether these aspirations and needs are natural, and companies only utilise them to further their goals, or they have been

artificially groomed and fed to normalise them through decades of marketing, advertising, and obsolescence-filled production, it is clear that customers still have the power of choice about whether to purchase a product or not and where to obtain it from. So as long as consumers are satisfied with the current system of production, the self-inflicted cycle of obsolescence will continue to function, and demand will be met with adequate supply. The role of customers in the planned obsolescence mechanism is to provide the demand and consume everything, that producers, who will make sure to convince them about making purchases, offer.

2.5 Benefits & Positive obsolescence

As mentioned at the beginning of this paper, planned obsolescence is a two-faced coin, that due to its complexity, can be examined from numerous standpoints. Both the beneficial and detrimental nature of this phenomenon can be argued, as it relates to many areas of the industry and society. At first glance obsolescence seems like a scam, an attack on customers that exploits them in order to raise profits, subsequently harming the environment. While there is truth in this assumption, the case can be examined from the perspective of benefits to see how it drives forward the economy, technology, and society.

Due to the application of planned obsolescence ‘companies can produce more, generate employment, profits, stimulate competition among companies, improve the search to incorporate innovation/new technologies in their products and thus generating progress.’ (Satyro et al., 2018, p. 749)

Subsections 2.1; 2.2 and 2.3 presented the concept of planned obsolescence and the different methods it can be applied and utilised. This subsection (2.5) will continue exploring planned obsolescence by presenting the positive side of the argument revolving around it, discussing the benefits it provides in different environments in the following categories:

- I. Benefits for firms
- II. Benefits for employees
- III. Benefits for technology
- IV. Benefits for consumers
- V. Functional obsolescence

As stated previously in Section (2), Karakuş Umar and Beyaz (2021) explored the concept of planned obsolescence by conducting in-depth interviews with 21 experts in the fields of economics, business, mathematics, sociology, and engineering. According to the statements of the interviewees, two sides of the argument were brought up. A significant rate of the experts

argued the advantages of planned obsolescence, stating its values and importance in social, economic, technological, and ecological development.

I. Benefits for Firms

The most obvious sector, that benefits from the obsolescence phenomenon is that of production. It is the producers and manufacturers that apply planned obsolescence to further the goals of their company, so it is only natural, that they profit from it. By implementing planned obsolescence into product design, manufacturers have a notable amount of control over the lifespan of their products. As it was previously discussed, firms have numerous opportunities to incite purchases, and more purchases lead to increased incomes for the companies.

‘Usually, the longer the life span, the costlier the system will be’. (Gomes de Oliveira, 2013, p. 262) This means that durable products can be sold for higher prices, but this way fewer consumers will be able to afford the products. Although by applying a non-durable product design, producers charge less for a product, than they possibly could in case of long-lasting products, the low lifespan, that incites repeat purchases provides the possibility for great income. The higher profit margins allow the company to continue producing further products and/or services and thus enabling the firm to stay profitable and relevant in competitive markets.

II. Benefits for Employees

Employees, as professional workers of a firm can also benefit from the application of planned obsolescence methodologies in product design. The benefits of employees are derived from the advantages that producers experience from the phenomenon, as the higher profit margins enable the firms to continue their work, thus maintaining and creating jobs. The planned obsolescence mechanism is oftentimes an element of mass production, that brings forth different work processes before, during, and after a product's lifetime, such as designing, manufacturing, assembling, repairing, redesigning, developing, inventing, etc. These processes are amplified by obsolescence as it creates shorter release periods and these processes are actually always present simultaneously, overlapping with each other. To be able to keep these work-flows going, companies need plenty of employees. Compared to a durable product-design-based approach, where specific products are sustained for a longer period and are less prone to failure, less redesigning, assembling, and repairing is needed, so fewer employees are utilised in the labour market. Owing to planned obsolescence, many workers are provided with job opportunities, that might bring possibilities, such as professional development, work experience, education under the supervision, and many times with the support of the company,

and most importantly, an increased number of jobholders can earn a salary, needed to sustain themselves.

III. Benefits for Technology

When it comes to describing the beneficial impact of planned obsolescence, technology is often brought up in literature as one of the main sectors of interest. (Packard, 1960; Fishman, Gandal and Shy, 1993; Pantano, Iazzolino and Migliano, 2013; Satyro et al., 2018; Karakuş Umar and Beyaz, 2021)

Pantano, Iazzolino and Migliano (2013) state, that innovation has become a critical driving factor in the competitive sphere. The pressure of competition induces motivation to improve and innovate, creating new technologies and shortening the lifespan of current technology. ‘Guiltinan (2008) considers planned obsolescence as a tool that enables innovations to spread to the whole society.’ (Karakuş Umar and Beyaz, 2021 p. 188.)

The technological benefits of planned obsolescence, which can be achieved by producing low-durability goods, can also be examined via exploring the inconveniences of durable good production. Fishman and Rob (2000) argue, that if a monopolist strives for a durable good manufacturing strategy, they innovate too slowly, which must be compensated by waiting a longer period of time between releasing new products, which in turn leads to a slow pace of technological innovation. If the producer were to release a product earlier, it would not provide an attractive number of new services, social value, and utility, considering that the previous model is still perfectly functional, so the monopolist would not be able to charge a satisfactory price for the new model. On the contrary, consumers are willing to pay for more new products if the previous ones have limited lifespans. According to Fishman and Rob (2000) by synchronizing the "expiration" of previous models and the appearance of new ones, the monopolists are incited to innovate.

Fishman, Gandal and Shy (1993), according to the results of their model, that compared durable and non-durable product design, also concluded, that planned obsolescence promoted technological progress and advancement. They associated non-durable product design with continuous innovation, while durable product design was linked with stagnation, as in the case of such product design, potential innovators might lack the incentive to improve the current technologies.

IV. Benefits for Customers

When it comes to a business strategy, such as planned obsolescence, it is intriguing to consider, that it bears any advantages towards consumers, considering its manipulative and exploitative nature, previously described, however, it in fact can provide numerous benefits to customers in several different ways.

It is important to remember that the economy is powered by consumer demand, which naturally evolves and changes over time. Customers are used to and thus expect innovation. They do not stay pleased with a product for long periods, the marginal satisfaction that they derive from owning a product deteriorates at a faster pace, and thus they will crave newer and better products. This shows, that planned obsolescence allows them to satisfy these needs and wants for improvement and evolution. In order to keep up with these constantly changing trends in demand, it is not optimal for manufacturers to create long-lasting products, as they would become psychologically obsolete in the eyes of customers after a certain amount of time. This idea is reinforced by the experts' opinions in Karakuş Umar and Beyaz (2021), that state, that oftentimes customers either get bored of or just do not wish to use products for longer periods.

Installing planned obsolescence and opting for a non-durable product design means, that manufacturers can use cheaper materials and use less capital in constructing the products, thus reducing the price of the final product as well. Due to the affordability of non-durables, consumers can more easily repurchase products in case of failure and can save themselves the hassle of repairs and maintenance and the costs related to these processes, while also making it possible for low-income consumers to access the given products. There appears to be an 'invisible agreement between customers and producers' regarding the pricing of products, meaning, that usually the price of a product indicates its durability, and one can know, that by opting to purchase a low-price product, they accept its inferior quality and shorter lifetime. (Karakuş Umar and Beyaz, 2021) In brief, it can be stated, that planned obsolescence eliminates the extra costs, that would emerge from durable good production, making the products available for a broader range of customers.

Strausz (2009) proposed a theory, exploring planned obsolescence in a rather unique way, as an incentive device, that might benefit customers. Strausz (2009) argued, that owing to planned obsolescence inciting more frequent purchases, customers have power over producers, as they can punish a lack of quality in products more frequently. If a product does not have the expected quality, customers might opt for a different product, leading to losses for the company.

V. Functional Obsolescence

The obsolescence of products should not always be regarded as something negative. We can identify a branch of obsolescence, that is closely related to innovation, technological benefits, consumer benefits, and perceived product value: functional obsolescence.

Packard (1960) described the obsolescence of function the following way: ‘In this situation an existing product becomes outmoded when a product is introduced that performs the function better.’ (Packard, 1960, p. 38)

As it was previously discussed, innovation is a constant part of product design. Products have evolved over time and continue to do so. This evolution is a normal part of the process, as depreciation is natural in the lifecycle of a product. Innovators find better ways to manufacture products, invent and use new technologies and create better outputs, that function better than their older counterparts. Examples of this process include the transition from horses to cars, and the improvement of different car models, better engines, and additional functionalities; the evolution of phones, the creation of mobile phones and their progress to where they are today; the advancement of televisions, from bulky boxes with black and white screens to flatscreen, high resolution coloured tv sets with high sound quality; etc. However, a part of this process is outshining a previous model, which loses from its perspectival value and might become obsolete. This, in most cases, is beneficial for technology, customers, and society as a whole.

Functional obsolescence can also be described as ‘the reduction of an object's usefulness or desirability because of an outdated design feature that cannot be easily changed or updated.’

(Hayes, 2021)²¹ Hayes (2021) explains, that functional obsolescence can be present in the real estate industry as well, as house and apartment designs can become outdated or can be unfit for a neighbourhood due to either their old age or their excessive modernity, depending on the characteristics of the area, but he also mentions the furniture industry and technology.

In conclusion, we can say, that functional obsolescence exists as a justifiable and viable type of obsolescence, which is driven not by malicious intentions, but by striving to improve our products and thus can be seen as part of the progress in technology and innovation.

In summary, it can clearly be stated, that the planned obsolescence phenomenon possesses numerous advantages to both the economy and society. As a matter of fact, it is a great driving force of the economy, that creates a constant flow of products and capital, makes products available for lower-income people, satisfies the fast-changing trends in demand, creates employment, and also supports and encourages innovation and development.

²¹ <https://www.investopedia.com/terms/f/functional-obsolescence.asp>

‘And Brooks Stevens, a leading industrial designer, explained obsolescence planning in these terms: "Our whole economy is based on planned obsolescence, and everybody who can read without moving his lips should know it by now. We make good products, we induce people to buy them, and then next year we deliberately introduce something that will make those products old fashioned, out of date, obsolete. . . . It isn't organized waste. *It's a sound contribution to the American economy.*"’ (Packard, 1960 p. 38.)

3. The environmental impact of planned obsolescence

3.1 Limitations of the linear economy

Planned obsolescence, due to its nature of inciting frequent product displacement and replacement, reinforces the problematic current view of production in most industries: the linear economy. *Figure 6.* shows the main idea of the linear economy: Extract resources, transform them into products, distribute them, use them, and eventually get rid of them. This process assumes (or at least works in a way, that pretends), that the resources and the regenerative capacity of Earth are unlimited. This is a major flaw, as one of the key base ideas of economics is scarcity, which states, that the resources, that are available in the economy (and in the world in general) are in fact, limited.

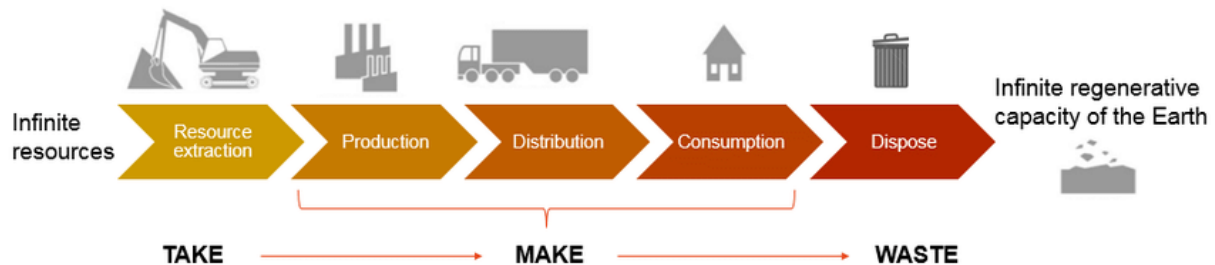


Figure 6. The linear economy - The 'take, make and waste' approach of production

Source: Wautelet (2018) p. 18

Satyro et al. (2018) argue, that what once was acceptable and justifiable in terms of inciting purchases in order to boost the economy, using the abundant resources, is no longer sustainable and should not be upheld any longer. They used a population growth model (*Figure 7.*) to demonstrate the unsustainability of the practice of planned obsolescence. The figure based on the estimates of the Netherlands Environmental Assessment Agency, History Database of the Global Environment shows the global population from 1900 to 1950, from 1950 to 2015, and from 2015 to 2100 with three different projected scenarios: low fertility, medium fertility, and high fertility.

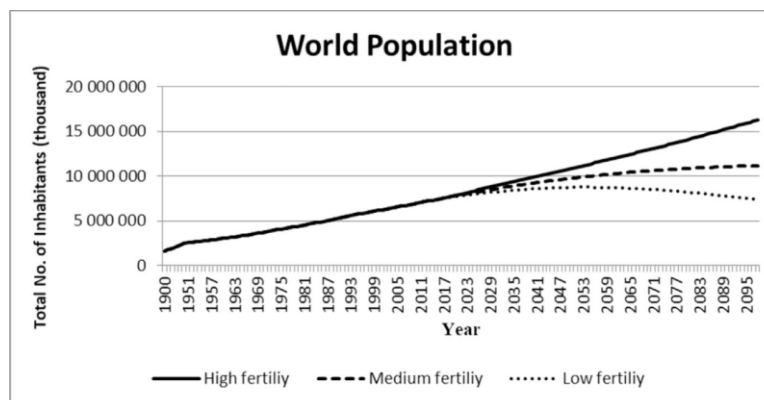


Figure 7. World Population
Source: Satyro et al. (2018) p. 747

Initially, as written in Chapter (1), planned obsolescence was used to help the economy recuperate from the economic crisis of the 1930s. The global population in that period was about 2.08 billion. According to the medium fertility scenario of the world population figure of Satyro et al. (2018), it can be seen, that by 2050, the global population will grow to 10 billion. That's around a 2 billion increase from today's (2022) world population, almost the same amount as the population of 1930. A larger population means a larger market, which provides the possibility of a higher profit for manufacturers and entrepreneurs. However, to satisfy the natural and artificially induced needs and wants of a population, five times larger, than that of 1930, requires significantly more industrial activity, leading to higher emissions from factories.

Greenhouse gas emissions are one of the highest contributing factors of human Induced climate change. Ever since the Industrial Revolution, industrial activity started to rise exponentially. Climate change refers to the long-term shifts and changes in the patterns of Earth's weather and climate. (United Nations (2020); Stillman, D. and Green, J. (2014); Australian Academy of Science (2021); ec.europa.eu. (n.d.))²² Partially it's a natural and paternal process, as Earth's climate is ever-changing. Climate can be affected by natural sources, like distance from the Sun, solar activities, tectonic activities, volcano eruptions, etc. The climate, under natural circumstances, shifts slowly and gradually over various thousands of years, however over the last 250 years, human activities started to significantly interfere with the natural cycle of the planet's climate, accelerating the process. The Earth's climate is experiencing changes, that

²² <https://www.un.org/en/climatechange/what-is-climate-change>
<https://www.nasa.gov/audience/forstudents/k-4/stories/nasa-knows/what-is-climate-change-k4.html>
<https://www.science.org.au/learning/general-audience/science-climate-change/1-what-is-climate-change>
<https://ec.europa.eu/eurostat/web/climate-change>

have never been seen before. With the Industrial Revolution, the industry, technology, and society went through a serious change. Mass production and mass consumption began and so did the significant increase in pollution, with more and more CO₂ and other greenhouse gases entering the atmosphere. Coal, oil, and fossil fuels; all these energy sources combined with industrialization induce a level of contamination that has never been seen before. *Figure 8.* shows the cumulative CO₂ emissions worldwide from 1750 to 2020, by region (in billion metric tons). This helps us fathom the progress of contamination from the Industrial Revolution until today.

Cumulative carbon dioxide emissions worldwide from 1750 to 2020, by region (in billion metric tons)

Global cumulative CO₂ emissions 1750-2020, by region

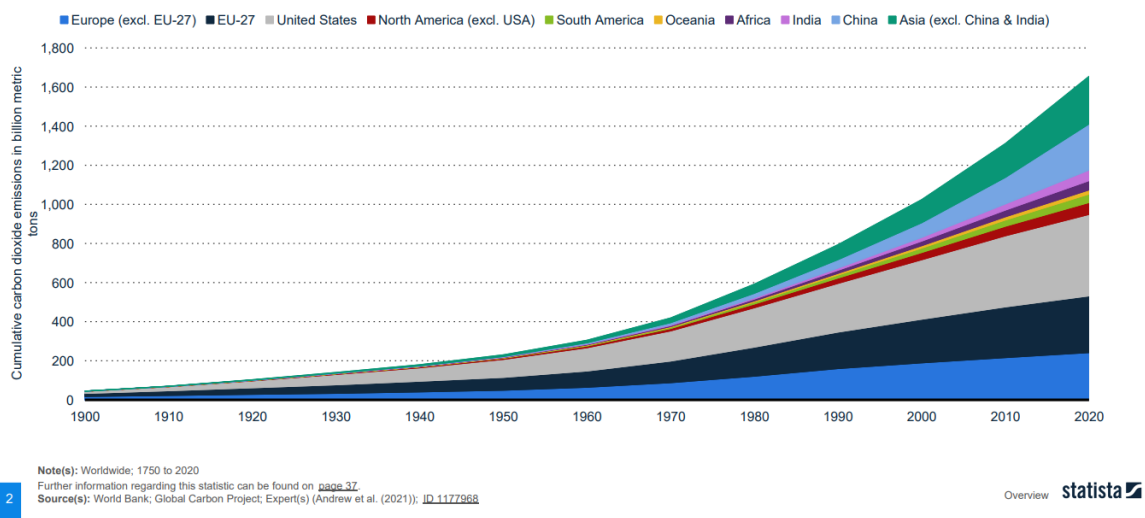


Figure 8. Cumulative carbon dioxide emissions worldwide from 1750 to 2020, by region (in billion metric tons)

Source: Expert(s) (Andrew et al. (2021)); Global Carbon Project; World Bank - Emissions Worldwide - Statista.com

It can be seen, that due to fossil fuel combustion, around 40 billion metric tons of carbon dioxide was emitted into the atmosphere from 1750 to 1950. Countries in Europe emitted roughly three-quarters of the total emissions up to that point. Despite the fact, that the United States started to industrialise later, than most European countries (late 1800's – Second Industrial Revolution), the country rapidly became one of the biggest emitters, contributing a total of 92 gigatons of CO₂ (GtCO₂) by 1950, almost the same amount as Europe. The US industry continued to significantly expand, leading to an immense amount of greenhouse gas emissions. By 2020, the US stands as the highest producer of such substances with 416.72 GtCO₂ emitted into the atmosphere in 2020. China is the 2nd highest emitter in history as of 2020, however, the country

only started to experience a large expansion in its industries in the last couple of decades. Compared to 1950, when China contributed only 1.87 GtCO₂ to the global total, by 2020 they stood at 235 GtCO₂. By 2020 the global total of cumulative carbon emissions is nearing 1700 gigatons.

It is clear that the current economic system is unsustainable in the long run. Natural resources are scarce and environmental pollution is becoming a serious issue. Planned obsolescence ignores both these issues, as it keeps on feeding the linear cycle of mass production and the 'throw-away society'. The creation of these products requires industrial processes, that further contaminate the environment. From the initial phases of manufacturing until consumers get rid of the product and create waste. The life cycle of products is prone to contamination. To reduce the levels of contamination and meet the goals set in the Paris Agreement, unnecessary product manufacturing should be reduced. The already scarce natural resources will not be able to satisfy the consumer needs under a system that functions in a way as the current one.

“Anyone who believes that infinite growth is compatible with a finite planet is a fool or an economist” (Serge Latouche – The Lightbulb Conspiracy)

3.2 “The Waste Makers”²³

One of the main issues of planned obsolescence is its nature to reinforce actions and behaviour, that are detrimental to the environment. Apart from the growing water and air pollution deriving from extensive and excessive industrial activities, planned obsolescence also plays a significant role in waste generation.

The throwaway culture and the common product replacement induced by planned obsolescence contribute to waste generation in significant measures, and in turn to air, soil, and water pollution as well, due to the contaminants released during production and the numerous hazardous toxins contained in the waste streams. Accordingly, a significant amount of resources and energy are used in the production of electric and electronic devices and the continuous hedonistic acquisition of goods for individual joy encourages the unnecessary waste of these limited resources.

According to Karakuş Umar and Beyaz (2021), planned obsolescence can also be defined as the sum of characteristics that pollute the environment and waste resources. The world is on the

²³Reference to Vance Packard's book of the same title. An essential element of literature on the topic of consumerism

verge of a climate crisis and there are already irreversible consequences in motion. Packard in his book, "The Waste Makers" (1960) already argued the societal consequences of a 'throwaway society'. In his paper it was stated, that 'manufactured obsolescence significantly accelerates the depletion of scarce resources and, as a consequence, exacerbates environmental pollution'. (Hellmann, and Luedicke, 2018, p. 84) Packard pointed out the connection between hedonic consumption and environmental decline. He concluded that individual happiness was society's most significant focus, pushing everything else to the side. Hellmann and Luedicke (2018) pointed out the 'irony (or tragedy)' of a throwaway society: Everyone is striving to increase personal happiness through consumption, while the very same consumerist behaviour induces numerous issues, such as 'diminishing social ties, increasing toxic imbalances, and destructing the environment.' (Hellmann and Luedicke, 2018, p. 85)

3.2.1 E-waste generation and management

E-waste or in other words waste electrical or electronic equipment (WEEE) is a relevant and growing issue related to planned obsolescence. EEE can be described as a wide category of products 'with circuitry or electrical components with power or battery supply.' (The Global E-waste Monitor 2020) These products are present in almost all parts of our everyday life, ranging from our household appliances to health care and transportation, as well as many other places, becoming more and more popular. Although having exact measures to gauge e-waste is not commonplace yet, we can state, that once these products are disposed of, they become e-waste. *Table 3.* Shows data on e-waste generation worldwide (2014, 2019).

Table 3. Data on e-waste generation worldwide (2014, 2019)		
	2014	2019
Volume of e-waste in million metric tons (Mt)	44,4	53, 6
Volume of e-waste in kilograms per capita	6,4	7,3
Global e-waste documented to be collected and properly recycled in million metric tons	7,5	9,3

Table 3. Data on Waste Generation Worldwide (2014, 2019). Own edit based on statistical data from statista.com²⁴ and The Global E-waste Monitor 2020.

Although it is hard to forecast exact trends in the growth of e-waste generation, current statistical data can be used to better understand ongoing tendencies. Forti et al. (2020) in The Global E-waste Monitor 2020 compared data on waste generation and recycling between 2014 and 2019 to highlight the progression of trends in waste flows. In 2014, 44Mt (6,4 kg/capita)

²⁴ <https://www.statista.com/statistics/499891/projection-ewaste-generation-worldwide/>
<https://www.statista.com/statistics/499904/projection-ewaste-generation-per-capita-worldwide/>

of e-waste was estimated to be generated worldwide, out of which 7,5Mt (17% of total e-waste) was documented to be collected and recycled in a proper manner. In 2019 the e-waste generated reached 53,6 Mt (7,3/capita), a growth of 9,2 Mt since 2014, while the e-waste recycled also increased to 9,3 (17,4% of total e-waste), a growth of 1,8 Mt. The statistical data from this 5-year period allows us to draw some conclusions. There's a clear increasing tendency in the amount of e-waste generated, however the 0,9 kg per capita increase in the volume of e-waste shows, that the e-waste generated grew at a higher rate than the population, hence showing, that the tendency in personal waste generation rose. Positive tendencies can be seen as well, as the collected and properly recycled e-waste has also increased. Not only that but the proportion of the total annual e-waste that was recycled increased as well, by 0,4%, however, it must be highlighted, that this 1,8Mt increase in recycled e-waste, a 0,36Mt mean annual growth between 2014 and 2019 is minuscule compared to the 9,2Mt or 1,84Mt mean annual increase in the total documented e-waste generated, indicating, that current recycling trends cannot keep up with the increasing trends with the global e-waste growth.

The report also states that in 2019 'the large majority of e-waste generated (44,3 Mt - 82.6%) was most likely not formally collected and not managed in an environmentally sound manner' and that this amount was handled outside of the official collections system or shipped to developing countries, which is also stated in Malinauskaite and Erdem (2021), as in their paper it is stated that EU countries ship approximately 352,474 metric tonnes of electronic waste to developing countries annually. Moreover, in The Global E-waste Monitor 2020, it is also revealed, that presumably around 0,6Mt of e-waste ended up in waste bins together with regular municipal solid waste (MSW).

The proper handling of WEEE is also really important due to the fact that these waste streams contain numerous toxic materials and substances. Malinauskaite and Erdem (2021) point out that the high prevalence of permanent toxins in e-waste, such as arsenic, cadmium, and radioactive substances are detrimental to the health of those residing near sites affected by this waste and can lead to illness and disease. Moreover, WEEE, without adequate handling and management can further contaminate and pollute the environment and cause hardship and illness for the people in affected areas in the recycling process. Lin et al. (2021) state, that in China, the major receiver of WEEE from the USA and Japan in the 2000s, and in countries like Ghana, India, Vietnam, Thailand, and Pakistan, where e-waste has been diverted to in meaningful quantities since the more firm restrictions imposed in 2012 in China, primitive recycling processes and methods have been adopted repeatedly, without considering the

consequences these actions have for the environment and human health. In their research paper, they describe how different unsafe and unprofessional recycling methods lead to different toxic substances being released into the soil, dust, air, and water. These pathways make it possible for these toxic materials and chemicals to enter the human body through inhalation or ingestion.

It can clearly be seen that there are huge waste-management issues that need to be settled and fixed in order to tackle the issue of the growing wastelands, landfills, and the problem of wasting scarce resources, that could be valuable in recycling. As long as the large majority of the generated e-waste is not collected properly and its management is unknown, no significant changes can be expected in the matter of the environmentally friendly and progressive handling of WEEE.

3.2.2 Fashion waste

The tendencies related to consumer society are expanding more and more to the EEE, which is especially true for fashion products, most importantly clothes. To satisfy the fast-changing demand of buyers, producers and manufacturers opt for the adaptation of planned obsolescence to keep up with fast fashion, by creating cheap and non-durable products. This is the reason for the large increasing tendency in the textile waste generated over the last decades. According to the measures of EPA, which can be seen in *Table 4.*, we can see, that in 2018 over 17 million tons of textile waste were generated. This represents 5,8% of the total municipal solid waste of the year. In the same year, around 2,5 million tons of textile were recycled, demonstrating a 14,7% recycling rate. This shows that the large majority of clothing items and other textiles are disposed of. 3,2 million tons of textile waste were combusted, 18,9% of the total textile waste generated and 11,3 million tons were landfilled, which represents over 2/3 of the annual waste generation. There seem to be positive trends, as according to this data, the textile waste generation is growing at a slower and slower rate, while the recycling tendency increased up until 2005 and the rate of landfilled textiles decreased until the same year. However, after 2005, these latter 2 trends turned around, recycling rate started to diminish, while the rate of landfilled textiles started to rise.

According to RoadRunner (Brown, 2021)²⁵, the landfilled textiles take more than 200 years to decompose. During this process, they also release greenhouse gases, that contribute to climate change, as well as release toxic substances and chemicals to the soil and groundwater.

²⁵ <https://www.roadrunnerwm.com/blog/textile-waste-environmental-crisis>

Table 4. 1960-2018 Data on Textiles in MSW by Weight (in thousands of U.S. tons)										
Management Pathway	1960	1970	1980	1990	2000	2005	2010	2015	2017	2018
Generation	1,760	2,040	2,530	5,810	9,480	11,510	13,220	16,060	16,890	17,030
Recycled	50	60	160	660	1,320	1,830	2,050	2,460	2,570	2,510
Composted	-	-	-	-	-	-	-	-	-	-
Combustion with Energy Recovery	-	10	50	880	1,880	2,110	2,270	3,060	3,170	3,220
Landfilled	1,710	1,970	2,320	4,270	6,280	7,570	8,900	10,540	11,150	11,300

Table 4. 1960-2018 Data on Textiles in MSW by Weight (in thousands of U.S. tons)
Source: (US EPA, 2018) - American Apparel and Footwear Association, International Trade Commission, the U.S. Department of Commerce's Office of Textiles and Apparel, and the Council for Textile Recycling

4. Current movements and the future implications of planned obsolescence

In this chapter, the current issues, legislation, and movements related to planned obsolescence will be discussed, as well as future possibilities in product design.

To understand the current and future implications for planned obsolescence, the 'Circular economy' model must be explored first. According to the official website of the European Parliament, the circular economy 'is a model of production and consumption, which involves sharing, leasing, reusing, repairing, refurbishing, and recycling existing materials and products as long as possible. In this way, the life cycle of products is extended.' (European Parliament, 2015) It is evident that this system is an extension of the 'Linear economy model' mentioned in Chapter (3), but instead of following the take-make-use-throw-away mindset, this process has the goal of 'closing the loop' (Malinauskaite and Erdem, 2021, p. 729) and creating a more self-sustaining system. In contrast to *Figure 6.*, which shows the linear economy model, it can be seen that *Figure 9.* presents the model as a closed circle, that partially sustains itself and reuses materials instead of only relying on primary raw materials and additionally improves on waste-management.

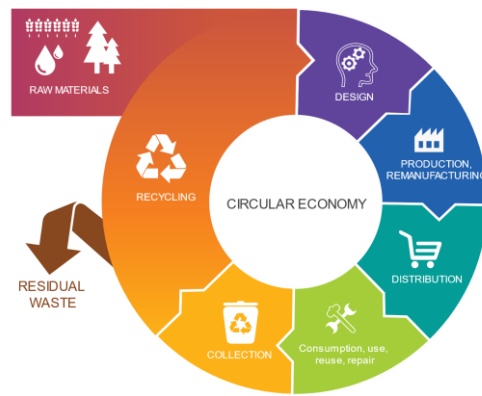


Figure 9: Circular economy model

Source: (European Parliament, 2015)

<https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits> (downloaded: 2022.10.14)

Planned obsolescence, as explored so far in this paper appears to contradict the main ideas of the circular economy, such as extending product lifetimes, reducing waste generation, reducing greenhouse gas emissions, etc. Hence, if there is to be a change in our current economic system and regulations are to be put in place regarding product design and waste management, the issue of planned obsolescence has to be addressed as well.

The legislations and current movements in the matter of the circular economy are highly connected to the different aspects and affected areas of planned obsolescence.

The European Parliament (2015)²⁶ describes 3 recent milestones in the process of transition of the EU towards a circular economy, which include sustainable product design and right to repair. Furthermore, Malinauskaite and Erdem (2021) discuss, that the European Parliament has urged the European Commission to address the issue of planned obsolescence by creating an ‘EU-level definition of planned obsolescence for tangible goods and software; to examine the possibility of establishing an independent system that could test and detect the built-in obsolescence in products’ (Malinauskaite and Erdem, 2021, p. 746).

A highly relevant movement related to planned obsolescence is the 'Right to repair' movement. This campaign was launched in 2019, to combat the high e-waste generation and pollution and advocate for sustainability. They are now present in over 20 European countries in the form of more than 100 active organisations. (Right to Repair Europe, n.d.)

²⁶ <https://www.europarl.europa.eu/news/en/headlines/economy/20151201STO05603/circular-economy-definition-importance-and-benefits>

The movement revolves around standing up for the right to repair, which is explained on their official website²⁷ in 3 main points:

1. Good design
 - Design of longer lasting and repairable products
2. Fair access
 - Making repair affordable
 - Removing legal barriers from repair, allowing everyone to fix products
 - Making spare parts and manuals accessible
3. Informed customers
 - Providing more information to customers at the time of purchase about products and their repairability

Source: (Right to Repair Europe, n.d.)

Both the circular economy model and the right-to-repair movement argue that there needs to be a significant change in the product design, that planned obsolescence relies on and stimulates. Recent papers suggest a solution for the issues of product design: products as services. World Economic Forum and PACE (2019) describe how certain products, previously owned by customers have shifted towards becoming services. Examples include physical CDs, DVDs, and even Blue-ray discs being over-taken by the subscription-based service of Netflix; car services like taxis or Uber, which act as substitute services instead of using our own car and Rolls Royce selling engine time in place of jet engines. So, this model, based on renting and a subscription model already exists. World Economic Forum and PACE (2019) propose a service model like this for electronics. The collaborating experts believe that a system like this could solve numerous issues that have been previously mentioned. With this model consumers would have reduced barriers to ownership and would avoid high up-front costs and would have continuous access to innovation. As a product's upgradability, repairability, durability, and recyclability would now serve the firms as well, manufacturers would have an incentive to properly allocate resources and create products with higher lifespans. Products being in use for a longer period, better upgradability and repairability would prove beneficial for the environment as well, as waste generation would reduce, and a more sustainable viewpoint could gain space in manufacturing. (World Economic Forum and PACE, 2019)

²⁷ <https://repair.eu/what-we-want/>

There may be many possibilities lying in a circular economy model, and it is certain, that in the process planned obsolescence needs to be addressed. However, it is important to keep in mind, that planned obsolescence has proven to be beneficial in the economy and in terms of jobs and so if the system were to change, there must be a solution for a possible disturbance in these fields.

5. Empirical research: Further exploration of the consumer side of planned obsolescence

During the literature survey about planned obsolescence, I realised, that most of the research papers put focus on exploring the corporate side of the phenomenon. Many papers aim to study specific areas of the process, such as the functionality of obsolescence, environmental impact, sustainability, or the consumer side. However, I have found, that the latter aspect could use further elaboration and exploration, as its examination in literature is limited, especially in the case of the Hungarian adult population, where I could not find any investigation, that would gauge data in this layered area.

In this chapter, the consumer side of planned obsolescence will be further explored through conducting empirical research. The multiple aspects and areas of planned obsolescence, that have previously been explored in past chapters of this paper, such as physical, technological, perceived, and functional obsolescence; repairability, perceived product value, marketing strategies, and sustainability will be examined from a different point of view: the consumers' side. This way the empirical research will not only be an independent chapter but will also act as a complementary part to the literature review.

The topic of my research is the role, that customers play in the process of planned obsolescence and how they contribute to its existence, as well as their reactions, opinions, and feelings related to the practice of planned obsolescence. My goal was to explore the habits, preferences, and opinions of the target group, which is the Hungarian consumer population above the age of 18. With my research, I intend to answer the following *research questions*:

- How satisfied are the consumers with the lifetime of their devices?
- What are consumers' standpoints on product repair?
- What are the reasons consumers replace their products and what does this reflect about planned obsolescence?
- What are the consumer opinions and standpoints on the practice of planned obsolescence?
- What is consumers' perception of their products in case of functional and/or aesthetic faults?

For my research, I have decided to implement a mixed methodology of quantitative and qualitative research, as I believe these methods can complement each other well in the research of consumer behaviour. The weaknesses of one method could be compensated for by the strength of the other. The different types of data allow me to present a broader picture of the topic, from different standpoints. The qualitative research can function as an explanatory continuation of the quantitative findings. To fill the void of findings in the Hungarian environment I conducted an online survey with the goal of gauging consumer behaviour and habits related to planned obsolescence. My intention with this quantitative research is to get a broader image, through a direct examination, of the consumer choices, that reflect on planned obsolescence, which can be presented with numerical data. This way, using by studying the data and statistical analysis, correlations can be explored among the different measured factors.

To better understand consumer choices and behaviour and to get insight into the consumer reactions to planned obsolescence, I have decided to also conduct qualitative research in the form of a focus group interview. The aim of this research is to provide background information for the quantitative research in the form of feelings, opinions, and reactions, related to this phenomenon.

I believe that these research methods complement each other well and provide the possibility for getting a comprehensive view of the different aspects of the consumer side of planned obsolescence.

5.1 Quantitative research – Online survey

5.1.1 Methodology

For conducting the quantitative research, the usage of an online survey was chosen, due to its straightforwardness and quickness in reaching people. I have utilised a nonprobability sampling procedure, conducting the research with the date of the people I could reach in an uncomplicated manner. The online survey was mainly presented on social media and got distributed via sharing. Moreover, my more immediate proximity also got aware of it by word of mouth.

The target group of the survey was the adult consuming population of Hungary. The set out required sample was 100, which was successfully fulfilled. The survey ran from September 27 through October 22, 2022. A sample of 161 was collected.

The goal of the survey was to measure the target group's experiences, preferences, and feelings, related to different product types. In order to get the most comprehensive data, the survey was split into different sections, exploring different aspects of product lifecycles and the related

consumer behaviour. After the initial part of a cover letter (see Appendix 1.) and warm-up questions, the questionnaire was split into the following main parts: the preferred lifetime of products, the real lifetime of products, incurred utility during product lifetime, product repairability and repairing habits, product replacement. The closing part was the collection of demographic information. When an answer was to be given on a gradual scale, respondents were presented with a 6-point Likert scale in almost every case, for better comparison.

The responders were asked about multiple product groups to better see the different types of behaviour and preferences related to them. The product groups were the following: small household appliances (coffee machine, microwave, blender, vacuum cleaner, etc.); big household appliances (refrigerator, washing machine, dishwasher, oven, etc.); electronic appliances (mobile phone, television, computer, laptop). Due to the different functionalities and related behaviour of the different electronic appliances, they were examined separately. The reason behind the election of these product groups is that they mostly cover the products, that consumers encounter on a daily basis, and consumer behaviour could be measured well with them. Consumers were purposefully asked in an open manner, that encourages opinion and feeling-based answers, rather than fact-based ones, as I believe this method is more appropriate for understanding consumer behaviour.

After conducting a pre-testing with 4 people and reflecting on the received feedback, the survey was put out for the public on September 27, 2022, and ran until October 22, 2022. The final number of respondents and thus the sample size for further examination of data was 161 people.

5.1.2 Data analysis

The online survey was divided into different sections based on their topic of interest. Respondents were asked to provide some demographic information and after a set of warm-up questions, they were asked questions in the fields of product lifetime, product repairability and repair, and product replacement. *Table 5.* and *Table 6.* summarise the demographic data collected in the survey.

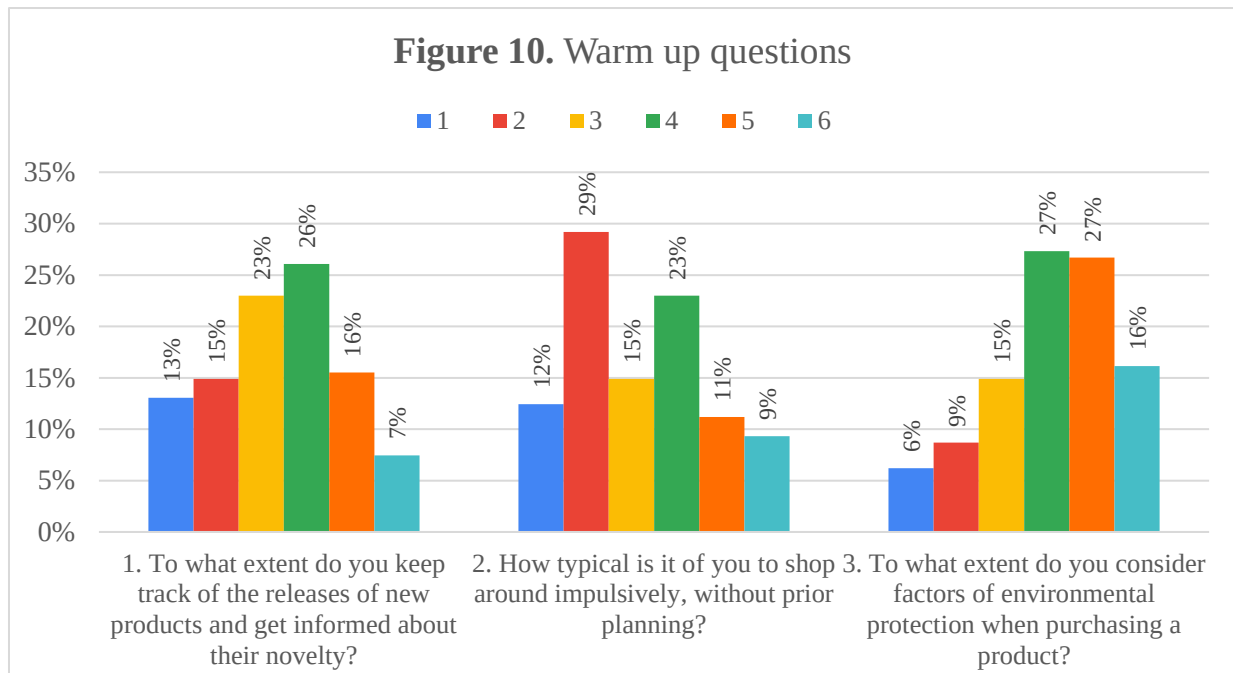
Table 5. Demographic Information of the online survey (1)							
Gender		Age		Place of living		Highest educational level	
Female	65,8%	18-25	33,5%	Village	18,0%	Less than primary school	0,0%
Male	33,5%	26-35	18,0%	City	32,9%	Primary school	0,6%
Other	0,6%	35-45	16,8%	Chief town of a county	41,6%	Technical institute/Vocational high school	19,3%
		45-55	20,5%	Capital city	7,5%	High school	36,6%
		56-65	9,3%			College and above	43,5%
		66+	1,9%				

Table 6. Demographic Information of the online survey (2)					
Number of habitants in household		Perceived value of income		Perceived value of savings	
1	8,1%	Far below average	5,6%	"I possess little savings"	43,5%
2	32,9%	Below average	16,8%	"I possess a saving, that provides security"	31,1%
3	26,1%	Average	39,8%	"I possess a saving, that provides more than security"	6,2%
4	24,8%	Above Average	21,1%	"I possess significant savings"	1,2%
5	6,2%	Far above average	3,1%	"I possess no savings"	18,0%
more than 5	1,9%	No personal income	13,7%		

It is important to note, that most of the respondents (total: 62,2%) value their income as average or below average and most of them (43,5%) possess little savings. It is important to keep this information in mind while examining the consumer behaviour of the sample.

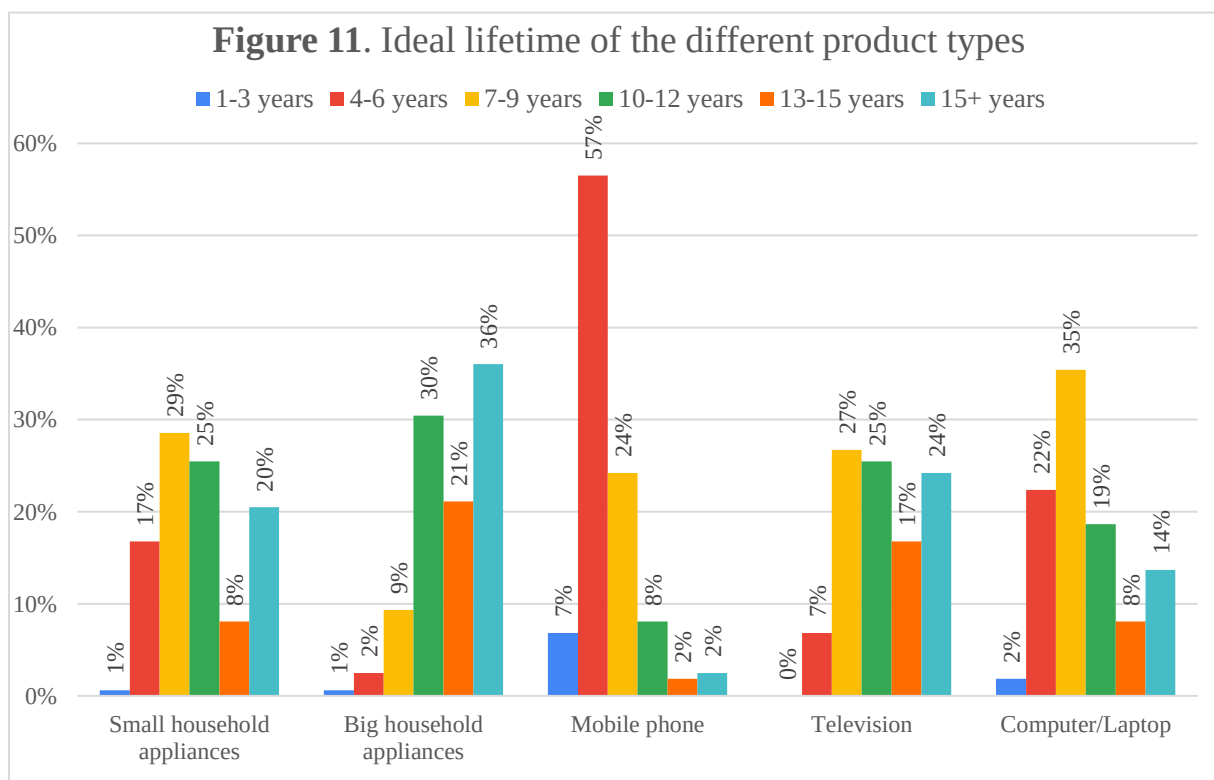
Before the main parts of the survey, the target group was presented with 3 warm-up questions, regarding their up-to-dateness of product releases and innovation, shopping impulsivity, and environmental awareness. These questions relate to different aspects that have been examined in the literature review. *Figure 10.* summarises the responses to these 3 questions. The target group was presented with a 6-point Likert scale, with the extremities representing the following:

- Question 1: 1: I do not follow novelties at all. 6: I completely pay attention to novelties.
- Question 2: 1: It is not typical of me at all. 6: It is very typical of me.
- Question 3: 1: I do not bother with such factors at all. 6: These factors play a really important role in every shopping.



Product lifetime

In the first question regarding product lifetime, consumers were asked about their hypothesized ideal lifetime of the different product types. *Figure 11.* shows the distribution of these ideal lifetimes in the given categories.

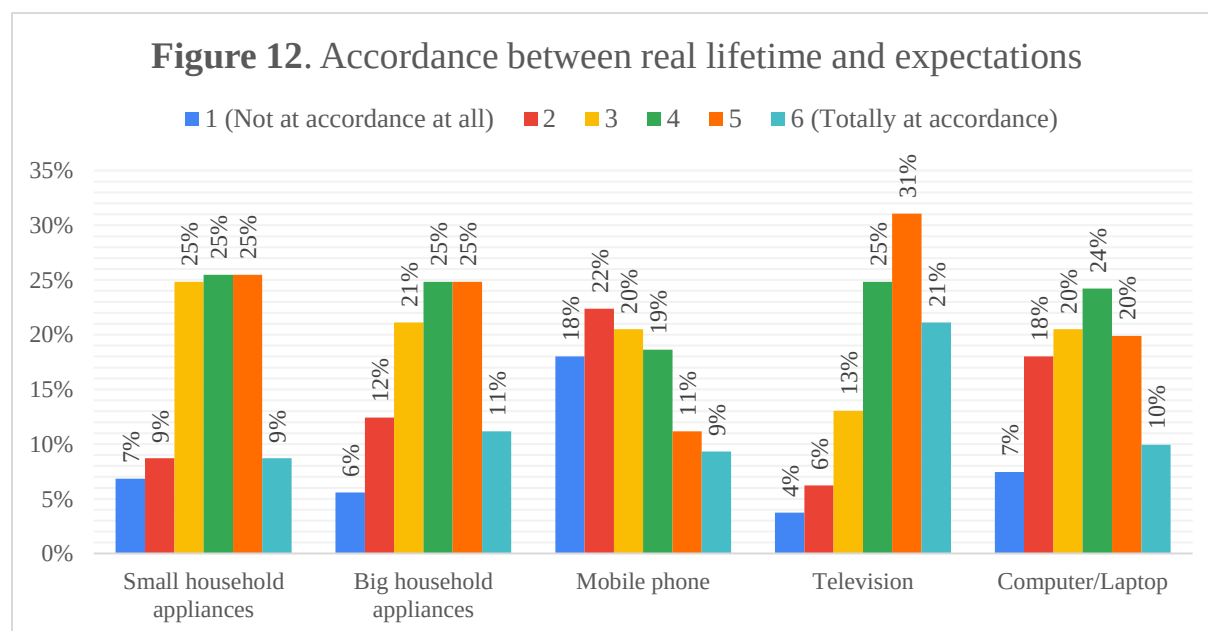


Considering the distribution of data, the categories do not seem to have extreme outliers, with the exception of mobile phones, where more than half (56,5%) of the respondents marked 4-6

years as the ideal lifespan for these products. The category of mobile phones was also the highest with regard to standard deviation, with a value of 34,049. Also, interesting to note, that the rate of respondents, that find 1-3 years the ideal lifetime for mobile phones (6,83%) is higher than that of those who would find lifetimes above 12 years ideal (4,35%).

The only category, where the highest lifetime (15+ years) was dominant, was 'big household appliances', followed by televisions, small household appliances, computers/laptops, and finally mobile phones. In the case of small and big household appliances as well as televisions, the idealised lifetime values seem to be in accordance with the price values associated with them, however mobile phones, and computers/laptops, yield smaller ideal lifetime values, than it would be expected, considering their oftentimes high price ranges.

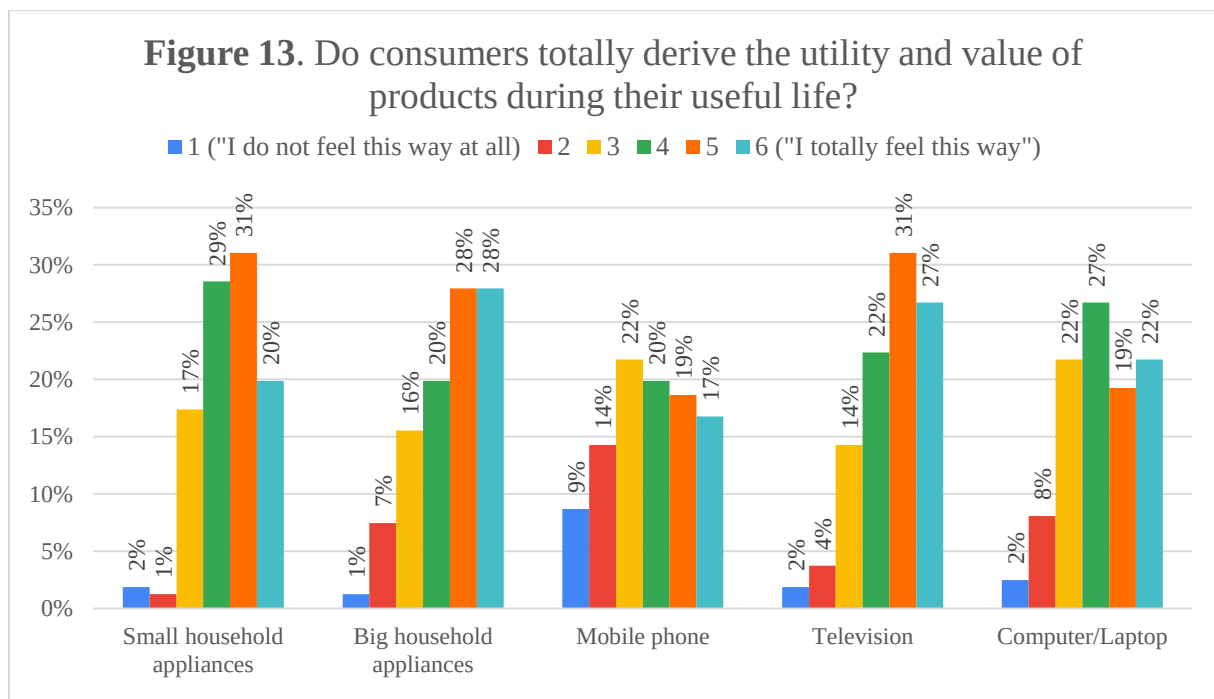
Figure 12. shows the accordance between real lifetime and expectations, or in other words the extent to which consumers feel the real lifetime agrees with their personal expectations. The data provided by the respondents can help in understanding the consumer perception related to product lifetimes. Respondents were asked to what extent the real lifetime of the different product types was in accordance with their expected lifetime. Respondents could mark answers on a scale of 1-6, where 1 meant no accordance at all between the two factors and 6 meant that the two factors were totally in accordance.



Apart from the category of 'mobile phones' all other product types follow an upward sloping tendency, tending to high accordance, but experiencing a fall at total accordance. In these categories, scales 4 and 5 were mostly dominant and the proportion of those, who chose the latter 3 options over the first three options was higher, so it can be said, that in general there

was accordance between the expectation and experiences of the respondents. However, the average proportion of the respondent who felt to different degrees, that there was no accordance between the real lifetime of their products and their expectations, was 41,86%. Mobile phones, however, seem to be outliers once again, being the only category with a downward slope and where the proportion of people not feeling accordance between their expectations and the reality regarding device lifetime outweighed the proportion of those who did. The summed-up proportions of those who opted for the first three options (those, that state 'no accordance' to different degrees) was 60,87%. Additionally, 18% of the respondents stated, that there was no accordance at all between their expectations and the real lifespans of their mobile devices. Seemingly consumers have different expectations for mobile phones, than what they experience right now.

As a final question about product lifetime, consumers were asked if they feel like they can totally derive the value or utility of their product/device throughout its lifetime. Respondents were asked to state their standpoint using a 6-point Likert scale, where 1 stood for 'I do not feel this way at all' and 6 stood for 'I totally feel this way'. With this question as well, my intention was to understand the connection between the preferences of the consumers and their perceived reality connected to product lifetime. As the previous question also tried to tackle this topic, from a different perspective, I expected similar tendencies to appear. *Figure 13.* summarises the data derived from the responses to this question.



If considering the number of consumers, responding with option 6. ('I totally feel this way'), the category with the highest utility provided turns out to be 'Big household appliances'. If

considering the summed-up proportions of options 4, 5, and 6 in their respective categories, which translate to agreeing to certain degrees to the question: 'During the real lifetime of your [product category] can you fully derive the value that you have paid for?', the data shows, that the leading category is 'Television' (80,12%) immediately followed by 'Small household appliances' (79,5%). As in all five categories, the proportion of those who responded with any of the answers, that represent agreement outweighed the proportion of answers of disagreement, it can be stated, that the responding consumers mostly feel like, they can more or less derive the value they seem appropriate for the price they paid, during the lifetime of the product. However, it should be noted, that in the categories 'Mobile phone' and 'Computer/laptop', this tendency is less significant as the previously argued proportions in these groups were 55,28% and 67,7% respectively, while the three other categories' proportions were over 75% in each case.

Product repair

To get a starting image regarding repair habits, the respondents were asked to choose from three choices, that best reflect their behaviour in case of a product failure. 80,1% stated, that they would turn to a professional, 14,9% stated, that they would repair their product themselves and 5% stated, that they would not repair their product.

In the following question, the sample is presented with a multiple-choice table, that included the five product categories and six product defects/faults. The respondents were asked if they would repair their product or get them repaired in case of the following flaws: Aesthetic defect; The product is deteriorated, the state of its material is unsatisfying; Certain functions are impaired; Deteriorating performance, slowing software; The product does not work and cannot be used; I would not repair my product.

To see the different tendencies in these categories, I have decided to examine the responses from both the perspective of product types and defects. As different numbers of responses were submitted for the different categories, proportions are going to be used for comparing the tendencies.

Table 7. and *Table 8.* summarise the number and proportion of responses for the different product categories and divides the information into 'Repair' and 'No repair' categories. By examining the data of the product categories I have found, that among the respondents, *there is a high tendency towards opting for repair in case of product failure.* *Table 8.* shows, that in all product categories, respondents showcased an 85,1% - 96,52% willingness to repair or get their products repaired. This tendency was lowest in 'Small household appliances' (85,1%) and highest in 'Big household appliances' (96,52%).

Table 7. Tendency to repair different products (1)

	Responses		
	TOTAL	Repair	No repair
Small household appliances	261	222	39
Mobile phone	302	271	31
Television	293	271	22
Computer/Laptop	343	331	12
Big household appliances	316	305	11

Table 8. Tendency to repair different products (2)

	Response proportion	
	Repair	No repair
Small household appliances	85,1%	14,9%
Mobile phone	89,7%	10,3%
Television	92,5%	7,5%
Computer/Laptop	96,50%	3,50%
Big household appliances	96,52%	3,48%

Table 9. showcases the responses collected about the different product failures and defects. The presented responses show the number and proportion of people who stated that they would repair their products and devices in the occurrence of the different product faults.

Table 9. Responses and proportions of the different product defects

	Responses	Proportions
Aesthetic defect	103	7%
The product is deteriorated, the state of its material is unsatisfying	216	15%
The product does not work and cannot be used	304	22%
Deteriorating performance, slowing software	315	23%
Certain functions are impaired	462	33%
TOTAL	1400	100%

It can be seen, according to the data provided, that aesthetic defects are less likely to be repaired by consumers than other defects. The tendency to repair aesthetic defects was highest in the product group of 'Mobile phones'. The most dominant product defect, that prompted responses of willingness to repair was 'Certain functions are impaired' (30,5% of the total responses of the product defects) (see Appendix 2. Q5.1.1), however, 'Deteriorating performance' was a leading factor in 'Mobile phones' and 'Computer/laptop', as expected and was also the 2nd most dominant category (20,79%), closely followed by the defect of 'The product does not work and cannot be used' (20,07%). According to the collected and summed up data from this question,

115 responses out of the total 1515 were of the statement 'I would not repair my product'. This yields 7,59% of the total answers, which is fairly close to the 5% rate, that was provided in the previous question, considering the different nature of the questions and that this question was more specific and offered a multiple-choice answer modality.

To see and better understand the respondents's viewpoint on manufacturers practicing certain forms of planned obsolescence, they were asked if they believe, that manufacturers utilise a strategy, that intentionally makes it more difficult to repair products. This question refers to the literature review, more specifically, the 'Limitations on repair' part of the Physical Obsolescence subchapter. Responses were rather uniform, as 93,79% of the respondents agreed to different degrees, that manufacturers, in fact, utilise such strategies, moreover, 50,31% of the respondents stated, that they completely believe, that this is the case.

Having seen and analysed the tendencies to repair or not certain product faults, I now wish to examine the data provided by respondents to the following question: 'If you would not repair your product or would not get it repaired, why do you choose so?'. My goal with this question was to get more insight into the consumer behaviour related to product repair and to see if there are barriers, that might relate to planned obsolescence, and could negatively affect the.

Table 10. demonstrates the number of responses to the different answer options and their proportion of the total responses to the question. Respondents could choose multiple answers.

Table 10. Reasons for choosing not to repair products

	Repair barriers	Number of responses	Response rate
1	It is more economical (price-value rate) to buy a new device than to repair the current one	99	68,3%
2	High repair costs	70	48,3%
3	I am not adept in repairing products	68	46,9%
4	The necessary spare parts are not available for me	36	24,8%
5	I do not have the necessary tools	33	22,8%
6	There is no repair store available	31	21,4%
7	There are too many burdens related to the repairing process	28	19,3%
8	I desire something new	16	11,0%
9	It would be ideal to change the product anyway	1	0,7%
10	The material is worn-out	1	0,7%
11	The defect does not bother me	1	0,7%
	TOTAL RESPONSES	145	

Due to the question's obvious relevance to product repair, the majority of responses in fact related to factors that were previously mentioned in subchapter 2.1.2, 'Limitations on repair', and thus confirm their validity in the literature review. These questions are the following: 1, 2,

4, 6, 7. Answers 1 and 2 both related to the pricey nature of the repairing process and were the most notable answers with 68,3% and 48,3% of the respondents choosing them respectively as reasons for not repairing their products. Answers 4, 5, 6, and 7, which were also significant, ranging from 19,3% to 24,8%, are related to the lack of promotion and infrastructure of repairing, which was also argued in the literature review. Answer 8, which was chosen by 11% of the respondents (although not necessarily) could be related to perceived obsolescence, but there is not enough evidence to state this for sure. Answer 10, which was not originally part of the survey, but was added by one of the respondents states 'The material is worn-out', which I interpret as 'worn-out to a degree, that makes repair pointless'. This answer can have relations with physical obsolescence too, although does not necessarily prove intention from a manufacturer's side. Answer 9 is similar in this case, as it can be related to factors, such as physical or functional obsolescence, the intentional nature of 'planned obsolescence' cannot be stated for certain. The remaining answers, answer 3 and 11 are what I would call justifiable reasons for opting not to repair devices or get them repaired, although the reason provided in answer 3 would only be sensible in case of self-repair.

Owing to the literature review emphasizing electronic devices and mobile phones on multiple occasions, this part of the survey also intends to reflect this by having two questions focusing on EEE and mobile phones. The target group was asked if they believe that it has become more difficult to repair their own electronic devices at home in the last 5-10 years? 77,02% of the respondents answered 'Yes', 4,35% answered 'No' and 18,63% answered 'I do not know'. Based on this information we can state that consumers feel like the self-repair of electronic appliances has become more difficult in the past decade. In the last question about product repair, the target group was asked specifically about their hypothesized behaviour regarding mobile phone repair. They were presented with the following question: 'If the appropriate tools and repair manuals were available, in which of the following cases would you repair your own mobile device?' *Table 11.* presents the responses to the question.

Table 11. Mobile phone repair 'at home'

	Response rate
Battery replacement	51,6%
I would not repair my device myself	48,4%
Screen replacement	32,9%
Camera repair/replacement	24,2%
Other hardware repairs	2,5%
TOTAL	100,0%

Out of the 161 respondents, 78 (48,4%) stated, that they would not repair their own mobile devices, even with repair manuals and proper tools. If we subtract these respondents from the total respondents (, knowing, that these respondents have not opted for any of the other responses), 83 remain, out of which everyone stated, that they would replace the batteries in their mobile devices. 53 people (63,9% of the total respondents minus those who opted they would not repair), would intend to execute a screen replacement, 39 would replace or repair the camera and 4 people would fix other, more complex hardware issues as well. Based on the information provided by the respondents, it can be said, that there is a willingness in consumers to repair their own products, as over 50% of the respondents stated, they would repair (at least) one of these issues in their mobile devices.

Product replacement

In the first question regarding product replacement, the target was asked the following question: 'On what platforms do you get informed when planning to purchase a new product?'. Multiple answers could be chosen by those filling in the survey. The following data will describe those who have chosen the different options as part of their answer and not those who only opted for the specific option. Checking the data provided by the 161 respondents of the target group, it can be said, that when planning a new purchase, over 90% of the respondents utilise the internet to browse and compare products; 55,9% get information from friends and acquaintances; 52,2% get information from professional stores; 32,3% stated, that 'Internet advertisement' was an informative platform for them; 7,5% stated the same about television advertisements; while none of the respondents marked 'Radio commercials' as a source of information.

In the following section of the survey, the target group was asked to provide reasons for replacing their different products with multiple choices allowed. The question was asked for each product group separately and the summarising tables, due to their size, are placed in the appendix but will be used to analyse and draw conclusions from the data provided by respondents. Among the received answers (161) there are numerous, that could be called

justifiable reasons for replacing a product, such as selling the product due to its still relevant value on the second-hand market (5-11 responses) or changing to a new operational system, however, these options were placed lower on the list. The other answers can be grouped by the different obsolescence types (Physical, Technological, Perceived, Functional) that, if implemented, would incite the replacement of the product and so in the analysis of the data the groups will be referred to as the obsolescence type related to its possible incitement. The most prominent answers in all categories were related to issues that could be induced and provoked by practicing *physical obsolescence*. The option 'My old device is broken and does not function' was the highest in all product groups, ranging from 76,5% to 84,5% of respondents choosing them as reasons for replacing products, which comes as no surprise. Partial functional impairment was also prominent in all categories, ranging from 42,9% to 61,5%. Aesthetic issues were also grouped into this category, however, this reason was less prominent with 1,9%-7,5% of responses among the different categories. Reasons, that could be provoked by the practice of *technological obsolescence*, were also among the more dominant answers, being in the top 5 answers in all product categories, however, it is important to clarify, that there is an intersection between answers of physical and technological obsolescence, as the options provided could be achieved by either one. An answer option, which was present in the 'Mobile phones' category, can be highlighted as a solely technological issue, that could possibly be induced by the practice of planned obsolescence. This answer option is 'My old phone is slow', which was chosen by 95 respondents (59%) and was the 4th most dominant issue listed in this category. Other answers were of partial or total functional impairment, as in the physical obsolescence part. Reasons for replacement, which could be related to *functional obsolescence* (, and even perceived obsolescence in some ways), are present around the middle of the ordered lists. In the case of 'Big household appliances' and 'Small household appliances', the tendencies were really similar. Energy efficiency and new and better functions in a new product were the main reasons given by respondents in this category. The better energy efficiency of the new product prompted 94 responses in the case of 'Big household appliances' and 58 in the case of 'Small household appliances', taking 2nd 4th place in their respective tables among the answers with the most responses. The answer 'The new device has better functions, that I deem useful' was chosen by 61 and 68 people. Other reasons given were also related to shortcomings and inconveniences of the current device or improvements of the new one. In the category of 'Mobile phones' 'the new and better functions' reason prompted 39 responses and the superior camera qualities of a new device prompted 23. The category with the most answers that could be related to functional obsolescence was 'Televisions'. All the reasons given were related to the superiority of the new

product in some way, like better sound-image quality, bigger size, better functions or being 'smart'. 4 out of the 5 reasons in this category were chosen by 21,7%-27,3% of the respondents. In the product group of 'Computers/Laptops no answer option fit into this category. Reasons, that can be affected by *perceived obsolescence* were the less popular among respondents. These answers were mostly situated at the end of the ordered lists, mostly prompting responses from 1,2% to 7,5%. The reasons were mostly related to the desire for owning something new, even despite the current device functioning, or issues with the size or outside appearance of the owned product.

As the last question for this section, the target group was asked to state in the case of each product group, if they buy a new product or a second-hand device when replacing their current one. The answers were decently universal, as in each product group, the purchase of a new device was significantly more popular ranging from 86% to 91% of the total responses.

To better understand the expectations and preferences of consumers I have decided to analyse the statistical data which was used for *Figure 11.* and *Figure 12.* I used filtering on the responses for the questions 3.1-3.5 (See Appendix 2.), that revolve around the accordance between the ideal and real lifetime of products, to see the two extremes of the responses. I filtered those who choose option 1 ('No accordance at all') and those who choose option 6 ('Totally at accordance'). I will use '1' and '6', when referring to these options for the sake of simplicity. I did this for all product groups and then analyses the ideal lifetime responses from questions 2.1-2.5 (See Appendix 2.), corresponding to each product group. *Table 12.* summarises this data by the chosen extremity, lifetime, and product groups.

Table 12. Ideal product lifetime in case of extreme lifetime accordance

Answer choice	1-3 years		4-6 years		7-9 years		10-12 years		13-15 years		15+ years		TOTAL	
	1	6	1	6	1	6	1	6	1	6	1	6	1	6
Small household appliances	0	0	0	4	5	4	0	3	0	1	6	2	11	14
Big household appliances	0	0	0	0	0	2	1	8	1	2	7	6	9	18
Mobile phone	1	1	12	11	9	2	3	0	1	0	3	1	29	15
Television	0	0	0	1	1	11	0	5	1	6	4	11	6	34
Computer/Laptop	0	1	2	3	2	6	4	4	1	0	3	2	12	16

To be able to calculate an estimate average lifetime for the different product groups I assign each lifetime category an average value: 2 years, 5 years, 11 years, 14 years, and for the 15+ years category I will use 20 years.

In case of small household appliances 11 respondents choose '1' and 14 choose option '6'. The respondents who choose one and did not feel accordance between the expected and real lifetime in these products, marked 2 lifetime categories to be ideal. 5 respondents marked 7-9 years and 6 marked 15+ years. This translated to an average lifetime of 14,55 years. The ideal lifetimes marked by those who choose '6' were more diverse. The average lifetime marked as ideal by these respondents was 9,93 years. It can be seen that there is a significant difference between the expectations of these two groups. Those who did not feel accordance at all, had notably higher expectations for their products.

Similar tendencies can be observed in the case of big household appliances as well, although the difference between the two extremities is higher. 9 respondents choose option '1' and 18 choose option '6'. The average ideal product lifetime of those who did not feel accordance at all was 18,33 years, while that of those who felt complete accordance was 13,22.

The product group of mobile phones is different from the other groups. 29 respondents marked option '1' and 15 marked option '6', showing that the number of respondents who felt no accordance at all, immensely outweighed the number of those who felt total accordance. The average ideal lifetime of mobile phones expected by group '1' was 8,3 years. This can be considered a notably high lifetime according to current standards that mobile devices are held at. However, it is important to note, that the lifetime category marked by most in group '1' was '4-6 years', which can be considered a reasonable expectation, still, these respondents did not feel accordance at all between this ideal lifetime and reality. The average ideal lifetime of group '6' was 6,2 years, more than 2 years lower than that of the other group. However, it must be highlighted, that there is an outlier in this group. One respondent marked 15+ years as the idealised lifetime of mobile phones and they felt total accordance between this lifetime and the real lifespan. Without the response of this person, the average lifetime turns out to be 5,21 years, 3 years lower than the other group's average.

The product group of televisions is a direct contrast of the group of mobile phones. This was the group with the biggest difference between respondents feeling no accordance at all and feeling total accordance. 6 respondents marked option '1' and 34 marked option '6'. This group

demonstrated the biggest difference between the two extremes and had the highest number of respondents who felt total accord between the ideal and the real lifetime of their product. However, there was a notable difference in the mean ideal lifetimes in this category as well. The mean ideal lifetime of group '1' was 17 years and that of group '6' was 13,3.

The product group of computers/laptops was more moderated, similar to household appliances. 12 respondents opted for option '1' and 16 opted for option '6'. Following the tendencies of previous categories, the expectations of those not feeling accord at all was notably higher. The mean ideal lifetime for this group was 12 years, and that of group '6', those who felt total accord, was 9,31 years.

Interpretation

After analysing the derived data from the online survey, seeking relationships and similarities in tendencies, and looking for points of connection between the literature review and the responses with a focus on planned obsolescence I have developed a general interpretation of this information.

Although in the majority of the cases consumers felt positive about the lifetime of their products and the value they could derive during the lifecycle of the device, there was still a notable proportion of the respondents who did not feel this way, due to the lifetime of the product not reaching their expectations and experiencing product defects earlier than expected. The practice of the various forms of planned obsolescence can incite the various types of dissatisfaction that consumers experience and prompt them to either repair or replace their products. The two extremities on the spectrum of satisfaction with product lifetime demonstrated significant differences in the expectations regarding the ideal product lifetimes.

According to the responses, there is a high tendency for willingness to repair across the various product groups, however, consumers oftentimes experience different barriers to repair. Most consumers believe, there is intention behind the different restrictions on repair from the side of manufacturers. The unavailability of resources needed for repair and the price barriers that make repair uneconomical proved to be significant factors in choosing not to repair products or get them repaired. The lack of incentive behind product repair can easily drive consumers to purchase new products instead of prolonging the useful life of the current ones.

When it comes to product replacement, most of the reasons, that were stated by respondents, that justify purchasing a new product can be related to the different aspects of planned obsolescence. Many of the most prominent reasons can be triggered by the practice of the different types of planned obsolescence. While there is no factual answer in these responses,

that the provided issues are caused by such factors, it can be seen, that the different modes of behaviour that consumers display in case of product defects and experienced issues, can be exploited and played around by manufacturers in order to incite further product purchases and increase profits. With the proper marketing, and years of influencing in the form of creating a 'false consumer reality', consumers can be manipulated into accepting certain factors as norms and reality, which makes them not to question the issues they experience.

Mobile phones proved to be outliers in most parts of the examination. Seemingly consumers have different perceptions regarding these devices, that without a doubt have become an integral part of our everyday life, compared to other household appliances.

5.2 Qualitative research – Focus group interview

5.2.1 Methodology

To complement the findings of both the literature review and the quantitative research I have decided to conduct also qualitative research in the form of a focus group interview. I have found that a focus group interview could provide background information about the discovered consumer behaviour and product handling tendencies. The goal of this qualitative research was to uncover the thoughts, attitudes and feelings of consumers related to product obsolescence and repairability and to use a part of this information as a complementary addition to the numerical data of the quantitative research.

The target group for the interview was the same as for the online survey, the adult consumer population of Hungary. For my sample, 6 individuals were chosen from my proximity. To increase the potential of exploring the topic from different standpoints, I have chosen a sample group composition with different genders, ages, professions, lifestyles, and hypothesized consumer behaviour.

The interview was held on October 18, 2022, in Pécs. The interview was recorded using a dictaphone and mobile devices, which the participants agreed to by signing a document, that included the guarantee of data protection. Participants also provided their first name, gender, age, profession, and a preferred free-time activity in this document.

I have prepared open-ended questions (see Appendix 3.) for the interview, that could induce discussions related to the topics so that I could observe the reaction and feelings, that arose. My goal was to better understand individuals' perceptions of product values, innovation, repairability, and sustainability. I have also utilised visual aids in the form of pictures, to capture initial reactions and use them to encourage discussion among the participants, increasing their involvement. To prepare the questions, I have revised the literature review and the data of the

ongoing quantitative research to see the topics of interest, that could use exploration or further elaboration.

5.2.2 Interview analysis

In order to decipher the underlying consumer behaviour and understand the reasons behind feelings and actions, the focus group interview will be analysed question by question, detailing the prominent ideas, tendencies, and connections that arose during the session. The questions, minutes and the personal data of the participants are present in the APPENDIX.

In the first question, participants were asked to provide reasons for purchasing a new product before the current one breaks down. The participants provided different reasons from their personal experiences. Energy efficiency was brought up, which I consider to be a reasonable motive, related to functional obsolescence, as the new product contributes something new, that the old device would not be able to. Two participants had experiences, where despite the product still functioning, they were dissatisfied with them for certain reasons, prompting replacement. Technological obsolescence was mentioned using this expression literally. The participant argued the discomfort related to software- and hardware-based incompatibility issues. Issues related to perceived obsolescence were also mentioned, as two participants expressed cases of a product perfectly functioning but not fitting into the environment of their home, as well as a desire to own something new, although the participant mentioning this did not speak from his own experience. Different product defects and inconveniences, that would incite the replacement of functional products were mentioned by the participants. According to the information acquired from literature, it can be said, that the practice of the different forms of planned obsolescence could easily exploit the behaviour of consumers.

In the second question, participants were asked about their reactions and feelings when their device becomes obsolete sooner than expected. Anger and disappointment were immediately brought up and various participants agreed about these feelings and their combination arising. Participants shared personal experiences to express their distaste related to this phenomenon. To better see real-life occurrences of premature obsolescence and to try to make connections with planned obsolescence, these experiences will briefly be summarised. One of the participants had a TV device, that before reaching 5 years of age broke down and could not be repaired. The participant expressed her dissatisfaction with such a short lifetime in a product like this. Another participant had experience with a different kind of issue with a TV device, where the 'Smart television' lost its 'smart' functionality after a while and only functioned with

its base television features, due to support from the company ceasing. A different participant also had incompatibility issues, but with a mobile phone. The case was similar, as the company stopped supporting the device and thus the perfectly functioning phone was ruined through technology and software. The same participant also experienced an issue, that is similar to those mentioned in 'Subsection 2.1.3', which details other types of physical obsolescence. The participant experienced issues with a key component of the product (the filter of a vacuum cleaner), which is almost as expensive as the device itself. He had this experience with multiple devices. Another technological obsolescence-related issue was brought up as well by another participant, who detailed how his mobile phone started to degrade quickly after 2 years, slowing down and becoming virtually unusable, which he did not expect from a mid-category device. Three participants also expressed how experiences like these caused a break in their customer loyalty and lead to turning away from the company. The issues, personally experienced by the participants point towards different practices of physical and technological obsolescence.

The third question revolved around the increasing pace of product releases. The participants were asked about their standpoints and views on this process. Two of the three female participants stated that they are bothered by this. One of them detailed her point even further. As the eldest participant, she expressed, how the era she grew up in was different and that it was easier to choose from the few available products compared to the case now. She stated: 'Now if I go to the store, there are 100 coffee machines, 100 televisions, 100 everything ... but I am not [competent in technical things like this] and so this abundance of products just confuses me.' This case is an example of the 'confusopoly' concept, which was presented in the literature review. Among the male participants, there was an agreement on liking the wide availability of different products and that they could dig into the details and choose the most adequate product. Two male participants' opinion on the frequent product releases was coherent. They both believed that no real innovation lies in such frequent release periods, like 1 year, and the changes are only illusory and superficial, which serves as 'deception' of customers, as according to them, these changes do not serve the customer, rather just makes them feel they need to purchase it. One of them stated, that real meaningful innovation is more likely to arrive in 5-year periods. The third male participant expressed his idea, that lower-category products might experience more substantial changes in 1-2 years than upper-category products, however, he also stated, that their 'programmed death' (planned obsolescence) is also made quicker for this reason. There was also agreement on the statement, that the unnecessary over-production significantly reduces the durability of products, which might become disproportionate

compared to their price. From the experiences and expressions of the participants, it has become clear, that the participating consumers had more negative thoughts about the frequent product releases, finding them unnecessary even, although the abundance of choices was a positive factor for some. I also found out, that the participants were not susceptible to perceived obsolescence in the form of timed product releases.

Following up the discussion of dissatisfaction with the quality of products, the participants were asked if they could provide reasons, what incentives could manufacturers have to limit the lifespans of products. Two participants engaged in a discussion which led to ideas like: the goal of increasing revenues is obviously the reason for limiting the lifespans of products; the 'suffocating prestige' is present in many of us. The participant mentioning the latter idea provided a real example from his past work experiences, where upper managers were fixated on getting the newest iPhone device so much, that they would not sign their contract without being provided one. The other participant explained that this is a 'projection of the year-to-year releases'. Staying on this topic, the participants were asked about their opinions about this process from ethical and financial standpoints, based on their experiences. One of the male participants first tried to rationalise the obsolescence of products with logical points. Based on his own experiences he stated, that there really is a significant difference in lifespans and durability between lower, middle, and upper-category products. Moreover, he also said, that it can be argued, that in order to provide goods at a reasonable price to a wide range of customers, making sure that the target group can afford it, lower quality resources are used and durability decreases. However, he expressed, that it is of course unethical to program the eventual death of a product and that it is a fraud, that we cannot do anything about. In his words, he referred to this as 'programmed loss of quality' and 'programmed death'. Finally, he expressed that he does not believe, that every technological issue is programmed and intentional as mistakes and limitations occur naturally, but in his opinion, the right companies act and try to solve issues like these, 'which is not common nowadays, only in case of life-threatening problems.' One of the female participants expressed her financial issues related to the limitations in products' functionalities and life. She shared an experience of hers, as when an old smartphone of hers got broken, she stated that she was not satisfied with the newer ones, as they were actually inferior in many ways. She stated that one would think they get the same or higher quality with increased prices, but they do not get what they expect, which is a disappointment for her. Another female participant shared a unique standpoint on the issue, as she stated, that she does not experience this problem, as she replaces her products before the previous one breaks down

or runs out of their useful life. This discussion provided real examples of people being susceptible to perceived obsolescence and the 'desire for new'. Moreover, it was found out that consumers are actually aware of manufacturer strategies that could limit life, but feel helpless about it.

To see reactions and opinions firsthand, participants were presented with some information related to the survey. They were told, that the $\frac{3}{4}$ of respondents stated, that they believe, that the repair of electronics got harder in recent years and that a large majority believed, that manufacturers intentionally limit repairability. The focus group's opinion was asked on this matter. The participants' opinion agreed with the statement, that the various methods of restriction on repair by manufacturers is in fact reality. A participant shared an experience from his profession as a printing machine mechanic, that there are cases when buying a spare part for the printer costs more than the whole machine did previously. During the discussion, mobile phone repair was also brought up, and different issues, that were also part of the literature review got mentioned, such as the difficulty to remove the back of phones, the necessity for special tools, difficulty to avoid causing damage when trying to perform simple repairs, etc. Overall, it seemed, that the participants demonstrate a willingness to repair their products or get them repaired, however product repairability is way more restricted than it used to be and there are many practical and financial barriers that make repair unappealing. The participant who showed tendencies related to perceived obsolescence also did in this discussion, demonstrating less willingness and want to repair products, as she either does not wait until issues arise or finds it simpler to replace the product rather than repair it, although she highlighted that she might act differently based on the value of the product.

Circling back to innovative product evolution, the group was asked the following question: How do you personally balance the desire for innovation and your financial constraints? All the answers of the respondents demonstrated rational consumer behaviour. The respondents expressed, that they, in fact, have a desire for 'the new', innovation, or higher quality in certain product groups, but they have pre-determined reasonable boundaries when it comes to spending money on products.

In the next stage of the discussion, the participants were given a paper with 4 images, representing different types of obsolescence. *Figure 14.* shows these images.

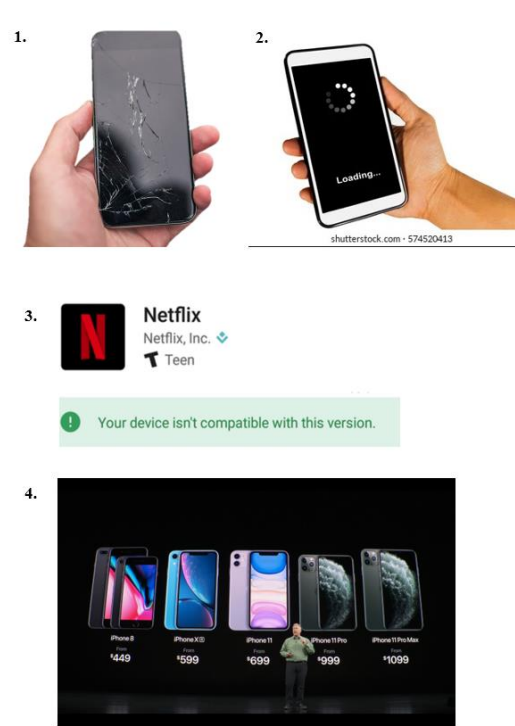


Figure 14. Focus group images (1)

Image sources:

(Asurion, 2022) - <https://www.asurion.com/connect/tech-tips/how-to-fix-a-cracked-phone-screen/>

(Shutterstock, n.d.) - <https://www.shutterstock.com/hu/image-photo/hand-holding-white-smartphone-black-phone-574520413>

(Dinita, 2020) - <https://www.technipages.com/netflix-this-app-is-not-compatible-with-your-device>

(HWSW, 2019) - <https://www.hws.hu/hirek/60787/apple-iphone-11-pro-max-okostelefon-mobil-kamera-a13.html>

The images mostly focused on EEE, more specifically mobile phone-related issues. Each image and the related ideas were discussed individually after one another. The first image, a mobile phone with a cracked screen, represents a physical (aesthetic) defect, related to durability issues and possibly physical obsolescence, as discussed in the literature review. In general, the standpoint of the participants was universal. 5 out of the 6 participants agreed, that this aesthetic issue causes them discomfort, although not to an extent that would prompt product replacement, but they agreed, that they would definitely try to get fixed. The eldest participant stated that she would not be that bothered by such an issue and would not want to pay to get it repaired. The second image, which shows a slow, loading mobile phone, represents software issues, which relate to technological obsolescence. An immediate reaction from one of the participants was very telling. He expressed a personal experience with a device that had similar issues, describing it as 'psychological warfare'. Various personal experiences were shared by

participants when discussing, the apparent deterioration of mobile phone performances after a software update. The expression 'planned obsolescence' was even brought up by one of the participants, stating that such issues are implemented this way. Various participants expressed that they have felt the negative impact of software updates on their phones in issues like the device slowing down, long loading periods, freezing, and even deterioration of the camera. The third image show incompatibility issues, another form of technological obsolescence. Participants seemed to agree on the existence and relevance of these issues. The upcoming ideas included helplessness and feeling like this issue has become a normalised part of production and products through possible 'cartel' actions, as one of the participants expressed, adding also that he does not wish to create conspiracies. This idea is indeed interesting and could have some truth. As it was stated in the first chapter of the literature review, the origin of obsolescence is highly connected to the Phoebus Cartel's business strategies. A male participant mentioned that he had a case, when a short while after getting a notification, that support for the device is ceasing, the functional device became unusable. He later added that issues like this make him feel like 'the market is not influencing supply, but supply influences the market.' This is also an idea that has been brought up in literature and is a significant point, as the duality and cyclical nature of planned obsolescence also beg the question, that which sector/actor of the economy influences and controls the other and to what extent. In the fourth and final image for this discussion, an image of the newly released iPhones was shown, which is meant to represent the constant and frequent releases of new products, which might cause a loss in the perceived value of current products. Participants were asked to imagine themselves in the shoes of a customer who owns a mobile device, and a new generation of the same brand gets announced. They were then asked if the perception of their current model changed in any negative way. 5 of the 6 participants almost immediately declared that they do not care about this, and their view of their own device is not determined by this, although one of the female participants, who has shown tendencies to be susceptible to perceived obsolescence on multiple occasions stated, that there was a period in her life, when this was a notable factor for her, as she always got the newest model from her preferred brand. The 6th participant went into more detail, explaining that as he gets more details about new products, he feels how the media is trying to affect the mind about the obsolescence of previous models of products, while there is no significant change about the contents, only mostly superficial modifications to incite the feeling of 'new' with the changed looks. He also added an experience of his, when after talking with a salesperson when comparing two TV devices, that had a notable difference in prices, he found out that there was actually only a minor functional addition (Bluetooth), that would not even affect all customers,

and did not interest him. He also expressed his opinion, that before, there were more significant changes in design as well, bringing up the example of the iPhone 4-5-6, compared to the current models.

To further explore the willingness to repair among consumers and as a means of extending the research of the online survey and the literature review, mobile phone repairability was discussed with the participants, more exactly the home repair of own products. Once again participants were presented with visual aids to help with the discussion. *Figure 15.* shows the images that were presented to participants. These are the same images that can be found in the respective section of the literature review.



Figure 15. Focus group images (2)

Image source:
(iFixit Store Europe, n.d.) -
<https://eustore.ifixit.com/products/iopener?variant=32254690394193>
<https://selfservicerepair.com/order>
(AppleInsider, 2022) - <https://appleinsider.com/articles/22/04/30/apples-self-repair-program-toolkit---hands-on-with-whats-inside>

Participants were asked to share their opinion on the DIY home repair of products. Two of the female participants stated, that they would not start to tackle issues by themselves, however, the third female participant, a retired person, stated, that she would engage in fixing certain issues that could arise in a household, however she would not start to repair electronics. Two of the younger male participants both said, they would engage in home repairs, but the third

participant said that he would not as these repairs either need 'special tools, specialists or acquaintance.' After that, the discussion focused on mobile phone repair specifically. At first, participants were presented with the 2 images on the left of *Figure 15.*, the base Apple repair kit, offered for rent by the company to perform mobile phone repair at home, and after that with the iFixit repair kit, on the right side of the image. Many ideas arose, but the main conclusion was the same in each of the repair kits. Although there was some interest in the kits, the main feelings seemed to be of intimidation. Female participants seemed uninterested in the thought of utilising the equipment, while the male participants agreed, that they would not utilise either kit, due to a lack of ability and knowledge, fear of damage, and the complicatedness of ordering and waiting for a kit and they stated, that would rather take the device to a professional at a repair store, where such machines, like those of the Apple repair kit, would be better fitting. Once again, despite the willingness to repair in consumers, barriers seem to be too severe, and thus people rather not engage in home repairs, but would still be willing to entrust professionals with fixing product defects.

As a closing part of the focus group interview, the topic of sustainability was brought up to reflect on this area of planned obsolescence as well, as did the literature review and the online survey. They were asked about their behaviour related to EEE disposal. The usefulness of companies taking away the replaced product was agreed on, however, when it came to the personal disposal of products, different types of behaviour were present. In the case of still functional products, giving them away to friends and family or selling them was mentioned by two of the female participants. The third woman stated that she intends to collect trash selectively, properly disposing of batteries, etc, unlike two other participants who stated, that they get rid of electronics by just throwing them away in the communal bins. A male participant mentioned several experiences when he encountered issues while trying to get rid of garbage in an environmentally friendly manner. One included the complicatedness of the process, which made the proper disposal unappealing, while in the other example he shared a local experience. He stated that there used to be a 'disposal event' organised by a company, where citizens could dispose of their devices properly, but its cancellation was confirmed to him by the official company that handles community duties in the city. Thus, the participants' behaviour during the interview suggested, that they feel like, the proper disposal of electronic waste is a bothersome process, which is not promoted enough and thus leaves consumers unsure of how to handle the issue.

Interpretation

After analysing the focus group interview, I have found, that many findings of the literature review and the survey were present in the case of the participating consumers as well, further solidifying the relevance and reality of the matter. All participants have had experiences from their personal and/or professional life, that demonstrated the workings of planned obsolescence. The general feelings associated with these cases were negative. Anger, disappointment, helplessness, and feeling cheated arose. After negative experiences, various participants turned away from companies. This shows that the practice of planned obsolescence is a thin line, which can bring many benefits for manufacturers, but if it crosses the line, consumers will feel betrayed, and the companies will lose their trust. I have found that the opinions, feelings, and behaviour that were expressed by the participants showed, that consumers present behaviour, that can be exploited by firms and gives space for the practice of planned obsolescence.

Participants showed some understanding and knowledge of the possibility and reality of the practice of planned obsolescence. They recognise the actions of companies and can even find rationality in them, however as the market is controlled by the actions of the supply actors, the consumers feel helpless and unable to do anything about the issues they experience. They also discussed the existence of social pressure and the affective marketing, that promotes overconsumption, but it seemed, that they are mostly conscious consumers and are not affected easily by these. As a form of rationalisation of planned obsolescence, the concept of faster innovation was mentioned, however, participants agreed, that the overly fast product releases in yearly cycles even, do not necessarily provide this and are just a way of acquiring more sales and scamming customers.

Regarding the topic of product repair, the participants showed similar tendencies and behaviour as the sample of the online survey. Participants demonstrated a willingness to repair, however it was found out, that they oftentimes encounter barriers, such as those that were discussed in the literature review or provided by the respondents of the online survey. These barriers make repair economically undesirable, complicated, unavailable, and difficult. Participants would be willing to repair their products or get them repaired, however the lack of incentive behind this might lead to them opting for replacement, which is a simpler choice. The sustainable disposal of electronics also proved to be a difficulty among consumers, due to it not being promoted and normalised.

5.3 Limitations of the empirical research

The empirical research has provided insight into the behaviour of consumers and its relation to the practice of planned obsolescence, however, it must be made clear, that there are limitations to this research. The research was conducted only in Hungary, by Hungarian consumers. The online survey was filled out by 161 respondents, which is a satisfactory sample, but not significant enough to draw too general conclusions. The focus group interview was conducted mostly with people from my proximity, and only represent a small sample of the wider consumer society. Furthermore, the research was conducted in a time of economic recession, and uncertainty due to the consequences of a global pandemic and ongoing political conflicts and war. Inflation is rising, in the case of the target product groups of this research and this must be taken into account.

5.4 Conclusion of the empirical research

Consumers are an integral part of planned obsolescence. They both stimulate and suffer the process of the phenomenon. Consumers are oftentimes aware of the power that suppliers hold when it comes to product lifetime, and believe, that they use that power to further their own goals, which might come at the expense of consumer well-being and consumer rights. Consumers believe that firms design products in a way that restricts repair and makes it increasingly difficult, and that they can and do limit the useful lives of the products. Despite this, most consumers are still satisfied with the lifespan of their products and derive satisfactory value during the usage of them. However, there is still a significant proportion of consumers, who does not feel accordance between their expectation and the reality of product lifetimes. Participants of the focus group interview confirmed that they have both personal and professional experiences with what they believe is planned obsolescence, which has limited the lifetime of their products on various occasions. Consumers feel powerless and frauded by companies.

Consumers however are also actors in this process, aware or not. The behaviour demonstrated by consumers, regarding product replacement, provides companies with the opportunity of exploiting them. Firms, using different methods of planned obsolescence, can incite the triggers, that consumers will react to. Consumers can also be susceptible to perceived obsolescence, and they proactively stimulate the process, by 'willingly' choosing to replace the product earlier than necessary. New product releases, change in trends can all or aesthetic defects can all cause this, however, the findings of this research show, that consumers are only slightly affected by aesthetic issues. Consumers demonstrate a willingness to repair products when experiencing

different product defects, however, the lack of incentive promotion and the existence of high barriers makes it highly complicated. Consumer experience numerous financial and practical barriers when they would choose to repair their devices. Over the last 5-10 years, consumers experienced an obvious rise in the difficulty of the repair of mobile phones, which makes it impossible for many to perform at-home repairs on their devices due to a lack of spare parts, tools, skill, or due to the fear of causing more damage. Consumers believe that the increased complicatedness and difficulty of the repair of products is an intentional action of companies.

Conclusion

Product obsolescence is a natural part of product lifecycles, however, the intentional limitation of a product's natural useful lifespan, planned obsolescence as it is called in literature, is an artificial interference in this process. Planned obsolescence is highly connected to our economic system and has been part of it for over a century. Its controversial assessment comes down to the duality of its nature, as historically it has brought many advantages to the economy, however in an age of sustainability, its viability can be questioned.

Manufacturers can utilise different methods to limit the lifespans of products, with the goal of reducing costs, reducing prices, appealing to a wider range of customers, and most importantly, increasing revenues. A product's physical characteristics, its technological aspects, and software and its relative perception compared to other products can all be used to make it obsolete. Supply and demand both play a role in this cyclic process, as along with the manufacturers and firms, consumers also keep this cycle going. Companies can capitalise on the behaviour that consumers demonstrate when issues arise with their devices.

The consumer society, that we live in today promotes over-consumption, which results in a 'throw-away society' and large amounts of waste. The impact of fast product obsolescence on the environment and society is substantial.

In recent years, after various confirmed cases of planned obsolescence practices by large companies, and with the increasing popularity of sustainability, the case of planned obsolescence and the right to repair has become more relevantly discussed. Regulations and restrictions are increasing and a change in the economical system is being argued and discussed. After the conduction of my literature review and empirical research, I intend to answer the research questions proposed at the beginning of this paper.

How viable is the concept of planned obsolescence today?

Planned obsolescence has proved to be beneficial for the economy various times. Its original conception related to the resurrection of the economy after the Great Depression. Nowadays its

beneficial nature is still significant. Planned obsolescence continuously boosts the economy, creates jobs, inspires innovation, etc. However, in the 21st century, other factors have gained significant importance as well. Planned obsolescence is part of a bigger issue: the consumer society and the promotion of overconsumption. Natural resources have become scarcer, the population multiplied, overconsumption has become more extreme, and the consequences of overproduction are now felt by the world, as climate change has become a real threat to society. 'It is no more possible trying to live in the twenty-first century based on paradigms created in the twentieth century, when the conditions of life on Earth were different and natural resources were abundant.' (Satyro et al., 2018, p. 750) Despite the beneficial nature of planned obsolescence towards the economy and technology, the conclusion of this paper is, that planned obsolescence is no longer a viable concept and cannot be upheld due to its direct contradiction of sustainable and circular models. The discussion about the circular economy shows, that there might be alternatives to our current, mostly linear economy. There have been proposals for new, circular visions for electronic products²⁸, which could make longer lifetimes appealing to companies as well.

How can manufacturers practice planned obsolescence?

According to my findings in the literature and my interpretation of them, I have divided obsolescence into four categories, three of which can be considered as branches of planned obsolescence, while the fourth is a natural form of product evolution.

Physical obsolescence is the limitation of product life through the intentional implementation of physical weaknesses. The use of non-durable materials in places where they are exposed to wear and tear, implementation of self-deteriorating mechanisms, and intentional design flaw are all part of this branch. These defects are then reinforced by limitations on repair, due to the unavailability of spare parts and tools and the design of products which makes reasonable repairs highly difficult or impossible. This way, in case of issues with certain parts of the product, might prove to be a reason for replacing the product.

Technological obsolescence is the usage of software-based methods that negatively influence the functionality of electronic devices. Tweaking the speed of the device or deteriorating the functionality of certain features through software updates and ending software support are all methods that can be used by companies to make products obsolete.

Perceived obsolescence relies on inciting the desire in consumers to purchase a new product, by convincing them of the superiority of the new product compared to the one they currently

²⁸ Reference to World Economic Forum and PACE (2019)

own. The essence of this method lies in psychology and manipulation, as the endless marketing that surrounds and targets us, continuously influences us. Companies utilise many methods, to convince customers of superior value in a product even if there is none. Changes in the outside appearance and design of new products, encouraging fast fashion with the creation of micro-seasons, and the proper usage of promotions all affect the consumers to perceive their current devices as less trendy, up-to-date, and valuable.

Functional obsolescence is a natural part of product evolution. It occurs when a new product significantly outvalues its predecessor due to its superior features and qualities. The change from large and bulky phones to mobile phones or the change from carriages to cars are examples of this branch of obsolescence. This can actually be viewed positively and the change in value perception is more justifiable.

What is the role of consumers in this cyclic process?

Consumers play a significant role in the cycle of planned obsolescence, as companies would not be able to achieve their business purposes with products if the consumers did not buy them. Manufacturers use and exploit the behaviour that consumers demonstrate to trigger the necessary points, that further their goals. Consumers are sensitive to product defects and issues. They often show a willingness to repair these issues, but if they encounter too many barriers to repair, they replace their products. In many cases, repair is already beneficial for the company, but replacement is a definite success. Despite consumers oftentimes feeling the effects of planned obsolescence, they show no action, due to helplessness or ignorance. Either way, this keeps the cycle going. Moreover, consumers many times consumers desire the 'new', the trendy, the prestigious, and will replace their functional products with new ones, solely due to perceived value, which might have rational reasons, but the question definitely arises: Do consumers have these wants, and companies react to it or do companies proactively plant these ideas into customers? 'Is it because businesses want it? Or is it because we want it ourselves? We always have a desire to buy a new one, it can be said that this request is a behavior style that only appeals to the system. This consumption behavior continues as it suits both the producers and consumers.' (Karakuş Umar and Beyaz, 2021, p. 186-187)

How does planned obsolescence affect the environment?

Planned obsolescence is in its current nature related to the linear economy model, the take-make-use-throwaway mindset. The promotion of the quick replacement of products has created a throw-away society, where electronic waste is generated in immense amounts. Many times still functional products get thrown out. The environmental impact of our consumer society, which planned obsolescence is a part of, is very significant. There are considerable waste-

management issues when it comes to the collection and handling of e-waste. The population has significantly increased in the past decades, the natural resources are decreasing, carbon dioxide emissions are still rising significantly and so does the exploitation of our environment. Greenhouse gas emissions are one of the highest contributing factors of human Induced climate change. "Anyone who believes that infinite growth is compatible with a finite planet is a fool or an economist" (Serge Latouche – The Lightbulb Conspiracy)

Planned obsolescence promotes a consumer society that is not sustainable and in its nature contradicts sustainability. If the goals of the Paris Agreement are to be met, planned obsolescence must be addressed.

One thing is clear: currently, there is a situation of stalemate. Selfishness contra sustainability. There is a need to move away from practices, like planned obsolescence to have a more sustainable economy and society, however, our economy is greatly dependent on the consumer society, making the transition highly difficult. Still, we must step away from the current system towards more sustainable economic models and take the necessary steps and sacrifices. Both society and the economy need to change and act if we are to reach the goals of sustainability that experts find necessary to protect and conserve our environment.

Limitations

During the writing process of this paper, there were evident constraints that can be considered limitations for the research. As a 2nd-year university student in Business Administration and Management, my knowledge of finance, economics, and statistic analyses is still limited.

The empirical research was limited to a small Hungarian sample, which is important to consider when viewing its results. Also, empirical research, that revolves around this topic, is scarce, even in international literature. Hence there are no time-tested methodologies, measuring and evaluative frameworks, that could have been of assistance in planning the empirical research and achieving the proposed research goals. Moreover, regarding the contents of research revolving around planned obsolescence, it must be made clear, that this concept is not black and white, and its factual representation is not always possible. Many times, it cannot be determined if a product failure is intentional or not, and its interpretation comes down to speculation, and this holds for the case of this paper as well.

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Appendices

Appendix 1. Cover letter and questions of the online survey

Cover letter of the online survey:

Dear Respondent!

I am Szántódi Benedek Máté, 2nd-year student at the University of Pécs on the Faculty of Business and Economics. The topic of my TDK research paper and my eventual Thesis is 'Planned obsolescence' and for my research I wish to examine the consumer behaviour of Hungarian citizens above the age of 18.

During the questionnaire you will be asked about your expectations, and behaviour related to the repair and replacement of different household appliances and electronic products. Please make sure to answer each question honestly, according to your best knowledge, contributing to the quality successfulness of my research! There are no wrong answers, with the survey I intend to examine your personal opinion and experiences.

Participation is totally anonymous. The results can only be seen by me, and in the paper, only summarised data will be presented. With the submission of the filled in survey, you consent to participation and to the processing and usage of your answers in the research. Completing the survey takes approximately 10-15 minutes.

Thank you in advance for the time spent on the survey!

Online survey questions:

- 1.1. To what extent do you keep track of the releases of new products and get informed about their novelty?
- 1.2. How typical is it of you to shop around impulsively, without prior planning?
- 1.3. To what extent do you consider factors of environmental protection when purchasing a product?
- 2.1. What would you consider an ideal lifetime in case of small household appliances?
- 2.2. What would you consider an ideal lifetime in case of small household appliances?
- 2.3. What would you consider an ideal lifetime in case of mobile phones?
- 2.4. What would you consider an ideal lifetime in case of TV devices?
- 2.5. What would you consider an ideal lifetime in case of computers/laptops?
- 3.1. To what extent the real lifetime of your small household appliances was in accordance with their expected lifetime?
- 3.2. To what extent the real lifetime of your big household appliances was in accordance with their expected lifetime?
- 3.3. To what extent the real lifetime of your mobile phones was in accordance with their expected lifetime?
- 3.4. To what extent the real lifetime of your TV devices was in accordance with their expected lifetime?
- 3.5. To what extent the real lifetime of your computers/laptops was in accordance with their expected lifetime?
- 4.1. Do you totally derive the utility and value of your small household appliances during their useful life?

4.2. Do you totally derive the utility and value of your big household appliances during their useful life?

4.3. Do you totally derive the utility and value of your mobile phones during their useful life?

4.4. Do you totally derive the utility and value of your TV devices during their useful life?

4.5. Do you totally derive the utility and value of your computers/laptops during their useful life?

5.1. Would you repair the following products or get them repaired in case of the following product defects?

(Small household appliances, Big household appliances, Mobile phone, Television, Computer/Laptop)

(‘Aesthetic defect’; ‘The product is deteriorated, the state of its material is unsatisfying’; ‘Certain functions are impaired’; ‘Deteriorating performance, slowing software’; ‘The product does not work and cannot be used’; ‘I would not repair my product’)

5.2. Please choose the option, which best describes your behaviour when a product of yours breaks down!

(‘I go to a professional repairer.’; ‘I repair the product myself.’; ‘I do not get the product repaired.’)

5.3. If the appropriate tools and repair manuals were available, in which of the following cases would you repair your own mobile device?

(‘Battery replacement’; ‘Screen replacement’; ‘Camera repair/replacement’; ‘Other hardware repairs’; ‘I would not repair my device myself’)

5.4. If you do not repair your product or would not get it repaired, why do you decide so?

5.5. In your opinion, has it become more difficult to repair your own electronic devices at home in the last 5-10 years?

5.6. In your opinion, do manufacturers utilise a strategy, that intentionally makes it more difficult to repair products?

- 6.1. Which platforms do you use to get informed when considering the purchase of a new product?
- 6.2. What are the reasons that would make you replace your small household appliances?
- 6.3. What are the reasons that would make you replace your big household appliances?
- 6.4. What are the reasons that would make you replace your mobile phone?
- 6.5. What are the reasons that would make you replace your TV device?
- 6.6. What are the reasons that would make you replace your computer/laptop?
- 6.7. When you purchase a new product do you rather buy a new one or a second-hand product?

Demographic data

Gender

Age

Place of living

Highest educational level

How many residents live in your same household?

In your opinion, your earnings are...

Far below average

Below average

Average

Above Average

Far above average

No personal income

What is your feeling regarding the amount of your savings?

"I possess little savings"

"I possess a saving, that provides security"

"I possess a saving, that provides more than security"

"I have significant savings"

"I have no savings"

Appendix 2. Tables of the quantitative research

Q5.1.1.1 Tendencies to repair product defect in the different product groups

	Small household appliances	Big household appliances	Mobile phone	Television	Computer/Laptop	TOTAL	
Aesthetic defect	10	15	38	19	21	103	6,80%
The product is deteriorated, the state of its material is unsatisfying	41	52	44	32	47	216	14,26%
Certain functions are impaired	90	108	70	95	99	462	30,50%
Deteriorating performance, slowing software	33	49	76	58	99	315	20,79%
The product does not work and cannot be used	48	81	43	67	65	304	20,07%
I would not repair my product	39	11	31	22	12	115	7,59%
TOTAL	261	316	302	293	343	1515	100,00%

Q5.1.2. Tendencies to repair product defect in the different product groups - Proportionate representation based on defect types

	Small household appliances	Big household appliances	Mobile phone	Television	Computer/ Laptop	TOTAL
Aesthetic defect	10%	15%	37%	18%	20%	100%
The product is deteriorated, the state of its material is unsatisfying	19%	24%	20%	15%	22%	100%
Certain functions are impaired	19%	23%	15%	21%	21%	100%
Deteriorating performance, slowing software	10%	16%	24%	18%	31%	100%
The product does not work and cannot be used	16%	27%	14%	22%	21%	100%
I would not repair my product	34%	10%	27%	19%	10%	100%
TOTAL						

Q5.3. Mobile phone repair at home (proportions) without 'No repair'

	Responses	Response rate
Battery replacement	83	100,0%
Screen replacement	53	63,9%
Camera repair/replacement	39	47,0%
Other hardware repairs	4	4,8%
TOTAL	83	100,0%

Q5.5. 'In your opinion, has it become more difficult to repair your own electronic devices at home in the last 5-10 years?'

Yes	124	77,02%
No	7	4,35%
I do not know	30	18,63%
TOTAL	161	100%

Q5.6. 'In your opinion, do manufacturers utilise a strategy, that intentionally makes it more difficult to repair products?'

1: I do not think so at all	1	0,62%
2: I do not think so	2	1,24%
3: I would rather say no	7	4,35%
4: I would rather say yes	23	14,29%
5: I mostly think yes	47	29,19%
6: I completely think so	81	50,31%
TOTAL	161	100%

Q6.1. 'Which platforms do you use to get informed when considering the purchase of a new product'

	Responses	Response rate
Internet browsing and product comparison	146	90,70%
Friends and acquaintances	90	55,90%
Professional store	84	52,20%
Internet advertisement	52	32,30%
Television commercials	12	7,50%
Radio commercials	0	0%
TOTAL	161	100%

Q6.2. Reasons to replace 'Big household appliances'

	Responses	Response rate
1 My old device is broken and does not function	136	84,5%
2 The new device is more energy-efficient	94	58,4%
3 Some of the functions of my old device are not working	92	57,1%
4 The new device has better functions, that I deem useful	61	37,9%
5 My old device is noisy	26	16,1%
6 My old device still has value on the second-hand market so I sell it	13	8,1%
7 The design of the new device fits my home better	11	6,8%
8 I desire a new device	10	6,2%
9 My old device has aesthetic issues	3	1,9%
TOTAL	161	100,0%

Q6.3. Reasons to replace 'Small household appliances'

	Responses	Response rate
1 My old device is broken and does not function	138	85,7%
2 Some of the functions of my old device are not working	88	54,7%
3 The new device has better functions, that I deem useful	68	42,2%
4 The new device is more energy-efficient	58	36,0%
5 The new device has more power	31	19,3%
6 The design of the new device fits my home better	12	7,5%
7 My old device still has value on the second-hand market so I sell it	11	6,8%
8 I desire a new device	10	6,2%
9 My old device has aesthetic issues	4	2,5%
TOTAL	161	100,0%

Q6.4. Reasons to replace 'Mobile phones'

	Responses	Response rate
1 My old device is broken and does not function	128	79,5%
2 My old phone has compatibility issues (application, updates not supported - software issues)	104	64,6%
3 My old phone needs charging often - there are issues with its battery	98	60,9%
4 My old phone is slow	95	59,0%
5 Some of the functions of my old phone are not working	83	51,6%
6 The new device has better functions, that I deem useful	39	24,2%
7 The camera of the new device is better and more up-to-date	23	14,3%
8 My old phone has aesthetic issues	12	7,5%
9 My old device still has value on the second-hand market so I sell it	11	6,8%
10 I am changing to a new operational system (e.g. iOS - Android)	11	6,8%
11 The appearance of my phone is obsolete	9	5,6%
12 Although my phone is still functional, I have used it long enough and desire something new	9	5,6%
13 The new device is trendier	2	1,2%
TOTAL	161	100,0%

Q6.5. Reasons to replace 'Televisions'

		Responses	Response rate
1	My old device is broken and does not function	123	76,4%
2	Some of the functions of my old device are not working	69	42,9%
3	The performance of my old device is deteriorating	54	33,5%
4	The new device has better sound-image quality	44	27,3%
5	The new device has better functions, that I deem useful	40	24,8%
6	I desire a bigger device	39	24,2%
7	I desire a 'smart TV'	35	21,7%
8	My old device has aesthetic issues	7	4,3%
9	I do not use television / would not buy a new one / it is not important to me	6	3,7%
10	I desire a new device	5	3,1%
11	My old device still has value on the second-hand market so I sell it	5	3,1%
12	Although my device is still functional, I have used it long enough and desire something new	4	2,5%
13	The appearance of my device is obsolete	3	1,9%
14	The new device is trendier	3	1,9%
15	The new device is more energy-efficient	1	0,6%
TOTAL		161	100,0%

Q6.6. Reasons to replace 'Computers/Laptops'

		Responses	Response rate
1	My old device is broken and does not function	132	82,0%
2	My old device is slow, there are issues with its battery	107	66,5%
3	Some of the functions of my old device are not working	99	61,5%
4	The performance of my old device is deteriorating	93	57,8%
5	The hardware of my old device is obsolete	92	57,1%
6	I am changing to a new operational system (e.g. Windows - Mac - Linux)	15	9,3%
7	I have issues with the size of my old device	13	8,1%
8	My old device still has value on the second-hand market so I sell it	10	6,2%
9	Although my device is still functional, I have used it long enough and desire something new	6	3,7%
10	My old device has aesthetic issues	4	2,5%
11	The appearance of my old device is obsolete	2	1,2%
12	The new device is trendier	1	0,6%
13	Only for environmental reasons, if my work depends on it...'	1	0,6%
TOTAL		161	100,0%

Appendix 3. Documents and questions of the focus group interview

FOCUS GROUP INTERVIEW MINUTES

Time of the interview: 2022.10.18

Location: Pécs

Participants:

First name/alias	Gender	Age	Profession	Free-time activity	Consent
Dénes	Male	23	Printing machine mechanic	Football	Yes
Betti	Female	27	Managerial administrator	Solving riddles	Yes
Viktor	Male	29	Student	Sport, music	Yes
Gabber	Female	32	Physiotherapist	Listening to music	Yes
Attila	Male	50	Train driver	Cycling, reading	Yes
Zsuzsa	Female	65	Lab assistant - retired	Tennis, yoga, hiking	Yes

PERSONAL DATA AND DOCUMENT OF CONSENT

First name/alias (that can be presented in the research):

Gender: Male ☐ Female ☐

Age:years

Profession:

Preferred free time activity:.....

I consent to the recording of the discussion.

Yes ☐ No ☐

I consent to the processing and usage of everything said during the discussion and the given date in the research.

Yes ☐ No ☐

Signature:

Focus group interview questions:

1. What reasons could you give for purchasing a new product before the current one breaks down?
2. What are your reactions when a product of yours breaks down sooner than expected?
3. What advantages do you see in the more and more frequent releases of new devices and products?
4. How do you balance between the desire for innovation and your financial constraints?
5. In your opinion, what could the reasons be for manufacturers intentionally limiting the lifespans of products?
6. What comes to your mind when looking at these pictures? What do you think about your device in cases?
7. What do you think about the at home repair of products? What do you think about this repair kit? (Apple Repair kit) Compared to that, what is your opinion on this one? (iFixit Repair kit) Which one is more sympathetic? Would you use any of them? (for the images, see the Appendices)
8. How do you handle your electronic devices, after replacing them?