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Financial strategies to mitigate planned obsolescence risk and its impact on technology product sustainability

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Abstract

Planned obsolescence, a prevalent strategy in the technology industry, accelerates product replacement cycles, impacting both consumer trust and environmental sustainability. With stricter regulations and increased consumer awareness, companies face the challenge of balancing profit with sustainable practices. This study aims to explore financial strategies that mitigate risks associated with planned obsolescence, ensuring companies maintain long-term profitability while addressing consumer and environmental concerns. This qualitative case study relies on a literature review as the primary data source, analyzing prior studies and regulatory frameworks on planned obsolescence. The study adopts a structured approach to identify financial strategies relevant to mitigating obsolescence risks and preserving brand loyalty. Findings suggest several effective financial strategies, including risk reserves for legal contingencies, investments in sustainable R&D, and the adoption of subscription or leasing models. These strategies help companies manage planned obsolescence more responsibly, enhancing consumer trust and supporting regulatory compliance. Transparency and consumer incentives further support brand loyalty despite periodic product updates. Mitigating planned obsolescence requires a strategic financial approach that balances profitability with responsibility. By adopting risk management practices, sustainable innovation, and alternative business models, companies can align planned obsolescence with environmental sustainability and consumer expectations. These findings underscore the importance of incorporating circular economy principles in financial strategy. Governments are encouraged to enhance regulations and offer incentives to companies demonstrating sustainable practices, fostering a technology sector that aligns economic success with environmental and consumer well-being.

Keywords:
Consumer loyalty; financial strategy; planned obsolescence; sustainability; technology industry.

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INTRODUCTION

In the technology industry, the practice of planned obsolescence has become a commonly used strategy to encourage regular product renewal cycles (Zhao et al., 2021; Nunes et al., 2021; Kuppelwieser et al., 2019; Satyro et al., 2018). By shortening the

product's lifespan, companies seek to increase the frequency of new product purchases, thereby increasing revenue (Sun et al., 2019; Li & Yang, 2019). However, this strategy not only impacts consumers who often have to replace products faster, but also negatively impacts the environment through increased e-waste (Khan et al., 2018; Nunes et al., 2021; Islam et al., 2021). On the other hand, pressure from governments and consumers regarding sustainability issues is increasing, so companies are faced with the challenge of balancing financial gain with environmental responsibility (X. Zhao & An, 2023; Nishitani et al., 2021; Han, 2021).

Countries such as France and Italy have imposed strict regulations on planned obsolescence to prevent practices that harm consumers and the environment (Maggiolino, 2019; Mugge & Bakker, 2018). To meet these demands, technology companies need to develop effective financial strategies as a form of risk mitigation, especially in countries with strict regulations (Zhu & Zhao, 2022). With the right financial approach, companies can anticipate legal risks, increase consumer loyalty, and reduce environmental impact through more sustainable innovation (Cui et al., 2020; Vergara & Agudo, 2021). The focus in this study is first, how planned obsolescence impacts the sustainability and reputation of technology companies. Next, what financial strategies are effective in mitigating planned obsolescence risk. Furthermore, what is the role of these financial strategies in increasing consumer loyalty and compliance with environmental regulations. Finally, how the application of the circular economy concept can reduce the negative impact of planned obsolescence.

Planned obsolescence is defined as a strategy to shorten product life in order to increase repeat purchases (Satyro et al., 2018; Malinauskaite & Erdem, 2021). In its development, many studies have begun to discuss the negative impact of planned obsolescence, especially on the environment. Kuppelwieser et al., (2019); Satyro et al., (2018); Hartl et al., (2022) showed that this strategy can undermine consumer loyalty if implemented without transparency. Along with the increasing awareness of sustainability, more recent research reveals the importance of a circular economy approach in designing products that are more durable and recyclable (Megevand et al., 2022; van Dam et al., 2020; Leal et al., 2020).

The application of circular economy in mitigating planned obsolescence is a rapidly growing innovation in various developed countries (Malinauskaite & Erdem, 2021). Policies related to e-waste regulation and restrictions on the use of hazardous materials are getting stricter in several countries such as France and the European Union, thus encouraging companies to look for sustainability solutions (Sutisna, 2024; Faisol.rahman, 2022). Recent research has also shown that financial strategies such as allocation of funds for recycling and eco-design innovations can be promising approaches to reduce e-waste and extend product life cycles (Fenwick et al., 2023; Yi & Wu, 2021; Wang et al., 2019; Wang et al., 2020).

Previous research relevant to this issue includes analyzing the impact of planned obsolescence on the environment, consumer perceptions, and risk mitigation financial strategies. On the consumer side, a study by Sielska, (2019); Yurtsever, (2023) highlighted that consumers feel disadvantaged by the short product life that is often not worth the price.

On the environmental side, a study by Zhen et al., (2021); Ahirwar & Tripathi, (2021) shows that e-waste generated from rapidly obsolete products triggers an increase in hazardous pollution. Meanwhile, in the regulatory realm, research conducted by Borsatto et al., (2020); Borsatto & Amui, (2019) concluded that the implementation of strict regulations in developed countries triggers companies to invest more in sustainable innovation.

While many studies have addressed the impact of planned obsolescence on the environment and consumers, few have explored financial approaches to risk mitigation in this context. Moreover, studies that integrate financial strategies with the concept of circular economy as a sustainability solution are still very limited. In the context of emerging markets such as Indonesia, research on planned obsolescence risk mitigation strategies based on circular economy and environmental regulation is rare.

Based on the identified research gap, this study aims to develop an effective financial strategy to mitigate planned obsolescence risk by considering regulatory aspects, consumer loyalty, and sustainability. This research also aims to contribute to the efforts of redesigning planned obsolescence in line with circular economy principles, especially in developing countries that have more flexible regulations but are faced with significant environmental issues.

LITERATURE REVIEW

Definition of Planned Obsolescence

Planned obsolescence is a sophisticated business tactic of working on products with a deliberately limited lifespan, causing products to become obsolete or outdated within a certain timeframe (Malinauskaite & Erdem, 2021). This strategy can lead to products that are no longer up-to-date or functionally suboptimal, even to the point of damage (Satyro et al., 2018; Populationmatters.org, 2024). This concept was born from the mind of American marketing pioneer Justus George Frederick in 1928. Frederick believed that this strategy was crucial in increasing long-term sales by shortening the buying cycle, forcing consumers to keep replacing old products with new ones (Populationmatters.org, 2024). As a result, transaction flow remains high and revenue continues to flow to the company. Frederick's inspiration has colored many companies around the world, especially in the technology industry.

Planned obsolescence is not just a method to determine the lifespan of a product, but also based on the perception of consumer trends (Makov & Fitzpatrick, 2021). When a product is already perceived as obsolete due to the latest trends, consumers tend to switch to the latest version (Pardo-Vicente et al., 2022). The main goal of planned obsolescence is to change consumers' perceptions to always choose products that are more up-to-date, superior, and more sophisticated than their needs (Koca et al., 2020). Apart from the consumer perception aspect, planned obsolescence can also be spurred through the concept of product durability, known as contrived durability, where product components are intentionally made to be perishable (Malinauskaite & Erdem, 2021). Although effective, over-implementation of this system can create a negative image for the brand and harm the manufacturer (Vesal et al., 2020).

Technology products are one example of goods that often implement planned obsolescence strategies (Mellal, 2020). As products with constantly evolving innovations, technology products that go too long without updates will lose their appeal in the market. Therefore, planned obsolescence becomes an effective tool in accelerating the obsolescence of old products when new products are introduced, encouraging consumers to switch to the latest version with appropriate incentives.

How planned obsolescence works on technology products

In the electronics industry, the practice of obsolescence is often encountered. Manufacturers often deliver electronic products with limited hardware and software features, limiting the functionality and durability of the product, encouraging customers to switch to new products (Mufidan, 2022). In response to this, manufacturers introduce new product models that address previous shortcomings. For example, in the context of smartphones, smartphone companies implement this strategy through three approaches, namely the development of new models, temporary product designs, and software updates that sometimes slow down smartphone performance (Ancing, 2024).

The first approach involves developing a superior and more advanced smartphone model, creating the perception that the previous model is obsolete due to the arrival of a new, more up-to-date version. The second approach involves designing smartphones to have a limited lifespan, for example by limiting battery life to three years. Once this period expires, consumers are forced to upgrade to a new smartphone. Findings from (Bhanarkar, 2022) show that most respondents (83%) replace their smartphones after three years of use, with most problems caused by battery failure (38.5%). The third approach involves the introduction of software 'updates' that can ultimately damage the performance of the smartphone.

The practice of planned obsolescence in the technology industry is often seen through strategies designed to make products obsolete faster than they should be.

Table 1.

Examples of Planned Obsolescence Practices in the technology industry

Product Example	Description	Source
iPhone	Apple slows performance of older models to encourage new purchases	https://wartaeq.com
Laptop	Laptops that suddenly experience bugs and errors, prompting new purchases	https://utopia.org
1923 Chevrolet car	Annual facelift that makes old models look obsolete	https://p2k.stekom.ac.id

Source: Authors work (2024)

One glaring example is the actions taken by Apple in 2017, where the company admitted that it slowed down the performance of older iPhone models to encourage consumers to buy the latest models. This created the perception that older devices were no longer working properly, despite still being physically in good condition. Research conducted by Harvard University showed that certain iOS updates resulted in a decrease in

processing speed on older iPhone models. This incident raised suspicions, given Apple's reputation for supporting iOS updates for five years. The impact of this incident led to Apple being fined EUR 25 million by the French consumer protection authority (DGCCRF) for allegedly intentionally slowing down the performance of a number of older iPhone models through iOS updates in late 2017. The fine was imposed on Apple because the company did not provide information to iPhone 6, iPhone SE, and iPhone 7 users about the impact of CPU performance degradation caused by iOS update versions 10.2.1 and 11.2. Complaints arose when users of these older iPhone models found their devices slow after updating to the latest versions. Speculation is rife that this may be a deliberate strategy by Apple to encourage older iPhone users to purchase the latest models (Mufidan, 2022).

Planned obsolescence from a consumer perspective

Planned obsolescence is characterized by an emphasis on the tactic of designing products that have a short lifespan, which allows companies to continue to encourage the purchase of new products by making old products no longer suitable (Makov & Fitzpatrick, 2021). Based on a study by Kwak, (2018), the greater the impact of obsolescence on a product, the lower the level of marketing that is considered socially optimal. The planned obsolescence marketing approach has implications for consumer welfare. When a new product is introduced, consumers still get the same value from the previous model. However, with the arrival of the new model, consumer interest in the previous version begins to fade.

Research also shows a relationship between planned obsolescence marketing strategies and consumer loyalty to products. Research results from van den Berge et al., (2020); Hou et al., (2020) show that product renewal initiatives have the potential to reduce consumer loyalty. The study concluded that more frequent product replacement by manufacturers might reduce the perceived value of the product for consumers.

Negative Impact of Planned Obsolescence Externalities: Increase in E-Waste and Environmental Degradation in the Long Run The inability of technological products to meet user expectations triggers a behavior where consumers tend to replace their products and call their previous products as waste. While this may increase the company's revenue, it has serious consequences in the long run. Planned obsolescence policies play a significant role in increasing the volume of toxic e-waste and damaging the natural environment.

Ikhlayel, (2018) notes that e-waste is often dumped in landfills without first sorting it from other household waste. This leads to a low possibility for e-waste to be recycled or reused. One of the last solutions often chosen to reduce e-waste is to send the waste to other countries such as Ghana and India, or through incineration. The practice of shipping such waste often includes electronics that are beyond repair but still contain valuable metals such as copper, silver and gold. This practice of shipping and incinerating waste occurs in Agbogbloshie, Ghana, where about 15 percent of e-waste from households in Europe and the United States is estimated to end up (Chandrasekhar, 2022).

Few e-waste managers realize that the combustion process results in the production of toxic gases and exposure to hazardous chemicals that damage the atmosphere, pollute water and soil, and threaten human health. This threat is caused by the presence of toxic

materials such as mercury, cadmium, lead, brominated flame retardants (BFRs), and polyvinyl chloride (PVC) in e-waste (Gangwar et al., 2019). Planned obsolescence policies, while providing short-term benefits, can ultimately lead to serious disasters for society at large.

Government regulations regarding planned obsolescence strategies

France has established strict regulations against the practice of planned obsolescence through the passing of Hamon's Law in 2015. This law clearly states that planned obsolescence is illegal. Companies proven to have intentionally shortened the lifespan of their products will be fined a maximum of 5% of the company's average annual sales in the last three years. In addition, company executives involved can be punished with a maximum two-year prison sentence (Mufidan, 2022).

In the United States, the Consumer Product Safety Commission is responsible for implementing regulations that protect consumer rights. Despite having the authority to create product standards to prevent planned obsolescence, until now there has been no regulation that explicitly prohibits the practice (Bisschop et al., 2022).

The situation in Indonesia is similar to the United States, where there is no regulation that specifically addresses planned obsolescence. The prevailing law emphasizes more on consumer protection, as stipulated in Indonesian Law No. 8/1999 on Consumer Protection. Article 7 letter d states that business actors are obliged to guarantee product quality based on applicable standards, while Article 8 paragraph (1) letter d prohibits the production and trade of products that are not in accordance with the standards stipulated in laws and regulations (Mufidan, 2022).

RESEARCH METHOD

This research is a qualitative study with a case study approach that focuses on financial strategies to mitigate planned obsolescence risk in technology companies. This method was chosen to gain an in-depth understanding of the strategies implemented by companies in dealing with the impact of planned obsolescence on consumers, the environment, and regulations. Using literature review as a desk study, this research seeks to collect and analyze data from various relevant scientific sources to build a theoretical basis and identify best practices in mitigating planned obsolescence risk.

The data in this study was collected through a literature study that included scientific journals, books, government regulatory reports, and international organization publications related to sustainability, circular economy and planned obsolescence where the data collection steps included First, literature search where the search was conducted using keywords such as planned obsolescence, sustainability financial strategy, circular economy, consumer loyalty and environmental risk mitigation. Next, source selection and evaluation where the literature obtained was then selected based on relevance to the research topic, year of publication (to prioritize recent sources), as well as source quality. Publications from reputable journals or trusted organizations were prioritized to ensure data accuracy.

The collected data were analyzed qualitatively through thematic analysis method, which aims to identify important themes or patterns related to financial strategies to

mitigate planned obsolescence risk. The steps of data analysis include first, data reduction, namely selecting and reducing data in accordance with the research focus which includes financial aspects, sustainability, consumer loyalty, and compliance with regulations. Next, categorization, where the data that has been selected is then categorized to identify the main themes, such as risk backup strategies, subscription business models, product recycling and circular economy. Next, thematic analysis where through this analysis the data that has been categorized is further analyzed to understand the relationship between themes. this approach allows researchers to identify interrelated factors and provide recommendations for effective mitigation strategies. Finally, data interpretation where the results of the data analysis are then interpreted to obtain conclusions that answer the research questions and provide recommendations regarding effective financial strategies in facing sustainability challenges.

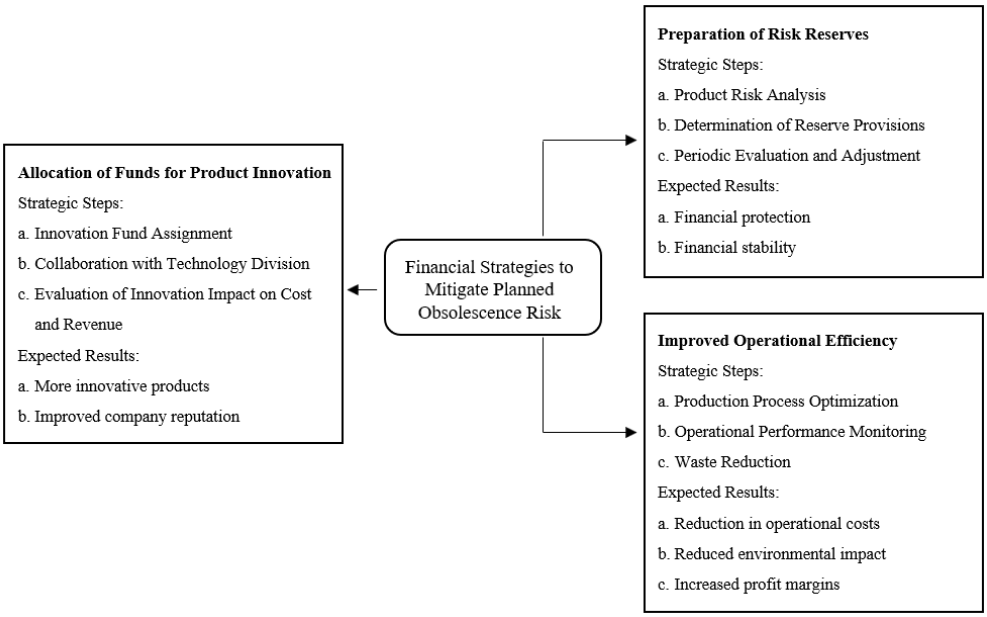
To increase the validity and reliability of the data, this research uses the source triangulation method, which is by comparing and confirming information obtained from various sources of literature and reports. Data triangulation was carried out by means of data consistency from various sources, comparison with similar case studies and confirmation through regulatory documents. This research adheres to the principles of research ethics where all literature sources used in this research come from legitimate and credible sources and copyright is safeguarded by giving credit or citations to the original authors who are referenced.

FINDINGS AND DISCUSSION

Financial strategies to mitigate planned obsolescence risk

Planned obsolescence has become a common practice in the technology industry. However, this strategy brings negative impacts to consumers and the environment (Malinauskaite & Erdem, 2021). Therefore, risk mitigation through financial strategies is an important aspect that needs to be developed to face this challenge. An effective financial strategy can balance the company's long-term profits and sustainability responsibilities. Financial strategies that can be used include establishing risk reserves, allocating funds for product innovation, and increasing operational efficiency.

Figure 1.
Financial Strategies to Mitigate Planned Obsolescence Risk



Source: Author(s) work

Countries such as France have implemented strict regulations against planned obsolescence, imposing high penalties and fines for companies found to be doing so. Companies that have markets in countries with these strict regulations need to develop risk reserves in anticipation. This risk reserve is not only to cope with fines that may arise, but also as a risk management effort to maintain the company's reputation (Mugge & Bakker, 2018).

Planned obsolescence is often associated with the production of goods with a short useful life. To reduce the negative impact, companies can allocate a portion of profits into continuous research and development (R&D). Through R&D, companies can produce products that are more environmentally friendly and have a long lifespan, without sacrificing competitiveness in the market. In addition, by introducing the concept of "eco-design," products will be easier to repair and recycle, which can indirectly increase consumer loyalty (Bisschop et al., 2022).

One way to reduce the pressure of planned obsolescence is to adopt a subscription or leasing business model. With this model, companies can still maintain revenue without having to rely on new product purchases. Consumers also have the option to upgrade products periodically without having to buy new products. This can be a risk mitigation solution to the increase in electronic waste, as well as provide incentives for companies to produce goods with a longer useful life (Indrawati et al., 2024).

The use of planned obsolescence strategy increases the volume of e-waste that pollutes the environment. To reduce this negative impact, companies can develop take-back programs that facilitate consumers in returning old products. This program, which can be financed through planned obsolescence proceeds, allows companies to collect old products and recycle them. In addition to reducing environmental impact, this program can add a source of revenue through the utilization of valuable materials from the recycled products.

The effect of planned obsolescence strategy on consumer loyalty and brand perception

The planned obsolescence strategy can reduce consumer loyalty if not implemented carefully. Based on Jung et al., (2022), consumers tend to lose trust if companies continue to force product upgrades in the short term. This creates a negative perception that impacts brand value. Therefore, companies need to develop marketing strategies that are transparent in providing information about product durability and renewal plans.

First, Transparency to Consumers. Transparency about product life and renewal can increase consumer trust in the company. This information can include a detailed explanation of the durability of key components such as batteries and the physical durability of the product. By doing so, the company will find it easier to maintain consumer loyalty, as well as avoid legal sanctions for alleged manipulation of product lifespan

Next, Providing Incentives for Loyal Consumers. Considering that the effects of planned obsolescence can reduce consumer loyalty, companies need to consider providing incentives such as special discounts, extended warranties, or free services for loyal consumers. This strategy can maintain long-term relationships with consumers and increase satisfaction with the product, despite periodic product updates.

Impact of planned obsolescence on environment and government regulation

Planned obsolescence in technology products has a significant impact on the environment, especially in the form of an increase in the amount of electronic waste. E-waste contains hazardous chemicals that are difficult to recycle and require special attention from companies and regulators. In addition, companies operating in regions with stricter regulations, such as in France, the United States and Indonesia, need to adjust their business practices to comply with local regulations. Mitigation strategies include compliance with environmental regulations, reduction of carbon emissions through operational efficiency, and development of e-waste management policies.

In countries with strict regulations on e-waste and planned obsolescence, companies need to develop financial policies that focus on resource efficiency and environmental compliance. For example, through funding recycling programs that can reduce e-waste and increase the utilization of recycled raw materials in the production process. The electronics industry contributes high carbon emissions during the production process. In the long term, sustainable planned obsolescence strategies need to be geared towards reducing carbon emissions through energy efficiency and the use of more environmentally friendly materials. Companies can allocate a portion of the proceeds from product sales to improve energy efficiency in the production process. As described by Wirtu & Tucho, (2022); Rautela et al., (2021), most electronic waste does not go through a proper management process, thus polluting the environment and damaging human health. Therefore, companies need to strengthen responsible e-waste management policies through proper budget allocation for recycling facilities, as well as educating consumers on how to properly dispose of electronic products.

Implications of planned obsolescence policy for achieving sustainability

To maintain a balance between business profits and sustainability, planned obsolescence strategies must be redesigned to align with circular economy principles. This can be achieved by designing products that are easily recyclable, providing long-term repair services, and creating a business ecosystem that supports product reuse rather than product replacement. The policies that can be implemented include the application of circular economy in technology products, sustainable product innovation.

The circular economy concept can reduce the impact of planned obsolescence by prioritizing the reuse of materials from obsolete products. In this case, companies need to implement financial strategies to increase recycling capacity, such as providing after-sales service or procuring spare parts for old products. In achieving sustainability, innovation needs to be directed towards efficient and environmentally friendly production. Technology that has modular features can be a solution so that products can be updated without having to buy a whole new product.

CONCLUSIONS

This research examines financial strategies for mitigating planned obsolescence risk in the technology industry, with the aim of understanding effective approaches in maintaining a balance between business profits, consumer satisfaction, and environmental sustainability. Based on the results of the analysis, effective financial strategies include developing risk reserves in anticipation of fines and legal liabilities, allocating investments in research and development of sustainable products, and adopting business models that reduce pressure for new product purchases. In addition, companies implementing a planned obsolescence strategy need to increase transparency on product lifetimes and incentivize loyal customers to reduce the negative impact on customer loyalty and brand perception. This overall strategy allows companies to not only mitigate the negative impacts of planned obsolescence, but also maintain competitiveness by meeting sustainability demands.

As a recommendation, companies need to develop sustainability policies oriented towards circular economy principles by strengthening product take-back and recycling programs to minimize e-waste. The implementation of subscription-based or leasing business models can also be an effective alternative to reduce dependence on purchasing new products while increasing consumer satisfaction. In addition, the government is expected to strengthen regulations related to planned obsolescence and incentivize companies committed to sustainable production practices. Thus, the synergy between companies' internal strategies and government policies is expected to reduce environmental impacts and increase the technology sector's contribution to sustainability.

LIMITATION & FURTHER RESEARCH

This study has several limitations that should be noted. First, it uses a qualitative approach with a single case study, limiting the generalizability of findings to other contexts. The data relies primarily on secondary sources from literature and public reports, which may not fully reflect the latest industry conditions or internal company perspectives on planned obsolescence issues. Additionally, the study is primarily focused on mitigating planned

obsolescence through circular economy and financial strategies, while other factors such as government policies or technological innovation have not been explored in depth. Lastly, the study lacks a long-term projection on the environmental impact and profitability of implemented mitigation strategies.

Future research should consider using a quantitative, cross-country approach to understand the impact of planned obsolescence across diverse regulatory contexts. Primary data collection through industry interviews could provide more specific insights into the challenges and opportunities in implementing sustainability strategies. Research could also focus on quantitatively assessing the effectiveness of the circular economy in reducing the impact of planned obsolescence and exploring the integration of environmentally friendly technologies. Moreover, a longitudinal study on consumer loyalty to sustainable products could offer a clearer understanding of the long-term effects of mitigation strategies on customer satisfaction.

AUTHOR CONTRIBUTION

Author: Conceptualisation and Research Design, Data Collection, Methodology, Supervision, Writing Entire Paper, Conceptualisation, Data Collection and Analysis, Editing and Layouting. All Authors have read the final version of the paper.

Declaration of interest

The authors declare that there are no financial interests or personal relationships that could influence the results presented in this paper. All research processes, analyses, and data presentations were conducted objectively and without any conflicts of interest. Our commitment is to uphold academic integrity by adhering to established research ethics standards, ensuring that the results can be transparently utilized for the advancement of knowledge. There were no sponsors or external entities influencing the design or outcomes of this study. All data sources used are publicly accessible, and none of the authors have personal interests directly related to the research theme or topic. We affirm that the entire content of this article represents the authors' independent views and research findings without influence from any party.

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References

Ahirwar, R., & Tripathi, A. K. (2021). E-waste management: A review of recycling process, environmental and occupational health hazards, and potential solutions. *Environmental Nanotechnology, Monitoring \& Management*, *15*, 100409.

https://api.semanticscholar.org/CorpusID:232787772

Ancing, J. (2024). *Planned Obsolescence: Why Your Phone Becomes Obsolete Too Fast*. Cellularnews.Com. https://cellularnews.com/mobile-phone/planned-obsolescence/

Bhanarkar, S. (2022). *Planned Obsolescence — dark truth of the smartphone industry*. Uxplanet.Org. https://uxplanet.org/planned-obsolescence-dark-truth-of-the-smartphone-industry-c9131c5ff7c4

Bisschop, L., Hendlin, Y., & Jaspers, J. (2022). Designed to break: planned obsolescence as corporate environmental crime. *Crime, Law and Social Change*, *78*(3), 271–293. https://doi.org/10.1007/s10611-022-10023-4

Borsatto, J. M. L. S., & Amui, L. B. L. (2019). Green innovation: Unfolding the relation with environmental regulations and competitiveness. *Resources, Conservation and Recycling*. https://api.semanticscholar.org/CorpusID:198478907

Borsatto, J. M. L. S., Bazani, C. L., & Amui, L. B. L. (2020). Environmental Regulations, Green Innovation and Performance: An Analysis of Industrial Sector Companies from Developed Countries and Emerging Countries. *Brazilian Business Review*. https://api.semanticscholar.org/CorpusID:220882595

Chandrasekhar, A. (2022). *The battle against global e-waste dumping reaches tipping point*. Www.Swissinfo.Ch. https://www.swissinfo.ch/eng/society/the-battle-against-global-e-waste-dumping-reaches-tipping-point/47445264

Cui, H., Wang, R., & Wang, H. (2020). An evolutionary analysis of green finance sustainability based on multi-agent game. *Journal of Cleaner Production*, *269*, 121799. https://api.semanticscholar.org/CorpusID:219413866

Faisol.rahman. (2022). *Sampah Elektronik dan Hak Untuk Memperbaiki (Right to Repair)*. Pslh.Ugm.Ac.Id. https://pslh.ugm.ac.id/sampah-elektronik-dan-hak-untuk-memperbaiki-right-to-repair/

Fenwick, C., Mayers, K., Lee, J., & Murphy, R. (2023). Recycling plastics from e-waste: Implications for effective eco-design. *Journal of Industrial Ecology*, *27*, 1370–1388. https://api.semanticscholar.org/CorpusID:260009317

Gangwar, C., Choudhari, R., Chauhan, A., Kumar, A., Singh, A., & Tripathi, A. (2019). Assessment of air pollution caused by illegal e-waste burning to evaluate the human health risk. *Environment International*, *125*, 191–199. https://api.semanticscholar.org/CorpusID:73451800

Han, H. (2021). Consumer behavior and environmental sustainability in tourism and

hospitality: a review of theories, concepts, and latest research. *Journal of Sustainable Tourism*, *29*, 1021–1042. https://api.semanticscholar.org/CorpusID:233247168

Hartl, R. F., Kort, P. M., & Wrzaczek, S. (2022). Reputation or warranty, what is more effective against planned obsolescence? *International Journal of Production Research*, *61*, 939–954. https://api.semanticscholar.org/CorpusID:245862930

Hou, C., Jo, M.-S., & Sarigöllü, E. (2020). Feelings of satiation as a mediator between a product's perceived value and replacement intentions. *Journal of Cleaner Production*, *258*, 120637. https://api.semanticscholar.org/CorpusID:214362994

Ikhlayel, M. (2018). An integrated approach to establish e-waste management systems for developing countries. *Journal of Cleaner Production*, *170*, 119–130. https://api.semanticscholar.org/CorpusID:117218060

Indrawati, Widarmanti, T., Ramantoko, G., Pillai, S. K. B., & Rachmawati, I. (2024). Towards a Unified Model of Planned Obsolescence and Innovation Adoption in Consumer Behavior: A Literature Review and Conceptual Proposition using the Stimulus-Organism-Response Framework. *Management and Production Engineering Review*. https://api.semanticscholar.org/CorpusID:271409991

Islam, T., Huda, N., Baumber, A., Shumon, R. H., Zaman, A. U., Ali, F., Hossain, R., & Sahajwalla, V. (2021). A global review of consumer behavior towards e-waste and implications for the circular economy. *Journal of Cleaner Production*, *316*, 128297. https://api.semanticscholar.org/CorpusID:237663997

Jung, W., Peck, J., Palmeira, M., & Kim, K. (2022). An Unintended Consequence of Product Upgrades: How Upgrades Can Make Current Consumers Feel Left Behind. *Journal of Marketing Research*, *59*, 1019–1039. https://api.semanticscholar.org/CorpusID:246345790

Khan, M. A., Mittal, S., West, S., & Wuest, T. (2018). Review on upgradability – A product lifetime extension strategy in the context of product service systems. *Journal of Cleaner Production*. https://api.semanticscholar.org/CorpusID:158324120

Koca, E., Valletti, T., & Wiesemann, W. (2020). Designing Digital Rollovers: Managing Perceived Obsolescence through Release Times. *Production and Operations Management*, *30*, 3698–3712. https://api.semanticscholar.org/CorpusID:219378894

Kuppelwieser, V. G., Klaus, P. 'Phil,' Manthiou, A., & Boujena, O. (2019). Consumer responses to planned obsolescence. *Journal of Retailing and Consumer Services*. https://api.semanticscholar.org/CorpusID:169359689

Kwak, M. (2018). Optimal Line Design of New and Remanufactured Products: A Model

for Maximum Profit and Market Share with Environmental Consideration. *Sustainability*. https://api.semanticscholar.org/CorpusID:158613433

Leal, J. M., Pompidou, S., Charbuillet, C., & Perry, N. (2020). Design for and from Recycling: A Circular Ecodesign Approach to Improve the Circular Economy. *Sustainability*. https://api.semanticscholar.org/CorpusID:229444615

Li, J., & Yang, F. (2019). The optimal upgrade frequency and lifecycle under maintenance for a single-product rollover. *Journal of the Operational Research Society*, *71*, 1816–1829. https://api.semanticscholar.org/CorpusID:201145178

Maggiolino, M. (2019). Planned Obsolescence: A Strategy in Search of Legal Rules. *IIC International Review of Intellectual Property and Competition Law*, *50*(4), 405–407. https://doi.org/10.1007/s40319-019-00812-1

Makov, T., & Fitzpatrick, C. (2021). Is repairability enough? big data insights into smartphone obsolescence and consumer interest in repair. *Journal of Cleaner Production*, *313*, 127561. https://api.semanticscholar.org/CorpusID:236255818

Malinauskaite, J., & Erdem, F. (2021). Planned Obsolescence in the Context of a Holistic Legal Sphere and the Circular Economy. *Oxford Journal of Legal Studies*, *41*, 719–749. https://api.semanticscholar.org/CorpusID:234025383

Megevand, B., Cao, W., Maio, F. P. Di, & Rem, P. C. (2022). Circularity in Practice: Review of Main Current Approaches and Strategic Propositions for an Efficient Circular Economy of Materials. *Sustainability*. https://api.semanticscholar.org/CorpusID:246028804

Mellal, M. A. (2020). Obsolescence – A review of the literature. *Technology in Society*, *63*, 101347. https://api.semanticscholar.org/CorpusID:224904051

Mufidan, A. (2022). *Strategi Planned Obsolescence pada Produk Teknologi*. Wartaeq.Com. https://wartaeq.com/planned-obsolescence/

Mugge, R., & Bakker, C. A. (2018). Product Lifetimes and the Environment (PLATE) – A Human-Centred Approach to Designing for Product Lifetimes. *The Design Journal*, *21*, 447–450. https://api.semanticscholar.org/CorpusID:116256779

Nishitani, K., bich thao Nguyen, T., Trinh, T. Q., Wu, Q., & Kokubu, K. (2021). Are corporate environmental activities to meet sustainable development goals (SDGs) simply greenwashing? An empirical study of environmental management control systems in Vietnamese companies from the stakeholder management perspective. *Journal of Environmental Management*, *296*, 113364. https://api.semanticscholar.org/CorpusID:237150077

Nunes, I. C., Kohlbeck, E., Beuren, F. H., Fagundes, A. B., & Pereira, D. (2021). Life cycle analysis of electronic products for a product-service system. *Journal of Cleaner Production*, 127926. https://api.semanticscholar.org/CorpusID:236302419

Pardo-Vicente, M.-Á., Camacho-Magriñan, P., & Pavón-Domínguez, P. (2022). Influence of Technology on Perceived Obsolescence though Product Design Properties. *Sustainability*. https://api.semanticscholar.org/CorpusID:253410793

Populationmatters.org. (2024). *From lightbulbs to smartphones: the practice of Planned Obsolescence*. Populationmatters.Org. https://populationmatters.org/news/2024/04/from-lightbulbs-to-smartphones-the-practice-of-planned-obsolescence/

Rautela, R., Arya, S. K., Vishwakarma, S., Lee, J., Kim, K., & Kumar, S. (2021). E-waste management and its effects on the environment and human health. *The Science of the Total Environment*, *773*, 145623. https://api.semanticscholar.org/CorpusID:231944118

Satyro, W. C., Sacomano, J. B., Contador, J. C., & Telles, R. (2018). Planned obsolescence or planned resource depletion? A sustainable approach. *Journal of Cleaner Production*. https://api.semanticscholar.org/CorpusID:158912608

Sielska, A. (2019). Planned obsolescence: gain or loss to the consumer? *Scientific Papers of Silesian University of Technology. Organization and Management Series*. https://api.semanticscholar.org/CorpusID:214305974

Sun, Y., Cai, H. H., Su, R., & Shen, Q. (2019). Advantage of low quality in short life cycle products. *Asia Pacific Journal of Marketing and Logistics*. https://api.semanticscholar.org/CorpusID:211816852

Sutisna, M. A. R. (2024). Pencemaran limbah printed circuit board dari kegiatan kelistrikan PLN. *Humans and Chemical Regimes*, *1*(1), 15–23. https://doi.org/10.61511/hcr.v1i1.639

van Dam, K., Simeone, L., Keskin, D., Baldassarre, B., Niero, M., & Morelli, N. (2020). Circular Economy in Industrial Design Research: A Review. *Sustainability*. https://api.semanticscholar.org/CorpusID:230535123

van den Berge, R., Magnier, L., & Mugge, R. (2020). Too good to go? Consumers' replacement behaviour and potential strategies for stimulating product retention. *Current Opinion in Psychology*, *39*, 66–71. https://api.semanticscholar.org/CorpusID:221237169

Vergara, C. C., & Agudo, L. F. (2021). Fintech and Sustainability: Do They Affect Each

Other? *Sustainability*. https://api.semanticscholar.org/CorpusID:237899952

Vesal, M., Siahtiri, V., & O'Cass, A. (2020). Strengthening B2B brands by signalling environmental sustainability and managing customer relationships. *Industrial Marketing Management*. https://api.semanticscholar.org/CorpusID:216304442

Wang, Z., Huo, J., & Duan, Y. (2019). Impact of government subsidies on pricing strategies in reverse supply chains of waste electrical and electronic equipment. *Waste Management*, *95*, 440–449. https://api.semanticscholar.org/CorpusID:198367314

Wang, Z., Wang, Q., Chen, B., & Wang, Y. (2020). Evolutionary game analysis on behavioral strategies of multiple stakeholders in E-waste recycling industry. *Resources, Conservation and Recycling*. https://api.semanticscholar.org/CorpusID:214189699

Wirtu, Y. D., & Tucho, G. T. (2022). E-waste: Growing environmental and health problems and its management alternatives in developing countries. *Environmental Reviews*. https://api.semanticscholar.org/CorpusID:248589654

Yi, S., & Wu, C.-F. (2021). Green-Extension Design—A New Strategy to Reduce the Environmental Pressure from the Existing Consumer Electronics. *International Journal of Environmental Research and Public Health*, *18*. https://api.semanticscholar.org/CorpusID:237935306

Yurtsever, A. E. (2023). The Role and Importance of Shortening Product Life Cycle with A Planned Obsolescence Strategy in Green Marketing. *Turk Turizm Arastirmalari Dergisi*. https://api.semanticscholar.org/CorpusID:260599385

Zhao, X., & An, H.-S. (2023). Research on the Mechanism of Heterogeneous Corporate Environmental Responsibility in Z-Generation Consumers' Sustainable Purchase Intention. *Sustainability*. https://api.semanticscholar.org/CorpusID:259690386

Zhao, Y., Wang, X., Jiang, Y., Wang, L., Singh, A. K., Huang, L., & Yang, M. (2021). An enhanced planned obsolescence attack by aging networks-on-chip. *J. Syst. Archit.*, *117*, 102093. https://api.semanticscholar.org/CorpusID:233668090

Zhen, Z., Malik, M. Z., Khan, A. A., Ali, N., Malik, S., & Bilal, M. (2021). Environmental impacts of hazardous waste, and management strategies to reconcile circular economy and eco-sustainability. *The Science of the Total Environment*, 150856. https://api.semanticscholar.org/CorpusID:238581008

Zhu, Y., & Zhao, T. (2022). Exploring the Role of Environmental Regulation and Technological Innovation in Financial Performance: Evidence from Chinese Heavy-

Polluting Industry. *Sustainability*. https://api.semanticscholar.org/CorpusID:251505344