

# **Design Durability and its Role in Product Design**

*A thesis submitted in partial fulfilment of the requirements for the degree of*

**Doctor of Philosophy**

By

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## Thesis Certificate

It is certified that the work contained in the thesis entitled **Design Durability and its Role in Product Design** by **Jetti Rahul**, a student in the Department of Design, Indian Institute of Technology Guwahati, India, for the award of the degree of the **Doctor of Philosophy** has been carried out under my supervision and that this work has not been submitted elsewhere for the degree.

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## Declaration

I hereby declare that the work presented in this thesis, titled “Design Durability and its Role in Product Design,” is my original work carried out under the supervision of Dr. Debayan Dhar, Associate Professor, Department of Design, Indian Institute of Technology Guwahati, Assam, India. To the best of my knowledge, it does not include any material previously published or written by another individual, nor does it contain substantial portions of material that have been submitted for the award of any other degree or diploma at the Indian Institute of Technology Guwahati or any other academic institution, except where proper acknowledgment is provided in the thesis. Contributions to this research by collaborators or others, with whom I have worked at the Indian Institute of Technology Guwahati or elsewhere, are explicitly acknowledged in the thesis. I affirm that the intellectual content of this thesis is my own work and writing. Where the ideas, work, or words of others are included, they are appropriately cited and referenced. I also confirm that I have adhered to principles of academic honesty and integrity and have not misrepresented, fabricated, or falsified any ideas, data, facts, or sources in this submission.

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## **Abstract**

The increasing environmental load resulting from mass production and planned obsolescence have heightened the demand for sustainable product design. Durability is an important aspect of product design that influences product quality. Traditionally, concepts of durability have centred on physical longevity and the life-cycle of a single product. This thesis introduces a new concept called design durability, offering a comprehensive approach to ensuring that specific design attributes remain relevant across a wide range of products and life cycles.

Design durability emphasises the lasting characteristics of design elements, including form, function, and usability, enabling products to adjust to changing market dynamics, consumer expectations, and technological progress. In contrast to traditional durability, which prolongs a product's physical lifespan, design durability focusses on the resilience of design elements that can be adapted, altered, and reinterpreted across various product categories and generations. This approach supports a circular economy by reducing waste and encouraging adaptable, modular design solutions.

Through a mixed-methods approach that identifies factors from literature review, expert focus groups, and product reviewing, this research identifies 22 critical factors contributing to design durability, such as aesthetic continuity, adaptability, and standardisation. An exploratory factor analysis further refines these factors, revealing seven strategic approaches—such as modularity, user experience, and operational integrity—that designers can apply across various product types, including convenience, shopping, specialty, and unsought goods.

The thesis offers a new concept and practically usable strategies that assist designers in evaluating and enhancing the continuity of the feature, thereby promoting the development of

durable, adaptable products that minimise waste and prolong product value. This research emphasises resilient design features over product-centred longevity, establishing design durability as a crucial element of sustainable design and advocating for a paradigm shift towards adaptable, enduring design in light of global sustainability challenges.



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# Chapter 1 Durability in Product Design

## **Chapter abstract:**

*This chapter provides a holistic overview of durability in product design, emphasising its critical role in achieving sustainability and advancing the principles of the circular economy. It explores the challenges associated with integrating durability into product design, addressing traditional and modern considerations. Furthermore, the chapter introduces the thesis structure.*

## **1.1 Introduction**

Traditionally, durability was referred to as the ability of a product to withstand physical damage caused by environmental stresses (Frohnsdorff & Masters, 1980). However, the increased environmental concerns and evolved customer expectations have made traditional durability insufficient in addressing sustainability and user needs (Chapman, 2008). Traditional durability overlooks important factors that are crucial for achieving a circular economy. These include the psychological and emotional connections that consumers have with products, flexibility of designs to accommodate shifting consumer needs, and incorporation of elements that encourage resource conservation, reuse, and repair. The growing concern for sustainability and its initiatives compels the durability to evolve and attain a broader perspective that can address the contemporary challenges (Chapman, 2008). This expanded view includes not only physical robustness but also emotional, psychological and strategic dimensions (Chapman, 2008; Haase, 2023; Haines-Gadd, 2019; Haug, 2019). These aspects are vital as they influence how products maintain functional, aesthetic, and emotional value over the extended lifecycle, reducing waste and prolonging product usability. Considering these, this chapter explores how durability can be integrated into product design to meet contemporary sustainability challenges, enhancing

the relationship between product longevity, consumer engagement, and environmental stewardship.

## **1.2 Guiding Objectives of the Research**

This research aims to broaden the concepts of durability in product design by focusing on the persistence and evolution of features across product generations. By addressing gaps in existing concepts, this study seeks to provide a foundational understanding and practical guidelines for sustainable product design. The research objectives are:

The initial guiding research objectives are as follows:

1. To examine the integration of durability and its associated concepts in product design.
2. To evaluate existing durability and associated concepts in relation to obsolescence and identify the gaps and limitations.
3. To identify and define underexplored dimensions of durability.
4. To develop actionable strategies that enhance the durability of features, promoting their longevity and relevance across product generations.

### **1.2.1 Rationale for the Problem Chosen to be Investigated**

In the modern era, innovation has always played a critical role in ensuring the success of product design across the increased competition. Innovation can be broadly categorised into iterative and radical based on the evolution and differentiation of products and the unique features that distinguish them from their competitors (Datta & Srivastava, 2023). However, across all these innovations, certain features are consistently retained across product generations for various reasons, such as familiarity for better usage (Zhou & Nakamoto, 2007) and easy integration across products (Maniak et al., 2014). Despite its importance, the existing literature offers a limited understanding of how specific features achieve enduring appeal and how designers can leverage this to create sustainable designs.

Historically, the concept of feature endurance was explored through frameworks such as timeless design, slow design, design continuity, strategic durability, emotionally durable design, and psychologically durable design (Chapman, 2015; Grosse-Hering et al., 2013; Haase, 2023; Haines-Gadd, 2019; Haug, 2019; Lobos, 2014). While these approaches provide valuable insights into design endurance, they predominantly adopt a product-centric perspective, focusing on the longevity of individual products or product lines. These approaches do not explain why certain features endure across products and generations, nor do they address how these can be utilised in modern product development.

Moreover, modern product development rarely stems from the efforts of a single designer. It involves collaborative, multidisciplinary teams, each contributing specific features to an overall design (Minder & Heidemann Lassen, 2018). This shift necessitates a deeper understanding of design endurance at the feature rather than the product level. Conventional concepts primarily describe the persistence of product forms or entire product lines but do not address the universal appeal and resistance to the obsolescence of specific design features across time and diverse products.

By exploring design endurance at the feature level, designers can identify principles that cause the feature relevance and constitute their continuity. This approach offers a novel perspective on design endurance, enabling the reduction of relentless innovation cycles, minimising waste, and fostering the development of sustainable products. This contributes to sustainable needs along with meeting consumers' demands for making durable and eco-friendly solutions.

### **1.3 Overview of Durability in Product Design**

This section provides an overview of durability in product design, highlighting its definitions, importance, historical context, key challenges, and controversies.

### 1.3.1 Defining Durability in Product Design

The term durability has been defined and interpreted differently across various fields. In architecture and construction, durability refers to the ability of buildings and infrastructure to resist weather, seismic forces, and environmental degradation (Berto et al., 2020; Dhir et al., 2003). In mechanical engineering, durability emphasises material strength, wear resistance, and the capability to endure repeated and continuous stresses (Bilikam, 1985; Lindroos et al., 2015; Reifsnider & Case, 2002). Whereas in the case of product design, durability goes beyond physical endurance and robustness. It expands itself to physical, emotional, psychological, and strategic durability. Physical durability emphasises the robustness of materials and structures to resist degradation and wear of the product and maintain functionality and aesthetics to maintain visual appeal over time (Chapman, 2009; Mesa et al., 2022). Gorilla glass provided in smartphones is scratch-proof and resists damage for maintaining functionality under expected usage conditions (Hsu et al., 2017; Wei-Ming Yeh, 2012). Emotional durability fosters a long-term user attachment with the product (Chapman, 2009; Haines-Gadd, 2019). Heirloom Jewellery and Patagonia's repairable designs resonating with users on a deeper emotional level is an example of emotional durability (Moore, 2016; O'Rourke & Strand, 2017). Psychological durability helps maintain product relevance by meeting user's psychological needs (Haug, 2019). Premium branded products like Rolex make themselves through timeless hedonic values they provide to the users, which is an example of psychological durability (Stokburger-Sauer & Teichmann, 2013). Lastly, strategic durability involves decision-making that integrates a company's long-term business goals with the extended lifespan of its products. Companies like Fritz Hansen incorporating digital product passports (DPP) into their high-end furniture, providing comprehensive information regarding product materials, care instructions, and repair options to enhance longevity is an example of strategic durability (Haase, 2023).

Durability in product design is a holistic concept that integrates technical, emotional, and strategic considerations, aligning with sustainability, consumer expectations, and business strategies (Bocken et al., 2016). It enhances functionality, user experience, and economic value, extending product longevity while supporting sustainable production and consumption models. By reducing waste, extending product life cycles, and fostering a circular economy through reuse and repair, durability addresses overconsumption and waste challenges. It bridges environmental and economic objectives, promoting resource efficiency and aligning with broader sustainability goals. This comprehensive perspective underscores its vital role in transitioning toward a sustainable and resilient future.

Figure 1.1 illustrates the concept of durability in product design from three perspectives: user-centric, product-centric, and manufacturer-centric. This multidimensional approach encompasses emotional and psychological durability for users, physical durability focused on the product itself, and strategic durability emphasising manufacturer goals to enhance overall durability.



Figure 1.1 Types of Durability in Literature

### 1.3.2 Historical Context of Durability in Product Design

The concept of durability evolved with time, shaped by technological advancements, economic requirements, and environmental concerns. This section on the evolution of durability informs the interplay between these factors and how they influence the prioritisation of durability in products. Figure 1.2 illustrates the historical progression of durability in product design from pre-industrial era to contemporary sustainability-focused practices.

- a. *Pre-Industrial Conceptions of Durability:* Before industrialisation, durability in products was synonymous with their quality and long-lasting nature. Products were handcrafted by artisans, making them labour-intensive and costly. Additionally, due to their scarcity, products were used with great care, and items from this era were built to endure, often becoming cherished heirlooms handed down through generations (Chapman, 2009). The approach to the durability of this era was driven by the high costs and intensive nature of manual craftsmanship, which made long-lasting products desirable and necessary. This era valued meticulous crafting and maintenance across all products.
- b. *Industrial Revolution and Mass Production:* The late 18th to 19th centuries marked the Industrial Revolution, which caused the rise of mass production. The Industrial Revolution introduced new methods, such as the assembly line, which cut production costs and time. However, faster production created problems for industries. They struggled to make a profit because consumers preferred products that lasted longer. To mitigate economic instability, the concept of planned obsolescence was introduced, which involved designing products with limited lifespans to encourage repeat purchases. A notable example of this is the lightbulb cartel of the 1920s (Krajewski, 2014). This era has seen the introduction of standardized parts, which has significantly facilitated repairs and maintenance processes.

- c. *Mid-20th century quality assurance*: By the mid-20th century, there was a renewed focus on durability through the establishment of quality assurance frameworks like Total Quality Management (TQM) (Bradley, 1994; Magd & Curry, 2003; Mouhib et al., 2024) and standards from organisations like the International Organisation for Standardisation (ISO) (Zhao et al., 2020). These developments are made to ensure consistent quality and durability through comprehensive testing and control processes. This emphasis is in alignment with principles of effective quality management, ultimately resulting in the production of goods that exhibit resilience to wear and tear.
- d. *Shift towards sustainability*: In the late 20th and early 21st centuries, the recognition of the environmental crisis and resource depletion led to an evolution of the concept of durability, emphasizing its importance in the context of sustainability and the circular economy. These principles emphasised increasing product lifespans through strategies such as reuse, repair, refurbishment, and remanufacturing (Mesa et al., 2022). Emphasising the need to reduce waste and minimise environmental impact, policies like the European Union's (EU) Ecodesign Directive included durability in the regulatory frameworks (Polverini, 2021; Tecchio et al., 2017). Modern design practices include modularity, repairability, and adaptability to user needs, with a focus on minimising environmental impact. Brands like Patagonia followed this trend of promoting repairable and durable products.
- e. *Longer usage span*: Jonathan Chapman's research into durability has expanded by including an emotional dimension (Chapman, 2008; 2016). This perspective redefines durability not just as a technical quality but also as an experiential one, addressing the behavioural and perceptual aspects of sustainability. Additionally, it has developed a psychological dimension that contributes to an extended usage period, akin to the concept of emotional durability (Haug, 2019). Subsequently, the approach evolved to

encompass a strategic dimension that focuses on extending a product's lifespan. This involves aligning with the company's goals and broadly addressing sustainability by considering economic, environmental, and ethical factors.

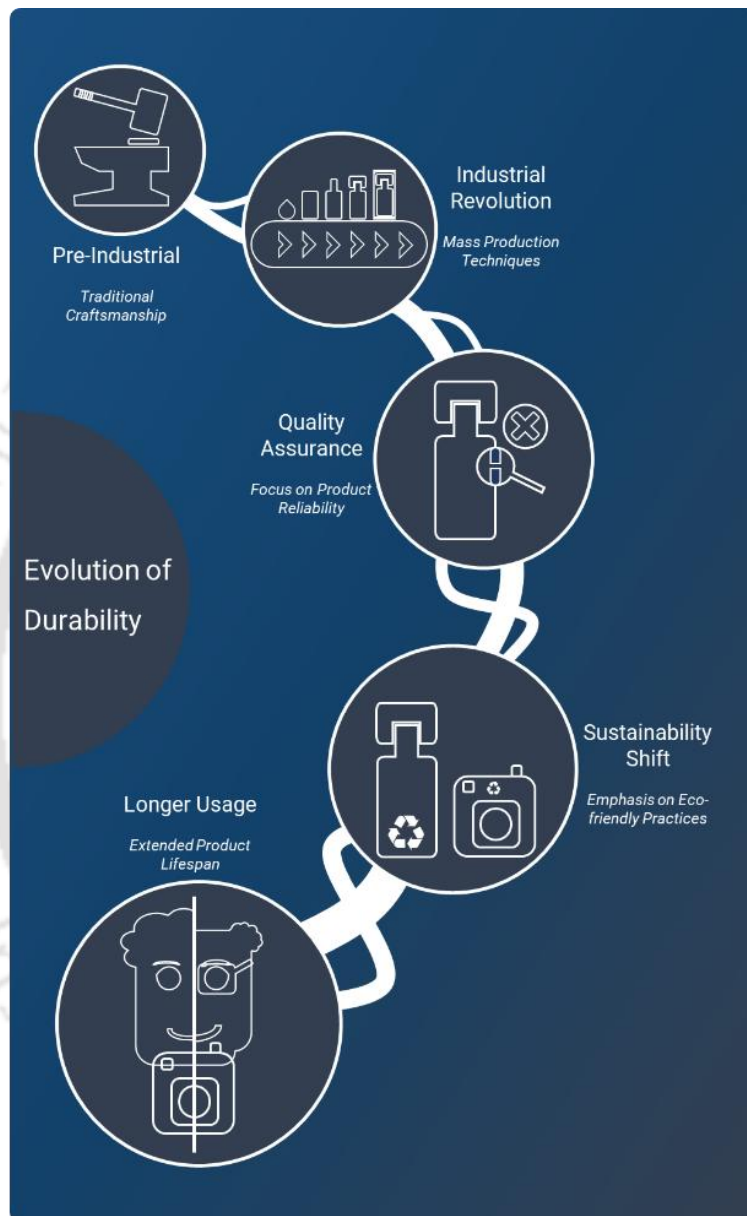


Figure 1.2 Evolution of Durability in Product Design

Modern design practices seamlessly integrate traditional craftsmanship with contemporary needs for sustainability and adaptability. This approach creates eco-conscious products that balance aesthetics, functionality, and environmental responsibility. Durability, which was once a fundamental requirement for handcrafted goods in the pre-industrial era, has transformed into

a multifaceted concept that includes cost, quality, environmental impact, and consumer behaviour. This evolution highlights its essential role in the ethical development of products and its connection to design, sustainability, and business.

By combining the quality-focused principles of traditional craftsmanship with modern approaches like modularity and repairability, designers can create products that meet both aesthetic and functional demands while also promoting resource conservation and reducing waste. Historical insights into reuse and the creation of long-lasting products offer valuable guidance for developing eco-conscious policies, as seen in initiatives like the European Union's Ecodesign Directive. This underscores the importance of fostering emotional durability and consider wider spectrums of durability from various perspectives to be developed to achieve the contemporary needs.

For businesses, embracing durability provides a competitive advantage by shifting from planned obsolescence to strategies that align with ethical and economic priorities. This transformation fosters advocacy for durable, repairable products through informed policymaking, promotes material innovation, and encourages the adoption of practices that balance cost, quality, and environmental considerations. Ultimately, a thorough understanding of durability enables designers and businesses to navigate the intersection of tradition and modernity while furthering sustainability and ethical responsibility in product design.

### **1.3.3 Key Concepts Associated with Durability in Product Design**

- a. **Sustainability:** This concept focuses on designing products by considering ways that minimise environmental harm, conserve natural resources, and ensure that future generations can meet their needs (Kuhlman & Farrington, 2010). Developing a product production pathway that considers the economic, environmental, and societal implications is the key to achieving sustainability.

- b. **Circular design:** This integrates the principles of circular economy at the design stage by envisioning a product's entire lifecycle, including disposal. It emphasises creating products designed for easy disassembly and reusing components or materials to ensure nothing becomes waste (Moreno et al., 2016). Designers need to think about each product component and what should be done when it is no longer used or needed.
- c. **Product longevity:** This defines creating products that last longer and remain functional throughout use (T. Cooper, 2010; Van Nes & Cramer, 2005). By focusing on durability, product longevity can be achieved, which reduces frequent product replacement, conserves resources and reduces waste. Achieving extended product longevity is cost-effective over time and minimises the environmental impact caused by the manufacturing, distributing, and disposing of products (Bakker et al., 2014). Strategies like slow, timeless and resilient designs help achieve long-term product usage and longevity (Grosse-Hering et al., 2013; Haug, 2018; Lobos, 2014).
- d. **Obsolescence:** Products becoming outdated or no longer desirable are considered obsolete (Schallmo et al., 2012). Traditionally, design practices promoted obsolescence by embracing trends and technological advancements. Modern design practices aim to combat obsolescence by creating durable products that resist user-centric changes, manufacturing limitations, environmental regulations, and economic shifts, extending their viability and reducing the need for frequent replacements.

These concepts are linked by their shared commitment to enhancing product durability, leading to greater satisfaction and longevity for consumers. Durability extends both the inherent and usage lifespans of products, supporting the principles of the circular economy by reducing material waste. This waste reduction helps achieve sustainability, as it lessens the need for frequent manufacturing and disposal, minimising environmental impact (Figure 1.3). Circular design specifically focuses on creating products that can be easily disassembled and reused,

further extending their usage and longevity. All these concepts address durability by promoting longer product usage, combating obsolescence, and helping align with both circular economy and achieve broader sustainability goals.

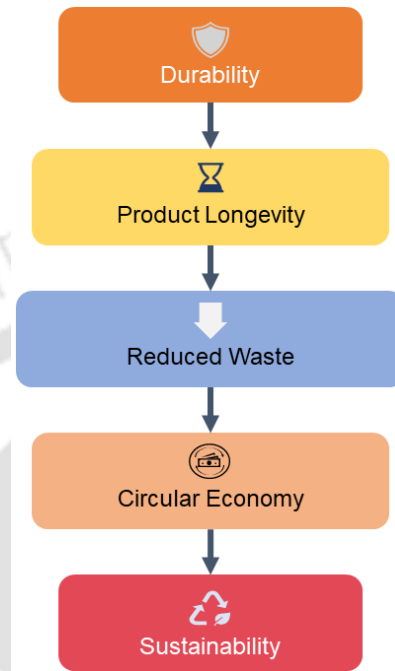


Figure 1.3 Durability Associated Concepts

### 1.3.4 Challenges Identified in Durability in Product Design

Pursuing durability in product design is crucial for sustainable practice. However, it is fraught with numerous controversies and challenges. The complex interplay of ethical considerations, economic pressures, consumer behaviour, and technological advancements leads to these challenges and controversies. A few key controversies and challenges are presented below:

- a. Through planned obsolescence, manufacturers intentionally design products with limited lifespans to encourage frequent replacements. This practice is often criticised for prioritising profits over consumer interests and environmental sustainability, leading to increased electronic waste. Ethical concerns arise as this practice manipulates consumer behaviour and sacrifices long-term sustainability for short term gains. It

reflects the competitive need for innovation in rapidly evolving markets (Galbreth & Ghosh, 2013; Sharma, 2016).

- b. The practice of over-engineering deals with designing products to be excessively durable or robust raises concerns about inefficiency, higher costs, and impracticality. While this practice is warranted in certain safety-critical applications where products must endure harsh conditions. Even in these scenarios, over-engineering can have downsides, such as increased environmental impacts from greater resource and energy consumption during production. Furthermore, the resulting higher product costs may deter consumers, reducing market appeal despite their durability (Asche et al., 2009).
- c. Durability often clashes with rapid technological advancements, causing long-lasting products to become obsolete as newer features emerge. This requirement pushes innovation and contributes to electronic waste and consumer demand for the latest technologies. Achieving a balance between the latest advanced features and maintaining product longevity is a critical challenge to ensure sustainability without compromising user experience or product lifespan (Chapman, 2009; Park, 2005).
- d. Creating durable products often involves higher production costs due to the use of robust materials and complex manufacturing processes. This poses a challenge for manufacturers to balance the cost and product quality while justifying the higher price for the consumers who are cost-sensitive (Liberali et al., 2011; Luo et al., 2005). The dominant economic model of repeated product purchases to generate profits adheres to various obsolescence, conflicting with the idea of durability.
- e. Consumers often prefer trendy, novel, or cost-effective products over more durable alternatives, driven by fast-changing fashion and technology trends. This creates a challenge for manufacturers who must decide whether to prioritise consumer preferences or the durability of their products (K. B. Cooper, 2017).

- f. Designers face the challenge of effectively integrating durable features into modern products, balancing innovation with familiarity, ensuring interdisciplinary collaboration, and aligning with sustainability goals to create designs that remain relevant, functional, and appealing across generations.
- g. While durable product is perceived as environmentally friendly due to reduced consumption and waste. However, the challenge lies in ensuring that these products are designed to be upgradeable and recyclable. Products without the ability to adapt to evolving needs and technologies may use resources inefficiently or be unable to incorporate newer or more energy-efficient technologies. This failure to adapt can significantly challenge their initial eco-friendly advantages, informing the criticality of the issue in sustainable product design.
- h. The absence of standardised testing methods and metrics for durability, especially dimensions such as emotional durability, makes it difficult for industries to adapt them. Additionally, there is debate in the literature regarding how regulations should enforce standards and policies to effectively accommodate technological changes and market dynamics.

To address these complexities, companies must innovate to enhance the usability and relevance of products over time. Strategies such as modular designs, repairability, and upgradeability help resolve the demand for innovations with durability. Regulatory frameworks such as the Right-to-Repair movement and increased consumer awareness are compelling manufacturers toward more sustainable practices. Aligning business strategies with environmental responsibility and catering to consumer demands contributes to long-term brand loyalty and savings.

## 1.4 Scope of the Thesis

This thesis is centred on exploring and advancing the concept that defines the feature's ability to continue and exist across products. It focuses on addressing unresolved challenges in durability by adopting a multidisciplinary approach that integrates design principles with sustainability and circular economy. The research investigates how products can be designed to endure, adapt, and remain relevant over extended lifespans, thereby meeting modern consumer and environmental demands.

The study redefines durability by moving beyond traditional notions of physical robustness to include emotional and psychological connections with users. The thesis emphasizes the persistence and adaptability of features across multiple product generations. This expanded perspective aims to foster stronger user engagement and align with circular economy principles by integrating repairability, reuse, and recyclability into product design.

A significant focus of the research is on the designer's role in influencing product durability. It examines how design decisions shape the adaptability and relevance of products and offers actionable strategies to help designers incorporate design durability principles into contemporary practices. This includes addressing challenges such as obsolescence and ensuring that products remain valuable and engaging throughout their lifecycle. Through the development of the design durability theoretical framework, this thesis aims to bridge critical gaps in durability research. It provides strategies to create adaptable, sustainable product designs while aligning with consumer needs and global sustainability objectives.

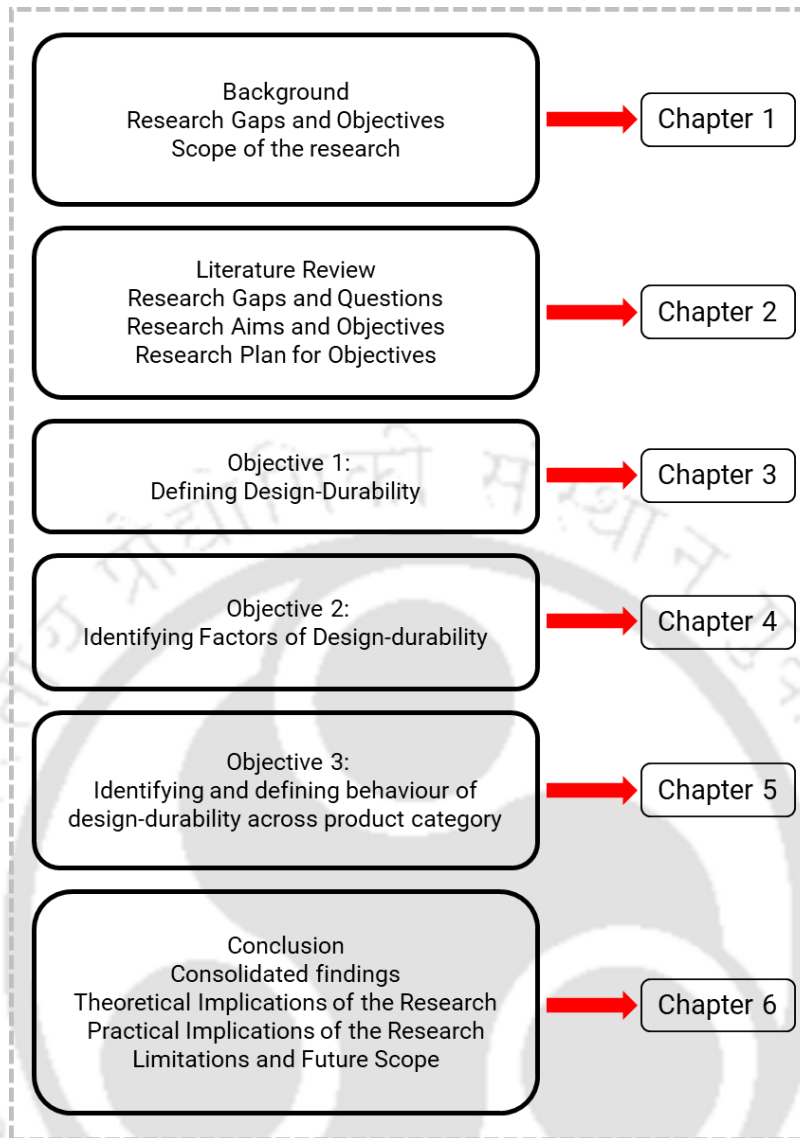


Figure 1.4 Structural Overview of Thesis Chapters and Objectives

### 1.5 Thesis Structure:

The structure designed to address the identified gaps is detailed in Figure 1.4, followed by a summary of each chapter:

#### a. *Chapter 1: Introduction*

This chapter presents an overview of the evolution of product design, with a particular emphasis on the concept of product durability.

This chapter sets the stage by discussing the evolution of product design with a focus on product durability. It identifies research gaps, formulates research questions, outlines research aims, and provides a brief plan and structure for the thesis.

b. ***Chapter 2: Literature Review***

A systematic review is conducted to assess the landscape of product durability in design, mapping durability to product obsolescence and exploring sustainable design approaches. The chapter identifies gaps in current designs that fail to achieve durability, setting the foundation for developing strategies to enhance product longevity.

c. ***Chapter 3: Defining Design durability:***

This chapter defines 'design durability', differentiating it from traditional durability focused on physical resilience and sustainable design that prioritizes eco-friendliness. It positions design durability as a concept emphasizing the relevance and persistence of design features across product generations.

d. ***Chapter 4: Factors of Design durability***

It highlights the importance of design durability in modern design, recognizing a gap in defining its influencing factors. A methodological approach is introduced to explore these factors, including form, functionality, and human factors, aimed at aiding designers in understanding and applying design durability.

e. ***Chapter 5: Strategies to Achieve Design durability Across Product Categories***

This chapter discusses the need for strategies that help designers create products that remain relevant across different categories. It describes a two-phase study involving an analysis of online product content and a survey to assess the importance of durability factors, leading to practical strategies for designers.

f. ***Chapter 6: Key Contributions and Conclusions:***

This chapter of the study summarizes the key findings and contributions of the thesis on design durability, offering recommendations for designers and suggesting future research directions to expand the understanding and application of design durability in sustainable design.



## Chapter 2 State-of-the-Art Literature Review

*Chapter abstract: This chapter conducts and presents the state-of-the-art literature review on durability in product design. Keyword-based search strategy was employed to identify and examine concepts related to durability, offering a more comprehensive understanding. The literature review explores various durability concepts and strategies, links them to obsolescence, and identifies the gaps that were presented along with the research questions, aims, objectives, and an overview of the methodology followed in this thesis.*

### 2.1 Introduction

The Industrial Revolution reshaped production capacities and consumer preferences, shifting away from valuing scarcity and durable items towards mass production and enhanced availability. However, this shift was not smooth, as the long-lasting products that were initially appreciated and manufactured resulted in unstable economic stability due to lower purchase requirements. This economic instability led to planned obsolescence, where products were made with a shorter lifespan, encouraging repeated consumption (London, 2014). Initially, the implementation of obsolescence focused on addressing the physical longevity or the functional longevity of a product. As time advanced, obsolescence diversified into various areas, encompassing psychological, economic, and logistical dimensions. While obsolescence contributed to economic activity, it also created a transition in consumer behaviour, resulting in a throwaway culture that increased waste and environmental load over time (T. Cooper, 2004). The heightened environmental risk prompted the industry to delve deeper into responsible production and consumption by rethinking the notions of obsolescence and product durability. In the current landscape, the emphasis on creating long-lasting goods, coupled with the changing landscape of product obsolescence, poses a challenge for designers as they navigate the selection and execution of optimal strategies. This underscores the necessity of a

thorough grasp of durability, its related principles, and their intricate relationships. A comprehensive examination of contemporary literature concerning product durability, encompassing its diverse facets such as types, methodologies, ramifications, and constraints, is imperative for informing designers and product design processes. Despite some articles delving into durability and product lifespan, they rarely address actionable strategies for designers. The current research endeavours to offer a more inclusive viewpoint on crafting enduring designs by synthesising literature that addresses the longevity of products comprehensively.

This study conducts a systematic literature review to explore and understand the concepts associated with durability in product design. The aim is to thoroughly review existing research and uncover new insights. This will shed light on the application, scope, and constraints of durability within product design. Additionally, the study aims to identify neglected aspects of durability that are significant in the field of product design.

## **2.2 Methodology**

This study employed a two-step approach to carry out the literature review:

- Initially, the data collection process involved conducting a comprehensive literature review on product durability by identifying relevant studies.
- Subsequent data analysis involved scrutinising the selected research articles on durability within the realm of product design. This was achieved through keyword-based analysis and a critical examination of the concepts associated with durability in the context of product design.

## 2.2.1 Data Collection: Systematic Search

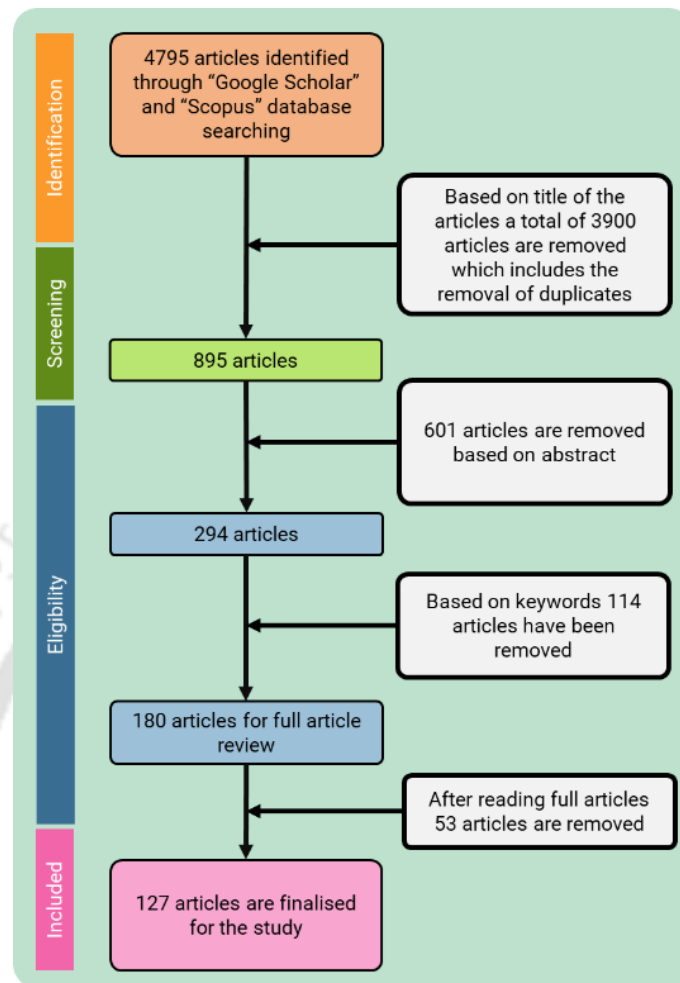


Figure 2.1 Flowchart of methodology opted in defining literature for systematic reviews

The literature review began by narrowing down the scope of the knowledge domain, specifically honing in on the concept of durability, with a particular emphasis on tangible artefacts or products. An exploratory systematic search was conducted using two online databases: Google Scholar and Scopus. Scopus maintains stringent quality control and primarily focuses on peer-reviewed articles, allowing to remove grey literature from Google Scholar's wide range of sources (Moed et al., 2016). The keywords used for the study were "product durability" and "design." The study excluded grey literature due to its low quality. Past literature has adopted a similar approach to ensure source reliability (Mesa et al., 2022). The search and identification of the literature was confined to material science, business and

management, social sciences, economics, arts, multidisciplinary, decision sciences, and psychology, as the literature included many articles from various fields like medical, construction, and engineering. Literature published in English about product durability or obsolescence in the context of product design up to March 2024 was considered for the review.

The combined keyword search from both Google Scholar and Scopus databases yielded a total of 4,795 articles. By evaluating the relevance of titles concerning product durability and removing duplicates, the scope of the study was narrowed to 895 articles (see Figure 2.1). Further scrutiny of abstracts from various perspectives, including studies on physical durability, economic sustainability, and sustainable product development, helped identify 294 articles. Then, keywords associated with product durability, obsolescence, product longevity, or the circular economy helped identify 180 articles. Subsequently, after reading the full articles, 127 articles were selected for literature review. The study selected peer-reviewed articles that focused on product durability, ways to extend product lifespan, or challenges to durability.

### **2.2.2 Data Analysis – Keyword-based analysis**

This study employed a keyword-based analysis to form research clusters, offering insights into the knowledge domain's distribution and helping pinpoint emerging research trends. By tracking keyword frequency and their synonyms, the focus was on those that appeared at least four times for further analysis. The threshold of four was selected as it effectively reduces noise, minimizes data loss, and sharpens the visualisation (Lu et al., 2021). Using VOS viewer, a dataset consisting of titles, abstracts, keywords, and publication years from 127 articles was examined. This analysis, based on Zhu & Hua (2017) and Mesa et al., (2022), identified the co-occurrence network. The resulting key terms were then reviewed to extract themes related to durability, sustainable design, and obsolescence.

## 2.3 Results and Discussion

The earliest article in the dataset was from 1994. As shown in Figure 2.2, the literature available before the year 2000 on the domain centred around product durability in product design was quite limited.

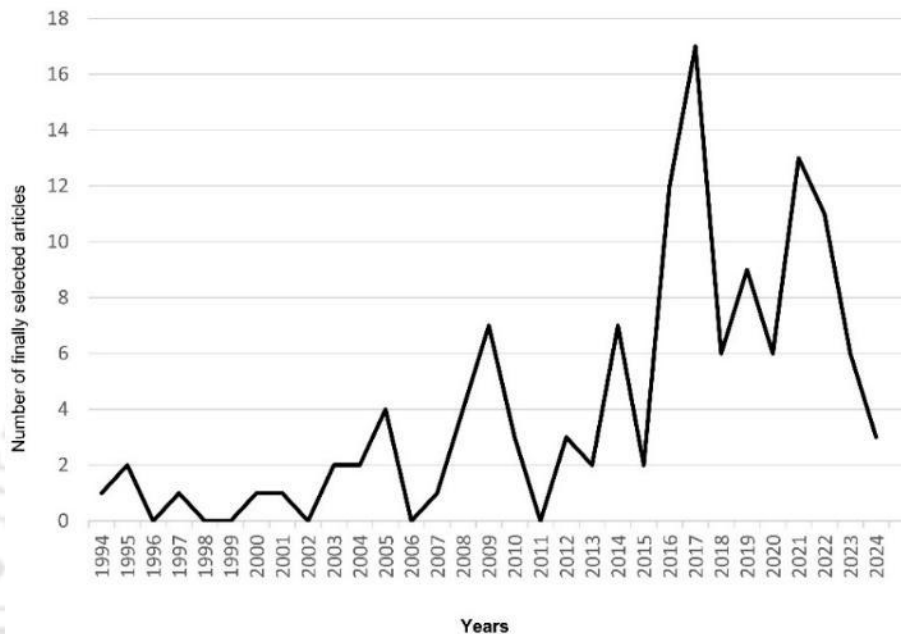


Figure 2.2. Temporal Distribution of Research Publications by Year and Frequency

### 2.3.1 Keyword-based Analysis

A keyword-based analysis using VOSviewer was performed, producing the keyword networks shown in Figure 2.3 and Figure 2.4. This helped uncover key terms, concepts, and trends (see Table 2.1). In Table 2.1, hierarchy of the keywords in each cluster was due to their centrality and connectivity in the keyword network, serving as key integrative nodes. These keywords often represent the defining theme of the cluster, which explains their prominent position. Appendix A's Table A.1 presents the literature that contributed to these clusters. Further insights into the contributing literature can be found in Appendix A, Table A.1, which lists the sources that informed these clusters.

Table 2.1 Keyword analysis of the identified literature

Keyword	Name of the Cluster	No. of Links	Total link strength	Occurrence
Commerce	Sustainable Product	19	24	5
Design for environment	Design and Durability	16	18	4
Durable goods		15	17	4
Durable products		29	58	14
Eco-design		13	15	4
Emotional durability		22	29	6
Extended Producer Responsibility		9	13	4
Manufacture		17	23	4
Optimization		17	23	5
Planned Obsolescence		13	16	5
Product durability		30	42	10
Recycling	23	35	8	
User experience	9	10	5	
Circular design	Circular Economy and Sustainable Design Strategies	22	43	7
Circular economy		36	97	23
Conceptual framework		17	25	4
Consumer behavior		17	29	5
Consumption behavior		22	31	4
Design method		28	59	9
Design strategies		30	54	8
Emotionally durable design		19	38	8
Longevity		20	28	6
Product development		35	81	16
Product life extension	13	15	4	
Product longevity	22	39	11	
Life cycle analysis	Sustainable Product	16	18	4
Obsolescence	Design and Lifecycle Management	26	50	12
Product attachment		14	19	7
Product design		42	190	43
Product lifetime		18	35	8
Research		17	22	4
Sustainable consumption	16	19	5	

Keyword	Name of the Cluster	No. of Links	Total link strength	Occurrence
Sustainable development		34	99	20
Decision making	Sustainable Decision-Making and Environmental Impact Assessment	12	15	4
Durability		36	93	22
Ecodesign		31	78	15
Environmental impact		20	30	5
Life cycle		26	60	13
Life cycle assessment (lca)		10	18	4
Design	Emotion-Driven Sustainable Design	30	64	15
Emotion		18	24	4
Emotional design		11	19	5
Literature review		13	19	4
Sustainability		38	108	30
Sustainable design		25	48	11

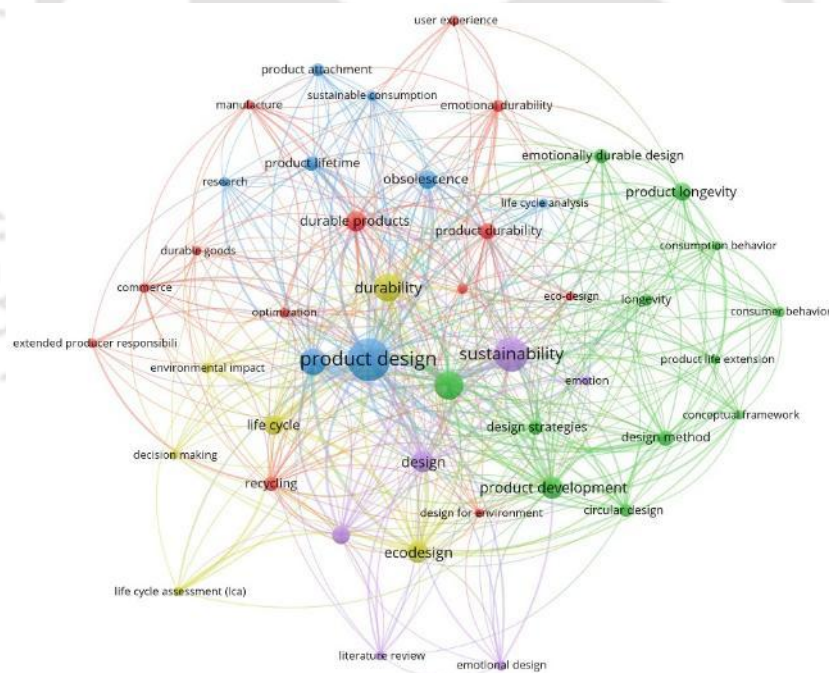


Figure 2.3 Keyword-based analysis showing network formed through literature

The data from the keyword analysis in VOSviewer was drawn from the provided bibliographic information on sustainable design, product durability, and related concepts. Keywords, along

with their linked concepts and relationships within the literature, were identified and extracted.

The insights are detailed below:

- a. *Central themes and Interconnectedness*: The most frequent and strongly linked terms were sustainability, product design, circular economy, design, product development, durability, and obsolescence. This indicates that the core concepts of durability in product design are closely tied to sustainable development and circular economy principles. These keywords highlight a trend in the literature that focuses on integrating sustainability throughout a product's lifecycle. Product durability and design play a crucial role in influencing environmental impact, recycling, and the overall ecological footprint, underscoring the need to assess and reduce ecological impact through lifecycle assessment.
- b. *Emerging trends*: Emotional durability, emotionally durable design, product lifetime, and product longevity exhibited moderate frequencies but had substantial link strengths. These characteristics define emotionally durable design and related concepts as a growing research area within the context of product design.
- c. *Gap areas*: Extended producer responsibility and user experience display fewer links and instances, suggesting opportunities for future research into incentivising producers for product longevity and integrating user experience into sustainable design practices.
- d. *Design consideration*: Product lifetime, user design method, and life cycle assessment (LCA) appeared infrequently, pointing to a gap in practical applications and methods for extending product lifetimes through design. This highlights the need for further research on integrating various life-extending strategies into the design process.

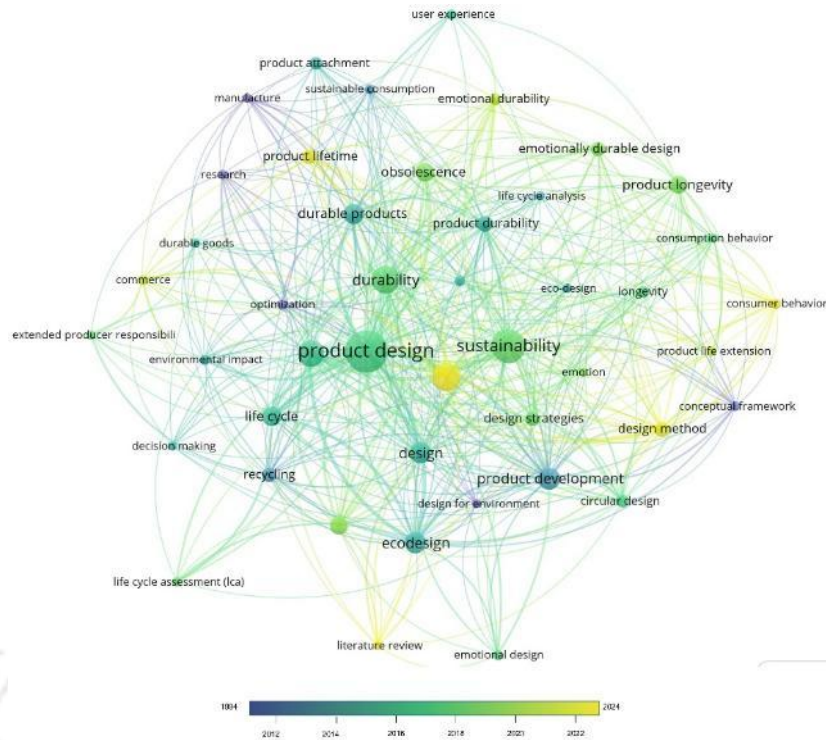


Figure 2.4 Keywords from research mapped across years

The map shown in Figure 2.3 displays five distinct clusters, each marked by a different colour. Figure 2.4 highlights how trends have shifted over time by showing the average publication year for documents linked to each keyword. Investigating product durability within sustainable product design is crucial to addressing obsolescence and its environmental impact. The following sections outline key dimensions and implications for design.

## 2.4 Product Durability

Product durability refers to the ability of a product to maintain its functionality and performance over time (Chapman, 2009; Haug, 2018; Mesa et al., 2022). Various domains such as electronics, automotive, fashion, and household appliances have explored product durability in literature (Chapman, 2008; Kam, 2021; Mulet et al., 2022; Proske et al., 2016). Initially, durability was characterised solely in terms of a product's physical dimension; however, it has since evolved to encompass the product's capacity to withstand changing consumer preferences and technological advancements. Product durability includes various dimensions that include

physical robustness, emotional significance, and adaptability to technological advancements (Haines-Gadd et al., 2018; Mesa et al., 2022). Understanding and effectively managing product durability is critical to implementing circular economy and sustainable development, as durable products reduce waste, minimise resources, and limit environmental pollution by reducing product replacement through increased product lifespan (Den Hollander et al., 2017; Joustra et al., 2021). Products that last longer provide more value to consumers as they reduce the need for replacements and provide enough time for users to connect emotionally with the product (Chapman, 2009).

#### **2.4.1 Dimensions of Product Durability**

Throughout the literature, product durability has been broadly categorised into four aspects, which are as follows:

- i. Physical durability:* Physical durability refers to the lifespan of products and their functional ability; this can define how long a product can preserve itself from degrading under environmentally aggressive forces and perform its intended functions (Den Hollander et al., 2017; Joustra et al., 2021). The robust design is adapted to achieve the highest possible functional life for products and parts. Xing & Belusko (2008) envision physical durability as a circular design strategy for product longevity, encompassing repairability, maintainability, and upgradeability.
- ii. Emotional Durability:* Emotional durability has gained significance in product design, particularly in addressing the disposable nature ingrained in our consumer culture. Emotional durability refers to the ability of a product to form and maintain an emotional connect with a person over time, delaying the product replacement (Chapman, 2009; Haines-Gadd et al., 2018; Huang et al., 2023). Emotionally driven longevity complements a product's physical durability by creating an emotional resonance that

helps foster sustained user engagement (Haines-Gadd et al., 2018; Mesa et al., 2022). Emotional durability was explored through a six-point experiential framework, which included narrative, detachment, attachment, surface, fiction, and consciousness. (Chapman, 2009). This method addresses symbolic obsolescence, emphasising emotional attachment over functional/economic factors, which leads to product lifespan extension (T. Cooper, 2004).

The effectiveness of emotional durability in achieving product longevity becomes critical, especially for products susceptible to rapid consumption cycles (Goworek et al., 2020). Incorporating emotional durability into the design process also fosters the development of circular economic business models, such as second-hand markets and product-service systems, emphasising prolonged use rather than product ownership (Claxton & Kent, 2020). The literature underlines personal memories, the enjoyment of use, and self-expression are fundamental elements that contribute to establishing lasting emotional connections (Maclachlan et al., 2009; Page, 2014; Schifferstein & Zwartkruis-Pelgrim, 2008). Furthermore, literature provides examples highlighting emotional durability and attachment principles in creating products that foster profound emotional connections, enabling products to endure the test of time physically and emotionally (Grosse-Hering et al., 2013; Gulden et al., 2010; Huang et al., 2023; Ji & Lin, 2022; Kam, 2021; Ko, 2017; Lacey, 2009; Mulet et al., 2022; Padró, 2014; Rodrigues, 2010; Van Krieken et al., 2012).

*iii. Psychological Durability:* Psychological durability is a product's ability to stay psychologically relevant by fulfilling the user's psychological needs over time, creating a lasting sense of attachment, dependency and value, making the product irreplaceable (Haug, 2019). This concept expands beyond emotional and aesthetic appeal, integrating functional, symbolic, and hedonic values that together sustain the user's relationship

with the product. Haug (2019) defines psychologically durable design extends beyond the emotionally durable design, by incorporating dimensions including instrumental performance and symbolic identity. Psychological and emotional durability counter the psychological obsolescence.

iv. *Strategic Durability*: Strategic durability emerges as a holistic concept that intertwines a product's tangible longevity with a company's overarching strategic goals, emphasising sustainability, market presence, and stakeholder value generation. This multi-faceted approach to product development is characterised by creating offerings that align with enduring consumer needs, competitive differentiation, and corporate environmental objectives (Haase, 2023; Haase & Laursen, 2022). It aims to bolster brand allegiance, ecological responsibility, and financial viability by marrying the durability of products with a company's core mission and ethical standards. Integral to this strategy is digital product passports (DPPs), which serve as instruments for transparency, fostering consumer engagement, and ensuring that products reinforce the principles of a circular economy and sustainable commerce, as Plociennik et al. (2022) noted. Strategic durability, therefore, encapsulates a comprehensive view of product life span that integrates the physical, emotional, and psychological aspects of durability with the strategic necessities of contemporary business dynamics.

#### **2.4.2 A case study to demonstrate the differentiation of durability concepts**

Many times, few concepts of durability overlap; however, they always have different focuses and aims when achieving durability in a product. A simple smartphone example can help demonstrate how these are different.

- i. *Physical durability:* A smartphone with a water-resistant case and Gorilla Glass demonstrates robustness and resistance to drops and elements. These keep the phone functional and physically intact.
- ii. *Strategic durability:* A smartphone company designs its products with recyclable materials and promotes buyback. It aligns with the company's environmental goals. This strategy appeals to environmentally conscious consumers and enhances brand reputation. Increased consumer trust and loyalty can increase sales, supporting economic sustainability.
- iii. *Emotional durability:* A smartphone with advanced technology and 2000s iconic aesthetics evokes nostalgia, enhancing emotional attachment through memories. Smartphones with customisable features can form an emotional bond with users, making them less likely to discard them.
- iv. *Psychological durability:* A smartphone with stress and sleep monitoring helps manage health and meet psychological needs. Smartphones' adaptive user interfaces, which learn users' habits, reduce digital stress and boost productivity. With time, people find it challenging to switch brands or goods due to the interface's efficiency and convenience.

### **2.4.3 Product Obsolescence**

Product obsolescence is the process by which a product becomes outdated or no longer helpful. A precise understanding of product obsolescence is essential to ensure a product's longevity (Yamamoto & Murakami, 2021). An extensive exploration has been conducted on product obsolescence, examining numerous pathways through which a product may become obsolete (Agrawal & Ülkü, 2013; Koenigsberg et al., 2011; Maitre-Ekern & Dalhammar, 2016; Maulia & Halimatussadiyah, 2018; Pardo-Vicente et al., 2022; Poppe et al., 2021; Schallmo et al., 2012; Sierra-Fontalvo et al., 2023; Valusyte, 2021; Yamamoto & Murakami, 2021).

Details of the same are summarised below (T. Cooper, 2004; Schallmo et al., 2012; Sierra-Fontalvo et al., 2023; Yamamoto & Murakami, 2021):

- a. *Technological obsolescence*: This obsolescence replaces older product versions with newer ones, promoting technological progress. Technological obsolescence makes the older versions depreciable, even if they are functional. This obsolescence is a combination of technical and compatibility-caused obsolescence. Technological obsolescence replaces the old one by making the user perceive the product as outdated. This is closely related to the psychological aspect (Haug, 2019; Sierra-Fontalvo et al., 2023).
- b. *Functional obsolescence*: Products become obsolete when they no longer meet performance requirements, cannot be upgraded, or lack necessary features and functionalities for the current usage context (Sierra-Fontalvo et al., 2023).
- c. *Psychological obsolescence*: The desirability of a product diminishes due to changing consumer preferences or design trends, regardless of its lifespan. This is caused by psychological, aesthetic, and stylistic obsolescence. The literature cites this obsolescence in addressing psychological and emotional durability (Sierra-Fontalvo et al., 2023).
- d. *Economic obsolescence*: This obsolescence is observed when maintaining or using an existing product becomes less economically viable than replacing it with a new one (Sierra-Fontalvo et al., 2023).
- e. *Diminishing manufacturing sources and material shortages (DMSMS)*: This obsolescence occurs when essential components, materials, or technologies become unavailable due to discontinuation or supply chain disruptions, affecting the product's maintainability and upgradeability (Sierra-Fontalvo et al., 2023).

- f. *Planned obsolescence*: This happens due to the production of parts with lowered life compared to what is technically possible. This obsolescence makes the products fail, compels product replacement, and increases repeat sales (Sierra-Fontalvo et al., 2023).
- g. *Optional obsolescence*: This obsolescence arises when product manufacturers continue producing products with outdated technology, leading to a natural decrease in demand as consumers choose more modern alternatives (Mellal, 2020).
- h. *Ecological obsolescence*: Products replaced due to their adverse impact on the environment beyond acceptable limits are termed ecological obsolescence (Schallmo et al., 2012).
- i. *Social obsolescence*: This form of obsolescence arises from a shift in societal perception of a product prompted by changes in social norms or values (Schallmo et al., 2012).
- j. *Legal obsolescence*: This obsolescence arises when products can no longer be used because they are deemed illegal or non-compliant with legislative requirements (Schallmo et al., 2012).

#### **2.4.3.1 Categorising Obsolescence**

Broadly, the ten obsolescence can be classified into four categories, which are as follows (shown in Figure 2.5):

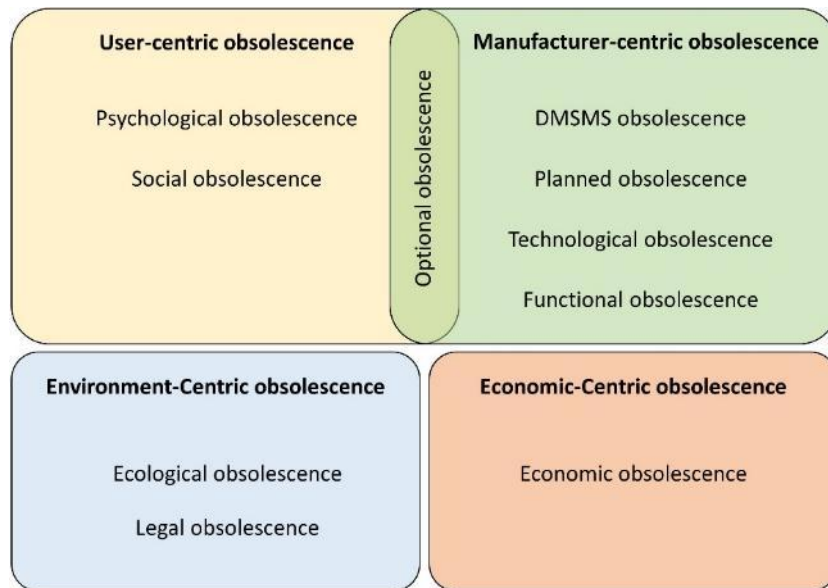


Figure 2.5 Obsolescence Categories

- a. *User-centric obsolescence*: This category is defined by how consumer's perceptions and behaviours changes to cause psychological and social obsolescence.
- b. *Manufacture obsolescence*: This category addresses aspects of product production, design, and material composition. Manufacture obsolescence includes diminishing manufacturing sources and material shortages (DMSMS), planned, technological, and functional obsolescence are categorised under this manufacturing obsolescence.
- c. *Environment-centric obsolescence*: This category includes obsolescence that is influenced by environmental and regulatory attributes. Ecological and legal obsolescence are categorised as environment-centric obsolescence.
- d. *Economy-centric obsolescence*: This category includes financial variables that influence the product's viability and consumer's inclination to purchase or maintain it. Economic obsolescence is the only one that is included in this classification.

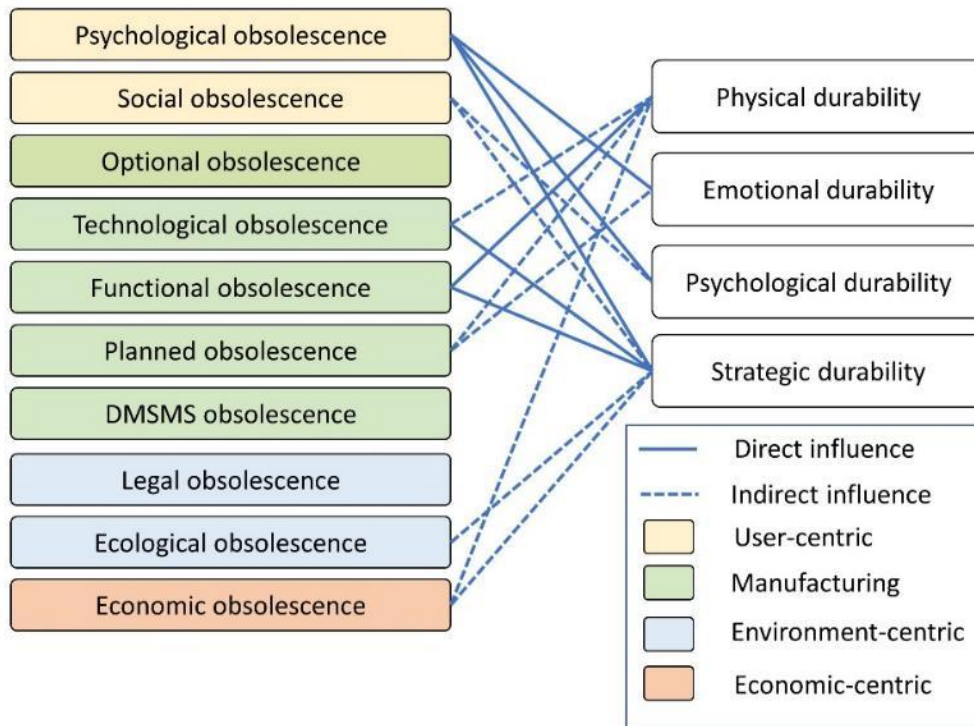


Figure 2.6 The Interplay of Durability and Obsolescence

Understanding the relationship between obsolescence and durability in contemporary contexts is crucial to recognise that durability strategies are primarily framed from the user's viewpoint, suggesting room for investigating durability concepts from the manufacturer's standpoint (Figure 2.6).

- a. Physical durability of a product ensures its functional lifespan and contributes to its robustness and longevity. This durability directly impacts functional obsolescence (Becher & Sibony, 2021). Furthermore, physical durability has an indirect impact on economic obsolescence by reducing the expenses associated to product replacement and maintenance (Sierra-Fontalvo et al., 2023).
- b. Emotional durability directly confronts psychological obsolescence by strengthening the emotional connections between products and their users (Sierra-Fontalvo et al., 2023). Additionally, this indirectly alleviates the issue of planned obsolescence, as

enduring user loyalty aids in prolonging the product's operational lifespan and reducing the frequency of replacements.

- c. By satisfying the psychological needs of users and fostering a lasting attachment to products, psychological durability directly combats psychological obsolescence (Haug, 2019; Sierra-Fontalvo et al., 2023). Additionally, it indirectly influences planned obsolescence by nurturing enduring emotional connections and diminishing the perceived necessity for frequent product replacements.
- d. Strategic durability ensures competitiveness, sustainability, and adaptation to evolving demands and preferences, in alignment with business objectives. This durability withstands functional, technological, and psychological obsolescence by offering adaptable, relevant, and appealing products. Long-term consumer and societal values indirectly influence economic, ecological, and social obsolescence (Haase, 2023).

The existing body of literature on circular design reveals that there are two primary approaches for addressing obsolescence: resistance and postponement. Resistance to obsolescence encompasses the enhancement of both physical and emotional durability, alongside the delay of obsolescence. This process requires the design of products that facilitate maintenance, upgrading, recontextualization, repair, refurbishment, and remanufacturing.

#### **2.4.4 Strategies to achieve product longevity and sustainable product development**

Approaches found within the durability literature linked to enhancing product longevity include:

- a. *Resilient design*: This design philosophy focuses on creating products that can adapt to changes in the environment, usage, as well as emotional and psychological shifts. It emphasizes the need for flexibility, adaptability, robustness, and ease of repair and

maintenance. By following this approach, products are designed to remain functional and valuable to users over time (Haug, 2018).

- b. *Slow design*: This strategy is characterized by a deliberate pace of product usage, aiming to create products that slow consumption and extend lifespans. This is mainly accomplished by designing products that are visually captivating and emotionally engaging (Grosse-Hering et al., 2013).
- c. *Timeless design*: Timeless design involves creating products that go beyond trends and remain relevant over time by combining aesthetic appeal with functionality (Lobos, 2014). Designers achieve timelessness by focusing on factors like appearance, product efficiency, material selection, and user experience (Lobos, 2014). Flood Heaton and McDonagh (2017) emphasise timelessness through exceptional beauty, nostalgia, and simplicity. This design approach often aligns with classicism, anti-fashion, simplicity, and minimalism (Lobos, 2014; Zafarmand et al., 2003).
- d. *Emotionally durable design*: In the quest for fully sustainable products, Chapman (2009) advocated for emotionally durable design, which includes elements like attachment, fiction, consciousness, narrative, detachment, and surface. Haines-Gadd (2018) expanded on emotional durability, seeking to thoroughly address psychological and emotional obsolescence in relation to product longevity. This approach to emotionally durable design introduces nine themes to foster emotional durability: narrative, integrity, identity, relationship, imagination, materiality, evolvability, consciousness, and conversation.
- e. *Psychologically durable design*: Haug (2019) introduced this concept, explaining how certain products achieve durability by maintaining their value. Haug's study (2019) highlights the differences between emotionally and psychologically durable designs, demonstrating how specific attributes allow products to achieve durability in particular

contexts. Psychologically durable design is defined by qualities such as timelessness, exclusivity, personality, personalisation, and graceful ageing. Its goal is to preserve a product's value by maintaining its instrumental, hedonic, and symbolic significance (Haug, 2019). This concept broadens the scope of durability by suggesting that design elements can enhance a product's appeal over time.

- f. *Circular design*: This strategy integrates circular economy principles into the design process to create sustainable and environmentally friendly products. It focuses on reducing waste by promoting product reuse, refurbishment, and recycling to preserve both product and material integrity (Bocken et al., 2016; Joustra et al., 2021). Walter Stahel's inertia principle advocates avoiding repairs when nothing is broken, avoiding remanufacturing when repairs are possible, and avoiding recycling when remanufacturing is feasible (Den Hollander et al., 2017; Stahel, 2010). Following this hierarchy helps determine the appropriate strategy to apply.

Figure 2.7 illustrates the interconnections among various sustainable design philosophies. Psychologically durable design builds on emotionally durable design, focusing on fostering strong emotional connections between users and products, while adapting to users' evolving psychological values. Resilient design emphasizes adaptability to environmental and usage changes and is a subset of slow design, which aims to reduce consumption by extending product lifespans. Timeless design, a key aspect of slow design, ensures both aesthetic and functional durability. Circular design incorporates principles of reuse and recycling, aligning with slow design but excluding emotionally enforced designs, as it focuses primarily on material sustainability.

Additionally, Table 2.2 shows how the identified strategies align with different product lifespans related to durability. This alignment outlines strategies for designing products with

specific lifespans, focusing on obsolescence, which extends product integrity beyond a single lifespan through recovery strategies that maintain functionality across multiple cycles. Product integrity combines durability and recovery to enhance longevity through long life (inherent longevity, extended use, and reuse) and lifetime extension (repair, maintenance, and upgrading). Table 2.2 highlights these strategies for enhancing product longevity.

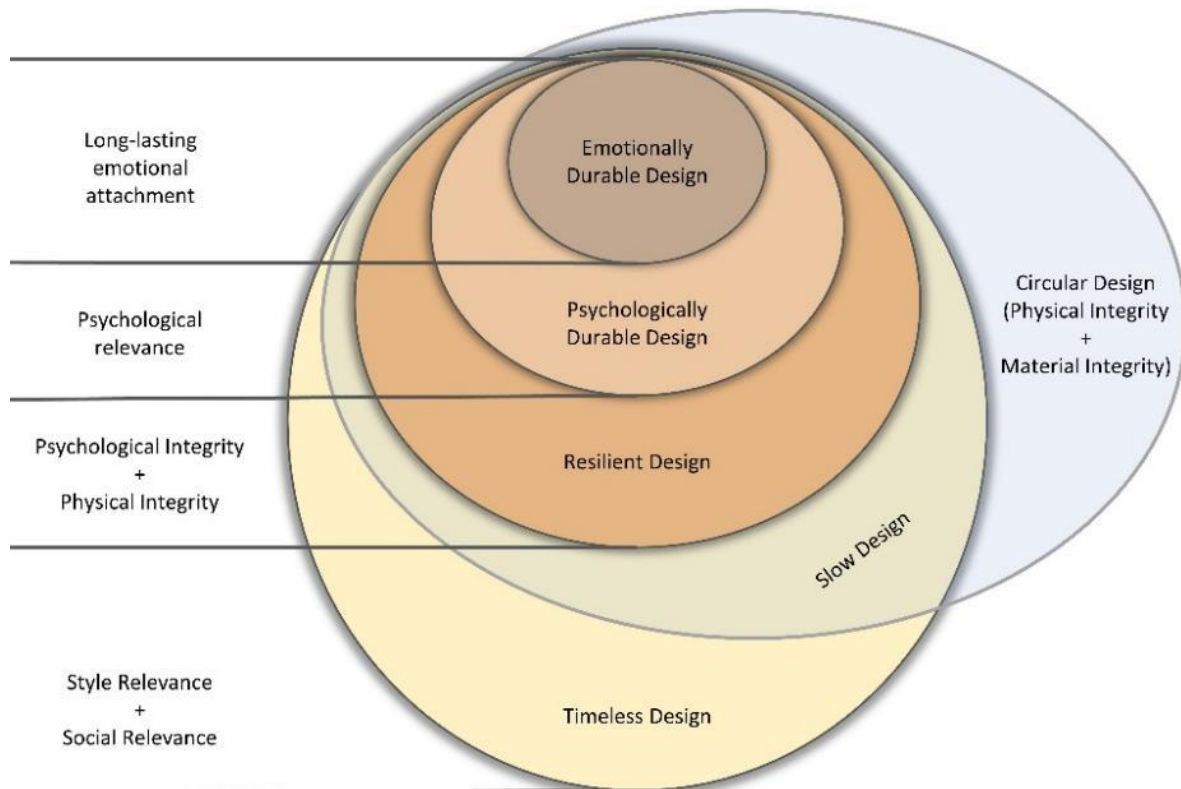


Figure 2.7 Design strategies that influence product lifespans'

Table 2.2 Keyword analysis of the identified literature

Life-span	Strategy	Timeless design	Slow design	Resilience design	Emotionally durable design	Psychologically durable design
<b>Long life</b>	Long inherent life			X		
	Long use	X	X	X	X	X
	Reuse			X	X	X
<b>Life extension</b>	Repair and maintenance		X	X	X	
	Upgrade		X	X	X	X

## 1. Achieving Long-Life:

- a. Long inherent life: This concept focuses on designs that naturally endure over time. Resilient design prioritizes flexibility and robustness, enabling products to withstand changes and stresses, thus extending their lifespan.
- b. Long use: This involves designing products to remain functional and relevant for an extended period before needing replacement. Timeless, slow, emotionally durable, and psychologically durable designs contribute to this by ensuring products retain their appeal and usefulness over time.
- c. Reuse: This refers to a product's ability to continue being used beyond its initial lifecycle. Resilient, emotionally durable, and psychologically durable designs encourage repeated use, making the products suitable for multiple life cycles.

## 2. Achieving life extension:

- a. Repair and maintenance: This focuses on strategies that ensure products can be easily repaired or maintained, thereby prolonging their lifespan. Resilient, slow, and emotionally durable design strategies support this by prioritizing ease of repair and robustness.
- b. Upgrade: This approach emphasizes adapting existing products to evolving needs or technologies instead of replacing them. Resilient, slow, emotionally durable, and psychologically durable designs promote this by focusing on flexibility and lasting appeal.

### **2.4.4.1 Mapping obsolescence and various sustainable product development strategies**

Sustainable design strategies are aligned with various forms of obsolescence to demonstrate their effectiveness in mitigating these issues, as illustrated in Figure 2.8.

- a. *Timeless design*: This approach focuses on enduring aesthetics, functionality, and the use of high-quality materials to craft products that remain pertinent despite shifting trends and consumer preferences (Lobos, 2014). By maintaining aesthetic relevance for the user, timeless design directly counters psychological obsolescence (Haug, 2019). It also indirectly addresses social obsolescence, as classic designs retain social acceptance over extended periods. Additionally, this strategy indirectly promotes ecological sustainability by reducing the need for frequent product replacements.
- b. *Slow design*: Contrasting rapid consumption patterns, slow design adopts a holistic philosophy aimed at forging strong connections between the user and the product. This deep bond extends the product's lifespan and diminishes the necessity for frequent replacements, directly combating psychological obsolescence (Haines-Gadd, 2019). It also directly influences functional and technological obsolescence by advocating for easy maintenance and upgradeability of products (Park, 2005). Indirectly, slow design impacts ecological and economic obsolescence by encouraging sustainable consumption and the creation of long-lasting products. It further indirectly challenges social obsolescence by fostering a culture that values longevity and meaningful engagement with products.
- c. *Circular design*: This strategy seeks to minimize waste by considering the entire lifecycle of a product, emphasizing reuse, recycling, and upcycling (Suppipat & Hu, 2022). It directly confronts technological obsolescence by allowing products to evolve or adapt alongside technological advancements. By extending the useful lifespan of a product, circular design addresses economic obsolescence. It also plays a crucial role in reducing purchase frequency, which is essential for mitigating ecological obsolescence. Moreover, this approach indirectly promotes social sustainability by encouraging the development of societal values that prioritize sustainability.

- d. *Emotionally durable design*: Aiming to establish a profound emotional connection between products and users, this strategy extends the product's lifespan. It directly tackles psychological obsolescence by fostering this emotional bond (Haines-Gadd, 2019). By encouraging users to care for and maintain their products, it also addresses functional obsolescence. Indirectly, emotionally durable design counters social obsolescence by creating products whose value surpasses transient societal trends.
- e. *Psychologically durable design*: Concentrating on fulfilling users' psychological needs, this strategy prolongs a product's relevance and value, effectively countering psychological obsolescence (Haug, 2019). By ensuring products meet needs over an extended period, it reduces the desire for replacements and indirectly promotes economic sustainability through prolonged product lifespans. Additionally, this approach can indirectly address functional and social obsolescence by keeping products aligned with user demands and evolving social standards. It underscores the significance of psychological satisfaction in enhancing product durability and sustainability.
- f. *Resilient design*: This approach focuses on crafting products capable of adapting to and recovering from various challenges, including damage, wear, and technological changes (Haug, 2018). Incorporating adaptability, repairability, and upgradeability, it addresses functional and technological obsolescence. Resilient design mitigates DMSMS obsolescence by ensuring products can operate with alternative components or materials (Zolghadri et al., 2021), reducing reliance on scarce resources and addressing immediate obsolescence issues. It also enhances social durability by keeping products relevant amidst changing societal norms and technological advancements. Additionally, resilient design tackles psychological and ecological obsolescence by

boosting product durability and flexibility, thereby increasing user satisfaction and reducing waste.

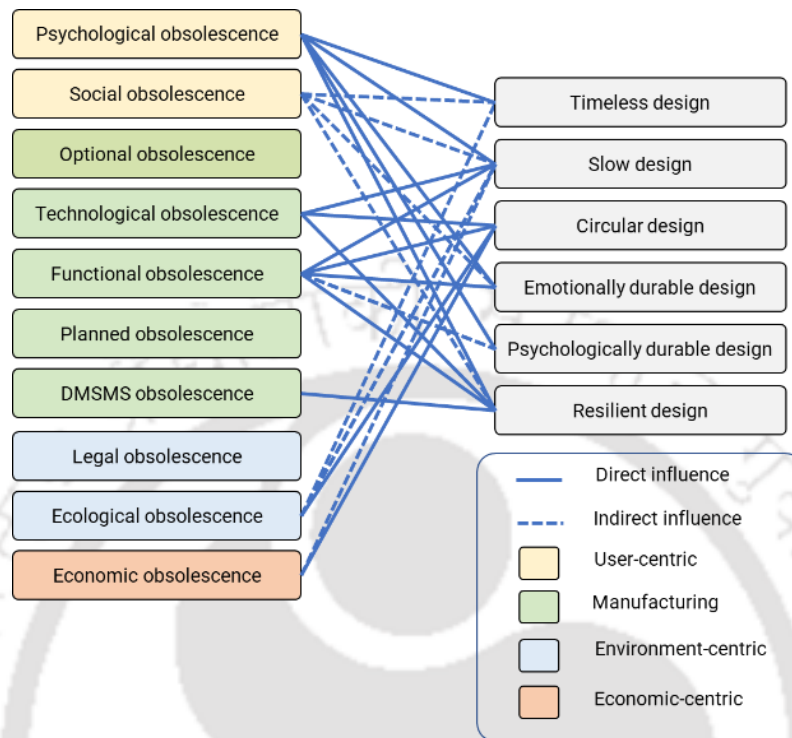


Figure 2.8 The interplay of sustainable design strategies and obsolescence

Figure 2.6 showcases the various forms of obsolescence and their direct and indirect associations with different product durability concepts, such as physical, emotional, psychological, and strategic durability. In contrast, Figure 2.7 shifts the emphasis to sustainable design strategies closely linked to product durability. It demonstrates how timeless, slow, circular, emotionally durable, psychologically durable, and resilient design approaches interact with different types of obsolescence.

Moreover, a closer examination of Figures 2.6 and 2.8 indicates that durability strategies are predominantly defined from the user's standpoint. This observation highlights an opportunity to explore durability concepts from the perspectives of manufacturers, as well as environmental and economic considerations, especially in relation to the choices made by designers.

## 2.5 Insights from the literature:

The existing literature on product durability in design has predominantly addressed emotional, psychological, and physical aspects from the user's perspective. However, these have limitedly focused on the designer's role in achieving product longevity. While much of the research is centred on prolonging the lifespan of individual products, it overlooks how designers make strategic decisions that influence the persistence of specific design features over time. This gap in understanding designers' perspective limits the scope of current durability concepts.

Furthermore, the emphasis on the individual product lifespan overlooks the continuity of design features across multiple product generations. The literature does not fully explain why certain features, like QWERTY keyboard layout or flip-top caps on bottles, endure across different product categories and iterations. While technical advancements often drive changes in product elements, some features remain consistent, and current durability concepts do not adequately address why this occurs. This gap highlights the need for a deeper understanding of how technological progress interacts with the enduring nature of certain design choices.

## 2.6 Identified Gaps and Research Questions

### 2.6.1 Research Gap 1

- a. *Gap 1:* Traditional product durability models emphasize the longevity of individual products. These concepts fail to adequately explain why certain design elements or features persist over time across multiple product lifecycles, such as the QWERTY keyboard and flip-top caps.
- b. *Problem Statement 1:* Current durability models focus on individual products and overlook the factors that allow specific design elements to endure through generations.
- c. *Research Question 1:* What design decisions and specific design elements influence the durability of products across multiple product generations?

### 2.6.2 Research Gap 2

- a. *Gap 2:* Existing models often neglect the designer's perspective in understanding the persistence of design features. There is little research into the factors such as form, functionality, communication, materialization, and human factors—that enable design elements to remain relevant over time.
- b. *Problem Statement 2:* The factors contributing to the persistence and adaptability of design features across multiple product generations are not well understood.
- c. *Research Question 2:* What factors contribute to the endurance and relevance of features across various products?

### 2.6.3 Research Gap 3

- a. *Gap 3:* There is a lack of practical strategies for ensuring that design features maintain market relevance and adaptability across multiple product generations. Current models focus on single product lifespans, neglecting strategies for the continuity of design elements.
- b. *Problem Statement 3:* Designers need practical strategies to implement design durability principles, ensuring the relevance and adaptability of design elements in changing market environments.
- c. *Research Question 3:* What strategies designers undertake to ensure the long-lasting market relevance of the identified features?

## 2.7 Research Aim and Objectives

Research Aim: To explore and identify phenomena in product design from the perspective of durability, aiming to help designers create enduring and relevant features that maintain their adaptability and significance across multiple product generations and categories.

### **2.7.1 Research Objectives**

1. To identify and define the concept of durability that contributes to enduring features in product design and distinguish it from traditional durability concepts such as physical, emotional, and psychological durability.
2. To identify the key factors that contribute to enduring and relevant design features, including form, functionality, communication, materialization, and human factors.
3. To examine how durability-related factors influence design features across various product categories, identifying shared patterns and differences in their impact, and developing practical strategies for designers to create adaptable and enduring designs across multiple product generations and categories.

### **2.8 Research Plan**

A brief description of the research plans for each objective of the study has been presented below, and the methodology followed in the thesis is shown in Figure 2.9.

#### **2.8.1 Brief Research Plan for Objective 1:**

The research objective 1 is to identify existing product durability literature within the field of product design and address gaps by expanding traditional durability concepts. To achieve this objective, the study followed a systematic methodology. First, a comprehensive literature review of traditional durability frameworks and sustainable product design approaches was conducted, revealing various unaddressed gaps, as discussed in Chapter 2. Subsequently, the research introduced an expanded perspective of durability, which includes the persistence and relevance of design features across multiple product generations. In the following chapter, a unique phenomenon is identified and defined by distinguishing it from traditional concepts of durability, emphasizing its application across different product generations and categories.

### **2.8.2 Brief Research Plan for Objective 2:**

This study investigates the factors that contribute to the persistence of design features across various products and iterations. It focuses on elements such as form, functionality, communication, materialization, and human factors, which are key to making lasting and meaningful designs. The study employs a three-phase methodological approach to identify and define the factors that enable design features to persist across diverse products and iterations. The research begins with a comprehensive literature review on feature continuity and durability in product design, followed by product analysis conducted with the input of design experts through focus groups. By integrating theoretical insights with practical observations, this approach aims to establish a final set of attributes that directly influence the longevity and relevance of design features. The findings will offer a holistic understanding of the elements contributing to the enduring nature and adaptability of product designs over time.

### **2.8.3 Brief Research Plan for Objective 3:**

This objective focuses on analysing the behaviour of durability-related factors across various product categories and developing practical strategies for designers. A two-phase mixed-method approach was employed to achieve this. In Phase 1, an analysis of online product content was conducted to identify the presence of durability-related factors across different categories, such as Convenience, Shopping, Specialty, and Unsought products. Phase 2 involved a survey with 25 participants, assessing the importance of these factors using an 11-point Likert scale. Mean and median scores were calculated, and Friedman's mean rank was performed to determine the ranking of the factors. Additionally, through exploratory factor analysis (EFA), the underlying structure of key durability factors was uncovered. This approach aims to provide actionable insights for applying durability-focused principles, ensuring the longevity and relevance of design features across product lifecycles.

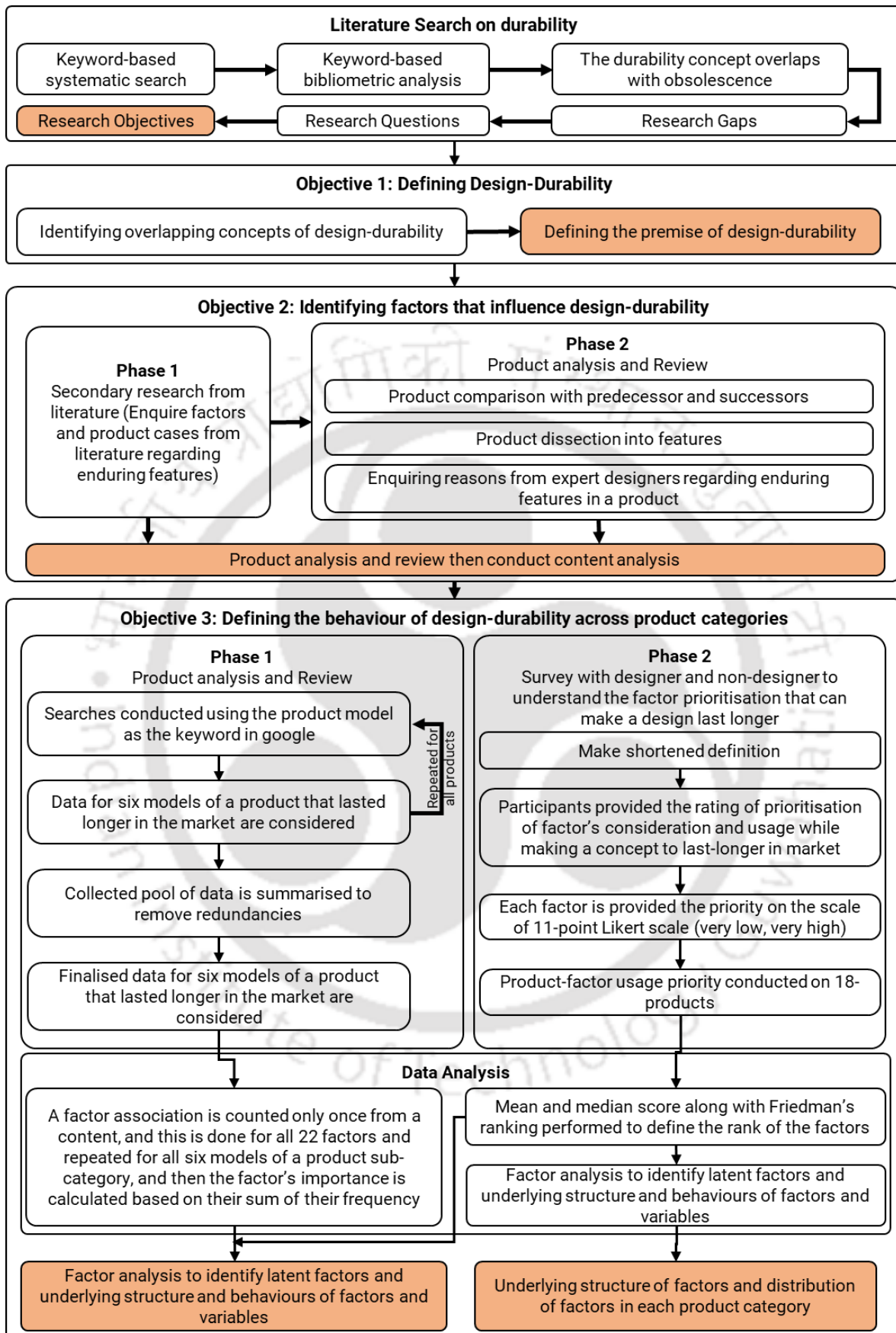


Figure 2.9 Methodological overview followed in the research

## 2.9 Conclusion

The literature on product durability in design highlights the importance of extending lifespans through various dimensions: physical, emotional, psychological, and strategic. These durability concepts are closely tied to sustainability and circular economy principles, focusing on reducing environmental impacts and mitigating obsolescence. However, much of the existing research centres on the user perspective, overlooking the designer's role in ensuring the persistence of design features across multiple product generations. While these models provide valuable insights into product longevity, they do not fully address how specific design elements—such as form, functionality, and materialization—can remain relevant across iterations. This gap points to the need for a more comprehensive framework. The next chapter introduces design durability to fill this gap. By focusing on the durability of key design features rather than just the product's lifespan, design durability offers designers tools to create adaptable, sustainable products that maintain relevance in changing market conditions.

## Chapter 3 Defining Design durability

*Chapter abstract: This chapter identifies and introduces the concept of design durability, highlighting its role in making features durable across product lifecycles and iterations. The chapter compares design durability with traditional durability concepts such as physical, emotional, and timeless design, showcasing its importance in market endurance. This chapter presents a theoretical overview illustrating its significance in enhancing market competitiveness and aligning with sustainable economic models.*

### 3.1 Introduction

The state-of-the-art literature review conducted in previous study provides a comprehensive overview on durability in the context of product design. Further it also revealed significant gaps in existing durability concepts and unaddressed domains. The contemporary durability concepts, physical, emotional, psychological, and strategic durability, primarily emphasise extending the lifespan of individual products and enhancing user satisfaction. However, they fail to explain why specific design features continue to exist across multiple product lifecycles, despite the evolving consumer requirements, trends, and technological advancements. This chapter defines this unexplored phenomenon as design durability.

Product durability and sustainability over the ages have continued to evolve. However, there exists a critical gap which is unaddressed. This gap is regarding the understanding of why certain design features persist across multiple product lifecycles. Despite the changing market trends, technology, and consumer preferences, some design elements endure and continue to exist. This gap is not addressed in any of the traditional durability frameworks which have comprehensively studied to extend a product's lifespan. To bridge this gap, we introduce the concept of design durability.

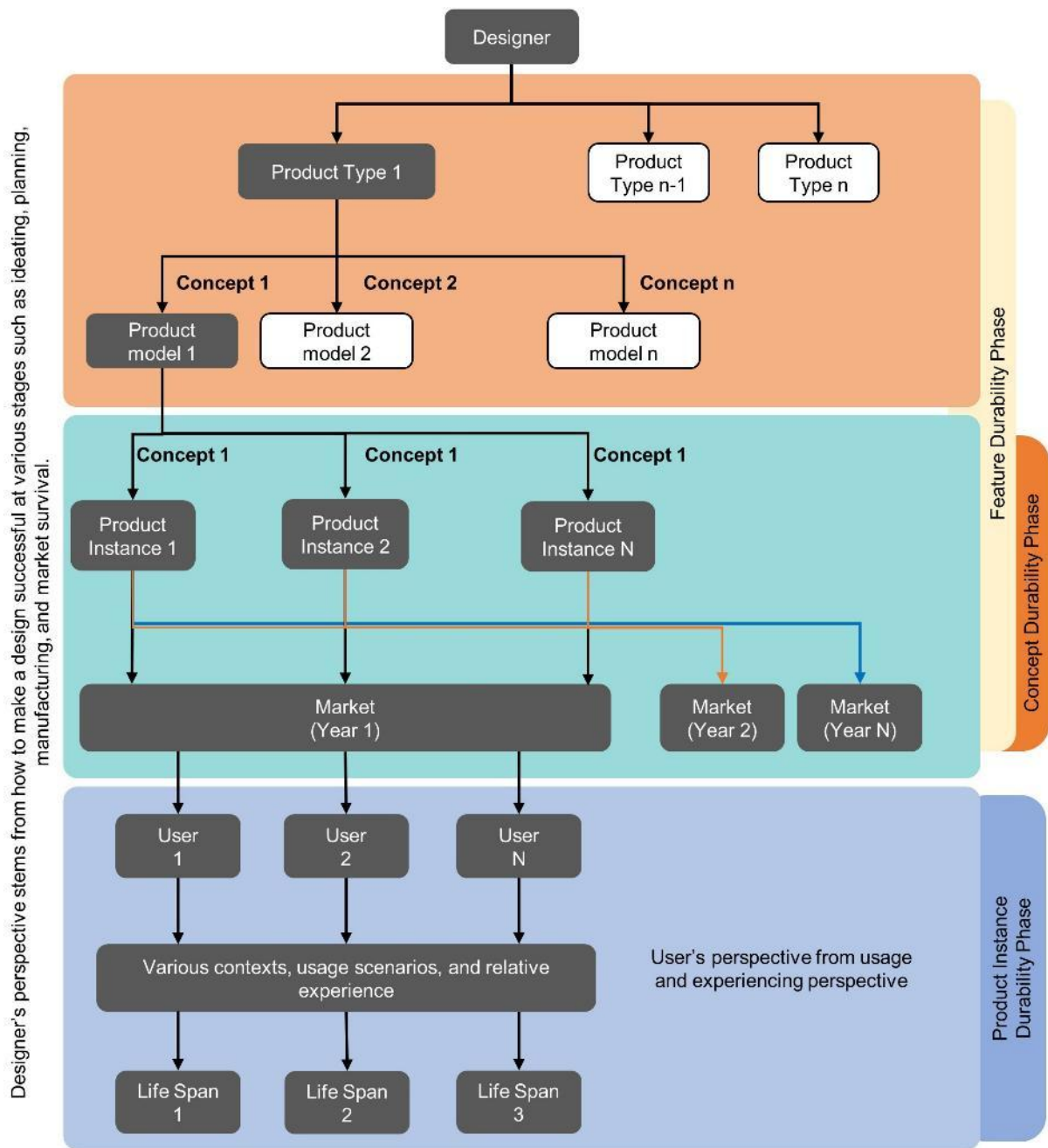


Figure 3.1 Design and user perspective on durability

Design durability focuses on the persistence of design features over time and across different product generations and categories. Design durability emphasizes the long-term relevance of specific design elements, which can be aesthetic, functional, or structural. A key aspect of design durability is the designer's role in maintaining continuity, by focusing on strategic decisions related to form, functionality, material choices etc. Unlike traditional durability, which emphasises user attachment and satisfaction, design durability highlights how specific

features remain relevant across multiple product iterations. This designer-centric approach bridges the gap by acknowledging the long-term value of consistent design features. The difference of perspectives of designers and users are depicted in Figure 3.1.

### 3.1.1 Real-life examples depicting design durability

A case study of Gillette is presented in Figure 3.2 to depict how design durability varies across different product types and models in Gillette's line up. Gillette introduced the five-blade model to enhance multi-directional blade adjustability for better facial contouring. However, the three-blade model continues to be available and widely used. This indicates that the three-blade design remains effective and relevant. This example shows that design durability applies not only to the overall product concept but also to specific features that endure across different models, such as the Gillette Mach3 and other cartridge-type safety razors.

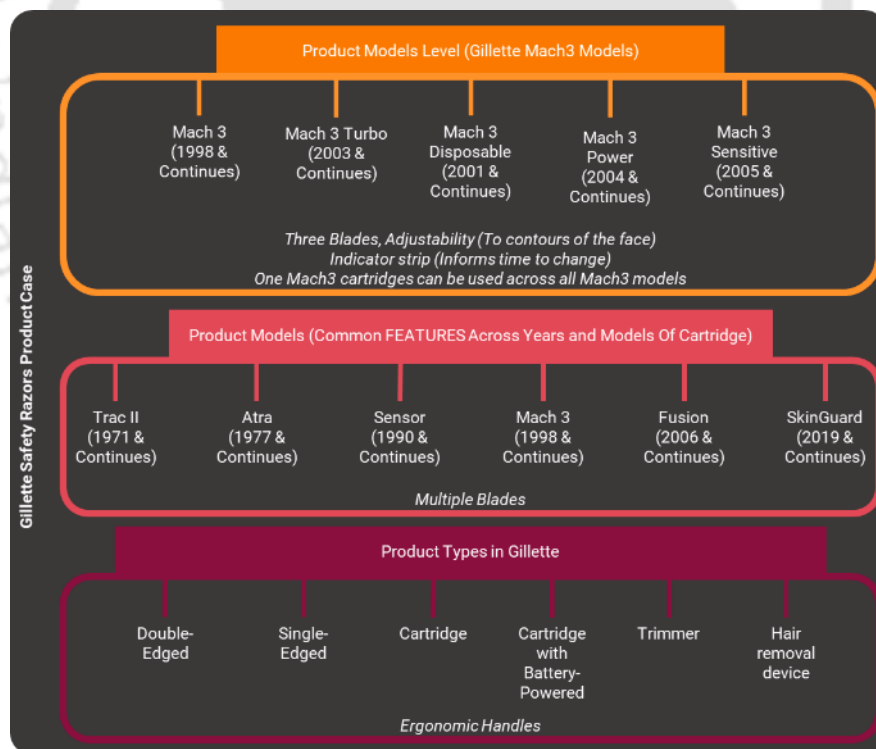


Figure 3.2 Design durability and its existence using a product case of Gillette

A few real-world examples that depicted the existence of the design durability phenomenon are as follows:

- a. The shift from micro-USB to USB-C in digital devices demonstrates design durability. This change reflects ongoing technical advancements and widespread adoption. It improves interoperability and enhances user experience.
- b. The placement of speedometers remains consistent across dashboard designs, even as digital technology evolves. This highlights design durability by preserving usability across generations of vehicles.
- c. The QWERTY layout continues to be used across devices, from typewriters to digital keyboards. This shows design durability, as it supports ease of learning and smooth transitions for users.
- d. E-book readers retain a traditional book-like form. This emphasizes design durability by focusing on readability and user comfort.
- e. Bicycle frames maintain consistent geometry despite innovations in materials. This demonstrates design durability, ensuring reliable performance and comfort over time.
- f. The crown mechanism remains a key feature in both traditional and digital watches. This enduring design illustrates design durability through its utility and aesthetic value.
- g. The design and functionality of flight control sticks remain consistent in aircraft. This demonstrates design durability by preserving intuitive control for pilots.
- h. Standard designs for screw threads and fasteners ensure compatibility across applications. This underscores design durability in facilitating repair and assembly.
- i. The traditional design of the wood-cased graphite pencil persists despite new writing technologies. This reflects design durability in maintaining its form, function, and ease of use.

- j. The round design of manhole covers remains simple yet effective. This design durability prevents accidental falls and ensures functional reliability in urban infrastructure.

Though the concept of design durability has been defined based on gaps identified and the real-life examples that depict this phenomenon. This chapter further defines the design durability by comparing it with the traditional durability concepts and the sustainable design strategies.

### 3.2 Methodology

To attain comprehensive understanding of the concept of design durability, the study defines the differences, overlaps, complementarians with traditional durability concepts and sustainable design strategies that were identified in the literature review presented in the previous study, which is the state-of-the art literature review chapter (Chapter 2). Using the data from the comparison, a conceptual model will be created that maps out the relationships and interactions between design durability and traditional durability concepts.

### 3.3 Results and Discussion

#### 3.3.1 Design durability conceptual placement

Designs crafted with principles of design durability inherently prioritise sustainability from a multi-faceted standpoint. The distinction in philosophy of design durability with the rest of the traditional durability and endurance concepts is outlined in Table 3.1 and Table 3.2 below.

Table 3.1 Comparative overview of design durability and related concepts in the literature

<b>Design durability overlapping concepts</b>	<b>Definition</b>	<b>Difference of the concept with Design durability</b>
Physical Durability	The product's ability to resist environmental and physical stresses to continue performing its intended functions over time (Den Hollander et al., 2017; Joustra et al., 2021).	Physical durability enables a product to withstand environmental and physical stresses over time, whereas design durability emphasizes the lasting presence of specific design features.

<b>Design durability overlapping concepts</b>	<b>Definition</b>	<b>Difference of the concept with Design durability</b>
Emotional Durability	This durability provides the ability for the product to form and cultivate a strong emotional attachment to a product, helping it deter product replacement (Chapman, 2009; Haines-Gadd et al., 2018; Huang et al., 2023).	Emotional durability focuses on building a strong connection between a single product and its user, while design durability emphasizes the consistency of design features across multiple products.
Psychological Durability	The psychological durability of a product is to meet the user's psychological needs over time (Haug, 2019).	Psychologically durable design focuses on maintaining long-term user appeal and addresses the lifespan of a single product's usage. In contrast, design durability ensures consistent design and functionality across products, prioritizing lasting presence over user attachment.
Strategic Durability	This concept helps intertwine a product's longevity with a company's strategic goals, emphasising sustainability, market presence, and value generation for stakeholders (Haase, 2023; Haase & Laursen, 2022).	Strategic durability connects a product's lifespan to a company's sustainability and market objectives. In contrast, design durability emphasizes the adaptability and longevity of design features, improving user experience without involving broader corporate strategies.
Timeless Design	Timeless design helps create products that transcend trends (André & Nilsson, 2024; Christiansen et al., 2010; Flood Heaton & McDonagh, 2017; Lobos, 2014; Shin et al., 2021; Shin & Ghim, 2020; Spreafico & Landi, 2022; Sugimoto & Nagasawa, 2017; Wallner et al., 2020; Zafarmand et al., 2003).	Timeless design focuses on maintaining a product's appeal and utility throughout its lifespan. In contrast, design durability ensures that specific design elements persist across multiple product cycles and various products. It makes components, interfaces, and aesthetic choices adaptable or reusable in future products. While timeless design is centered on the user and usage, design durability also considers factors like regulatory compliance, industrial evolution, and product viability. Both philosophies

Design durability overlapping concepts	Definition	Difference of the concept with Design durability
Slow Design	This strategy helps create visually captivating and emotionally compelling products to lower consumption and extend product lifespans of a product instance (De Hooge et al., 2024; Grosse-Hering et al., 2013).	complement each other, working together to achieve product longevity by balancing user interest with adaptability for future viability.
Resilient Design	This notion helps prioritise adaptable, robust products that remain functional and valuable amidst environmental, usage, and psychological changes (Haug, 2018).	Resilient design differs from design durability by prioritizing a product's ability to retain its functionality and form under challenging conditions, rather than ensuring the consistent presence of design features across different product versions.
Style Longevity	This is defined as the preference to purchase and wear clothing to remain relevant and valuable over an extended period, avoiding fast fashion trends (Armstrong & Lang, 2018).	Style longevity focuses on the lasting appeal and functionality of fashion items, while design durability addresses the continuous use of specific design features across multiple products, maintaining their practical and aesthetic value over time.
DNA	In the context of product design, DNA is the aesthetic and conceptual framework defining a brand's identity, ensuring consistency and enabling innovation across product families (Eves & Hewitt, 2009; Rahim et al., 2015; Zhaolin Lu et al., 2009; Zuyao Zhang et al., 2009).	Product design DNA helps preserve a brand's identity and ensures product coherence, while design durability guarantees the continuity of specific design elements across different iterations and categories. Design DNA provides a framework for brand consistency and market positioning. In contrast, design durability emphasizes sustainability, user-focused considerations, and the adaptability of

<b>Design durability overlapping concepts</b>	<b>Definition</b>	<b>Difference of the concept with Design durability</b>
Design Continuity	Design continuity ensures seamless integration of visual and functional elements throughout the product design process. This helps maintain brand identity and enhances user experience, efficiency, customer recognition, and loyalty (Althuizen & Chen, 2022; Hsiang et al., 2011; Talke et al., 2017; Yu et al., 2022).	Design durability broadly makes a feature achieve longevity across various product iterations, whereas design continuity focus is narrower to maintain consistency within a single product's development cycle.

Design durability focuses on the longevity of design features, while circular design takes a holistic approach to sustainability. These strategies complement each other, addressing various sustainability aspects and reducing environmental impact. By integrating both principles, companies can create innovative solutions that meet consumer expectations and support ecological sustainability goals.

Table 3.2 Comparative analysis of design durability and related concepts across various forms of longevity

<b>Concepts</b>	<b>Attributes</b>	<b>Types of Product's Longevity</b>		
		<b>Long product life (T. Cooper, 2010; Stahel, 2010)</b>	<b>Long product use (Chapman, 2009; Mugge et al., 2005)</b>	<b>Market endurance (Mellquist et al., 2022)</b>
Physical Durability	Materialization	X		
	Feature			
	Style			
	Product Model			
	Product Instance	X		
Emotional Durability	Materialization	X	X	
	Feature			
	Style			
	Product Model			
	Product Instance	X	X	

Concepts	Attributes	Types of Product's Longevity		
		Long product life (T. Cooper, 2010; Stahel, 2010)	Long product use (Chapman, 2009; Mugge et al., 2005)	Market endurance (Mellquist et al., 2022)
Psychological Durability	Materialization			
	Feature			
	Style	X		
	Product Model	X		
	Product Instance			
Design durability	Materialization			
	Feature			X
	Style			X
	Product Model			X
	Product Instance			
Timeless design	Materialization	X	X	
	Feature		X	X
	Style		X	X
	Product Model		X	X
	Product Instance			
Slow design	Materialization	X		
	Feature	X	X	
	Style		X	
	Product Model		X	
	Product Instance		X	
Resilient design	Materialization	X	X	
	Feature		X	
	Style		X	
	Product Model		X	
	Product Instance	X	X	
Style longevity	Materialization			

Concepts	Attributes	Types of Product's Longevity		
		Long product life (T. Cooper, 2010; Stahel, 2010)	Long product use (Chapman, 2009; Mugge et al., 2005)	Market endurance (Mellquist et al., 2022)
	Feature			X
	Style			X
	Product Model			
	Product Instance			
DNA	Materialization			
	Feature			X
	Style			X
	Product Model			
	Product Instance			
Design Continuity	Materialization			
	Feature			X
	Style			X
	Product Model			X
	Product Instance			

Using the concepts outlined in Tables 3.1 and 3.2, we aim to map various durability concepts that are similar to or overlap with design durability. This mapping illustrates their contribution to longevity based on materialisation, features, style, product model, and product instance. These attributes are key factors in achieving different forms of longevity. Materialisation refers to the product's physical attributes and interactions, focusing on how tangible qualities influence its lifespan and relevance; style addresses the aesthetic and visual aspects of design; the product model is the variant of a product type in the market; and the product instance refers to the individual product owned by the consumer:

- a. Long-product life refers to the physical survival of a product over an extended period (T. Cooper, 2010; Stahel, 2010). Physical durability, emotional durability, strategic

durability, and resilient design all contribute to this longevity through materialisation. Materialisation relates to the product's physical attributes and interactions, focusing on a single product instance to ensure its durability over time.

- b. Long-product use refers to consumers extending a product's lifespan beyond its typical cycle (Chapman, 2009; Mugge et al., 2005). Emotional durability supports this by building strong emotional connections between the user and the product. This approach targets individual product instances to achieve long-term usage. Psychological durability keeps the product relevant by incorporating well-known features and styles. Timeless design also aids in extending product use by offering features that resist changing trends, making the design more valuable to the user. Slow design prolongs usage by focusing on materialisation, ensuring the product remains psychologically relevant and fosters emotional attachment through timeless features. Resilient design further extends product life by enabling it to withstand and recover from physical, environmental, and social challenges. These concepts work together to increase both product longevity and usage in different ways.
- c. Market endurance ensures that a design remains relevant across different time periods (Mellquist et al., 2022). Design durability plays a key role in this by introducing adaptive features and styles that apply to multiple products. It focuses on product models rather than individual instances. On the other hand, timeless design helps a product model maintain a long-lasting presence in the market. It does this by offering features and styles that can outlast trends and retain value. Product DNA shapes features and styles that reflect a brand's identity and ensures their ongoing presence in the market. The goal of Product DNA is not to create a single model but to establish lasting brand characteristics. Additionally, design continuity guarantees consistency in design elements and branding across a manufacturer's product line or related products.

### 3.4 Practical Implications

Design durability is a potential yet context-dependent strategy in sustainable product design. Instead of focusing on the longevity of an individual product, this concept highlights the persistence of essential design elements throughout product generations. This approach can diminish waste and improve resource efficiency, but under only specific conditions.

It is peculiarly important to understand that design durability doesn't ensure sustainability on its own. Its effectiveness depends on whether products remain in active use for a significantly extended period. Durable features may offer little environmental benefit if products are discarded prematurely due to factors such as aesthetic obsolescence, technological changes or emotional detachment even when they are still functionally intact. In such cases, the resource investment into durability may be environmentally neutral or even counterproductive.

Modular and platform-based design strategies are essential complements of design durability to mitigate the challenges. These approaches emphasize the creation of a durable core or persistent core (e.g. a car's structure or an appliance body) while allowing parts or features to be replaced, upgraded or customised over time. This decouples product differentiation from full material renewal, enabling innovation, evolution and waste reduction.

Design durability also aligns with slow design strategies, which promote long-term user engagement, repairability, and emotional connection. Design durability is inherently compatible with circular economy strategies supporting consistency, standardisation, and upgradeability enabling repair, refurbishment, and component reuse. Modular systems, emotional attachment, and circular business models fall apart without these durable design foundations.

While emotional, psychological, and slow design strategies focus on specific product-user relationships, design durability offers resilience at the system level. Even when individual

products are replaced as the emotional attachment or psychological resilience fade, persistent design features can evolve and retain value. This helps extend lifecycles across entire product families. In this way, design durability amplifies and enables the benefits of other durability concepts. It does not replace them, but provides a structured foundation needed to sustain their impact at scale.

### **3.5 Conclusion**

This chapter introduces the concept of design durability and provides initial insights into this emerging phenomenon. By defining design durability, it expands the understanding of product durability and offers a new notion that complements existing sustainability strategies. By aligning with sustainable and circular economic models, design durability can extend product longevity and improve market competitiveness. It also ensures compliance with environmental standards, supporting sustainability goals. Design durability offers a fresh approach to creating products that last, adapt, and remain relevant over time. It may play a vital role in advancing research on sustainable design by integrating various other longevity and durability associated concepts. While design durability concept has been outlined, further exploration is needed to fully understand how to achieve design durability and integrate it into product design processes. A deeper investigation will clarify its implications and potential benefits.

## Chapter 4 Factors that define and influence Design durability

*Chapter abstract: Design durability, introduced in the previous chapter, expands the conventional understanding of product durability. However, the factors influencing this concept remain underexplored. This study defines design durability by identifying factors that enable features endure beyond a single product lifespan and continue to exist across various products and generations. Using a mixed-method approach of literature review and product case studies, the research identified 22 contributing factors. These factors are mapped across design attributes to enhance understanding from a design perspective.*

### 4.1 Introduction

In the ever-evolving field of product design, traditional methods have primarily centred on physical durability as a marker of product quality (Chapman, 2009; 2016). Over time, the scope of durability has grown to include emotional, psychological, and strategic aspects (Chapman, 2009; Haines-Gadd, 2019; Haug, 2019; Razeghian & Weber, 2019). Despite this expansion, the main aim remains reducing environmental impact by extending a product's physical and functional lifespan, thus promoting a more sustainable lifecycle. In the previous chapter, we introduced a new concept, design durability, that helps expand the premise of durability. This concept highlights the importance of retaining design features across product iterations, which makes features adapt to shifts in market conditions, consumer needs, and technological progress.

Design durability encourages designers to carefully choose features that can be used across multiple products, fostering sustainability by integrating adaptable and flexible elements. This concept aligns with Farina et al.'s (2013) findings on sustainable design, as it helps advance the circular economy by reducing the frequency of redesigns, which improves resource efficiency and lowers environmental impact. Design durability differs from physical, emotional and

psychological durability (Chapman, 2009; Haug, 2019) by ensuring the survival of key design elements beyond a product's physical life. Modular parts are repurposed across different systems by cutting costs for companies while enhancing quality and ensuring compatibility, which is an example of design durability. This method supports strategic durability by embedding sustainability into business objectives, enabling companies to adapt to market changes while maintaining a commitment to long-term environmental goals.

Design durability aligns with user-centred design by creating adaptable, emotionally engaging features that stay relevant to changing user needs. This approach supports long-term sustainability by encouraging practices that keep designs useful and valuable in a shifting market. While current research has discussed design durability theoretically and offered a few examples, it has yet to explore practical applications across different products in depth. As the concept is still in early development, this exploratory study seeks to gain insights from designers on how design features can surpass the limitations of a single product lifespan, evolving through multiple iterations. The primary research question is: "What factors contribute to the endurance and relevance of design features across various products?"

#### **4.2 Methodology**

To investigate the question, "What factors contribute to the endurance and relevance of design features across various product?" this study uses a three-phase methodological approach (Figure 4.1), inspired by Kien et al. (2014). The study involves an in-depth review of current literature and product analysis through focus groups, aiming to uncover the continuity and durability of design features. Initially, the literature review identifies relevant literature on feature continuity and design durability. This was followed by design experts conducting a series of product analyses. This approach combines theoretical findings with practical insights to deepen the understanding of factors that make product designs enduring.

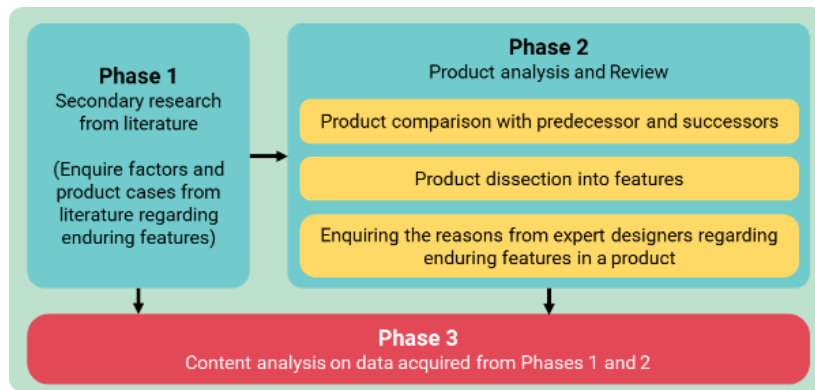


Figure 4.1 Overview of Study Methodology

#### 4.2.1 Phase 1: Review of Scholarly articles

In this phase, an exploratory systematic search was performed across two online databases, Google Scholar and Scopus, using keyword searches combined with Boolean operators. The search was focused on disciplines directly aligned with the research objectives, such as material science, business and management, social sciences, economics, arts, multidisciplinary fields, decision sciences, and psychology. Fields deemed less relevant, such as medical science, construction, and certain branches of engineering focused on lifecycle analysis, production methods or material durability, were excluded. In contrast, design-related fields, including design engineering and craft, were included due to their valuable contribution to understanding feature continuity and design durability.

The keyword strategy aimed to encompass a wide array of durability-related ideas, including longer-lasting designs, durable design, and design durability, along with the persistence of specific design features across product lifespans. To identify relevant studies, keywords such as "feature continuity," "feature longevity," "feature consistency," "feature adaptability," "design continuity," "design longevity," "design consistency," "design adaptability," "timeless design," and "product durability" were used (Table 4.1). These keywords address aspects of emotional and psychological durability, sustainable design strategies, and concepts of resilience and timelessness, all integral to understanding design durability.

Though the keyword strategy was comprehensive, it also has its limitations. Emphasising "feature" and "design" continuity, longevity, adaptability, and acceptance may have skewed the results towards feature-centric studies, potentially overlooking broader aspects like emotional or psychological durability, which are crucial in product design. Additionally, the lack of keywords related to the circular economy, lifecycle assessments, or material durability may have excluded essential systemic and technical perspectives. Nevertheless, keywords such as "product durability" ensured coverage of key dimensions, encompassing physical, emotional, psychological, and strategic durability, along with the circular economy and product attachment aspects.

To ensure methodological rigour, specific criteria guided the article selection process. Articles were chosen for their novel theoretical contribution and robust research methods, with a preference for those using empirical data, case studies, or innovative approaches to product durability. Only studies directly addressing durability — whether physical, emotional, psychological, or strategic—were included. Articles lacking a strong link to product design or durability were excluded from the final selection. Priority was given to studies offering recent, innovative insights, ensuring the review captured contemporary trends and challenges in design durability. Foundational works were included if they have significantly contributed to the theoretical foundations of the field. Studies incorporating engineering, business, psychology, and sustainability perspectives on product durability in design were prioritised.

This focused approach ensured that the literature reviewed closely aligned with the research question. Only English-language articles published from 2000 to 2024 were included in this study. Major studies on obsolescence and product durability in design primarily emerge from this timeframe, as highlighted in state-of-the-art literature review. This trend is also supported by Mesa et al.'s study (2022).

This review phase plays a crucial role in analysing the literature to identify significant trends and constructs that contribute to the enduring qualities of product designs. The findings gained are intended to enhance both theoretical frameworks and practical applications in product design.

The inclusion and exclusion criteria followed during the review are shown below:

a. Inclusion Criteria:

- Relevance to design durability was required, covering elements such as feature longevity, material resilience, emotional durability, or adaptability.
- Only peer-reviewed academic articles or conference papers were selected to ensure credibility.
- Studies had to be in English and have full-text access to be considered.
- Only articles published from 2000 to 2024 were included to ensure contemporary relevance.
- Studies providing significant theoretical or empirical insights on design durability were selected.

b. Exclusion Criteria:

- Studies from unrelated fields, like medical science, construction, and non-relevant engineering disciplines, were excluded.
- Articles that mentioned durability without a connection to product design or obsolescence were excluded.
- Non-peer-reviewed sources, such as white papers, blogs, magazine articles, and thesis (Masters and PhD), were excluded.
- Articles published before 2000 were excluded, excluded for foundational or seminal works in design durability.

Table 4.1. Search String Used for the Study

Search String
("product durability" AND "design")
((("feature continuity" OR "feature longevity" OR "feature adaptability" OR "feature acceptance" OR "design continuity" OR "design longevity" OR "design adaptability" OR "design acceptance") AND ("timeline" OR "sustainable design" OR "timeless")))

Two trained researchers independently reviewed a total of 5,506 articles, eliminating duplicates to refine the pool to 5,320. A preliminary title-based screening focused on articles strongly associated with product durability and design, further reducing the selection to 1,173. These articles then underwent an abstract review, leading to 146 articles being selected for full-text analysis. Only peer-reviewed articles were considered, excluding institutional sources, such as master's and PhD theses. Articles unanimously marked as unsuitable by both reviewers were removed from the final selection.

Further, 24 articles related to non-tangible studies, such as visual design, have been removed. From the remaining 122 articles, the literature was categorised into two groups: core articles and application-oriented articles. Of these, 97 articles focused on practical applications were excluded, leaving 25 core articles for content analysis. These core articles, which introduced new attributes and theoretical insights into product durability, provide the foundation for exploring the theoretical basis of design durability. The distribution of the literature is as shown in Table 4.2.

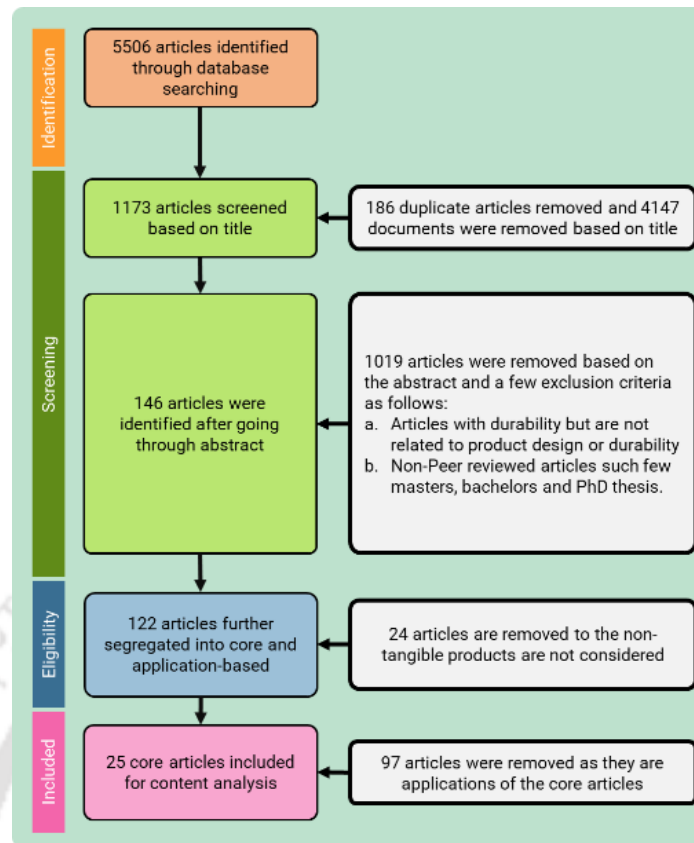


Figure 4.2. Literature Review Process

Table 4.2 Literature Distribution Across Different Concepts and Strategies

Article theme	Core articles present	Application-based articles
Emotional durability	9	54
Timeless design	2	11
Ageless design	1	1
Slow design	1	5
Resilient design	1	5
Product attachment	4	6
Circular economy	1	7
Design consistency	3	2
Product DNA	1	0
Psychological durability	2	6

#### 4.2.2 Phase 2: Product Analysis and Review

In this phase, various product cases were analysed to investigate the factors contributing to the enduring market presence of specific designs. This approach combined two methodologies: a

comparative analysis of products with their predecessors and successors, and product dissection, drawing on methods from Aurisicchio et al. (2011) and Laursen & Barros (2022). Further, narrative-based inquiry was employed with participants to explore the reasons behind feature continuity.

To identify and analyse enduring features and designs, 80 renowned products were initially chosen from categories such as décor, transport, home, and kitchen appliances, recognised for their iconic or classic designs. These categories were chosen as they include both technologically advanced and classic, iconic products frequently used in daily life. These products demonstrate both functional durability and timeless appeal, making them ideal for studying design durability. The selection was conducted by three research team members, who ensured the products would be familiar and easily recognisable to participants. The profiles of the researchers involved are presented in Table 4.3. Researchers involved in the product selection process were chosen for their expertise in industrial and product design, as well as their ability to conduct research experiments and engage in design practice.

Table 4.3. Profiles of Design Researchers

<b>Interview</b>	<b>Designation and Research Experience</b>	<b>Design Expertise</b>	<b>Research Domain</b>
Researcher 1	PhD Scholar 5 years 5 months	Industrial Design, 6 years	Product durability
Researcher 2	PhD Scholar 5 years	Product Design, 12 years	Medical device design
Researcher 3	PhD Scholar 4 years	Product Design, 5 years	Design Ethics

The study refined the initial selection of 80 products to focus on those that maintained stable and consistent features despite technological changes. The goal was to identify models that have remained in production beyond the typical lifespan of their category. Models that have sustained this way can be considered more desirable than others. According to the literature, average lifespans are defined as 15-20 years for electronics, 7-15 years for kitchen appliances,

and 10-20 years for automobiles (Maulia & Halimatussadiah, 2018; Mendjargal et al., 2022; TerziOğlu, 2013). During this filtration, attention was given to ensuring a balanced distribution across hedonic and utilitarian products, minimising bias in participant responses. Hedonic products are highly associated with emotional attachment aspects, while utilitarian products serve functional purposes (Haug, 2019). The final selection includes five utilitarian products (Mosquito rackets, Vacuum cleaners, Wet mops, Lemon squeezers, and Safety razors), five hedonic products (Coca-Cola, Chuck Taylor, Cars, Fountain pens, and Table lamps) and five mixed products (Motorbike, Hexa-Dumbbell, and Pencils, Door handle, and Safety Pin) that are the combination of hedonic and utilitarian. Finally, fifteen distinctive products were selected and placed on a timeline (Figure 4.3) to illustrate their historical context, innovation parallels, and feature evolution.

#### **4.2.2.1 Product Reviewing**

After selecting the appropriate products for the study, participants were asked to identify the enduring features and reasons for their longevity. A standardized protocol was sent to participants via email to ensure consistency, with additional clarification provided through an audio call.

##### **i. Participant Selection**

The study sought insights from designers, as design durability focuses on enduring features and the design decisions that contribute to their longevity. Twelve industrial designers, each with over five years of experience and a solid background in product design, were selected, using the five-year experience benchmark for expertise based on Eteläpelto's (2000) study. These experts were chosen for their innovative portfolios and extensive practical experience in real-world product design, essential for addressing design durability through practical, inventive solutions across diverse product

categories. The group included eight male and four female industrial design experts from India, each associated with fabrication units or design studios specializing in areas like installations, automotive design, prototype manufacturing, electronics, and medical products. Table 4.4 provides further details on their expertise and backgrounds.

Table 4.4. Participants and their Participatory Stage

<b>Interviewee</b>	<b>Products they worked with</b>	<b>Expertise and years of experience</b>	<b>Participated in the stage</b>
Participant 1	Electric motorcycle, medical devices, Smartwatch	Automotive designer, five years	Feature and functional dissection and Interview
Participant 2	Inhalers, Vaporizer, Shaker, Camera lens attachment	Industrial designer, six years	Feature and functional dissection and Interview
Participant 3	Composter, Electric cigarette, Washing machine filter, Medical mask, Green gym	Industrial designer, six years	Feature and functional dissection
Participant 4	Jogger park seating, Vacuum cleaner, cloth lane design, Sink waste remover	Industrial designer, five years	Feature and functional dissection and Interview
Participant 5	The urinating device, Deodorizing kit	Industrial designer, Eight years	Feature and functional dissection and Interview
Participant 6	Hydration vest for hikers, Floor viper, Teapoy table	Industrial designer, five years	Feature and functional dissection and Interview
Participant 7	Ferro mania toy, Microscope toy, Hanging lamp, Jute jacket, Multi-utility Cardboard chair, Installation	Industrial designer, ten years	Feature and functional dissection and Interview
Participant 8	Customised motorcycles, Medical equipment for Endoscope and Duodenoscopy, Dome for mushroom cultivation	Industrial designer, seven years	Feature and functional dissection
Participant 9	Waste management kit for Scavenging employee, Cumin seeder, Polyhouse,	Industrial designer, eight years	Feature and functional dissection and Interview

Interviewee	Products they worked with	Expertise and years of experience	Participated in the stage
	Calves strengthening device		
Participant 10	Modular display devices, delivery van based on REVA electric car, Styling of various scooters, motor controller, Swing arm covers, Rain guard system for rubber plantations	Industrial designer, 15 years	Feature and functional dissection and Interview
Participant 11	Ergonomic neck rest, Blender, composter unit, Locomotive suspension seat	Industrial designer, six years	Feature and functional dissection
Participant 12	Dishwasher unit, Furniture design	Industrial designer, six years	Feature and functional dissection

## ii. Procedure and Protocol:

After attaining the final product collection, this phase involved an in-depth dissection and analysis of the products across multiple levels to uncover the enduring features of each. Given the task's complexity and time requirements, the study was divided into three stages to fit within participants' schedules effectively.

The three levels of the study are as follows:

### a. *Level 1: Comparative Analysis*

Participants reviewed the product's origin model alongside its most enduring versions, as illustrated on a timeline in Figures 4.3. This comparison highlighted consistent features and factors influencing core functions and usage over time. Findings from this level guided the development of questions for Level 3's narrative-based inquiry.

### b. *Level 2: Feature and Function Dissection*

Auricchio et al. (2011) documented an analysis of a product's features and functions by dissecting it, which was used as a reference for the present study's methodology

where popular and lasting product models were analysed. For example, the hexagonal shape of the hexa-dumbbell provides stability, while its black colour suggests durability and serious tone. Similarly, features and their corresponding functions were analysed. Participants used a structured protocol (Table 4.5) to virtually examine each product, with visual aids included (Figure 4.3). This protocol specified conditions and examples to guide the analysis across fifteen selected products.

### iii. Example of a product case: Dyson Vacuum cleaner over time

By comparing models, we can see how Dyson balances continuity and change to stay a market leader in making home appliances.

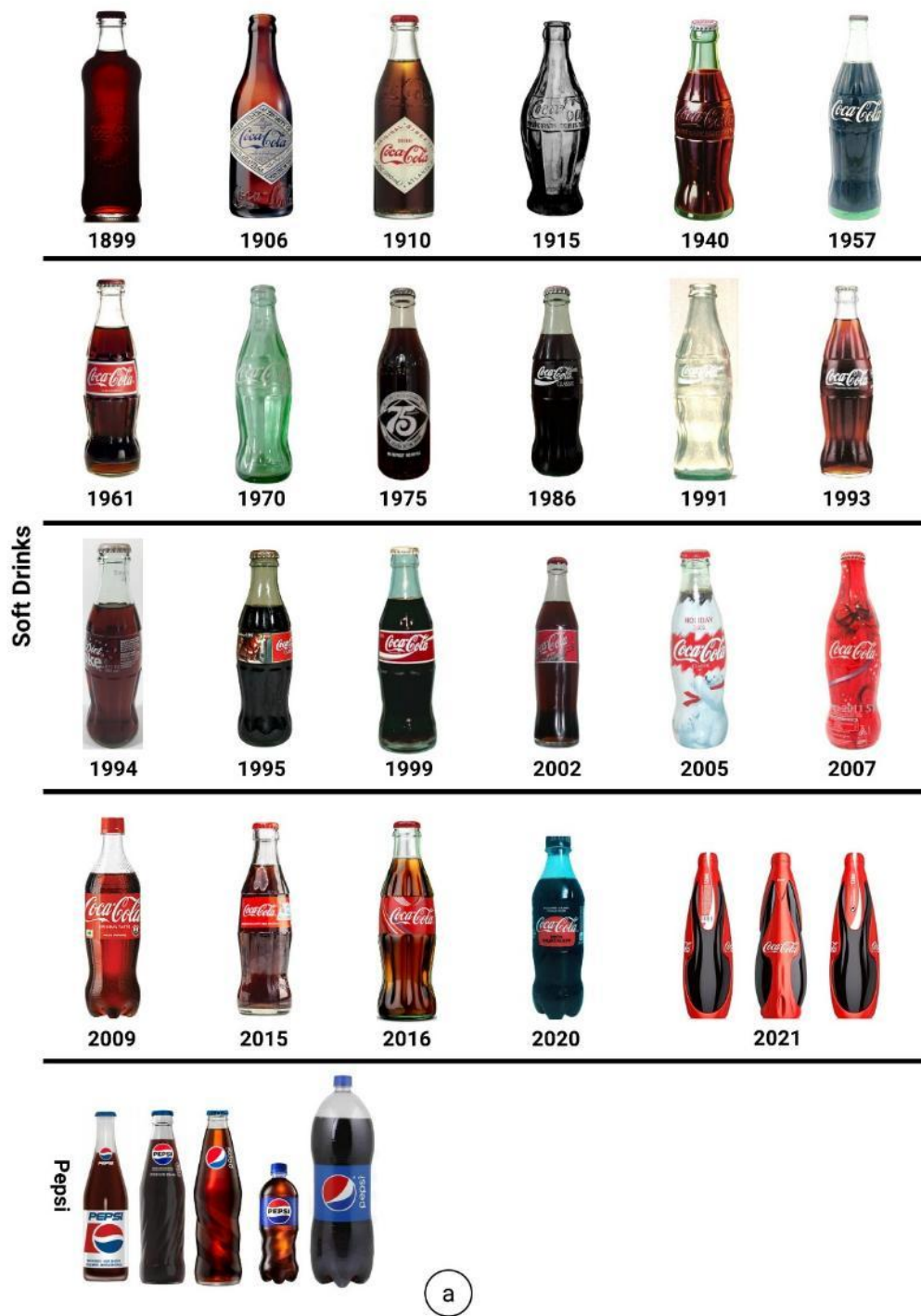
#### a. *Iconic features that continued:*

- Cyclic suction technology was introduced in the 1990s; this core feature prevents suction loss and has been continuously refined.
- A transparent dustbin is a consistent feature across models as it allows users to monitor dust levels, enhancing functionality and user trust.
- Futuristic aesthetics such as bold, sleek designs with vibrant colours were used across Dyson's vacuum cleaners.

#### b. *Iconic features that changed:*

- Ball technology was introduced in the mid-2000s and helped improve manoeuvrability using a spherical pivot.

Cordless models in the V-series introduced cordless vacuums, shifting towards portability and convenience.



**Chuck Taylor Shoes**



**Original  
1917**



**Olympics  
1936**



**Classic  
1949**



**Classic Low-Top  
1957**



**Leather  
1970**



**Chuck 70  
2013**



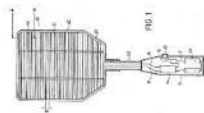
**Chuck II  
2015**



**Street  
2016**



**Shield  
2016**



**Tsao-i shih electronic  
insect killing swatter  
1996**



**Elucto Electric Bug  
Zapper**



**Hit Anti Mosquito  
Racquet**

**Mosquito Rackets**



**Nippo Terminator  
mini Rechargeable  
Insect Killer**



**Oreva Mosquito Racket  
with Torch**













**Weird Wolf Mosquito  
Racket with USB**



**Fiskars Mosquito  
Racket Bat with UV  
Light Lamp**

(b)

<b>Safety Razors</b>		
	<p><b>Feather artist club SS</b> (2000's - Continuing) (1762 - 1<sup>st</sup> Straight Razor)</p>	<p><b>Edwin Jagger DE 89</b> (1980's -2021) (1847-1<sup>st</sup> Double edge)</p>
		
	<p><b>Mercur Razor FUTUR 702</b> (2000 - Continuing) (1878 - 1<sup>st</sup> Single edge)</p>	<p><b>Gillette Mach 3</b> (2006 - Continuing) (1974 - 1<sup>st</sup> Cartridge)</p>
<b>Hexa-Dumbbell</b>		
	<p><b>Ivanko IRD model</b> (1983 -Continuing) (Mid 19<sup>th</sup> Century)</p>	<p><b>Akari Light</b> (1950 -Continuing)</p>
<b>Fountain Pen</b>	<b>Some Other Fountain Pens</b>	
		<p><b>Banker's lamp</b> (1909 -Continuing)</p>
		
<p><b>Sonnet Parker Pen</b> (1993 - 2021)</p>	<p><b>Reynolds 045</b> (1975 - Continuing)</p>	<p><b>Lamy Safari</b> (1975 - Continuing )</p>
		
		<p><b>Traditional Safety Pin</b> (1849 - Continuing)</p>

C

Vacuum Cleaners

Dyson Vacuum Cleaner



Dyson V8  
(2016)



Dyson V10  
(2018)



Dyson V11  
(2019)



Dyson V12  
(2022)



Dyson V15  
(2022)

Other Vacuum Cleaner



Miele C3 Series  
(2012-2021)



LG Kompressor  
(2012-Continuing)

Cars

Innova Cars



Innova 1<sup>st</sup> Gen  
(2004)



Innova 2<sup>nd</sup> Gen  
(2016)



Innova Crysta  
(2016)



Innova Venturer  
(2017)

Other Iconic Cars



Ambassador Car  
(1958-2014)

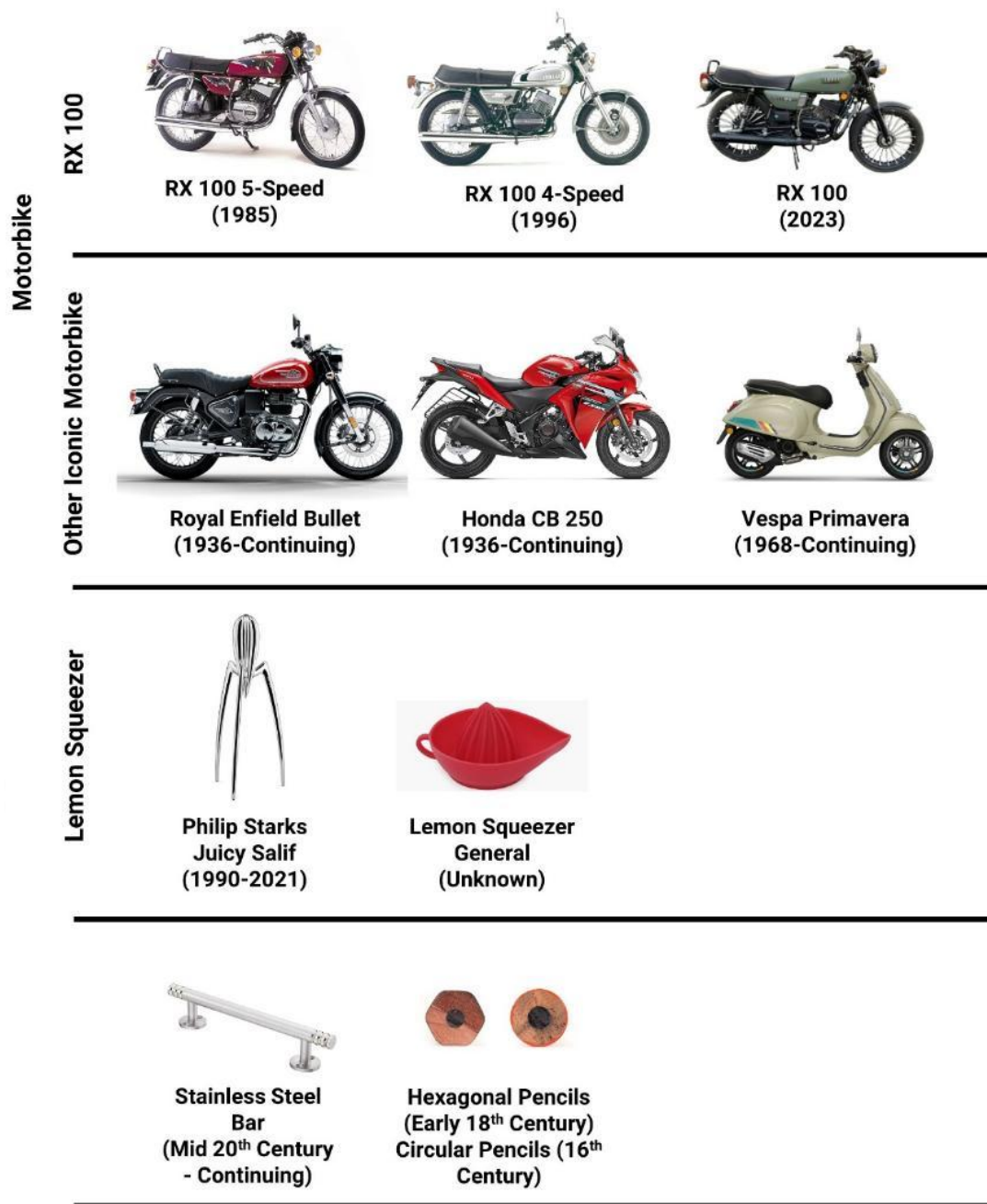


Porsche 911  
(1963-Continuing)



Ford Mustang  
(1964-Continuing)

d



e

Figure 4.3. Products Considered for the Study

As industrial and product designers, participants were familiar with iconic products and innovations, minimising the need for physical samples. Due to geographical limitations across India, physical products could not be provided. The dissection task was

completed online within three days, with an example shown in Figure 4.4. This timeframe allowed designers to thoroughly analyse sensory and functional aspects across fifteen diverse products, ensuring detailed evaluations. Due to the virtual setup, additional time was allocated to mitigate the lack of physical interaction with the products. When participants faced challenges visualising certain stages, they were instructed to refer to product images and videos of the products for better understanding.

Table 4.5. Protocol for Level 3

S.no	Protocol	Example
1.	You see the product from a distance.	If the shape of a car's front headlights is aggressive, it seems more attention-seeking. The design is sharper and has thin lighting structures.
2.	You see it from nearby.	A smoother form persuades you to touch and feel comfortable.
3.	You see it while holding it in hand.	The peculiar freezing sensation of holding the Coke glass bottle makes it more enjoyable.
4.	You see the product while it is packed.	Coke glass bottle demonstrates how the design supports rough transport conditions.
5.	You are unboxing or opening the product.	Carbonated drinks need gas to stay fizzy and taste good. Coke glass bottles with tin caps are better at keeping the gas than other material bottles, even in varied climates.
6.	You are using the product for the first time.	A pen with a rubbery grip communicates the gripping part to the user.
7.	You are watching the product while it is being used.	A person wearing spectacles can make them appear more aggressive and not approachable.

*c. Level 3: Identifying product features and reasons for continuity*

At this stage, the same participants from Level 2 were engaged in a narrative-based inquiry, focusing on the longevity of product features and their underlying reasons. In this approach, participants were asked to share their experiences and insights, explaining why specific design elements have endured. Through interviews, they

reflected on their interactions with the products, providing narratives that revealed functional and emotional factors contributing to these features' longevity.

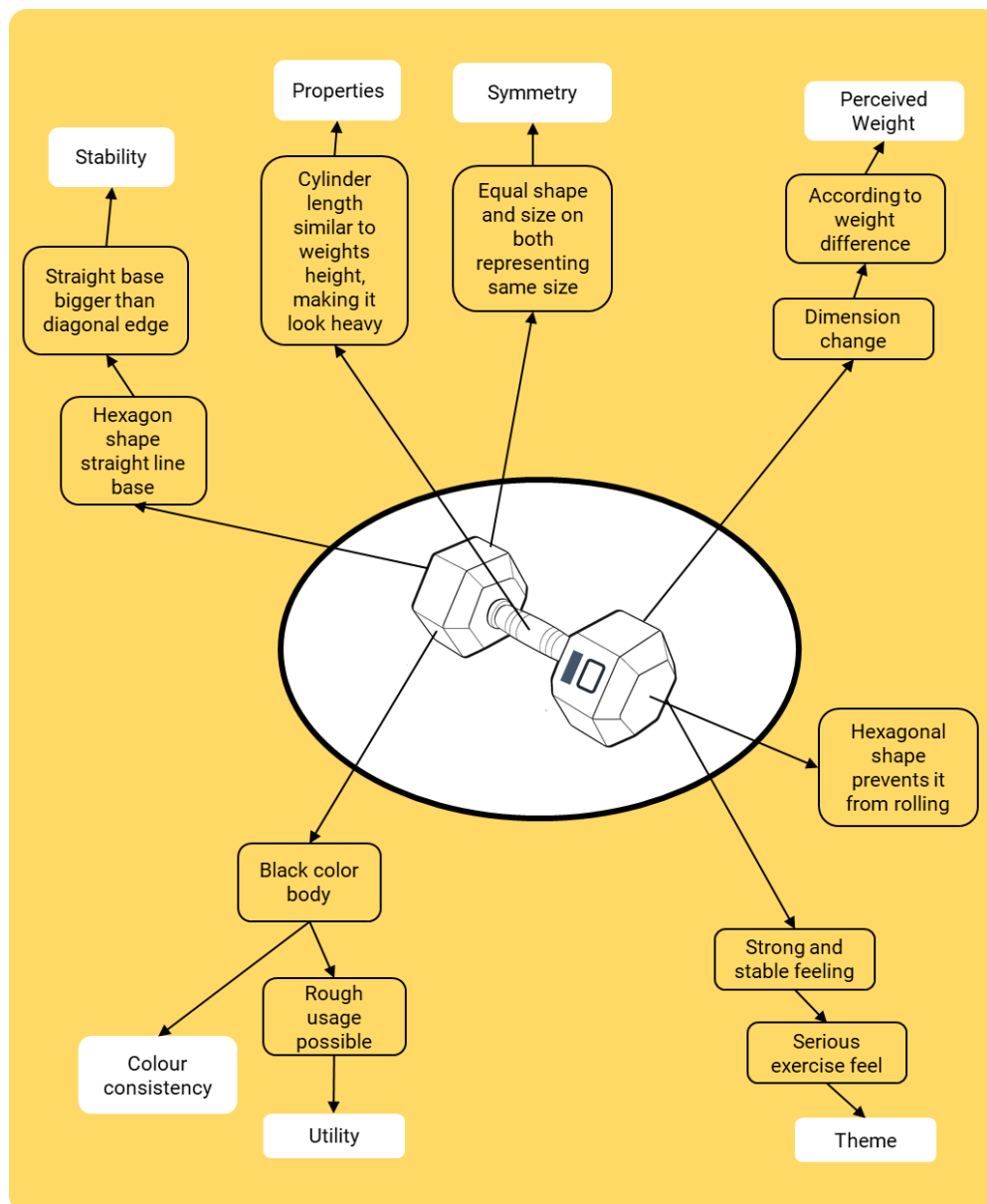


Figure 4.4. An Example of Product Dissection Performed by a Participant

This method offered a deeper understanding of why certain features remain consistent across product generations, modelled after Haines-Gadd et al. (2018), which combines analytical and reflective processes. Narrative-based inquiry was conducted with only eight participants, as data saturation occurred and no new insights emerged regarding feature continuity. Interviews lasted one to three hours, during which industrial

designers discussed the persistence of specific features. Product images assisted participants in exploring the reasons behind these enduring design elements. Some participants presented their product dissections through sketches. Figure 4.4 presents a compilation of various insights from several designers combined into one visual representation.

### 4.2.3 Content Analysis

Content analysis was applied to Phases 1 and 2 data, following a procedure adapted from past studies (Kraus & DuBois, 2017; Lettieri et al., 2009; Mayring, 2014; Nag et al., 2022; Xu & Zammit, 2020). This process involved two industrial designer researchers, both experienced in thematic coding, who thoroughly reviewed insights from the literature and product evaluations. The analysis focused on identifying design durability attributes through a literature review and interviews. Initially, key attributes were derived from the literature, forming the basis for the initial coding scheme. In the second phase, the narrative-based inquiry data attained from product review and analysis was analysed through content analysis, generating new codes that provided further insights into product features and continuity. These new codes were integrated with the literature-based ones to create a comprehensive set of factors.

Table 4.6. Content Analysis Example

Code	Axial Code	Content
Standardisation	Standardisation to lower production cost	The throat of Coke and many other products from Coca-Cola looks the same

A hybrid approach was used, combining top-down (theory-driven) and bottom-up (data-driven) methods. The literature informed initial codes, while product review and analysis data revealed emergent themes. Thematic coding was applied to group similar features into broader categories. The example coding scheme is shown in Table 4.6. Although the literature could

have influenced code identification, integrating both data sources provided a thorough exploration of factors driving design durability.

### **4.3 Results and Discussion**

Before presenting the combined results that illustrate design durability attributes, results from the scholarly literature review and the product review are presented separately.

#### **4.3.1 Results from the Literature Review (Phase 1):**

The concept of design durability, as defined in chapter 3, explains why certain features persist across products and timelines. While this concept builds on existing concepts of durable designs and products, overlaps still exist. Identifying these overlaps is crucial in defining the key attributes of design durability (Figure 4.5):

- Emotionally durable design focuses on creating products that encourage a strong emotional bond with users. This deep attachment makes users less likely to discard the product, thus extending its lifespan (Chapman, 2016; Haines-Gadd, 2019). As a result, products with this design approach often become iconic within their brands. By embedding emotionally meaningful features in new versions, designers enhance durability. Both strategies lower ecological impact, cutting down on the need for frequent replacements and promoting a more sustainable model of consumption.
- Psychologically durable design boosts a product's perceived value by fostering emotional attachment (Haug, 2019). This strategy keeps users feeling connected and satisfied, extending both their functional and emotional lives. It aligns with design durability by maintaining iconic and enduring features across versions, reinforcing a lasting psychological bond.

- Resilient design focuses on creating products that are adaptable, repairable, and upgradeable, resisting both functional and technological obsolescence (Haug, 2018). Emotional durability enhances resilient design by fostering user attachment. Combined, resilient design and emotional durability support design durability by retaining adaptable and relevant features, enabling products to evolve while preserving their core design essence.
- Timeless design emphasizes aesthetic and functional elements that remain relevant over time, despite the shifting trends (Flood Heaton & McDonagh, 2017; Lobos, 2014). Design durability supports timeless design by ensuring the core features of a product remain both aesthetically and functionally significant across various product lifecycles, thereby minimizing the need for frequent replacements.
- Slow design promotes the creation of long-lasting, maintainable, and upgradeable products by enhancing emotional bonds, reducing the need for replacements, and supporting sustainable consumption (Grosse-Hering et al., 2013). It addresses functional and technological obsolescence by focusing on maintainability and upgradeability, ensuring products stay relevant and valuable over time. Design durability complements slow design by retaining sustainable elements that evolve over time, carrying these into future products to combat social obsolescence and foster enduring designs across generations.
- Physical durability refers to a product's ability to endure environmental and physical stresses, maintaining its intended functionality over time (Den Hollander et al., 2017). Design durability ensures complements this by preserving essential design features as the product withstands wear.

- Strategic durability aligns product longevity with corporate goals, focusing on sustainability, market presence, and stakeholder value (Razeghian & Weber, 2019). Design durability complements strategic durability by enabling key design features to adapt and evolve with these goals, enhancing user experience over time while maintaining the brand's core identity.
- Design DNA refers to the unique aesthetic and conceptual features that shape a brand's identity, ensuring consistency while enabling innovation across product families (Eves & Hewitt, 2009; Rahim et al., 2015; Zhaolin Lu et al., 2009; Zuyao Zhang et al., 2009). While Design DNA aligns products with the brand, design durability maintains core design elements throughout product lifecycles, preserving brand identity and user recognition as products evolve.
- Design continuity guarantees the consistent use of essential visual and functional elements across products, reinforcing brand identity and enhancing user experience, recognition, and loyalty (Althuizen & Chen, 2022; Hsiang et al., 2011; Talke et al., 2017; Yu et al., 2022). Meanwhile, design durability ensures these features are preserved and stay relevant through product updates or redesigns, balancing innovation with brand heritage across product lines.

Upon reviewing the overlap among these durability concepts, strategic durability stands out as the most comprehensive. It aligns product longevity with corporate sustainability goals and encompasses slow design, which emphasizes maintainability and emotional attachment. As part of strategic durability, slow design supports sustainability and intersects with resilient, psychological, emotional, and physical durability. Resilient design upholds design durability by ensuring adaptability, repairability, and relevance, while psychological durability strengthens emotional bonds and perceived product value. These bonds intersect with emotional durability, resilient design, and slow design to extend product lifespan.

Emotional durability fosters strong user attachment, minimizing the need for frequent replacements, and links with psychological durability, resilient design, and slow design. Physical durability focuses on resisting physical wear and aligns with design continuity, timeless design, and slow design. Timeless design secures long-term relevance, linking with design durability, design continuity, and emotional durability. Product DNA shapes brand identity and intersects with slow design, resilient design, psychological durability, and emotional durability, ensuring consistency and enduring recognition. Lastly, design continuity preserves consistent elements across products, reinforcing brand loyalty and recognition while supporting timeless design and design durability.

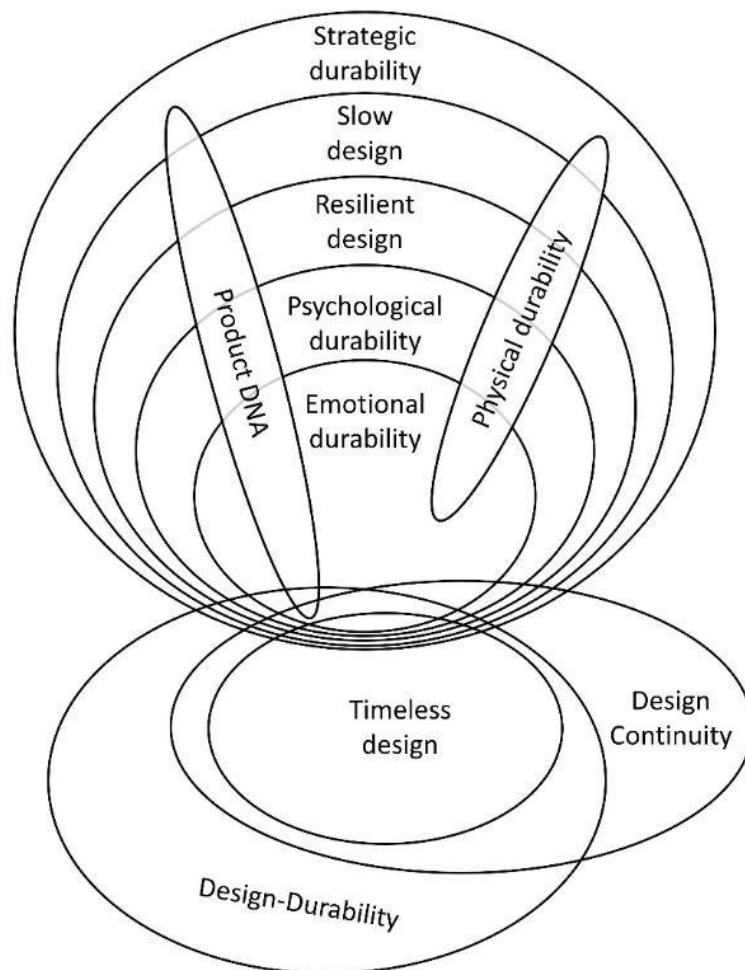


Figure 4.5. Overlap of Various Similar Concepts with Design durability

The 117 factors identified from 25 foundational studies on durability, as outlined in Table 4.7, were drawn from existing literature. Further validation is required to determine which attributes most closely align with design durability. To achieve this, we extended our study by comparing and synthesizing these factors with those derived from product reviews, as detailed in the next section. The comprehensive theoretical framework on durability concepts discussed previously established the foundation for evaluating design longevity. This assessment identified 35 unique critical attributes. The factor selection process from Phase 1 is demonstrated through examples depicted in Table 4.8.

Table 4.7. Factors Defined from Reviewing the Literature

<b>Factors extracted from the literature</b>
Product attachment; reliability and robustness; repair and maintenance; upgradability; variability (Van Nes & Cramer, 2005)
Affect, lived experience and meaning; cultural philosophy and sustainable development; immateriality and irrationality (Borjesson, 2008)
Evoke enjoyment; memories (Schifferstein & Zwartkuis-Pelgrim, 2008)
Attachment; consciousness; detachment; narrative; surface; users are enchanted by the product (Chapman, 2009)
Group affiliation; memories; pleasure; self-expression (Mugge et al., 2010)
Aficionado-appeal; rarity (Jung et al., 2011)
Adapt to the user's identity; animacy; evoke memories; Involvement; rewarding (Van Krieken et al., 2012)
Engage; evolve; expand; participate; reflect; reveal; ritual (Grosse-Hering et al., 2013)
Brand design consistency; category design consistency (Sheng Goh et al., 2013)
Appearance; materials selection; product efficiency; user experience (Lobos, 2014)
Ability; memories; pleasure; reliability; usability (Page, 2014)
Aspiration; belonging; intimacy; memory; pleasure; self-image (Ko, 2017)
Cognitive economy; timelessness durability; visual simplicity (Flood Heaton & McDonagh, 2017)
Autonomy; environmental mastery; personal growth; positive relations with others; purpose in life; self-acceptance (Casais et al., 2018)
Color, form and material; design cues and language; explicit references; sensory elements; visual form and symmetry (Gonzalez et al., 2018)
Increasing sensory variety; aging well; maintenance quality; exclusivity; pre-purchase personalisation; making social connections (Haug, 2018)
Incorporating significant memories and associations (Orth & Thurgood, 2018)

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**Factors extracted from the literature**

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Conversations; consciousness; evolvability; identity; Imagination; integrity; materiality; narratives; relationships (Haines-Gadd, 2019)

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Ageing well; exclusivity; personality; personalisation; timelessness (Haug, 2019, p. 019)

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Brand extension attitude; consumer-brand identification; perceived fit and tie; value congruity (Shokri & Alavi, 2019)

---

Adaptable to new functions; easy maintenance; flexible design; high durability; personalised; refurbished (Agost & Vergara, 2020)

---

Avoiding time markers; enduring icons; fulfilling deep human needs; neo-retro designs; quality and durability; simplicity (Ke & Yoon, 2020)

---

Supporting emotional value (Supporting product attachment, sustaining aesthetic value); supporting functional value (Stimulating product care and maintenance, Enabling upgradeability) (Van Den Berge et al., 2021)

---

Dual-extended resource base; social meaning; structural and visual elements; symbolic communication (Alam et al., 2023)

---

Artistic Innovation and cultural integration; cultural heritage and identity; ergonomic considerations; market demand orientation; socio-economic context; technological advancement (Ao et al., 2024)

---

Table 4.8 presents a representative output from the content analysis carried out. In this process, 117 factors were extracted from the literature and individually evaluated by expert researchers to determine their relevance to the concept of design durability. The table includes illustrative example of this evaluative approach, where each factor was judged to be either related or unrelated to design durability, along with a rationale supporting the classification.

Table 4.8. Sample Output of Content Analysis Conducted

<b>Example factors</b>	<b>Whether factors relate to design durability</b>	<b>Justification</b>
Brand extension attitude	NO	This pertains to marketing strategies rather than the inherent durability of design.
Detachment	NO	Involves user disengagement in certain aspects, which is the opposite of what design durability is trying to achieve
Cognitive economy	YES	Cognitive economy deals with the cognitive effort needed to use the product, so features made with adept cognitive economy make the features appreciated and accepted immediately.

<b>Example factors</b>	<b>Whether factors relate to design durability</b>	<b>Justification</b>
Design Cues and Language	YES	Design cues and language enhance user understanding and interaction, reducing errors and increasing satisfaction, thereby extending product usability and lifespan.

### **4.3.2 Results from Product Reviewing (Phase 2)**

In this phase, popular product models or icons were compared to their earlier versions to analyse how their purposes evolved and the extent to which design features were preserved across generations. Similarly, unique and shared features that contribute to their lasting appeal were identified through comparisons with competing products. For example, both Coke and Pepsi bottles incorporate logos on smooth surfaces, and their bottle openings appear almost identical in design. The Pilot Vanishing Point fountain pen has maintained its popularity largely due to its unique retractable nib design.

Many products distinctly showcase styles such as mid-century modern, modern, art deco, industrial, futuristic, retro, and rustic. The study also examines how design attributes—line, shape, form, texture, pattern, colour, space, and size—and principles like order, harmony, grouping, proximity, emphasis, balance, proportion, simplicity, symmetry, contrast, and rhythm—collectively enhance product durability in the market. In phase 2, the narrative-driven inquiry and product analysis resulted in 253 axial codes. In Appendix B's Table B.1, all the open codes extracted from phase 2 are presented along with the associated design durability factor and sub-factor.

### 4.3.3 Combined results from Phase 1 and Phase 2

In Phase 3, we examined the combined findings from both the literature review and the product review analysis. This mapping process helped highlight 22 factors connected to design durability, as shown in Figure 4.6.

The example of how content from Phases 1 and 2 merges to form factors based on their affinity and commonality (Clapp et al., 2023) is presented below:

a. *Step 1: Combine results from Phase 1*

Phase 1 emphasizes timelessness, achieved by incorporating traditional, simple, and iconic designs. These avoid specific time markers, supporting long-lasting relevance.

b. *Step 2: Combine results from Phase 2*

Phase 2 focuses on style consistency, integrating cohesive and symbolic design elements. This ensures easy recognition and adaptability across varied contexts.

c. *Step 3: Combine results from Phase 1 and 2*

While style consistency does not fully align with timelessness, combining these concepts forms a new approach. As products adapt and evolve, they retain core elements. This integration creates a unified, enduring design, establishing "aesthetic consistency" as a new factor derived from merging timelessness and style consistency from Phases 1 and 2.

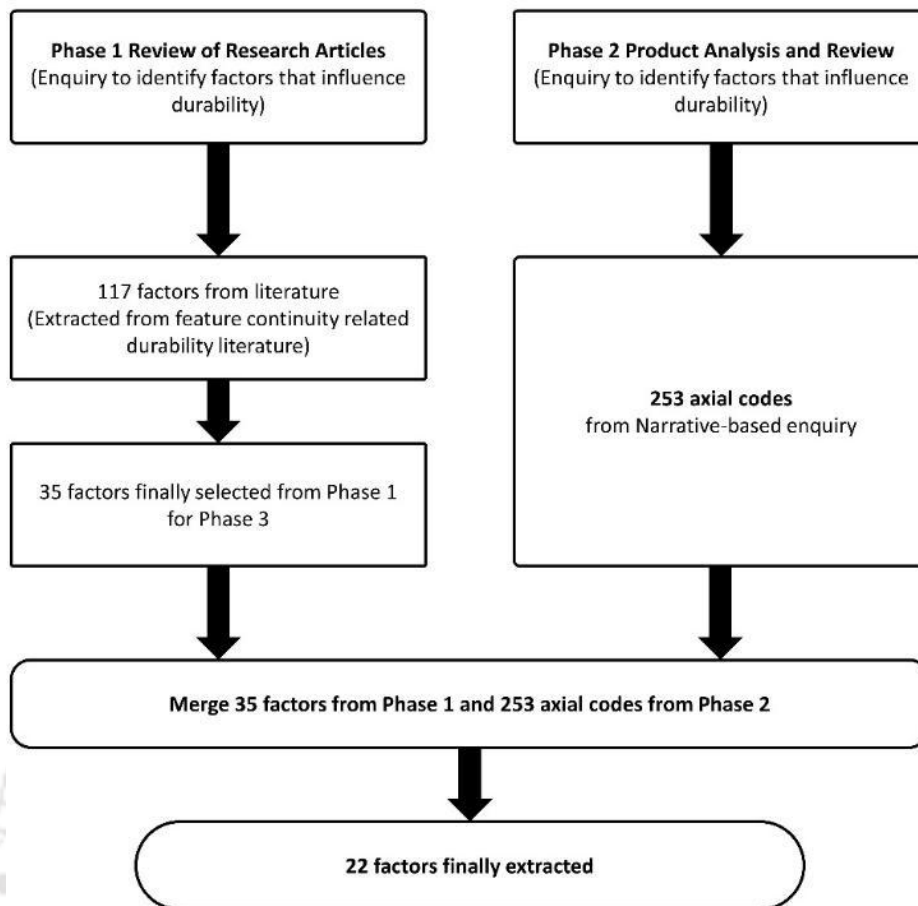


Figure 4.6. Map of Results Attained in Different Phases of Methodology

The identified 22 factors are outlined below, further elaborated through product cases from Phases 1 and 2 to highlight their practical application. Tables 4.9-4.30 further presents all the sub-factors and the phase which contributed to each sub-factor that helped define factors of design durability:

- i. **Accessibility:** Accessibility refers to the degree to which a product can be easily used by people with diverse abilities. It involves creating designs that accommodate users with different capabilities. For example, the spin mop handle is designed to be lightweight and easy to grip, making it accessible even for those with limited strength.

Table 4.9. Accessibility and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
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<b>Phase 2</b>	Accommodating various user segments	Accessibility
<b>Phase 2</b>	Visibility of the feature or product	
<b>Phase 2</b>	Commonly known shapes for better accessibility	
<b>Phase 2</b>	Flexible components used for Reachability	
<b>Phase 2</b>	Adjustability of product makes it more	

ii. **Aesthetic Continuity:** Aesthetic continuity is the ability of a product's appearance to stay relevant and consistent over time. Achieving this involves selecting timeless styles or aesthetics that can successfully reappear in new contexts. Research suggests that choosing styles true to the product's core can create enduring designs (Flood Heaton & McDonagh, 2017). Lobos' findings also indicate that designs with exceptional beauty, nostalgia, or simplicity contribute to timelessness (Lobos, 2014). The Porsche 911 exemplifies a lasting design, sustaining its market presence since 1963 by preserving its design language. Similarly, Chuck Taylor All-Star shoes, once popular in basketball, have evolved into a staple for casual wear.

Table 4.10. Aesthetic Continuity and their Contributing Sub-Factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 1</b>	Using Traditional designs	Aesthetic Continuity
<b>Phase 1</b>	Using Timeless designs	
<b>Phase 1</b>	Making simple products	
<b>Phase 1</b>	Designing Neo-Retro designs	
<b>Phase 1</b>	Using Enduring Icons in design	
<b>Phase 1</b>	Avoiding time markers while designing a product	
<b>Phase 2</b>	Using consistent Product style (Industrial, Simplistic, Minimalistic, Modernistic etc) across products	
<b>Phase 2</b>	Using timely styles that inform generation or timeline the product belongs to	
<b>Phase 2</b>	Using standard styles that informs the identity of a product type	
<b>Phase 2</b>	Using Iconic and Symbolic forms	

iii. *Affordance*: Affordances are the cues an object or feature provides about how it can be used and what actions users can perform with it. These are relational properties that connect artifacts and users within a specific environment. Research classifies affordances into natural and perceived types (Burlamaqui & Dong, 2015). Natural affordance involves cues from the product's inherent features, guiding users on how to use it. In contrast, perceived affordance refers to uses inferred by individuals based on past experiences and cultural influences. For instance, the Zap button on a mosquito bat exemplifies natural affordance—it can only be pressed downward, returning to its initial position when released. Meanwhile, a fountain pen is widely viewed as a tool for precise, elegant writing, illustrating perceived affordance.

Table 4.11. Affordance and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Provide cues that provide natural affordance	Affordance
Phase 2	Provide cues that provide perceived affordance	
Phase 2	Simplicity of form informs affordance	
Phase 1	Design Cues and Language	

iv. *Engaging Conversations*: Conversations refer to the interactions between a product and its user. Incorporating feedback mechanisms to make a product responsive to users and its environment enhances its perceived dynamic nature, facilitating smooth interactions (Haines-Gadd et al., 2018). For example, a table lamp that adjusts brightness based on ambient light exemplifies this concept (Haines-Gadd, 2019).

Table 4.12. Engaging Conversations and their Continuing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Ergonomic conditions help provide natural and intuitive interactions	Engaging
Phase 2	Feedback enforces interactions in a product	Conversations

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Human-like interaction or conscious interaction makes the interactions engaging	
<b>Phase 2</b>	Provide hidden features for surprising interaction	
<b>Phase 2</b>	Intrigue achieved by providing rare and least accessible product characteristics.	
<b>Phase 1</b>	Enhance consciousness of a product	
<b>Phase 1</b>	Enhancing relationships with product	
<b>Phase 1</b>	Product features that evoke enjoyment	
<b>Phase 1</b>	Make product features that provide pleasure	
<b>Phase 1</b>	Make products that can make a user participate in interaction	
<b>Phase 1</b>	Make the interaction more engaging	
<b>Phase 1</b>	Design rituals that make the interactions happen on regular basis	
<b>Phase 1</b>	User are enchanted	
<b>Phase 1</b>	Increasing Sensory Variety	
<b>Phase 1</b>	Sensory Elements	

- v. *Evolvability*: Evolvability in design combines adaptability and upgradability, allowing products to change according to users' needs (Haines-Gadd et al., 2018). An example is the evolving photo display, a concept from Haines-Gadd's doctoral thesis, which adapts over time to showcase a user's favorite images (Haines-Gadd, 2019).

Table 4.13. Evolvability and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Providing adaptable features to achieve optimised performance and actions	Evolvability
<b>Phase 2</b>	Adjustable product features to accommodate to different product contexts	
<b>Phase 1</b>	Providing features that are upgradeable	
<b>Phase 1</b>	Providing frame of the product architecture that can adapt to new features	
<b>Phase 1</b>	Personalised	
<b>Phase 1</b>	Personalisation	
<b>Phase 1</b>	Evolve	

- vi. *Exclusivity*: Exclusivity is the unique value a product offers to its user, allowing older technologies and designs to remain valued despite newer alternatives. This quality also enables products to confer a sense of status (Haug, 2019). An example is the Juicy Salif lemon juicer, whose distinctive form sets it apart, making it an exclusive item among juicers.

Table 4.14. Exclusivity and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Incorporating valuable product attributes	Exclusivity
Phase 2	Restricted and limited product feature and usage makes the product to be rare	
Phase 2	Antique products are considered to be rare	
Phase 2	Providing unique product features	
Phase 1	Exclusivity	

- vii. *Harmony*: Harmony is when various design elements in a product work together cohesively to enhance functional efficiency (Kumar & Garg, 2010). This interaction among a product's features, design elements, the user's mental model, and the environment fosters harmony. For instance, the arrangement of suction units in a Dyson vacuum cleaner boosts efficiency by working in unison. Similarly, rubber-coated dumbbells reduce noise during exercises, making them more comfortable to use in public settings. This example illustrates harmony between people, products, and the environment. Conversely, products lacking harmony in their surroundings, like table lamps that clash with room decor, are often replaced.

Table 4.15. Harmony and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Performance enhancement due to internal harmony	Harmony

<b>Phase 2</b>	Performance enhancement due to external harmony
<b>Phase 2</b>	Providing non-dominating entities in a product
<b>Phase 2</b>	Designing balanced product features

viii. *Identity*: Identity encompasses the traits and personality that set a product apart. When a product facilitates expression, connectivity, and self-discovery, users can sense its distinct identity (Haines-Gadd et al., 2018). Designs that resonate with users tend to endure over time. For instance, personal assistants are often given feminine characteristics—soft voices and approachable forms—as femininity is commonly associated with qualities like integrity and warmth. Similarly, the concept of "DNA" is used by companies to maintain signature product features, helping customers recognize brand identity. A notable example is the kidney-shaped grilles found in certain automobile brands.

Table 4.16. Identity and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Incorporating features that inform brand identity	Identity
<b>Phase 2</b>	Design product attributes for product personality	
<b>Phase 2</b>	Incorporate distinguishable features that inform identity of a product	Identity
<b>Phase 2</b>	Using typical product forms that represent a product category	
<b>Phase 2</b>	Embedding cultural symbols that inform identity	
<b>Phase 1</b>	Cultural Heritage	
<b>Phase 1</b>	Identity	
<b>Phase 1</b>	Self-expression	
<b>Phase 1</b>	Group affiliation	
<b>Phase 1</b>	Self-Image	
<b>Phase 1</b>	Belonging	
<b>Phase 1</b>	Making social connection	
<b>Phase 1</b>	Consumer-brand Identification	Identity
<b>Phase 1</b>	Expand	
<b>Phase 1</b>	Aspiration	

- ix. *Integrity*: Integrity in design refers to the quality of being honest and ethical, achieved through coherent and consistent design systems. This means staying true to a product's intended purpose, functionality, and aesthetic throughout its lifespan. For example, the Dyson vacuum cleaner, known for its industrial style, combines aesthetic appeal with durable construction, exemplifying integrity in design.

Table 4.17. Integrity and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Complex interaction products are made to last longer	Integrity
Phase 2	Designing products to induce humble nature	
Phase 1	Reliability and Robustness	
Phase 1	High Durability	
Phase 1	Ageing well	
Phase 1	Quality and Durability	
Phase 1	Surface	

- x. *Learnability*: Learnability is the ease with which users can quickly and accurately understand how to use a product or feature (Nielsen, 1993). Consistent, simple, and intuitive designs, along with clear instructions and familiar elements, enhance a product's learnability. By making systems easier to learn, designers can boost a product's appeal. Dyson vacuum cleaners exemplify this with their straightforward interfaces and easy-to-use buttons.

Table 4.18. Learnability and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Provide simpler functionality and features to ease of learning	Learnability
Phase 2	Learnability for better feature usage	

xi. *Maintainability*: Maintainability is a product's ability to achieve resilience through ease of care and repair. This includes features like cleanability and repairability (Joustra et al., 2021). For example, classic ceramic table lamps with washable and easily replaceable fabric lampshades demonstrate maintainability, helping the design remain popular and durable over time.

Table 4.19. Maintainability and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Make products features maintainable	Maintainability
Phase 2	Make products features cleanable	
Phase 2	Make products features repairable	
Phase 1	Repair and maintenance	Maintainability
Phase 1	Easy Maintenance	
Phase 1	Maintenance quality	

xii. *Maturity*: A design or feature is considered mature when it reaches a fully developed state, achieved through iterative optimization to meet top standards within its product category and context. This maturity provides designers with insights into optimized practices, guiding the creation of more effective, context-specific designs.

Maturity is achieved in two ways:

- a. Feature optimization involves selecting the most effective design feature from available options to suit a specific context. This process enhances product attributes, improving user experience and adding value. For example, adding a rubber grip to pens increases usability.
- b. Functional optimization focuses on refining a product's functional aspects to achieve optimal performance in a given context. For example, razor blade angles have been adjusted over time to reduce skin irritation, and ink flow mechanisms in fountain pens have been optimized to enhance functionality.

Table 4.20. Maturity and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Providing Functional optimisation	Maturity
<b>Phase 2</b>	Providing Feature optimisation	

- xiii. *Memorability*: Memorability is a user’s ability to recall how to use a product or feature. Consistent, simple, and intuitive design elements make products more memorable (Nielsen, 1993). Clear instructions and familiar symbols or metaphors also enhance memorability. The iDrive system in BMW cars exemplifies this, as its central console placement and intuitive controls help users operate it with ease. The factors memorability and learnability may sound similar, but designing for one doesn’t always make a design better for others. A product might be easy to learn initially but difficult to remember, thereby addressing of these attributes should be done individually.

Table 4.21. Memorability and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Simpler features for memorability	Memorability
<b>Phase 2</b>	Placement and order of elements enable memorability	

- xiv. *Narrative*: Narrative involves using shared stories as inspiration to create features that evoke memories of past product experiences, fostering a sense of nostalgia (Haines-Gadd et al., 2018). A notable example is the Bajaj V15 motorcycle, which incorporates metal from the INS Vikrant, India's first aircraft carrier, creating a historical connection that enhances its appeal.

Table 4.22. Narrative and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
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<b>Phase 2</b>	Metaphors and nostalgic features for incorporating story to a product	Narrative
<b>Phase 1</b>	Memories	
<b>Phase 1</b>	Intimacy	
<b>Phase 1</b>	Cultural Heritage	

xv. *Noticeability*: Noticeability is a feature’s ability to capture attention, achieved by making it visible or distinctive to users. Product visibility is often the most effective way to draw attention, using unique, recognizable, and distinctive elements. For instance, the zap button on a mosquito racquet stands out due to its contrasting colour. However, noticeability isn’t always about standing out; some products are designed to blend into their surroundings. For example, personal assistants are often made with fabric-like materials and neutral colours, allowing them to integrate seamlessly and create a comfortable presence in the home environment.

Table 4.23. Noticeability and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Distinctive product features for noticeability	Noticeability
<b>Phase 2</b>	Proportional variance for making a feature noticeable	
<b>Phase 2</b>	Conditions and environment enhanced visibility	
<b>Phase 2</b>	Visibility enabled through patterns	
<b>Phase 2</b>	Visibility enabled through textures	

xvi. *Portability*: Portability is a product’s ability to be easily moved between locations, achieved through features like modularity, collapsibility, carriability, and transportability. For instance, a vacuum cleaner with a detachable battery exemplifies modularity, enabling users to charge it separately. Similarly, a wet mop’s wringer can be detached from the handle, making it easy to store in small spaces. Coke bottles are designed to endure transportation demands, showcasing transportability. Additionally,

compact, lightweight safety razors are designed for easy carrying in travel bags, demonstrating carriability.

Table 4.24. Portability and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Designing products with compactness	Portability
Phase 2	Designing light-weighted product	
Phase 2	Designing products carriable	
Phase 2	Making products modularity	
Phase 2	Providing a movable mechanism in a product	

- xvii. *Production quality*: Materials, manufacturing processes, surface treatments, and structural design significantly contribute to a product's longevity (Joustra et al., 2021). Users often prioritize high-quality materials when selecting products, as materials not only enhance durability but also provide a multisensory experience that adds to user satisfaction. The concept of "celebrating imperfections" emphasizes the value of material uniqueness (Haines-Gadd et al., 2018). Certain materials, based on product category, have remained consistent over time; for example, stainless steel is common in double-edged safety razors, while plastic is used in cartridge-based ones. The glass bottle of Coke preserves flavor, extending its design's appeal, while Anglepoise lamps illustrate quality through their structural stability, which supports their enduring design.

Table 4.25. Production quality and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Connection quality influences durability	Production quality
Phase 2	Product features customised for appropriate production quality.	
Phase 2	Making appropriate finish quality for required usage	
Phase 2	Environmental aggressions through appropriate structural quality	
Phase 2	Material selection considers aggressions and changes it can go through and helps make the product recyclable and renewable	

xviii. *Proficiency*: Proficiency refers to an individual’s skill level in using a product to achieve the desired outcome (Brownell et al., 2021). Optimizing features to match proficiency levels can enhance product efficiency, supporting design continuity. For example, pencil shapes are tailored to different skill levels: round pencils cater to professionals and artists, hexagonal pencils suit moderately skilled users, and triangular pencils are designed for beginners to offer a more comfortable writing experience.

Table 4.26. Proficiency and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Hidden features and operations providing minding expert users	Proficiency

xix. *Protection*: This attribute refers to a product’s ability to provide protection, achieved through safety, privacy, and security measures. For instance, the curved razor head is designed to glide smoothly across the face, minimizing the risk of cuts, thereby enhancing user confidence. Similarly, the microphone off button on Alexa devices exemplifies security and privacy, allowing users to control when the device listens.

Table 4.27. Protection and their Contributing Sub-factors

<b>Sub-factor from phase</b>	<b>Sub-Factor</b>	<b>Factor</b>
<b>Phase 2</b>	Standardised shapes, forms, material, textures for increasing safety	Protection
<b>Phase 2</b>	Material property, status quo of function, error prevention increases protection	
<b>Phase 2</b>	Enhancing security through detectability and privacy of a feature	

xx. *Redundancy*: Redundancy involves incorporating backup mechanisms to ensure a product continues to function in case of failure, enhancing design durability (Joustra et

al., 2021). For example, bikes are equipped with reserve oil storage, accommodating longer drives and providing a safety net that mopeds typically don't require.

Table 4.28. Redundancy and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Backup mechanism for fail proof systems	Redundancy
Phase 2	Redundancy of features to tackle extreme scenarios	

xxi. *Standardisation:* Standardization is the process of establishing consensus on features and functionalities across industries, companies, and society. It encompasses design, materials, performance, and safety requirements, helping integrate products with other systems and enhancing their overall viability.

Broadly, standardisation can be classified into four categories:

- a. Industry standardization involves applying design constraints to boost product viability. For instance, many soft drink companies use standardized bottle sizes to lower manufacturing costs, allowing this feature to stay consistent. Similarly, the widespread adoption of USB-C ports across devices ensures compatibility and maintains relevance in today's tech market.
- b. Regional standardization includes socio-cultural norms, anthropometric data, and local standards. For example, bike companies in India often release brightly colored models, like red and yellow, to coincide with peak wedding seasons. Additionally, devices made in the US may be incompatible with India's electrical frequencies, leading to product failure. Therefore, many products are specifically adapted to align with India's standard electrical frequencies.
- c. Regulation refers to requirements that differ across regions. For example, in India, it is mandatory for bike headlights to turn on automatically when the

vehicle starts, a feature known as "Daytime Running Light," enforced by government regulations.

- d. Design conventions are widely recognized choices within a specific domain or industry, representing common methods or standards that designers follow when creating designs. A common example is the standardized layout of interaction buttons across most TV remotes, ensuring familiarity for users.

Table 4.29. Standardisation and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Providing features that are industrially standardised	Standardisation
Phase 2	Providing features that are regionally standardised	
Phase 2	Providing features that follow regulations	
Phase 2	Providing conventional designs and features	
Phase 1	Socio-economic consideration	

- xxii. *Versatility*: Design conventions are widely recognized choices within a specific domain or industry, representing common methods or standards that designers follow when creating designs. A common example is the standardized layout of interaction buttons across most TV remotes, ensuring familiarity for users.

Table 4.30. Versatility and their Contributing Sub-factors

Sub-factor from phase	Sub-Factor	Factor
Phase 2	Products made to accommodate multi-Context	Versatility
Phase 2	Products made to have multiple purposes	
Phase 1	Variability	
Phase 1	Flexible design	

#### 4.3.4 Factors and Design attributes

Based on the nature of the identified factors and their influence on designers' decisions to create enduring features, these factors are categorized into six broader design attributes, as defined by Ferrerira et al. (2016), and summarized in Table 31. The design attributes considered in the study include elements of form, organizational principles, communication, function, human factors, and materialization.

According to Ferrerira et al. (2016):

- a. Form encompasses the visual and physical characteristics that shape an object.
- b. Organizational principles address compositional aspects, including structure and spatial arrangement.
- c. Communication involves elements that help users understand a product or feature, conveying its intended meaning.
- d. Function relates to the purpose of a feature, including its usage, possibilities, and limitations.
- e. Human factors focus on the subjective aspects of understanding, using, and experiencing a product or feature.
- f. Materialization pertains to physical aspects such as manufacturing technologies, structural choices, and build quality.

Mapping the identified factors revealed that some are linked to multiple attributes. For example, the factor of protection was associated with both function and human factors. However, protection aligns more closely with function, as it relies on product design rather than user capabilities or interactions. Meanwhile, standardization and maturity appeared across all attributes, as these factors are essential to industrial practices and the market acceptance of features over time. Thus, they are grouped under a new category called industrial relevance.

These design durability factors assist designers in pinpointing features that contribute to a product's market longevity. For instance, aesthetic continuity reflects popular styles in digital devices, which can guide the design of a digital audio player. An example is the Saregama Carvaan, a digital audio device that successfully blends nostalgic design (AM/FM radio-style interface) with modern technology.

Table 4.31. Attributes of Design durability and Elements of Design

<b>Elements of Design</b>	<b>Attributes of Design durability</b>
<b>Communication</b>	Noticeability, Affordance, Engaging Conversation
<b>Form</b>	Aesthetic Continuity
<b>Function</b>	Portability, Versatility, Maintainability, Protection
<b>Human Factors</b>	Accessibility, Learnability, Memorability, Portability, Imagination, Identity, Narrativity, Exclusivity, Evolvability
<b>Materialisation</b>	Production Quality, Redundancy, Integrity
<b>Organisational principles</b>	Harmony
<b>Industrial Relevance</b>	Standardisation, Maturity

#### **4.4 Practical Implication:**

The study on design durability provides valuable insights for designers and manufacturers, focusing on creating products that are sustainable, emotionally engaging, and market-relevant. Unlike user-centered design, which targets immediate user needs, design durability adopts a long-term perspective, ensuring that product features remain desirable and functional across different iterations and contexts. This approach addresses emotional, psychological, and physical durability. By encouraging modularity and upgradability, design durability enables products to evolve alongside technological advancements, reducing the need for frequent replacements and promoting sustainable consumption.

Additionally, the study introduces a framework connecting design durability factors with specific design elements. This framework serves as a practical tool for novice designers, aiding them in identifying enduring features and building a knowledge base of design insights. It helps

create adaptable, future-proof designs that meet present needs while maintaining relevance over time. This approach complements user-centered design by extending product longevity and appeal amid shifting market demands, fostering sustainability and responsible design practices.

#### **4.5 Limitation and Future Scope**

While this study chapter provides designers with insights into factors that enhance design durability, it does not delve into the practical applications of these factors. This gap presents an opportunity for future research to expand the concept of design durability. Researchers could explore the interconnections, effects, and practical uses of these factors in achieving lasting designs. A significant limitation of this study is its lack of consumer perspective; future research should investigate how design durability factors resonate with users, influencing both product longevity and sustainable design. Additionally, as the expert study involved only industrial designers, the findings reflect their specific viewpoints. A broader understanding could be achieved by including insights from production engineers, maintenance engineers, logistics engineers, and marketing and sales managers.

#### **4.6 Conclusion**

This study presented in this chapter set out to identify factors that influence a new concept called design durability through an exploratory research approach. It highlights the role of adaptability and strategic foresight in maintaining the relevance of design elements across different product contexts. Beginning with a literature review to identify product cases and factors related to feature continuity, the study proceeded with tasks such as product analysis and designer interviews to understand how durability is perceived and applied in design practice. Through this process, 22 factors defining design durability were identified, with eleven factors uniquely characterized based on product analysis: aesthetic continuity,

affordance, harmony, learnability, maturity, memorability, noticeability, proficiency, protection, versatility, and standardization. The remaining factors were drawn from existing literature on durable designs. This study aims to refine these factors for practical use, providing valuable insights for designers, manufacturers, and policymakers working to reduce environmental impact and support sustainable design practices. However, aspects of these factors remain unknown. The next chapter will explore strategies by examining how these factors function across various product categories, deepening our understanding of design durability.



# Chapter 5 Exploring Design durability in Market Endurance: A Comparative Analysis Across Product Categories

## *Chapter abstract*

*This chapter explores the practical applications of design durability across various product categories to address its market relevance. Through a mixed-method approach involving online content analysis and surveys conducted with designers and consumers, the study evaluates how design durability factors influence consumer preferences differently across product categories. The findings reveal category-specific priorities and strategies, providing actionable insights for designs to achieve endurance.*

## **5.1 Introduction**

Product durability is a highly valued entity in product design, as it indicates the quality of the product and fosters trust. Traditional measures of product success often focus on short-term market impact. Currently, the emphasis on creating designs that are both enduring and remain relevant over extended periods to minimise environmental impact (Barbiroli, 2008; Homburg et al., 2015; Jindal et al., 2016). Historically, research has explored market endurance through concepts such as timeless design, slow design, design continuity, strategic durability, emotionally durable design, and psychologically durable design (Chapman, 2015; Grosse-Hering et al., 2013; Haase, 2023; Haines-Gadd, 2019; Haug, 2019; Lobos, 2014). While the existing concepts provide insights into design endurance from a few perspectives, they focus primarily on the endurance of a single product's design or product line perspective. This product-centric approach often overlooks that a single individual rarely designs modern-day products. Instead, they result from collaborative efforts involving multiple designers from multi-disciplinary teams (Minder & Heidemann Lassen, 2018), each contributing to specific features of the overall design. This shift from product-level to feature-level design requires

understanding design endurance at the feature level. However, traditional durability concepts provide insight into the longevity of product forms or product lines; they do not explain why certain design elements persist across products and time.

However, the concept of design durability can address this limitation. This perspective was broadened by introducing design durability, which aims to address the endurance of features across products and timeframes comprehensively. Design durability which has 22 key factors (see Table 5.1) that address various dimensions, including physical, emotional, psychological, and strategic durability, as well as operational and usability aspects. This comprehensive approach ensures the sustained consistency of features.

By leveraging design durability to create features with lasting market endurance, we can mitigate the need for continuous innovation, lowering environmental impacts and fostering sustainable product development. While design durability establishes a theoretical framework, its practical application has not been thoroughly explored. The existing literature does not adequately address the diverse impact of design durability while creating products. This gap in the literature informed us to conduct various studies on how these characteristics interact across different product categories. This study aims to explore how design durability relates to various product categories. This also investigates the efficient implementation of the factors.

Table 5.1. Design durability factors and their definitions

<b>Factor</b>	<b>Definition</b>
Accessibility	This aspect ensures that people with different capabilities can use a product with ease. An example of this factor is the spin mop handle, which is designed to be lightweight and easy to hold for those with limited strength.
Aesthetic continuity	A product's ability to maintain consistent and timeless designs is known as aesthetic continuity. Porsche 911 sustained since 1963 by staying true to its design language is an example of this factor.
Affordance	This factor refers to the characteristics of a product that provide cues that offer intuitive information about its usage. Natural affordance refers to inherent features such as a zap

<b>Factor</b>	<b>Definition</b>
	button on a mosquito bat, while perceived affordance is based on prior experiences a user had; one such example is viewing a fountain pen as a tool for precise writing.
Engaging conversations	This factor enhancing the interaction between a product and the user by incorporating responsive feedback mechanisms. Adjusting the brightness of a table lamp to provide ambient brightness is an example of engaging conversations.
Evolvability	This factor guarantees the adaptability and upgrading of a product to meet evolving needs. Haines-Gadd's evolving photo display is an example of this.
Exclusivity	The exclusivity of a product makes it valuable and appreciable even with newer alternatives. The Juicy Salif lemon juicer stands out due to its distinctive form.
Harmony	This attribute cohesively makes various design elements work together to achieve higher functional efficiency. The combination of Dyson vacuum cleaners' suction units ensures enhanced performance more than individual units, which is an example of harmony.
Identity	This attribute refers to a product's unique characteristics that differentiate it from others and foster user connection. The consistent kidney grilles on BMW cars are an example of brand identity.
Integrity	Integrity in design means being honest and ethical, maintaining a product's intended purpose and aesthetic appeal. Dyson vacuum cleaners exemplify integrity with their sturdy construction and industrial style.
Learnability	Learnability is the ease with which users can learn to use a product effectively. Simple and intuitive interfaces provided by the Dyson vacuum cleaners make it simple for users to use the product, which is an example of learnability.
Maintainability	This attribute describes the product's ability to achieve resilience through care and repair. A washable, replaceable fabric lampshade in classic ceramic table lamps illustrates maintainability.
Maturity	When users perceive a design as fully developed and optimised for its context, it achieves maturity. Adding a rubber grip to pens for better usability is an example of maturity.
Memorability	Memorability ensures that users can recall how to use a product in later instances. The iDrive system in BMW cars, known for its simple design and consistent use across product generations, is an example of this attribute.
Narrative	The narratives emphasise using shared stories in design to evoke nostalgia. An example of this attribute is the Bajaj V15 bike, which uses materials extracted from INS Vikrant.
Noticeability	Noticeability refers to the inherent nature of a product, where its characteristics are easily distinguishable and visible, drawing attention. A mosquito racquet's zap button stands out due to its different colour from the rest of the body, which is an example of noticeability.
Portability	Portability refers to the product's characteristics that allow it to be easily moved from one place to another. A detachable battery in a vacuum cleaner designed to be charged separately is an example of portability.

<b>Factor</b>	<b>Definition</b>
Production quality	Production quality concerns with using appropriate quality materials and manufacturing processes that can lead to the increase of a product's lifespan. Anglepoise lamps exemplify this with their structural strength.
Proficiency	Proficiency deals with considering the user's skill level when designing a product. This guarantees the product's effective use in a particular context. Pencil shapes vary by proficiency: round for professionals, hexagonal for moderate users, and triangular for novices.
Protection	Protection refers to the strategies and considerations used to ensure user safety, privacy, and security. The curvy razor head made to reduce the risk of cuts is an example of safety in design.
Redundancy	Redundancy provides backup mechanisms to maintain functionality. Bikes equipped with reserve oil storage are a prime example.
Standardisation	Standardisation involves considering design features that have consensus across industries. This includes industry, regional, regulatory, and design conventions. The regulation of providing USB-C ports across various devices is an example of standardisation.
Versatility	A product's ability to adapt to various situations by being multipurpose or multi-contextual is known as versatility. Personal assistants, which are designed to serve multiple functions, are an example of multipurpose design.

## 5.2 Methodology

The goal of this study is to understand the behaviour of design durability factors. It was conducted in two phases. The first phase involved analysing online product content related to these factors in order to identify consumer buying preferences and market projections concerning design durability. This phase was designed to provide insights regarding the factor's contribution to a product's long-term market presence. In Phase 2, a survey was administered to both designers and users to identify the significance of design durability factors across various products. The study needs an understanding of the product's survival in the market, which inherently depends on user buying preferences and market dynamics. Thereby, the product categories (Table 5.2) Convenience (staple, impulse, and emergency), Shopping (homogeneous, heterogeneous), Specialty (luxury, technologically complex and performance risk), and Unsought (new innovations, and regularly unsought) were chosen for the study as

they were defined based on consumer purchasing preferences (Teck Weng & Cyril De Run, 2013). The methodology employed in this study is outlined in Figure 5.1. The study included two representative products from each subcategory: convenience, shopping, specialty, and unsought products. The representative products were selected with the help of two design researchers.

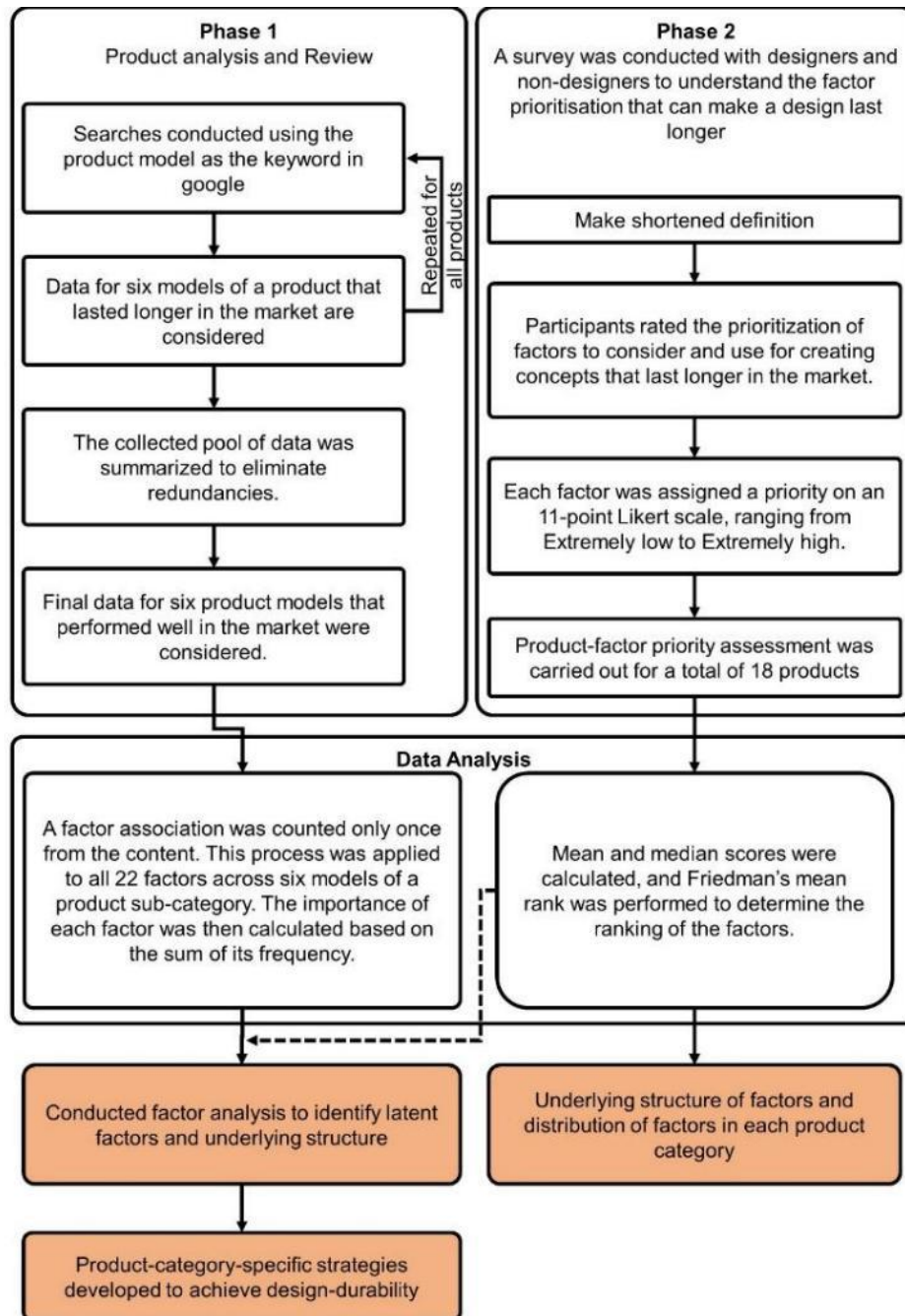


Figure 5.1. Overview of Study Methodology

Both researchers were professional product designers with a minimum of five years' experience in both industry practice and design research. They had worked on commercially launched products, demonstrating their applied knowledge and expertise across design and research domains. Their ongoing involvement in design research further reflects their sustained engagement with the field.

Table 5.2. Product categories and products included for the study

Category	Subcategory	Properties	Products used in the survey
<b>Convenience Products</b> (Products that are purchased frequently using minimal effort) (Allred & Chakraborty, 2004; Bogoro & Usman, 2019; Li & Gery, 2000)	Staple good (Consumers buy these items regularly)	Low cost, High frequency of purchase, essential for daily use, minimal decision-making involved	USB Wire, Earphones
	Impulse good (These are bought on a whim without any prior planning.)	Unplanned purchase, low cost, easily accessible in-store, driven by visual appeal or promotion	Portable phone adapter, Keychain LED flashlights
	Emergency good (These items are needed by consumers immediately in urgent situations)	Purchased due to immediate need, urgency drives the decision, often location-specific	Emergency radio, Portable emergency charger
<b>Shopping Products</b> (Products that are purchased less frequently and with more consideration and planning) (Allred & Chakraborty, 2004; Li & Gery, 2000; Schaninger & Sciglimpaglia, 1981)	Homogeneous (similar in quality but differ in price)	Primarily price-driven, low brand differentiation, simple to compare based on price.	Washing machine, Sound bar
	Heterogeneous (vary in quality and features)	Higher level of involvement in decision-making, comparison based on various attributes	Electric toothbrush, Trimmer
<b>Specialty Product</b> (These products are unique or high-end items that consumers willingly invest significant effort to acquire) (Allred & Chakraborty, 2004; Böß et al.,	Luxury (Expensive products which are usually exclusive and are associated with status, like designer	High price, brand prestige, low purchase frequency, strong emotional connection or status symbol.	Luxury watches, Handcrafted mobile phone

Category	Subcategory	Properties	Products used in the survey
2019; Inman & Blumenfeld, 2014)	fashion or luxury cars.)	Technologically complex products (Products that are complex in nature, involve significant performance risk and require proficiency)	Gaming Keyboard, 3D printer
<b>Unsought Product</b> (Products that the consumers do not actively purchase as they are not yet registered in the consumer's mind or the products that are not actively needed or feel unpleasant at the moment of time) (Allred & Chakraborty, 2004; Garcia & Calantone, 2002; Szymanski et al., 2007)	New Innovation (Products that consumers are unaware of until marketed to them)	Unknown or unrecognised needs often require market education and are driven by early adopters.	Smart home security, Safety alarms
	Regularly unsought (Goods purchased under unforeseen circumstances, like life insurance or funeral services)	Typically, it is not desired or considered until an immediate requirement, low purchase frequency, and often life-event driven.	Emergency survival kit, Portable translator

### 5.3 Phase 1: Online content-based ranking

Selection of products from each sub-category is involved in Phase 1. Following this, six product models for each selected product were identified based on their ability to remain in the market. An online search using the product model's name was used as keyword in the Google search engine. The initial 15 relevant web pages (Appendix C's Table C1) were reviewed to avoid missing any relevant information, as data saturation and repetition had been observed. Similar to Mulet et al. (2022), the product content pool of this study was analysed with the help of researchers to define the association with design durability factors. In this phase, data was

acquired from varied sources, which includes product reviews and details from e-commerce websites.

#### 5.4 Phase 2: Survey-based ranking

Survey with participants was conducted in Phase 2 to map the hierarchy of the factors across products. The products used in this phase are all mentioned in Table 5.2. This process involved with 25 participants, of whom 12 were designers and 13 were non-designers (Table 5.3). Participant types were determined through self-declaration during the recruitment process. Considering both users and designers for the study is essential as it is critical to bridge the gap of professional design intent and consumer expectations and experiences. This dual perspective ensures the design durability strategies are market-relevant, as by only achieving market relevance, endurance can be attained.

Each participant received an individual online survey sheet and was asked to evaluate the significance of each factor in contributing to a product's long-term presence in the market. Participants rated the priority of each factor using an eleven-point Likert scale (11-Extremely high and 1-Extremely Low) (Yang et al., 2019). Appendix C's Figures C1 and C2 shows the survey sheet provided to the participants.

Table 5.3 Profiles of the participants involved in the study

Participant	Participant type	Gender	Age	Experience
Participant 1	Non-designer	Male	26 years	2 years as a researcher at the Department of Design (non-design background)
Participant 2	Designer	Male	25 years	1 year as a product design aspirant
Participant 3	Non-designer	Female	25 years	1 year as a master's student at the Department of Design
Participant 4	Designer	Female	28 years	2 years as a design researcher
Participant 5	Non-designer	Male	26 years	1 year as a master's student at the Department of Design

Participant	Participant type	Gender	Age	Experience
Participant 6	Non-designer	Male	21 years	3 months as a research assistant at the Department of Design
Participant 7	Non-designer	Male	19 years	3 months as a product design intern
Participant 8	Non-designer	Male	22 years	6 months as a research assistant at the department of Design
Participant 9	Designer	Male	30 years	7 years as a user experience designer
Participant 10	Designer	Female	26 years	1.5 years as a user experience designer
Participant 11	Designer	Male	32 years	8 years worked as a product designer
Participant 12	Non-designer	Female	39 years	3 years worked as a researcher at the Department of Design
Participant 13	Non-designer	Female	29 years	3 years as a researcher at the Department of Design
Participant 14	Designer	Male	33 years	7 years as a user experience designer
Participant 15	Non-designer	Male	31 years	6 years worked as a CEO of an incubation centre
Participant 16	Designer	Male	33 years	9 years as a product designer
Participant 17	Non-designer	Female	26 years	1 year as a master's student at the Department of Design
Participant 18	Designer	Female	33 years	5 years as a user experience designer
Participant 19	Non-designer	Female	27 years	1 year as a master's student at the Department of Design
Participant 20	Designer	Male	28 years	5 years as a product designer
Participant 21	Non-designer	Female	29 years	1 year as a master's student at the Department of Design
Participant 22	Designer	Male	34 years	7 years as a product designer
Participant 23	Non-designer	Female	28 years	7 years as Fab lab executive
Participant 24	Designer	Male	27 years	3 years as a product designer
Participant 25	Designer	Male	33 years	5 years as a product designer

A Cronbach's Alpha value exceeding 0.7, as Gottems et al. (2018) suggested, indicates that the scale accurately measures the intended construct. Similarly, the Kaiser-Meyer-Olkin (KMO) value greater than 0.7 indicates that the sample is suitable for factor analysis and that the correlations between variables are appropriate, as stated by Nkanash (2018). No additional samples were included after the Cronbach's alpha and KMO values reached 0.7. This resulted in a sample size of 25 individuals.

## 5.5 Data Analysis:

### 5.5.1 Analysis of Phase 1:

The data gathered during Phase 1 was analysed with the help of two design researchers to verify the content's association with the design durability factors. If a design durability factor is associated with a product model based on the Phase 1 data, it is counted only once for that model, no matter how much other content from the description of a product model can be associated with a specific attribute.

An example of data analysis is presented below:

- 1) **Step 1:** Search the model of the product.

For example, the Kaito KA500 5-way powered emergency radio.

- 2) **Step 2:** Segregating relevant data from each web page:

- a. *Content from website 1:* "The ER310 can be powered by a solar panel, hand crank, or rechargeable lithium-ion battery, ensuring you're always prepared during an emergency."
- b. *Content from website 2:* "5-way powered emergency radio: AC, battery, hand crank, solar, computer"
- c. *Another content from website 2:* "At the heart of the KA500, there is an internal generator that recharges the internal replaceable Ni-MH battery pack and powers the radio, flashlight, and reading lamp."

- 3) **Step3:** Associating content with design durability factors:

Both contents of website 2, fall under "redundancy", then they are not counted as two.

Instead, they are recognized as one to show the attribute's presence.

The total frequency of each factor within a product subcategory across all six models was calculated, and these frequencies were used to determine the hierarchy of factor rankings. This process was consistently applied to all product models.

### **5.5.2 Analysis of Phase 2**

The Likert scores were utilised to rank the factors considered important in designing products with long-term market presence. Survey data was analysed to calculate the mean and median of the Likert scores. While the mean provides a general overview, it is susceptible to outliers, which prompted using the median instead (Leys et al., 2013). However, observing skewness in the data suggested a need for a more comprehensive approach. The Friedman rank test, a non-parametric method (MacFarland & Yates, 2016), was applied to triangulate with the ranks achieved from the mean and median Likert scores. The test delivers a reliable ranking comparison, removing any outlier effects and helps build cross-validating insights from the mean and median to ensure distribution-independent conclusions.

A consensus-based approach was adopted to classify factors into highly- and less- significant factors. This approach involved ranking the factors according to the three statistical measures (mean, median, and Friedman mean rank) individually. For each measure, the factors were divided into 11 equal groups, categorising as follows: *1 - extremely low, 2 - very low, 3 - low, 4 - below moderate, 5 - slightly below moderate, 6 - moderate, 7 - slightly above moderate, 8 - above moderate, 9 - high, 10 - very high, 11- extremely high*. The final classification was determined by observing the consensus across these measures. The factors that consistently ranked higher or lower across all the statistical measures were assigned to define the final significance-defining ranks.

In addition, the same data was subjected to exploratory factor analysis (EFA) as the friedman rank test provides effective influence of each attribute, but it will not provide the underlying

structure that helps us inform which combination of factors work together, to provide insight into how they can be used. Thereby, in this study the exploratory factor analysis (EFA) was conducted to identify latent factors that reveal the underlying structure of the factors contributing to the durability of designs. Promax rotation was employed, as there was a potential for correlations among the 22 design durability attributes. Factor reduction was performed to identify latent factors specific to each product category.

To ensure the data suitability for factor analysis, the KMO measure and *Cronbach's alpha* were applied. Across product categories, the KMO measure values ranged from 0.7-0.8; this indicates sufficient adequacy to perform factor analysis with the sample (Nkansah, 2018). Cronbach's alpha was used to evaluate the internal consistency or reliability of the scale, which also has values greater than 0.7, indicating the acceptability of the scale.

## **5.6 Results and Discussion:**

### **5.6.1 Phase 1 results:**

The results from Phase 1 revealed significant factors of design durability across different product categories (Table 5.4). Data was collected from six product models, each one representing a subcategory. The most relevant attributes were identified based on their frequency of occurrence. Frequencies ranging from 0-2 are considered low, 3-4 as moderate, and 5-6 as high, providing a clear, consistent interpretation of the impact of each factor across product sub-categories.

Table 5.4 Frequency of content attained from online content across product categories

	Convenience goods			Shopping goods		Specialty goods		Unsought goods	
	Staple (Earphone)	Impulse (Keychain LED Flashlight)	Emergency (Emergency Radio)	Homogeneous (Soundbar)	Heterogeneous (Electric Toothbrush)	Luxury (Luxury Watch)	Technically complex (Gaming Keyboard)	New innovations (Safety Alarm)	Regularly unsought (Translator)
Accessibility	6	6	1	1	5	0	2	6	5
Aesthetic continuity	3	3	0	6	3	6	5	0	0
Affordance	6	6	4	6	4	5	6	6	3
Engaging conversations	3	2	5	6	5	0	5	6	5
Evolvability	3	0	0	2	6	4	6	4	4
Exclusivity	4	4	0	3	2	6	5	2	3
Harmony	6	4	2	6	5	6	6	6	0
Identity	3	5	3	6	6	6	6	6	0
Integrity	4	4	6	6	6	6	6	6	5
Learnability	3	5	4	6	4	3	1	1	5
Maintainability	3	3	4	3	6	4	5	0	3
Maturity	5	3	4	6	6	6	6	6	6
Memorability	4	1	1	2	2	6	4	0	1
Narrative	1	1	4	6	4	6	3	0	1
Noticeability	5	2	2	5	5	6	5	6	2
Portability	6	6	6	3	5	4	6	0	6
Production quality	6	6	5	6	4	6	6	6	5
Proficiency	3	2	3	6	5	0	5	6	1
Protection	5	6	5	0	6	4	1	6	0
Redundancy	3	2	5	6	5	0	1	6	0
Standardisation	5	4	6	6	6	6	6	6	1
Versatility	6	5	6	6	6	6	6	3	6

The analysis demonstrates how design durability factors work for different categories such as convenience, shopping, specialty, and unsought products. Each category was evaluated based on essential factors such as accessibility, affordance, and aesthetic continuity. The insights attained are as follows:

- a. Portability, production quality, and versatility received high scores across all subcategories of convenience products. This indicates that convenience goods should be of excellent quality, easily transportable, and flexible to accommodate varied contexts. Both staple and impulse goods scored high for affordance, emphasising intuitive usage. Further, all subcategories of convenience products acquired a high score on protection, highlighting the importance of incorporating basic safety protocols. Emergency goods highly value standardisation and integrity, which aligns with the need for product reliability in emergency or unexpected situations. Staple and impulse goods have high accessibility scores but low scores for emergency goods. This suggests that people only use emergency goods when necessary. Standardisation is a key factor in emergency goods, which indicates that all products must meet established quality standards. Emergency products received a low memorability score, suggesting their occasional use. Aesthetic continuity and exclusivity scored poorly across subcategories of convenience goods. This score suggests that product variations are largely consistent. This also suggests a minimal focus on aesthetics. The evolvability score for impulse and emergency items is low, indicating a product's limited ability to adapt to the user's needs.
- b. Homogeneous and heterogeneous goods scored high for versatility, standardisation, integrity, maturity, and identity. This suggests that both subcategories should make products with assured and consistent quality. Additionally, both subcategories make adaptable products with a strong brand presence. Homogeneous goods scored slightly higher than heterogeneous in terms of harmony, engaging conversations, redundancy, and proficiency. However, both these subcategories are believed to have consistent performance for prolonged periods, and proficiency suggests products are designed and varied based on the user's skill to use the product. Higher production quality, affordance, and learnability scores in homogeneous goods indicate that the manufacturing process is a

critical entity that defines the quality of a product, and they are made to be user-friendly. However, homogeneous goods offered score lower in maintainability and portability than heterogeneous goods. This indicates that heterogeneous products offer better ease of maintenance and transportation, making them user-friendly and adaptable. Heterogeneous goods also excel in evolvability, protection, and accessibility. This makes them especially better homogeneous in terms of protection and accessibility. Further, both product types have similar scores for noticeability, so defining the consideration of noticeability is equally important. Finally, low memorability in both of these defines how users easily remember them after regular usage.

- c. Both luxury and technically complex goods scored high in versatility, standardisation, maturity, identity, harmony, and production quality. This makes them adaptable to varied contexts, high-quality craftsmanship, and cohesive design. Further, both of the products are more optimised for contexts. Luxury goods are made to be more noticeable, memorable, and exclusive, which makes them more emotionally connected with the user. Technically complex products score higher in affordance, portability, evolvability, and maintainability, which makes them more adaptable and easier to transport and maintain. Lower scores for learnability and accessibility in technically complex products are due to them being complex and needing greater effort to use.
- d. Maturity, integrity, engaging conversations, production quality, and accessibility scored high in both subcategories of unsought products, indicating the requirement to make durable, reliable, high-quality designs that help build trust with consumers in the long run. Noticeability, affordance, identity, and proficiency scored higher in the new innovation subcategory, highlighting their ease of use and requirement for strong branding. Regularly unsought goods excel in versatility and portability, supporting them to continue to exist with users for prolonged periods with ease. New innovations score lower in portability and

maintainability, which makes them harder to transport and maintain. Both categories have low scores in memorability, narrative, and aesthetic continuity, which suggests limited emotional or aesthetic appeal.

- e. Across all product categories, production quality, versatility, and affordance are observed to be highly significant, indicating that products are usually designed to be durable, adaptable, and user-friendly. Integrity is also observed to be consistently valued, which is essential to ensure product usage reliability and consistency. Portability scores high for staple and emergency goods, suggesting their nature of ease of transport as a key aspect for greater success. Standardisation and harmony are observed to be essential across all product categories, which ensures consistency of designs. Exclusivity and memorability are more prominent in luxury goods but are least emphasised for convenience and unsought goods.

### 5.7 Phase 2 results:

Data from Phase 2, which included participant-provided scores, was analysed to understand the participant's prioritisation of factors for achieving design durability. The initial analysis was done using the mean, median, and friedman mean rank score for each factor's usage across product categories. The results of the survey are presented in Table 5.5.

Table 5.5 Mean-Median and Friedman mean rank Likert scores of all product categories

Convenience Goods									
Factor	Staple			Impulse			Emergency		
	Mean	Median	Friedman Mean Rank	Mean	Median	Friedman Mean Rank	Mean	Median	Friedman Mean Rank
Accessibility	9.24	9.00	15.32	9.04	9.00	15.24	8.74	9.00	13.80
Aesthetic continuity	7.12	7.50	10.64	6.24	6.00	9.73	6.04	6.00	7.41
Affordance	9.34	9.00	16.58	9.14	9.00	16.25	8.70	9.00	14.08

Engaging conversations	5.88	6.00	8.18	4.66	3.00	6.50	6.32	6.00	8.97
Evolvability	6.88	7.00	10.57	6.24	6.00	9.56	6.94	7.00	10.53
Exclusivity	5.66	5.00	8.33	5.30	5.00	8.17	5.40	5.00	6.96
Harmony	8.12	9.00	13.02	7.78	9.00	12.65	7.82	8.00	11.81
Identity	6.98	8.00	10.75	6.04	6.00	9.76	6.42	6.00	8.05
Integrity	8.54	9.00	14.06	8.56	9.00	14.67	9.14	9.00	14.75
Learnability	7.36	9.00	11.78	7.66	9.00	12.79	7.50	7.50	11.60
Maintainability	6.10	6.00	8.53	6.24	6.00	9.85	7.00	7.00	9.97
Maturity	8.60	9.00	13.67	8.24	9.00	13.53	8.22	9.00	12.80
Memorability	7.22	8.00	11.35	6.84	7.00	10.83	6.96	7.00	10.35
Narrative	4.84	3.50	5.95	4.02	3.00	4.80	5.08	4.00	6.29
Noticeability	6.54	6.00	9.31	6.82	7.00	11.11	7.68	8.00	11.78
Portability	9.86	10.00	17.59	10.12	11.00	18.96	9.82	10.50	17.35
Production quality	8.04	9.00	12.67	8.02	9.00	13.06	9.06	9.00	14.99
Proficiency	7.26	9.00	11.30	6.80	7.00	10.90	6.72	7.00	10.27
Protection	7.68	9.00	12.10	8.10	9.00	13.35	8.58	9.00	13.45
Redundancy	4.24	3.50	5.18	4.52	4.00	5.88	6.56	7.00	10.04
Standardisation	9.38	10.00	16.27	8.60	9.00	15.22	9.02	9.00	14.98
Versatility	6.66	7.00	9.85	6.38	6.50	10.19	8.02	9.00	12.77

**Shopping Products**

Factor	Homogeneous			Heterogeneous		
	Mean	Median	Friedman Mean Rank	Mean	Median	Friedman Mean Rank
Accessibility	8.46	9	12.67	8.62	9.00	13.38
Aesthetic continuity	8.2	9	12.94	7.86	8.00	11.29
Affordance	8.5	9	13.03	8.88	9.00	14.97
Engaging conversations	6.94	7	10.14	6.40	7.00	8.43
Evolvability	7.46	8	10.67	8.16	9.00	11.74
Exclusivity	7.18	8	11.30	6.74	6.00	8.97
Harmony	9.66	10	16.75	8.78	9.00	13.59
Identity	7.84	8	11.99	7.88	8.00	11.48
Integrity	9.22	9	14.88	8.82	9.00	14.18
Learnability	7.38	9	10.85	7.32	8.00	10.83
Maintainability	7.98	9	12.13	7.46	8.00	9.77

Maturity	8.72	9	13.94	8.86	9.00	13.71
Memorability	7.06	7	9.51	7.56	7.00	10.45
Narrative	5.56	5	6.98	5.12	4.50	5.04
Noticeability	7.28	7	10.26	7.52	8.00	10.12
Portability	5.36	5	6.73	9.38	9.00	16.49
Production quality	9.52	9	15.61	9.02	9.00	13.84
Proficiency	7.02	7	9.21	7.36	8.50	10.41
Protection	8.34	9	12.99	8.42	9.00	13.37
Redundancy	5.22	5	5.84	5.98	6.00	7.02
Standardisation	8.72	9	14.09	9.02	9.00	14.92
Versatility	7.46	8	10.49	6.92	7.00	9.00

**Specialty Good**

Factor	Homogeneous			Heterogeneous		
	Mean	Median	Friedman Mean Rank	Mean	Median	Friedman Mean Rank
Accessibility	7.10	7.00	7.99	7.60	9.00	10.60
Aesthetic continuity	8.74	9.00	12.79	7.68	8.00	10.45
Affordance	7.84	9.00	10.70	8.58	9.00	13.40
Engaging conversations	7.46	9.00	9.43	7.92	9.00	10.70
Evolvability	7.68	8.00	9.65	9.00	9.00	14.08
Exclusivity	9.82	10.00	16.44	7.68	8.00	10.79
Harmony	9.04	9.00	13.49	9.28	10.00	15.50
Identity	9.68	10.00	15.62	8.54	9.00	13.09
Integrity	9.42	10.00	14.67	8.88	9.00	13.65
Learnability	7.30	7.50	9.19	7.64	8.50	10.27
Maintainability	8.54	9.00	11.40	8.50	9.00	12.49
Maturity	8.66	9.00	12.36	8.50	9.00	13.09
Memorability	9.02	9.00	12.26	8.10	9.00	11.23
Narrative	8.68	9.00	12.63	6.72	6.50	8.03
Noticeability	9.08	10.00	13.95	7.62	8.00	10.77
Portability	9.24	9.50	14.27	5.98	6.00	6.87
Production quality	9.54	10.00	14.98	9.10	9.00	14.13
Proficiency	7.40	7.00	9.26	7.92	9.00	10.78
Protection	8.44	9.00	11.15	8.12	8.00	11.55

Redundancy	5.64	5.00	5.88	6.44	6.50	7.00
Standardisation	6.54	6.50	8.13	8.44	9.00	13.05
Versatility	6.24	6.00	6.76	7.90	9.00	11.48

**Unsought Goods**

Factor	New Innovations			Regularly Unsought		
	Mean	Median	Friedman Mean Rank	Mean	Median	Friedman Mean Rank
Accessibility	8.30	9.00	13.13	9.28	9	14.73
Aesthetic continuity	6.16	7.00	8.40	6.50	7	7.86
Affordance	8.38	9.00	13.64	9.00	9	13.95
Engaging conversations	7.26	7.50	10.55	7.54	8.5	10.95
Evolvability	7.44	8.50	11.74	7.70	9	11.09
Exclusivity	6.40	6.50	8.95	6.10	6	7.34
Harmony	8.30	9.00	13.36	8.70	9	12.86
Identity	7.42	7.00	11.46	7.00	7	8.24
Integrity	9.06	9.00	15.21	9.20	9	13.93
Learnability	7.20	8.00	10.37	8.10	9	11.5
Maintainability	6.72	7.00	9.51	7.62	8	10.24
Maturity	8.28	9.00	13.08	8.10	9	11.73
Memorability	7.06	7.00	9.48	7.74	8	10.17
Narrative	5.00	5.00	5.31	5.96	6	6.44
Noticeability	7.34	7.00	10.89	7.86	8	10.41
Portability	6.70	6.00	9.91	10.08	11	17.48
Production quality	9.00	9.00	15.08	9.42	9	15.28
Proficiency	6.60	6.00	9.27	7.14	7.5	8.78
Protection	10.04	11.00	18.02	9.22	10	15.02
Redundancy	7.20	9.00	11.49	7.42	8	9.48
Standardisation	8.54	9.00	14.34	8.32	9	12.43
Versatility	6.90	8.00	9.81	8.42	9	13.09

The factor ranking across product categories is as follows:

## 1) Convenience Goods

### a. Staple Goods

- *Highly significant factors:* Portability, Standardisation, Affordance, Accessibility.
- *Less significant factors:* Engaging conversations, Exclusivity, Narrative, Redundancy.

### b. Impulse Goods

- *Highly significant factors:* Portability, Standardisation, Affordance, Accessibility.
- *Less significant factors:* Engaging conversations, Exclusivity, Narrative, Redundancy.

### c. Emergency Goods

- *Highly significant factors:* Portability, Production quality, Standardisation, Integrity.
- *Less significant factors:* Exclusivity, Narrative, Aesthetic continuity.

Portability emerges as a highly ranked attribute across staple, impulse, and emergency goods; this highlights the need for easy transport and on-the-go usage. Standardisation is highly scored across staple and impulse goods, which informs the consumer's expectations for consistent quality and the products adhering to the standards for common usage without restrictions. Affordance is similarly highly prioritised across staple and impulse goods, informing the need for intuitiveness of the usage. Accessibility is also valued across staple and impulse, suggesting the requirement of non-user ability-dependent products. Narrative, exclusivity, and redundancy have lower ranks across all product categories, suggesting that

convenience goods prioritise practicality and utility over emotional appeal, uniqueness, or repairability.

Staple goods place a strong emphasis on accessibility and standardisation, which suggests the commonly usable nature and consistency for ease of usage. Affordance and accessibility are highly prioritised across impulse goods, making these products commonly usable and intuitively useful. Emergency goods emphasise production quality and integrity compared to other sub-categories of convenience goods, suggesting non-failure and reliable products for urgent situations.

## 2) Shopping Goods

### a. Homogeneous Goods

- *Highly significant factors: Harmony, Production quality, Integrity.*
- *Less significant factors: Narrative, Portability, Redundancy..*

### b. Heterogeneous Goods

- *Highly significant factors: Portability, Affordance, Standardisation.*
- *Less significant factors: Exclusivity, Engaging conversations, Redundancy, Narrative.*

Homogeneous goods prioritise harmony and production quality along with integrity, highlighting the importance of seamless designs and superior craftsmanship and reliability of the product. In contrast, heterogeneous goods prioritise portability, affordance, and standardisation, portraying the need for ease of transport, intuitive usability, and commonly accepted quality and features.

Redundancy and narrative are ranked less significant in both categories, indicating that consumers prioritise functionality and utility over emotional storytelling or the availability of spare parts for long periods.

### 3) Specialty Goods

#### a. Luxury Goods

- a. *Highly significant factors: Exclusivity, Identity, Production quality, Integrity.*
- b. *Less significant factors: Standardisation, Accessibility, Versatility, Redundancy.*

#### b. Technically complex Goods

- *Highly significant factors: Harmony, Production quality, Evolvability, Integrity.*
- *Less significant factors: Narrative, Redundancy, Portability.*

Luxury goods prioritise exclusivity and identity, which informs consumers to look for uniqueness, brand prestige, and personal connection. However, technically complex goods prioritise harmony and evolvability; this reflects the need for seamless integration with the environment they are placed in and having the ability to evolve and adapt to technology to be future-proof. Standardisation, accessibility, versatility, and redundancy scored low across luxury goods, this informs that consumers value niche products and limited availability. Meanwhile, technically complex goods place less significance on narrative, redundancy, and portability, informing that these products focus on evolution and coherence rather than associated history or transportability.

On both luxury and technically complex goods, production quality and integrity are highly prioritised. This indicates that consumers prioritise superior craftsmanship and reliability.

### 4) Unsought Goods

#### a. New Innovations

- *Highly significant factors: Protection, Integrity, Production quality, Standardisation.*

- *Less significant factors: Proficiency, Exclusivity, Narrative.*

b. Regularly Unsought Goods

- *Highly significant factors: Portability, Production quality, Protection, Accessibility.*

- *Less significant factors: Identity, Aesthetic continuity, Exclusivity, Narrative.*

Both new innovations and regularly unsought goods prioritise production quality and protection. This indicates that both categories prioritise durability and safety across products. Exclusivity and narrative are commonly least prioritised across both goods, indicating the products are purely utilitarian and not at all inclined to emotional attributes.

New innovations prioritise integrity and standardisation, which reflects the consumer need for familiar and acceptable features and reliability. In contrast, regularly unsought goods prioritise portability and accessibility, emphasising ease of transport and the capability to be used by most possible users irrespective of their ability. Exclusively in new innovations, proficiency is less significant, defining that skill requirement is least considered. Identity and aesthetic continuity are least scored in regularly unsought goods, this informs personal connection and aesthetic familiarity is least prioritised.

**5) Commonalities across product categories:**

i. Across all product categories, production quality and integrity are consistently prioritised. This highlights that universally, consumers prefer well-crafted,

durable, and reliable products, as they expect the products to function as intended and stand the test of time.

- ii. Portability is highly significant in most product categories, especially in convenience, heterogeneous shopping, emergency, and regularly unsought goods. This suggests the importance of the goods to be easily transported or carried.
- iii. Standardisation is another factor that ranks highly across staple, impulse, heterogeneous shopping, and new innovation goods. Consumers value uniformity and consistency in products, and it helps provide the most accepted and industry-adhered features and functions.
- iv. Protection emerges as a priority across all unsought and emergency goods within the convenience category. This highlights the safeguard against potential harm, accidents, or risks, especially for products linked to safety or emergency use.
- v. Across all product categories, narrative is consistently ranked as a less significant factor. This suggests that consumers prioritise functionality, utility, and practical use over emotional appeal achieved through storytelling or historical context.
- vi. Exclusivity is ranked less significant across convenience, heterogeneous shopping, and unsought goods, indicating that consumers look for ease of use. Only in the case of luxury goods, the exclusivity is scored higher, this indicates the distinct consumer mindset.
- vii. Across all product categories, redundancy is consistently ranked lower indicating the least concern for spares or replacements, indicating the modern era trend towards products.

viii. Accessibility is a key entity across all convenience and regularly unsought goods, indicating that they are easy to use and include various users, indicating their commonly accessible nature.

ix. Aesthetic continuity and identity are less prioritised in convenience and regularly unsought goods. Consumers are more concerned with practical usability and function, especially in emergencies.

### **5.7.1 Insights from Phase 1 and Phase 2 Results**

Combining Phase 1 (market-driven) and Phase 2 (participant-driven), the data reveals key design durability for product development that helps ensure a design to achieve customer satisfaction and market presence. Despite the differences in data collection methods, certain core factors are significant across both phases. They are:

1. Production quality is universally recognised as a critical factor across all product categories in both phases. This confirms that creators and consumers value production quality as a core component of product design.
2. Integrity is an essential aspect across all product categories in Phase 1 and Phase 2, particularly being valued in emergency and shopping products. This reveals that product trust and reliability achieved through integrity are especially important for emergency or highly valued goods (shopping goods). The insight informs the cross-stakeholder consensus on the key role of integrity in product design and marketing.
3. Affordance is prominent in all convenience goods in Phase 1 and 2. This informs the importance of emphasising intuitive product usage. This has been prioritised by marketed information and participant responses informing the importance of highlighting the clues regarding the functional importance of the product.

4. Portability is consistently highlighted in all convenience goods and regularly unsought items in Phase 1, earning top rankings in emergency, heterogeneous, and unsought goods. Consumers and designers prioritise this to highlight the importance of portability as a key design consideration for making products usable in various contexts.
5. Standardization is notably prevalent across various categories, including emergency, shopping, and unsought goods in Phase 1, and it is highly esteemed in emergency, heterogeneous, and innovative products. Consumers expect predictable quality, while designers look to design standardised production. Emergency goods require standardisation to ensure compatibility and new innovations require it for helping users achieve familiarity.
6. Versatility has high priority in convenience, shopping, and unsought goods during Phase 1, and it is greatly esteemed in emergency, homogeneous, and unsought goods in Phase 2. The combined result regarding versatility highlights that designs need to be adaptable and can have relevance for dynamic consumer needs.
7. Protection is prominently addressed and rated in emergency and unsought product categories throughout both phases. This reflects that marketing and participant feedback focuses on product safety, security and damage resistance. The need for protection is evident in products like emergency kits.
8. Harmony is highly esteemed across homogeneous shopping and luxury goods in both phases. This is prioritised as this informs not just the feature and form of seamless integration but also it informs regarding the seamless alignment a product can achieve with its surroundings and the users.
9. In both phases, identity is highly valued in luxury specialty products. In Phase 1, identity is frequently emphasized in technically complex items alongside luxury products, whereas in Phase 2, it is particularly appreciated in homogeneous products.

All stakeholders appreciate this as this informs regarding the brand identity, and design philosophy.

### 5.7.2 Latent factors through Exploratory factor analysis:

The data from the designer-based survey is further considered and treated using exploratory factor analysis (Table 5.6). By applying Promax rotation, the following components have been defined, which can act as strategies when designing a product. This approach of making strategies using factor analysis aligns with how it was presented in a few previous studies (Nickerson & Sloan, 1999; Rahul & Dhar, 2021).

Table 5.6 Extracted components and pattern matrix for all product categories

Convenience goods									
		Components							
	Mean	Standard deviation	1	2	3	4	5	6	7
<i>Accessibility</i>	9.01	1.913	-.141	.103	.809	.032	-.186	-.010	.010
<i>Aesthetic continuity</i>	6.47	2.385	.555	-.138	.291	.128	.393	-.211	.075
<i>Affordance</i>	9.06	1.847	-.194	-.035	.754	.136	-.137	.428	.073
<i>Engaging conversations</i>	5.62	3.097	.789	-.129	-.101	.055	-.190	.211	-.003
<i>Evolvability</i>	6.69	2.826	.124	-.065	.128	.973	-.256	-.113	-.176
<i>Exclusivity</i>	5.45	3.195	.960	-.228	-.302	.031	-.099	.043	.100
<i>Harmony</i>	7.91	1.988	.480	.061	.476	.050	-.079	-.182	-.302
<i>Identity</i>	6.48	2.823	.862	.065	.085	-.044	.069	-.162	.147
<i>Integrity</i>	8.75	2.153	.156	.624	.320	-.205	-.461	-.126	.078
<i>Learnability</i>	7.51	3.155	.020	-.097	.155	-.123	-.063	.948	.070
<i>Maintainability</i>	6.45	2.874	.284	.631	-.149	-.144	.227	.105	-.022
<i>Maturity</i>	8.35	1.861	.144	-.089	.408	.350	-.825	.132	.127
<i>Memorability</i>	7.01	2.930	.397	.015	.203	-.040	.424	.237	-.036
<i>Narrative</i>	4.65	3.211	.883	-.001	-.156	.079	.035	-.101	.083
<i>Noticeability</i>	7.01	2.910	.530	.305	.154	-.198	.058	.255	-.120
<i>Portability</i>	9.93	1.587	.044	-.079	.528	-.185	.077	.051	.562
<i>Production quality</i>	8.37	2.212	-.046	.798	-.099	.073	-.134	-.156	.242
<i>Proficiency</i>	6.93	3.083	.272	-.022	.065	.175	.540	.053	-.021
<i>Protection</i>	8.12	2.354	-.373	.767	.280	.165	.139	-.016	-.114

<i>Redundancy</i>	5.11	3.163	.288	.441	-.315	.368	.027	.207	-.071
<i>Standardisation</i>	9.00	2.027	.172	.130	-.001	-.014	-.179	.066	.811
<i>Versatility</i>	7.02	2.946	-.116	.304	-.028	.666	.136	-.055	.305

### Shopping goods

	Components								
	Mean	Standard deviation	1	2	3	4	5	6	7
<i>Accessibility</i>	8.54	1.877	-.130	.017	.859	-.109	.012	.038	.169
<i>Aesthetic continuity</i>	8.03	2.222	-.119	.753	.252	-.269	.125	.148	.311
<i>Affordance</i>	8.69	1.680	-.086	-.100	.782	-.045	.002	.167	-.027
<i>Engaging conversations</i>	6.67	2.885	.919	-.159	-.094	-.057	.154	.043	.209
<i>Evolvability</i>	7.81	2.268	.102	.081	.071	.002	-.244	.817	.183
<i>Exclusivity</i>	6.96	2.821	.511	.510	-.151	-.207	.104	-.122	.061
<i>Harmony</i>	9.22	1.548	.330	-.004	.086	.216	-.103	.119	.933
<i>Identity</i>	7.86	2.292	.868	-.059	-.048	.048	-.054	.035	.119
<i>Integrity</i>	9.02	1.837	-.092	.114	.163	.692	-.092	.001	.426
<i>Learnability</i>	7.35	2.728	.396	-.125	.283	-.070	.712	-.176	-.176
<i>Maintainability</i>	7.72	2.142	-.052	.184	-.161	.168	.777	-.029	-.026
<i>Maturity</i>	8.79	1.513	.146	-.228	.268	.327	.217	.339	.209
<i>Memorability</i>	7.31	2.521	.611	.222	.239	.053	.098	-.334	.038
<i>Narrative</i>	5.34	3.023	.727	.187	-.225	-.056	-.117	.260	.133
<i>Noticeability</i>	7.40	2.314	.009	.831	-.053	.100	-.166	-.026	-.183
<i>Portability</i>	7.37	3.142	.229	-.039	.552	-.087	-.466	.148	.562
<i>Production quality</i>	9.27	1.582	-.037	-.134	-.236	.876	.133	-.023	.242
<i>Proficiency</i>	7.19	2.759	-.021	.758	-.124	.043	.239	.129	-.021
<i>Protection</i>	8.38	2.039	-.208	.317	.407	.360	.008	-.267	-.114
<i>Redundancy</i>	5.60	2.803	.135	.396	-.067	.108	.097	.461	-.071
<i>Standardisation</i>	8.87	1.835	.166	.100	.008	.500	.124	.119	.811
<i>Versatility</i>	7.19	2.419	-.188	.029	.247	-.094	.446	.573	.305

### Specialty goods

	Components								
	Mean	Standard deviation	1	2	3	4	5	6	7
<i>Accessibility</i>	7.35	2.819	.057	.849	.098	.094	-.030	-.198	.083
<i>Aesthetic continuity</i>	8.21	2.337	.138	.081	.792	.043	.000	-.058	-.169

<i>Affordance</i>	8.21	2.459	-.098	.790	.392	.048	-.100	.078	-.200
<i>Engaging conversations</i>	7.69	2.616	.374	.460	-.199	-.233	-.064	.406	.064
<i>Evolvability</i>	8.34	2.271	-.137	.036	-.035	-.012	.140	.857	.086
<i>Exclusivity</i>	8.75	2.307	.870	-.227	.051	.024	.007	-.005	-.180
<i>Harmony</i>	9.16	1.900	.012	.027	.178	-.202	.627	.569	-.041
<i>Identity</i>	9.11	1.994	.667	-.040	.350	-.113	.181	.037	-.037
<i>Integrity</i>	9.15	1.800	.160	-.014	-.032	.074	.847	.097	.060
<i>Learnability</i>	7.47	2.540	.157	.391	.068	.237	-.321	.214	.055
<i>Maintainability</i>	8.52	2.037	.215	-.350	.109	.493	-.125	.506	.176
<i>Maturity</i>	8.58	2.138	-.179	.095	.801	.099	.096	.074	.207
<i>Memorability</i>	8.56	2.115	.774	.091	-.077	.284	.038	.079	-.198
<i>Narrative</i>	7.70	2.901	.775	.229	-.134	-.049	-.111	-.066	.060
<i>Noticeability</i>	8.35	2.447	.793	-.001	-.071	-.036	.341	-.131	.144
<i>Portability</i>	7.61	2.991	.419	.001	.352	-.100	-.082	-.338	.406
<i>Production quality</i>	9.32	1.933	.025	.023	.198	.455	.542	-.138	-.061
<i>Proficiency</i>	7.66	2.371	-.094	.190	.165	.655	-.029	.042	.093
<i>Protection</i>	8.28	2.010	.074	.130	-.044	.808	.150	-.122	-.056
<i>Redundancy</i>	6.04	2.814	-.055	-.010	-.268	.242	.053	.056	.784
<i>Standardisation</i>	7.49	3.020	-.127	.024	.264	-.158	.002	.155	.757
<i>Versatility</i>	7.07	2.868	-.157	.665	-.221	.150	.312	.109	.083

#### Unsought goods

	Mean	Standard deviation	Components					
			1	2	3	4	5	6
<i>Accessibility</i>	8.79	2.171	.750	-.025	-.176	.151	.167	.034
<i>Aesthetic continuity</i>	6.33	2.701	-.005	.079	.108	.005	.313	.702
<i>Affordance</i>	8.69	1.873	.463	-.321	.259	.242	.278	.000
<i>Engaging conversations</i>	7.40	3.072	-.113	.745	-.036	.085	.202	.059
<i>Evolvability</i>	7.57	2.622	-.217	.062	.645	-.161	.418	.147
<i>Exclusivity</i>	6.25	2.893	.012	.604	.262	-.003	-.086	.311
<i>Harmony</i>	8.50	2.101	.174	.377	-.058	.020	.565	-.143
<i>Identity</i>	7.21	2.447	.051	.888	-.054	.052	.022	.032
<i>Integrity</i>	9.13	1.807	.167	.038	-.052	.503	.392	-.226
<i>Learnability</i>	7.65	2.702	.809	.107	.254	-.197	-.112	.016
<i>Maintainability</i>	7.17	2.437	.308	-.144	.722	-.153	-.060	.021
<i>Maturity</i>	8.19	1.993	-.024	-.288	.080	.309	.660	.165
<i>Memorability</i>	7.40	2.361	.764	.113	-.238	-.050	.084	.410

<i>Narrative</i>	5.48	3.070	-.002	.522	-.054	-.171	.664	.024
<i>Noticeability</i>	7.60	2.474	.764	.057	.084	.034	-.251	-.047
<i>Portability</i>	8.39	3.197	.817	-.171	-.054	-.226	.199	.010
<i>Production quality</i>	9.21	1.838	.150	.344	.183	.428	.058	-.421
<i>Proficiency</i>	6.87	2.565	.223	.155	-.006	.254	-.176	.794
<i>Protection</i>	9.63	2.028	-.161	-.077	-.083	.959	-.053	.133
<i>Redundancy</i>	7.31	2.891	.015	-.004	.766	.256	-.173	.025
<i>Standardisation</i>	8.43	2.180	-.145	.156	.015	.811	.102	.216
<i>Versatility</i>	7.66	2.829	-.179	.071	.769	-.035	.118	-.046

*N= 25 participants*

The strategies identified across categories are as follows:

### 1) Convenience Products:

#### a. Usability and Functionality:

- Key attributes: Accessibility (0.809), Affordance (0.754), Harmony (0.476), Portability (0.528)
- Explanation: This factor indicates the significance of intuitive product design, focusing on ease of use, accessibility, and consistency in interaction. The loadings indicate that these attributes are crucial for a seamless user experience. Implementing this component becomes an important strategic guide, especially when developing products meant for frequent use.

#### b. Standardisation:

- Key attributes: Standardisation (0.811)
- Explanation: This component emphasises strictly following industry standards, which ensures uniformity and reliability across different

environments. This component enforces affordance and memorability by providing easy product use through familiar norms.

c. Operational Integrity:

- Key attributes: Integrity (0.624), Maintainability (0.631), Production Quality (0.798), Protection (0.767), Redundancy (0.441)
- Explanation: This factor highlights the importance of the manufacturing process and craftsmanship, as they are critical aspects that consumers assess in a product to judge its value. This also emphasises reliability, long-term maintenance, and product protection. Providing this aspect safeguards the product's integrity over time.

d. Skill-based optimisation:

- Key Attributes: Maturity (-0.825), Proficiency (0.540), Memorability (0.424)
- Explanation: This component focuses on improving the systems or product processes for ease of use. Negative loading for maturity suggests a need for flexibility.

e. Learnability:

- Key Attribute: Learnability (0.948)
- Explanation: This factor stresses the importance of making a product which makes users quickly and efficiently learn to use the product, especially in markets that demand convenience and rapid adoption.

f. Adaptive innovation:

- Key Attributes: Evolvability (0.973), Versatility (0.666)

- Explanation: This factor emphasises making the products evolve and adapt over time. This ensures relevance and flexibility in dynamic environments. High loadings suggest that product adaptability is critical for long-term success.

g. Brand Story and Uniqueness:

- Key Attributes: Engaging Conversations (0.789), Exclusivity (0.960), Identity (0.862), Narrative (0.883), Noticeability (0.530)
- Explanation: This factor emphasises the product's ability to engage users by providing a distinct narrative and building a unique identity to help the product stand out in the market. High loadings for engaging conversations and exclusivity reflect the importance of meaningful interactions and exclusivity in establishing brand value.

## 2) Shopping Product:

a. Operational Integrity:

- Key Attributes: Integrity (0.692), Production Quality (0.876), Standardisation (0.500)
- Explanation: Implementing this factor ensures ethical production, consistent quality, and adherence to standards. This helps improve product reliability and consumer trust.

b. Harmonic Design:

- Key Attribute: Harmony (0.933)
- Explanation: This factor helps make well-integrated and aesthetically coherent products. This ensures that the product's design elements work together seamlessly.

c. User Experience:

- Key Attributes: Accessibility (0.859), Affordance (0.782), Protection (0.407)
- Explanation: This factor emphasises intuitive product design and safety. Accessibility and affordance play vital roles in helping achieve ease of use in products, while protection ensures product and user safety.

d. Aesthetics-driven proficiency:

- Key Attributes: Aesthetic Continuity (0.753), Noticeability (0.831), Proficiency (0.758)
- Explanation: This component highlights the importance of visual appeal and contributes to the visceral nature of a product. Further proficiency considers making the product features based on user skills.

e. Brand Story:

- Key Attributes: Exclusivity (0.511), Identity (0.868), Memorability (0.611), Narrative (0.727)
- Explanation: This factor focuses emphasises creating a unique identity, engaging storytelling, and memorable experiences to foster strong emotional connections with consumers.

f. Long-term usability:

- Key Attributes: Learnability (0.712), Maintainability (0.777), Portability (-0.466)
- Explanation: This factor stresses the ease of maintenance and learning. Also, the negative loading of portability indicates potential difficulties in universal application.

g. Adaptive innovation:

- Key Attributes: Evolvability (0.817), Redundancy (0.461), Versatility (0.573)
- Explanation: This factor emphasises making a product future-proof by providing adaptability, redundancy, and versatility. This ensures that products can evolve with market and user needs.

### 3) Specialty Product:

a. Operational excellence:

- Key Attributes: Harmony (0.627), Integrity (0.847), Production Quality (0.542)
- Explanation: This factor highlights seamlessly operating products. It also emphasises providing high ethical standards & superior production quality, and reliable product features. This enhances product reliability and consumer trust.

b. Brand Engagement:

- Key Attributes: Exclusivity (0.870), Identity (0.667), Memorability (0.774), Narrative (0.775), Noticeability (0.793)
- Explanation: This factor emphasises exclusivity, identity, and a compelling narrative to create a brand story and engagement for consumer loyalty and brand differentiation.

c. Optimised aesthetics:

- Key Attributes: Aesthetic Continuity (0.792), Maturity (0.801)
- Explanation: This factor merges aesthetic appeal with product maturity and helps make well-developed and visually consistent designs, contributing to product refinement and consumer attraction.

d. Maintenance:

- Key Attribute: Maintainability (0.506)
- Explanation: This factor emphasises ease of product maintenance to ensure continued functionality.

e. Secure operational proficiency:

- Key Attributes: Proficiency (0.655), Protection (0.808)
- Explanation: This factor highlights the importance of operational competence and safety features. Implementing this factor ensures that the product performs its intended functions effectively while safeguarding itself and the users.

f. User Interaction:

- Key Attributes: Accessibility (0.849), Affordance (0.790), Engaging Conversations (0.460)
- Explanation: This component deals with making the users interact with the product by providing dynamic interactions and creating intuitive designs that are user-friendly.

g. System resilience:

- Key Attributes: Redundancy (0.784), Standardisation (0.757)
- Explanation: This factor achieves the product's resilience and ensures reliability through backup systems and compliance with industry standards.

**4) Unsought Product:**

a. Operational Integrity:

- Key Attributes: Integrity (0.503), Production Quality (0.428), Protection (0.959), Standardisation (0.811)

- Explanation: This factor suggests using ethical production. Also, this emphasises providing protective measures, consistent quality, and adhering to industry standards. This factor builds consumer trust and ensures safety.

b. User Experience:

- Key Attributes: Accessibility (0.750), Affordance (0.463), Learnability (0.809), Memorability (0.764), Noticeability (0.764), Portability (0.817)
- Explanation: Products that have adhered to this attribute provide ease of use and memorable interactions to the user, leaving an impression.

c. Harmonised narrative maturity:

- Key Attributes: Harmony (0.565), Maturity (0.660), Narrative (0.664)
- Explanation: This component emphasises optimising the product and creating coherence and storytelling. Using this strategy leads to making products that are not only functionally optimised but also capable of communicating a narrative.

d. Adaptability and Maintenance:

- Key Attributes: Evolvability (0.645), Maintainability (0.722), Redundancy (0.766), Versatility (0.769)
- Explanation: This factor informs the creation of products that can adapt over time. This helps maintain functionality, incorporating features like redundancy and versatility to ensure continued relevance.

e. Brand Identity:

- Key Attributes: Engaging Conversations (0.745), Exclusivity (0.604), Identity (0.888)
- Explanation: This factor suggests providing meaningful interactions and a strong brand identity.

f. Aesthetic Designs:

- Key Attributes: Aesthetic Continuity (0.702), Proficiency (0.794)
- Explanation: This factor suggests using aesthetics that are highly appreciated for that product type and also defining product features by considering the user's skills. This contributes to product performance and consumer satisfaction.

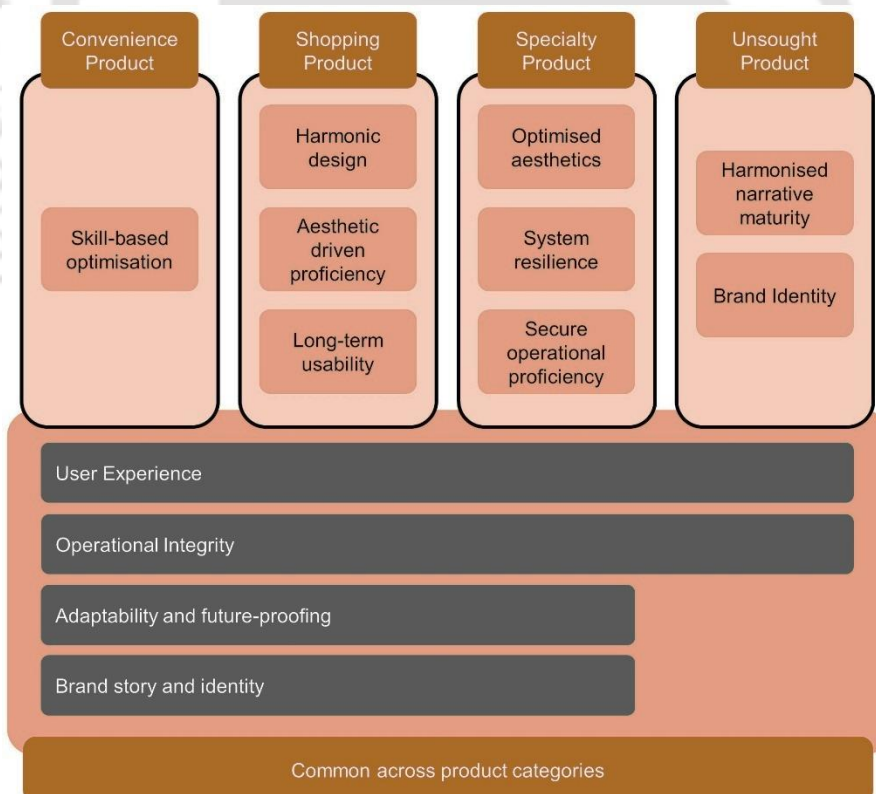


Figure 5.2 Design durability strategies with respect to product categories

The finalised strategies attained from all the product categories are illustrated in Figure 5.2. This diagram informs how design durability can be achieved through various strategies. It also showcases a few common factors that are essential for all product categories, such as operational integrity, user experience, adaptability and future proofing, and brand story and identity. In shopping and specialty goods aesthetic related strategies exist such as aesthetic driven proficiency and optimised aesthetics respectively, they were not clubbed as they intend differently, and if forcefully clubbed the nuances of each attribute is removed. Thereby only highly overlapping strategies are clubbed. These common strategies majorly are defined to enhance product longevity and user engagement. By examining the results from phases 1 and 2, a few strategies that support design durability are user experience, operational integrity, adaptability and future-proofing, brand story and identity, and optimised aesthetics.

### **5.7.3 Theoretical Implications**

This study contributes to the field of product design by exploring design durability factors and their impact on various product categories to achieve sustainable design. The analysis reveals that all product categories commonly prioritise production quality, versatility, and affordance. This emphasises the importance of durability, adaptability, and user-friendliness in creating a product. When creating convenience goods, prioritize portability, protection, and reliability. For shopping goods, emphasize consistency, proficiency, and accessibility. Speciality goods must prioritise exclusivity, identity, and adaptability, and unsought products should prioritise protection and reliability. This study highlights the relationship between consumer preferences and design attributes, offering an aid that combines insights from online content and survey data. These dual insights support design decisions that impact market success and serve as an aid for creating slow designs, especially in emerging technologies. Further conducting exploratory factor analysis (EFA) helped identify latent factors, which serve as strategies for helping define design elements across product categories. This study opens pathways for

further research on durable and adaptable designs that can support sustainable product development.

#### **5.7.4 Practical Implications**

This study provides practical guidance for designers, manufacturers, and policymakers to enforce product durability and sustainability. For policymakers, the need for regulatory interventions which involve standardisation, protection, and maintainability consistently ranks high across product categories. Regulatory mandates on transparency in product labelling enable consumers to make informed decisions about products and their usage by considering learnability and memorability. Policymakers enforce repairability standards and transparent labelling to sustainable production and consumer well-being.

Phase 1 and 2 results complement each other: one identifies the market-driven perspective of design durability while the other highlights what users find most important. By combining these insights, designers gain holistic understanding that informs both product design and advertising strategies. In practice, the findings highlight the need for manufacturers to prioritise integrity, production quality, and adaptability in their design. For instance, protection, production quality, and integrity need to be prioritised in emergency products as they have been scored higher in both phases. Additionally, the key attributes such as production quality, portability, integrity, standardisation, and versatility are universally prioritised across product categories, signifying their essential role in achieving market success and consumer satisfaction.

The study also provides category-specific design insights, such as convenience products should prioritise accessibility, affordance, and portability. Thereby, designers should consider creating functional, and user-friendly products instead of focusing on enhancing emotional aspects. The

category-specific insights allow manufacturers to develop products that are fit for purpose and aligned with market demand.

### **5.8 Limitations and Future Scope**

The online content analysis from Phase 1 emphasises popular design durability factors, potentially overlooking less visible yet important attributes. The participant pool in Phase 2 is composed primarily of individuals from industrial design-related disciplines. But the generalisability can further be achieved when studies such as this were conducted with various fields of design. Expanding the study to more product categories and emerging technologies would help identify additional design factors. Additionally, future studies could explore post-purchase impacts and how design durability perceptions evolve throughout the product lifecycle, providing a more holistic view of its influence on consumer behaviour.

### **5.9 Conclusion:**

This study uses a two-phase mixed-method approach to enhance the understanding of design durability and its application across various product categories. Phase 1 analysed online product content to identify consumer preferences and market-driven design durability attributes. Phase 2 conducted a survey with designers and non-designers to define design durability factors ranking. The diverse data of these two phases provide a well-rounded perspective on the significance of design durability factors. Through exploratory factor analysis (EFA), the study further provides product category-specific strategic guidelines that help make durable, adaptable, and sustainable designs. Designers can use these insights to improve both the emotional and functional aspects of their products while suggesting manufacturers enhance production quality and standardisation. This framework helps researchers with opportunities to explore how sustainable design practices and cultural factors affect product success.

## Chapter 6 Key Contributions and Thesis Conclusion

**Chapter abstract:** This chapter synthesizes the primary research findings, outlining significant contributions to design durability and its practical and theoretical implications. It provides an overview of the defined concept, identifies key factors, and presents strategies for its application across product categories. The chapter concludes with a discussion of limitations and future research opportunities to refine and expand the framework in response to evolving markets and technologies.

### 6.1 Key Research Findings

The research findings are mapped below as shown in Figure 6.1.

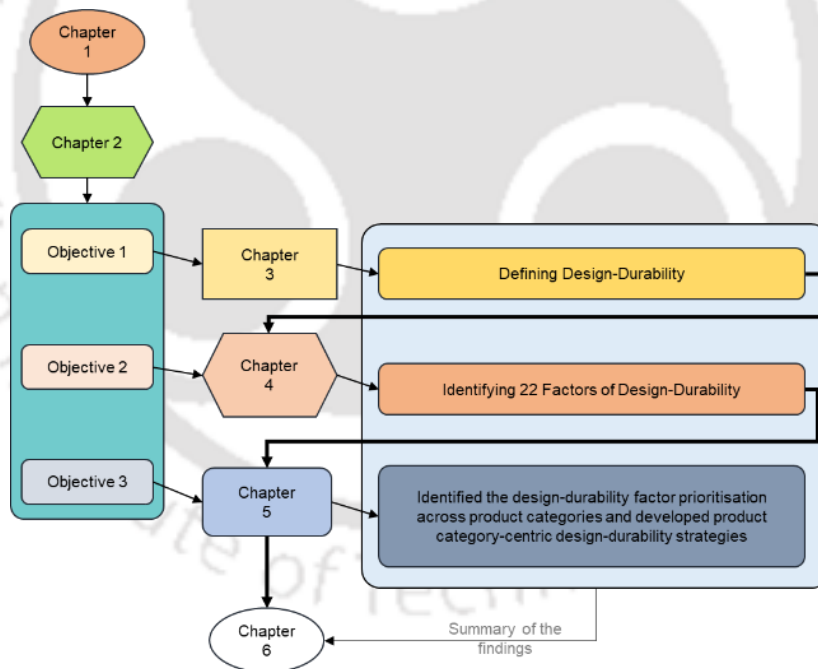


Figure 6.1 Mapping of Chapters to Research Objectives and Key Findings

#### a. Objective 1: Defining Design durability

Findings: Design durability is newly identified and introduced in this research as the persistence and adaptability of design elements—such as form, functionality, and

materialization—across multiple product generations and market conditions. This concept shifts the focus from product lifespan to the longevity of design features that retain relevance over time. Traditional durability concepts (physical, emotional, and psychological durability) are expanded to include the notion that emphasizes how design features, rather than individual products, endure.

- **Objective 2: Identifying Factors of Design durability**

Findings: The study identifies and defines factors contributing to design durability through a comprehensive literature review and product analysis conducted with expert focus groups. The factors uniquely identified through product analysis include aesthetic continuity, affordance, harmony, learnability, memorability, noticeability, proficiency, protection, versatility, and standardization. The remaining factors, which overlap with design durability, were drawn from durability concepts in the literature. These factors provide designers with tools to assess and select features with the potential to remain relevant and appealing over multiple product cycles.

- **Objective 3: Developing Strategies for Implementing Design durability**

Findings: Product category-centric (convenience, shopping, speciality, and unsought products) strategies were developed and categorised in this study to guide designers in applying design durability principles effectively. By tailoring strategies to each product category, designers can ensure that design features retain relevance while adapting to evolving consumer needs and market trends. This approach reinforces sustainable design practices by promoting products that endure and adapt over time.

## **6.2 Thesis Contribution**

This thesis makes several distinct and original contributions to the field of product design by introduction, development, and application of the concept of design durability. The primary contributions of the thesis are detailed below:

- a. Design durability is positioned as a fundamental concept in product design, emphasising that certain design features possess intrinsic qualities that enable them to endure across multiple product lifecycles. This ontological shift reframes durability from a product-centric view to a feature-centric approach, emphasising that elements such as form, materiality, and functionality play a crucial role in sustaining a product's value and functionality over time. This conceptualisation provides a tangible and observable perspective on durability. Further this equips designers with critical insights into identifying which features need to be prioritised—such as usability, aesthetics, and adaptability to ensure long-term relevance.
- b. Design epistemology is advanced through this study by providing a nuanced understanding of how designers develop insights into which design features are likely to remain relevant over time. By grounding design durability in empirical findings and theoretical knowledge, the study bridges theoretical concepts with sustainability practices. It emphasizes the roles of modularity, adaptability, and upgradability within sustainability theories and circular economy principles. This theoretical expansion clarifies these factors and establishes a foundation for implementing design durability strategies across various product categories.
- c. A novel approach consisting of 22 design durability factors was developed through a two-phase mixed-methods process. The mixed method that resulted in identifying these factors has systematic literature review, expert focus group engagement, and empirical product analysis, helped capturing the multidimensional nature of durable design features.
- d. A two-phase empirical study was conducted to test the real-world relevance and applicability of the 22 design durability factors. In the first phase, digital product content was analysed to examine how these factors appear in actual product

descriptions and user experiences, confirming their relevance in real-world design contexts. In the second phase, a structured survey was conducted to assess how the 22 factors are prioritised across four product categories: convenience, shopping, specialty, and unsought goods. The data from this phase was further analysed using exploratory factor analysis, which identified 13 latent dimensions underlying the 22 factors. These dimensions were then mapped to the four product categories, resulting in actionable, category-specific design strategies. This demonstrated how design durability principles can be effectively applied to address the contextual needs of diverse product types.

- e. In terms of praxeology, the research offers practical guidelines for designers to promote sustainability and extend product lifecycles through structured, feature-centric approaches. By aligning strategies with specific product types, designers can systematically implement design durability to meet various industry needs. These support designers in applying these principles throughout product development, illustrating the interconnectedness of critical design elements across different product lifecycles. For example, convenience products may focus on learnability and portability, while specialty products might prioritize aesthetic continuity and exclusivity. This adaptability ensures effective integration of design durability into diverse design practices. The study redefines existing design frameworks by incorporating a feature-centric approach, enabling designers to enhance the longevity of product features. By focusing on how specific design choices affect long-term product value, these frameworks support the application of design durability principles. This emphasis on sustainability highlights the role of design durability in reducing waste, promoting sustainable consumption, and driving an industry-wide shift toward environmentally responsible innovation.

## **6.3 Implications**

### **6.3.1 Theoretical Implications**

By integrating the concept of design durability, this research broadens existing durability frameworks and emphasises the endurance of design features and elements in evolving technological and market environments. This perspective promotes modularity, upgradability, and adaptability, aligning with circular economy models and supporting sustainable design. Furthermore, it bridges user-centred design—which focuses on extending product lifespan—with design-centred approaches that emphasise feature persistence, offering a comprehensive view that enhances current sustainability research. This holistic approach unites product longevity and feature durability, enriching the discourse on sustainable design.

### **6.3.2 Practical Implications**

Actionable insights were developed in this study for applying design durability principles across product categories. Designers should prioritize accessibility, portability, and affordance for convenience goods, while for specialty goods they need to focus on consistency, proficiency, and exclusivity. The design durability acts as a practical lens, especially for new designers, offering a structured guide to identify and apply factors for creating long-lasting, adaptable designs. The research outcomes from this study majorly influences various stages of requirement analysis and concept development. The design durability factors themselves can become lenses to identify the features and their metrics, which need to be consistent and evolving. These insights can further be used to develop design briefs that accurately help develop concepts which have the potential to endure. Further, the strategies and factor prioritization identified and defined in this study provide insight into concept development and refinement. These support the development of sustainable products that align with market demands, contribute to waste reduction, and promote sustainable consumption, meeting consumer expectations for durable, environmentally friendly products.

## **6.4 Limitations and Future Scope**

### **6.4.1 Limitations**

The focus is on the designer's perspective regarding design durability. However, the study is limited by the absence of direct consumer insights into how they perceive and value enduring design features over time. Future research should integrate consumer attitudes to deepen the understanding of user-driven factors in design durability. Expanding future studies to include professionals from engineering, logistics, and marketing could provide a more comprehensive view of design durability's role. While the study developed category-specific guidelines, the range of product categories analyzed was limited. Future research could explore a broader set of product categories and emerging technologies to refine and enhance the applicability of design durability principles.

### **6.4.2 Future Scope**

Future research should delve into consumer perspectives on design durability to understand how these perceptions influence product engagement and longevity, providing insights into how user expectations shape design durability. Additionally, examining the interactions among design durability factors and their combined effects on product longevity could enhance the existing concepts and guide better-informed design decisions. As technology continues to advance, future studies could explore how design durability principles apply to digital and smart products, where rapid innovation can challenge traditional notions of durability. This research could uncover strategies to balance technological progress with design continuity, fostering new paths for sustainable innovation.

## **6.5 Conclusion**

This research establishes and explores the concept of design durability, positioning it as a comprehensive framework for understanding and fostering the longevity of design features

across product generations. By shifting from traditional product-centered models to an approach that emphasizes enduring design elements and the active role of designers in promoting feature continuity, this study makes significant theoretical discussions around sustainable design practices. Though the findings equip designers with insights to develop adaptable, resilient products that align with evolving environmental goals and changing market demands, the research remains majorly exploratory in scope. The study suggests that design durability may support sustainable consumption and production practices, particularly through its alignment with principles such as repairability, modularity and long-term engagement. This potential can be effectively realized by integrating design durability principles into various product development processes.

By providing strategies, this thesis lays the groundwork for designers to integrate design durability into product development. These strategies can serve as origin for creating products that may not only endure but adapt to future challenges, reinforcing sustainability as a core design principle. In conclusion, this thesis enriches the discourse on product design, bridging theoretical insights and practical applications. It offers a new lens through which to view durability, advocating for an approach that balances user engagement, ecological responsibility, and technological advancement. The study encourages further exploration into how design durability can be applied in diverse consumer landscapes, ensuring that products not only endure but continue to provide value across generations.

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- Zuyao Zhang, Yuan Zhu, & Xiaoxiao Qiu. (2009). Study of product design DNA based on shape perception. *2009 IEEE 10th International Conference on Computer-Aided*



## List of Publications

### Journal Papers

- 1) Jetti, R., & Dhar, D. (2024). Design durability: Insights from Product Case Analyses. *Archives of Design Research*, 37(5), 93-134.  
<http://dx.doi.org/10.15187/adr.2024.11.37.5.93>
- 2) Jetti, R., & Dhar, D. (2024). Product Durability: A Systematic Literature Review. *Archives of Design Research*, 37(5), 137-173.  
<http://dx.doi.org/10.15187/adr.2024.11.37.5.137>.
- 3) Jetti, R., & Dhar, D. (2024) Exploring Design durability in Market Endurance: A Comparative Analysis Across Product Categories. *Journal of Industrial Ecology* **(Under Review)**

## Appendices

### Appendix A: Additional statistical data that supports the bibliometric analysis

Table A.1 Clusters and their respective literature

Name of the Cluster	References
<i>Sustainable Product Design and Durability</i>	(Agrawal et al., 2016; Ahmad et al., 2018; Aldridge, 2004; Alev et al., 2020; Alfieri et al., 2018; Almanzar Gomez & Bussracumpakorn, 2014; Aziz et al., 2021; Bakker et al., 2014; Chapman, 2008; Chen & Turpault, 2021; Den Hollander et al., 2017; Ghimouz et al., 2023; Goering, 1997; Guiltinan, 2009; Gulden et al., 2010; Haines-Gadd et al., 2017, 2018; Haug, 2018; Huang et al., 2019; Hunkeler & Vanakari, 2000; Jensen, Laursen, et al., 2021; Ji & Lin, 2022; Khosla, 2021; Kinokuni et al., 2019; Lobos & Babbitt, 2013; Løvbak Berg & Hebrok, 2024; Madge, 1997; Maitre-Ekern & Dalhammar, 2016; Mont, 2008; Mulet et al., 2022; Munten et al., 2021; Munten & Vanhamme, 2023; Nazzal et al., 2013; Nicolás et al., 2019; Okumura et al., 2001; Ossevoort, 2010; Pradish Kumar & Shanthi Imaculate Jaculin, 2023; Proske et al., 2016; Razeghian & Weber, 2019; Schifferstein & Zwartkruis-Pelgrim, 2008; Sellitto et al., 2017; Sierra-Fontalvo et al., 2023; Skuba & Suyetin, 2019; Sun et al., 2021; Van Krieken et al., 2012; Van Nes & Cramer, 2005; Vanacker et al., 2022; Willskytt & Brambila-Macias, 2020; Xiong et al., 2012)
<i>Circular economy and sustainable design strategy</i>	(Agrawal et al., 2016; Ahmad et al., 2018; Alfieri et al., 2018; Almanzar Gomez & Bussracumpakorn, 2014; Alqahtani & Gupta, 2017; Aziz et al., 2021; Bakker et al., 2014; Bocken et al., 2016; Boorsma et al., 2022; Carlsson et al., 2021; Chapman, 2015, 2016; Chapman, 2008; Chen & Turpault, 2021; T. Cooper, 1994, 2005; Cordella et al., 2021; Coscieme et al., 2022; Creusen et al., 2010; Cseke et al., 2020; Den Hollander et al., 2017; Frahm et al., 2022; Fuchs & Hovemann, 2022; Guiltinan, 2009; Gulden et al., 2010; Haase & Lythje, 2022; Habibollahi Najaf Abadi et al., 2023; Hagedorn et al., 2017; Haines-Gadd, 2019; Haines-Gadd et al., 2017, 2018; Hasling & Ræbild, 2017; Haug, 2019; Hebrok, 2014; Huang et al., 2023; Hunkeler & Vanakari, 2000; Jensen, Laursen, et al., 2021; Ji & Lin, 2022; Khosla, 2021; Kinokuni et al., 2019; Ko, 2017; Lacey, 2009; Løvbak Berg & Hebrok, 2024; Maitre-Ekern & Dalhammar, 2016; Mesa et al., 2022; Mestre & Cooper, 2017; Mont, 2008; Moreno et al., 2016; Mugge et al., 2008; Mulet et al., 2022; Nyström, 2019; Okumura et al., 2001; Pradish Kumar & Shanthi Imaculate Jaculin, 2023; Selvefors et al., 2019; Shin et al., 2021; Sonogo et al., 2018; Stahel, 2016; Suppipat & Hu, 2022; Van Dam et al., 2020; Van Krieken et al., 2012; Van Nes & Cramer, 2005; Van Weenen, 1995; Vermunt et al., 2019; Willskytt & Brambila-Macias, 2020; Wu et al., 2021)

<i>Sustainable product design and lifecycle management</i>	<p>(Agrawal et al., 2016; Ahmad et al., 2018; Aldridge, 2004; Alfieri et al., 2018; Ardenete &amp; Mathieux, 2014; Bahmed et al., 2005; Bakker et al., 2014; Blijlevens et al., 2009; Boyle et al., 2018; Ceschin &amp; Gaziulusoy, 2016; Chapman, 2009, 2016; T. Cooper, 2005; Cordella et al., 2021; Cseke et al., 2020; Den Hollander et al., 2017; Eichner &amp; Runkel, 2003; Ghimouz et al., 2023; Habibollahi Najaf Abadi et al., 2023; Haines-Gadd, 2019; Haines-Gadd et al., 2017; Haug, 2018; Huang et al., 2019, 2023; Hunkeler &amp; Vanakari, 2000; Jensen, Haase, et al., 2021; Jensen, Laursen, et al., 2021; Ji &amp; Lin, 2022; Khosla, 2021; Kinokuni et al., 2019; Løvbak Berg &amp; Hebrok, 2024; Mesa et al., 2022; Mittelman et al., 2020; Mulet et al., 2022; Munten et al., 2021; Okumura et al., 2001; Ossevoort, 2010; Razeghian &amp; Weber, 2019; Sellitto et al., 2017; Selvefors et al., 2019; Sierra-Fontalvo et al., 2023; Sonogo et al., 2018; Strandbakken, 2009; Sun et al., 2021; Suppipat &amp; Hu, 2022; Thornquist, 2017; Van Krieken et al., 2012; Van Nes &amp; Cramer, 2005; Van Weenen, 1995; Vanacker et al., 2022; Wiecek et al., 2019; Wieser, 2017; Willskytt &amp; Brambila-Macias, 2020; Xiong et al., 2012)</p> <p>Sonogo et al., 2018; Strandbakken, 2009; Sun et al., 2021; Suppipat &amp; Hu, 2022; Thornquist, 2017; Van Krieken et al., 2012; Van Nes &amp; Cramer, 2005; Van Weenen, 1995; Vanacker et al., 2022; Wiecek et al., 2019; Wieser, 2017; Willskytt &amp; Brambila-Macias, 2020; Xiong et al., 2012)</p>
<i>Sustainable decision making and environment impact assessment</i>	<p>(Almanzar Gomez &amp; Bussracumpakorn, 2014; Boorsma et al., 2022; Braungart et al., 2007; Ceschin &amp; Gaziulusoy, 2016; Chapman, 2008; 2016; Cupchik, 2017; Den Hollander et al., 2017; Fossdal &amp; Berg, 2016; Haines-Gadd, 2019; Haines-Gadd et al., 2017, 2018; Haug, 2018, 2019; Huang et al., 2023; Ji &amp; Lin, 2022; Khosla, 2021; Ko, 2017; Lacey, 2009; Lobos, 2014; Løvbak Berg &amp; Hebrok, 2024; Nicolás et al., 2019; Sweet &amp; Caudwell, 2017; Thornquist, 2017; Van Dam et al., 2020; Van Krieken et al., 2012; Vanacker et al., 2022; Walker, 1995; Wu et al., 2021)</p>
<i>Emotion-Driven Sustainable design</i>	<p>(Aldridge, 2004; Almanzar Gomez &amp; Bussracumpakorn, 2014; Alzaydi, 2024; Aziz et al., 2021; Bocken et al., 2016; Boorsma et al., 2022; Carlsson et al., 2021; Ceschin &amp; Gaziulusoy, 2016; Chapman, 2009, 2016; Chen &amp; Turpault, 2021; T. Cooper, 2016; Coscieme et al., 2022; Den Hollander et al., 2017; Fossdal &amp; Berg, 2016; Frahm et al., 2022; Fuchs &amp; Hovemann, 2022; Guiltinan, 2009; Guru et al., 2024; Haase &amp; Lythje, 2022; Habibollahi Najaf Abadi et al., 2023; Hagedorn et al., 2017; Haines-Gadd et al., 2017; Harper, 2018; Hasling &amp; Ræbild, 2017; Haug, 2018; Haug &amp; Busch, 2016; Huang et al., 2019, 2023; Hunkeler &amp; Vanakari, 2000; Jensen, Haase, et al., 2021; Ji &amp; Lin, 2022; Khosla, 2021; Kowalski &amp; Yoon, 2022; Lobos, 2014; Mesa et al., 2022; Mestre &amp; Cooper, 2017; Moreno et al., 2016; Mugge et al., 2005; Munten et al., 2021; Odom et al., 2009, p. 2; Ossevoort, 2010; Page, 2014; Porter, 2004; Schifferstein &amp; Zwartkruis-Pelgrim, 2008; Shin et al., 2021; Sierra-Fontalvo et al., 2023; Sonogo et al., 2018; Strandbakken, 2009; Sun et al., 2021;</p>

## Appendix B.

Table B.1 Design durability factors and their associated open-codes and sub-factors

Open code (Content from Phase-2)	Sub-factor	Factor
Handle length is limited to accommodate various people's ergonomic consideration	Accessibility through ergonomic consideration	Accessibility
Font in dumbbell informs and helps access the right product	Accessibility via visibility	Accessibility
Mosquito bat is easy to use and swing because of the form	Common knowledge for accessibility	Accessibility
The wet mop base is easily movable under the table as it has higher flexibility	Reachability via flexibility	Accessibility
Transparent body is used for the dust collection unit to show what's been sucked in and if anything, important exists	Accessibility via transparency	Accessibility
Detachable rechargeable battery can accommodate even smaller spaces and increase comfort	Accessibility via modularity	Accessibility
Simpler modes of use are provided in the vacuum cleaner for removing dust for better accessibility	Accessibility via complexity	Accessibility
The adjustable nature of the body of the table lamp makes it more accessible across the job space or table where it is placed in	Accessibility via adjustability	Accessibility
Dimensions of the door handle helps all people of demography reach it	Reachability via feature dimensions	Accessibility
Font size in the Coca-Cola makes product identifiable and accessible in the first glance even from far away	Form size defines noticeability and accessibility	Accessibility
Dyson vacuum cleaners suction units across models inform the technologically high level of products	Consistent Product style through shape	Aesthetic continuity
Neon colours used in Alexa can indicate the timeline of the product type	Timely style informing product generation	Aesthetic continuity
Roller is visible from transparent cover, which shows the functional entity	Technologically advanced product styles through transparency	Aesthetic continuity

Geometrical shape of table lamp makes it look simpler	Simplistic style via shape	Aesthetic continuity
Finite number of entities makes it feel more minimalistic	Minimalistic style via minimal entities	Aesthetic continuity
Body and shape when merged together in a table lamp, they will start to look simple and modernistic	Modernistic style via merging components	Aesthetic continuity
Squeezers usually are produced mostly in earthy colours like chrome, orange, yellow, green colours	Consistent colours usage across product type	Aesthetic continuity
Matte finish in cars informs futuristic nature compared to others	Finish of the product defines the timeline of the product	Aesthetic continuity
Octagon shape looking strong and stable and makes us feel it is serious to use	Form informs perceived strength and stability	Affordance
Straight base dimensions of dumbbell makes it feel bigger than diagonal edge	Dimensions inform visual perception	Affordance
Black colour body makes user perceive rough usage possibility	Colour informs product usage intent	Affordance
White colour in mosquito racket is used to indicate the non-functional components, instead of orange colour	Colour variance informs functional components	Affordance
Resemblance to tennis racquet shape for intuitive use	Form resemblance informs affordance	Affordance
Zap switch's in mosquito racquet its' restricted movements and freedom of motion defines the nature of the button	Freedom of movement informs affordance	Affordance
Activity frequency and type of work makes the switches in mosquito racquet is different from one another	Feature types informs activity affordance	Affordance
Lines over the torch provides help inform how the activity is done, as friction provided by them lets it know, the movement to be in forward and backward	Patterns inform usage	Affordance
Form of the mosquito racquet is mostly curvy in nature and making it look user friendly and very much like a bucket which makes it easier to buy for even new consumers	Form informs ease of use	Affordance
Certain surface transitions makes people know that product can be used roughly	Surface transition informs usage	Affordance

Colours are alternatively used to indicate important features in a product by lowering the colour variance	Grouping and colour combinations inform activity hierarchy	Affordance
Familiarity of the adjustable knob helps user achieve comfortable usage	Product familiarity informs usage	Affordance
The cap at the bottom of the tub functionality is easy to be recognized because of its placement	Feature placement in product informs activity	Affordance
Spin feature of the mop accommodated with the spin tub helps the new users know about rotational function even though it is unknown as it is similar to washing machine spin tub	Similarity informs activities	Affordance
The shape of Alexa doesn't have any wheels or something which makes it feel that it is a product that need to be kept in a place	Shape-based freedom of movement informs actions	Affordance
Texture being soft makes the product feel comfortable and touchable	Texture informs emotions	Affordance
Soft texture and that makes the surrounding nature makes us feel that sound system is three dimensional which can help keep it in centre of the hall	Texture informs functionality	Affordance
Crude nature of screw visibility makes us the surface is the bottom of the body	Features inform the product orientation	Affordance
The geometrical shape of the Dyson vacuum cleaners is used to make it look more standard and inform standard usage	Shapes inform standardised usage	Affordance
Colours are made different for different purpose and indicate functionally high- and low-level products	Colour variation informs functionality	Affordance
Red colour is commonly used for all the similarly functional features in the Dyson vacuum cleaner	Similar colour for functional similarity	Affordance
Uniquely shaped positive and negative form attributes inform users regarding the unique actions and compatible features	Form-specific compatibility informs activity	Affordance
Height of the table lamp helps us understand where to place it and how to place it	Product dimensions inform usage	Affordance
Images that are socially accepted helps users know where to keep it, as it is generic it can be placed in offices, bedroom, restaurants etc	Symbols and forms of product informs place it need to be placed	Affordance
Warm light instead of bright light is used to let people know when and how it can be used	Product feature type informs the place of use	Affordance

The pattern cover strip in front of the shoe sole makes the product to be used for rough usage such as sports which it is meant for	form features inform actions	Affordance
Lack of any door handle informs that the door can be pushed	Features inform activity	Affordance
Autonomous cars which are taxi uses forms which are boxy and like toasters making them feel safe	Product forms for emotional affordance	Affordance
Different parts in the pen are indicated with different colours	Colours inform part differentiation	Affordance
The material thickness of the metal makes it pressable	Dimensions of the product informs action	Affordance
Spin feature of the mop though being new feature to certain users it can be learnt and remembered easily due to its simplicity	Simplicity influences learnability and memorability	Learnability
Dyson's washing machine failed in the market as customers felt them too complex to use	Complexity of features makes it usage difficult	Affordance
Dyson Vacuum cleaner form is mostly symmetrical making us guess the other side of the body which lets us understand the body by understanding one side of the body	Symmetrical forms for simplicity	Learnability
Simple forms of the Chuck Taylor Allstar shoes makes them feel humble to users	Humble nature through simplicity	Integrity
Using safety pin doesn't require much of training for even first-time users	Complexity of the product informs need of learnability	Learnability
Logo being simply makes it more recognisable and noticeable	Memorability through simplicity	Memorability
Duplicate command can only be used effectively and efficiently by mastering the device	Complex products are made to last long	Integrity
Bottle is made with the broken glass and the renewing process is easier as this is a mix of least number of multiple materials	Material complexity to recycle and renew	Production quality
Hashed lines and its thickness are made in considering optimal damage to skin	Natural interaction through ergonomics	Conversation
Hashed lines placed with equal distance symmetric to centre making it easy to be held in both hands	Ergonomic consideration for better interaction	Conversation
Feedback from certain sounds gives insight to right practice	Feedback enforces interactions	Conversation
LED glow indicate changes from green to red this distinguishability makes it more status	Changing features inform feedback	Conversation

Intuitive interactions makes invest time in exploring through seamless interactions to let us explore the pure functionality	intuitive interactions helps achieve mastery	Conversation
Peculiar way of interacting and humanly sense of humor helps people interact	Conscious interactions helps making better conversations	Conversation
Product interactions are made to let users not feel lonely and lowered anxiety and increased comfort	Intuitive and human like interactions for security and comfort	Conversation
Snapping sound mechanism fittings increases the interactions	Multisensorial feedback increases interactions	Conversation
Visible status of battery life helps users understand the performance by letting it know when to recharge	Status visibility for feedback for better usage pattern	Conversation
Personal assistants adopt to the context and user by understanding the user's preferences	Continuous adaptability for optimised actions	Evolvability
Product fittings are made to function in different contexts	Features that are adjustable with slight alteration can fit the product for different contexts	Evolvability
Lace profile in the shoes can be changed according to the requirement and style aspiration of the user	Features in the product that can be altered with user's aspiration makes the product evolve	Evolvability
Colours of the squeezer being silver and gold makes the product more valuable among other products in the market	Colour of the products informs value	Exclusivity
Shape of the Philip Stark's lemon juicer which is organic and more unique represents an art piece	Uniqueness through product shape	Exclusivity
Product's usage restrictions of not using it to juice lemon to prevent from losing gold plating makes them unique	Exclusivity through restrictions	Exclusivity
The limited amount of juicers available in the market makes them more exclusive and valuable	Exclusivity through rarity	Exclusivity
Older car forms are a status icon to owners as they are considered rare and unique	Antique products are exclusive	Exclusivity
Special packaging of the Parker pen can make the product special	Packaging can make products more valuable	Exclusivity
Metal pens are more luxurious considered to be the plastic ones	Material informs value	Exclusivity
Pens which are used rarely for special occasions makes them more valuable	Rarity through product usage frequency	Exclusivity

Harmony achieved among activity and proportions	Internal harmony among product features	Harmony
Balance is achieved as the base and top ring of the table lamp have the same material	Balance helps achieve harmony	Harmony
Non-dominating simple entities of the table lamp make the body harmonious	Simple non-dominating entities makes harmony	Harmony
Colour of the door handle always fits the door body which are natural coloured like metal and wood	Colours of feature provides harmony with the product	Harmony
Colours on the body of parker pen alternatively used creates balance	Balance through colour combinations	Harmony
Balance in the pen is achieved through balanced ratio proportions of cap and body	Balance of the product feature proportions create harmony	Harmony
rubber-coated dumbbells make less noise when used together for specific exercises, making them less embarrassing to use in public.	Harmony with the environment	Harmony
Specific colours in specific product type of wet mop helps to know the brand	Colours provide brand identity	Identity
Oddly cut shape lets us see what's to be identified in wet mop	Distinguishable feature informs identity	Identity
Proportions of the body makes it look cuter and accessible	Proportions informed personality	Identity
Usually the light halo structure makes it look like halo of angelic beings or soul full beings making it more safer	Metaphors forms indicating consciousness and personality	Identity
Light fluidly changes from white and blue along with the brightness makes it look alive in Alexa	Peculiar changeable features for informs life and personality	Identity
Dyson vacuum cleaner form makes us feel it's distinctive nature of it from other vacuum cleaners but still it lets us know that it is vacuum cleaner because of form typicalness	Typical forms to identify product category	Identity
Cyberpunk style is used to make vacuum cleaners of Dyson	Theme informs personality	Identity
Perceived functional superiority of dyson vacuum cleaners with futuristic technology from others	Identity through branding	Identity
Peculiar sounds produced in the Dyson vacuum cleaner makes it iconic and remembered the product for it	Branding created through sound	Identity
Sakura flowers and trees provides the cultural identity to the table lamp that is apt for a place	Embedding cultural symbols for identity	Identity

Distinctive form from common beverage bottles which can recognized even in the night times or even if its broken	Distinctive entities for brand identity	Identity
Coca-cola bottle form is directly inspired from the coffee fruit shape, making it a metaphorical representation that makes it more distinctive and directly relatable	Brand identity through distinctive relatable shapes	Identity
Unchangeable feature becomes strong design language provides the brand identity to the Coco-Cola	Design language and product DNA for brand identity	Identity
Bottle is advaterised to be faminine as it is made in the shape similar to females' waist	Product forms inform personality	Identity
The inspiration of the product form of lemon squeezer made by Philip is UFO to make it feel more out of the world feeling	Form informs identity	Identity
Kidney front grille in BMW is a consistent feature to provide brand identity	Consistent features in a brand creates brand value	Identity
Arrow heads of the pocket pens are iconic and creates brand identity as they are consistent across parker pens	Consistent features create brand identity	Identity
The character figurines on the pens indicate the pens to be used by kids	Identity through aesthetic style	Identity
Front headlights have become aggressive to easily attract the attention of users among other models	Product personality makes them more attention seeking	Identity
Knowing hidden and unknown functionality or feature in a product makes user feel surprising	Hidden features makes user surprised	Imagination
Form of vaccuum cleaner resemblance to sniper rifle intrigue the user for enhanced handing experience	Forms creates intriguing holding experience	Imagination
chromium steel usage in the safety razor repsrents the durable nature of product and its humbleness	Material finish and colour induce humbleness	Integrity
Brand logo is made to be large enough to be noticed but kept inward of the shoes making it less noticeable informs humble functional nature	Branding and logo placement inform humble nature	Integrity
Minimal components in the product makes the product more humble	Minimalistic nature defines humble nature	Integrity
Simple forms of the Chuck Taylor Allstar shoes makes them feel humble to users	Humble nature through simplicity	Integrity
Efficient battery usage of the vacuum cleaner can be achieved through learning the function for a little amount of time	Learnability to use newer functionalities	Learnability

Consistent filter removal mechanism is same across all vacuum cleaners to lower new learning	Consistent features help learnability	Learnability
Dyson vacuum cleaners with simple, easy-to-use interfaces and buttons need less learnability	Complexity of the product informs need of learnability	Learnability
Shape and simplicity of the form complexity makes users feel better as they need less time to maintain the dumbbell	Maintenance through simplicity	Maintainability
Able to clean the handle of the dumbbell which is drenched in sweat of palms increases the life of product	maintenance through cleanability	Maintainability
If one in pair of dumbbell gets worn out, it can be replaced easily with other dumbbell	maintenance through spare part availability	Maintainability
The material of the table lamp and its smoothness makes the cleaning process easy and can be done regularly	material property informs maintenance	Maintainability
Form of the coke bottle is made in a way it is easily cleanable without much hassle	Form defines cleanability	Maintainability
Material used in the shoes makes user feel they can be washed in washing machine	Cleanability informed through material used	Maintainability
Transparent bodies of the pens inform the pen ink status and makes the user know when the product needs refill needs to be changed	Transparent bodies inform refilling	Maintainability
Standardised dimensions for optimised performance and practice	Functional optimisation through standardised forms	Maturity
Form evolves and gets optimised for the working contexts	Product form evolution for optimisation	Maturity
Gaps in the combed sticks is made to be same or similar and optimised across models to let har move freely between them	Optimised features used across models	Maturity
Designs of the shaving razors didn't change much and doesn't vary much as the designs are optimised for better functional effectiveness	Functional optimisation for design maturity	Maturity
Coke bottle are packed in a special container to make them be carried even in the harsh environments	Optimising forms to be carried in most standardised carriers safely	Maturity
Blade angles in the safety razors are made to made to reduce skin damage overtime	Optimised functional aspect of feature provides better performance	Maturity

Simpler designs are appreciated across times even among the competitors and the shape is not changed since the inception in Chuck Taylor All Star shoes	Timeless and simple designs for maturity	Maturity
The unchanged design of the Chuck Taylor All star form helps achieve optimisation in the manufacturability	Manufacturable optimisation is achieved through aesthetic optimisation	Maturity
Providing rubber grip in most of the pens for better usability	Compulsory features across various models for ages	Maturity
The curve of the juicers is made to be same across various models and to exist for a long time	Optimised designs to achieve performance makes the product mature	Maturity
Wipers of the cars are matured enough they didn't change much across modes	Matured features are consistent across time	Maturity
The car forms are standardised as they are optimised to fit the context and the car forms are changed by keeping the fixed dimensions	Optimisation of the dimensions to create standards	Maturity
The barrel in the fountain pens are optimised to provide long product usage	Feature optimisation for better performance	Maturity
The ink spill prevention from the nib of the pen makes the ball point pen more preferred than the ink ones because of the safety	Features optimised by making them safe to use are preferred among others	Maturity
shape of the product is made to suit a specific context	Design optimisation for specific context	Maturity
The iDrive system is always provided in the middle of the console and helps users easily operate it	Placement of feature defines memorability	Memorability
prints on Alexa is made to fit the demographics	Local metaphors to represent story or narration	Narrativity
People buy safety razors as they are the tools to define gentleman's nature	Iconic and symbolic nature of product make the product type continue across time	Aesthetic continuity
High school basketball player being the reason of the brand makes the product nostalgic in the high school context	Nostalgic products are specific to specific contexts	Narrativity
Letters are embossed on the surface by making a depression into the rubber surface of dumbbell cover, by understanding the surface abrasions into considerations	Noticeability through distinctive features	Noticeability
Difference in height of text and background makes dumbbell's text noticeable	Noticeability through distinctive features	Noticeability

Actionable switches with differentiated background colour for visibility in mosquito racquet	Distinctive features lead to noticeability	Noticeability
Proportions of the wet mop features help attract customers attention	Feature proportions define noticeability	Noticeability
LED glow of the Alexa helps us locate it in the dark rooms	Feature visibility and distinguishability helps noticeability	Noticeability
Camouflaged patterns lowers the visibility of Alexa with respect to environment	Patterns for invisibility	Noticeability
Colours being only blackish and greyish they are get mixed with normal products in the surroundings, especially this is observed in Western nations as they are very generic is nature	colours for invisibility	Noticeability
Visibility of the bottle is evidently possible when the drink exists in the bottle and available in the bottle	Functional products identified through visibility	Noticeability
Font size of the logo is evidently big in the case of such products, as they make us know from far away whether we found what we are looking at in the first glance itself	Form dimensions defines noticeability and accessibility	Noticeability
Depressed smooth surface of the coke bottle makes the product visible for all	Surface texture of product can make the feature visible	Noticeability
Contrast in logo and background and the shoe colour makes the logo visible from a far range	Noticeability through contrast	Noticeability
Front headlights in cars have become aggressive to easily attract the attention of users among other models	Product personality makes them more attention seeking and attractive	Noticeability
Pens becomes more visible based on the package background	Visibility depends on background	Noticeability
Lines over the body reduces the need of grip feature to provide friction in mosquito racquet	Form features are optimised to provide better performance	Maturity
Torch material is made considering the direction of usage	Material selection for affordance	Affordance
The size of the personal assistant makes it look being in control	Product dimensions affect controllability	Maturity
Lines over the torch helps increase friction by lowering the material redundancy	Form features are optimised to provide better performance	Maturity
Floor cleaning liquid placement helps user keep all required apparatus at a place for comfort and ease of use	Accessibility in a product helps achieve better performance through reachability	Accessibility

Hashed lines and dotted patterns on handle help us place our hand on rod and fingers accordingly	Affordance through texture	Affordance
Bulge in the centre of the handle helps to held in centre of palm	Form proportions for better affordance	Affordance
gaps between the words and font are important for clear readability of letters in dumbbell	Performance through form characteristics	Learnability
Rounded form of the mosquito bat makes people comfortable to use	Forms informs usage likeability	Affordance
The racquets body is elongated to make users feel the wider space of actionable range	Dimensions induced utility	Affordance
Handle is diameter is good enough to be held easily in the hand efficiently	Ergonomic consideration for better performance	Accessibility
Rounded forms of the mosquito bat make it feel for smoother usage	Forms inform usage likeability	Affordance
Torch material is made considering the duration of usage	Material informs usage duration	Production quality
Torch material is made considering job space area requirement	Product material is defined based on the job space requirement	Versatility
Colours like green and pantoleen helps cover the coloured stains, which makes certain users feel less uncomfortable to touch the bucket	Colour influences performance	Aesthetic continuity
Bigger wheels always assure the first-time users about the evident comfort that can be achieved using this mop is mentioned	Product feature dimensions can afford assured actions to provide better performance	Affordance
Bigger wheels helps least water turbulence even on rougher surface	Proportions define performance	Harmony
Floor cleaning liquid keeping space provided in the body helps lower the number of actions increased when they have to bring cleaning liquid multiple times	Accessibility improves performance	Accessibility
Spin feature of the mop is usually controllable by the users according to the required wetness of the mop for the users	Controllability defines performance	Proficiency
Spinning method is used in the mop to help the users easily dry the mops by minimizing the activities	Merging of activities affects performance	Engaging conversations
The water stored in the buckets if used efficiently can help clean 4-5 rooms easily	Performance through product feature optimisation	Maturity

Fluctuating slightly when its searching for an answer (like how people make hand movement gestures while thinking)	Real life gestures are considered for operation status	Engaging conversations
Alexa device can be connected to multiple speakers at a time to make us experience the best user auditorial experiences which lets it to be used for longer period	Features for better performance	Maturity
Alexa devices optimisation can continue to next product which makes it more comfortable to use for a specific person	Personal history transfer makes the product more likeable	Evolvability; Proficiency
Cylindrical surface makes us feel there is a three dimensional hearing ability which makes it reliable	Form improved product performance	Affordance
ponger battery in product makes people to use product with convenience	Greater utility provides convenience	Versatility
Flexibility in the joint lets it to move in specified range of angles to let it move in users assumed and estimated directions	Controllability defines performance	Versatility
Dyson vacuum cleaners uses same suction technology in all models without changing it much and letting the supportive mechanisms alter, lets the people believe it is of higher functionality than others	Highly efficient technology enhances performance	Evolvability
Detachable battery can be recharged when there is less space availability helps increase	Job space requirement for performance	Portability
If any fitting or mechanism is assembled imperfectly then it shows where is the location that need to be taken care of	Status visibility for better performance	Protection
Energy saving trigger extends run time, preserves battery life depending on user usage efficiency	Proficient usage of functions increases performance	Proficiency
Angular handle designed ergonomically to help people hold vacuum cleaners with ease in not stressful postures	Performance through inducing ergonomics	Accessibility
Auto power usage according to floor, fitting, pressure required	Automated systems for versatile and optimised performance	Versatility
White translucent shade provides an understanding to support good sleep as the light emitted through the shade is less brighter lighting	Material property for performance that fit context	Harmony
Lighting position in table lamp creates focus on the sakura flower tree printed on the shade	Design elements for higher performance	Design cues and language

Colours of the handle in safety razor helps not register stains	Colours of products opted for greater convenience	Aesthetic continuity
Neck of the razor is made to provide convenience while pinch holding it	Design features developed to make performance	Accessibility
Ridge lines extracted from the cocoa beans help to be held in hand without slipping	Performance achieved from bioinspired design	Affordance
CO2 preservation and its impacts are considered while making the form features of the neck of the bottle	Optimised features are achieved among functional attributes to achieve apt performance	Maturity
Bulge and the curve of the coke makes the bottle be held in the hand comfortably	Form features are optimised to achieve comfortable holding performance	Accessibility
Glass material bottles of the coke is more preferable as it is perceived to preserve the taste better compared to plastic bottled ones	Material of the product makes it perform better	Maturity
The body shape of the shoes makes them fixed tightly to the legs as it looks to be designed to fit and follow natural shape	Forms made to fit the body provides higher performance	Harmony
Thin ridges instead of big ones makes the juicer less effective than others	Dimensions of functional entities define performance	Maturity
Placement of the door handle helps increase the functional effectiveness	Placement of feature increases effectiveness	Harmony
For consistent product experience the steering is usually kept constant across all car models in a product category	Consistent features across models to provide consistent experience and performance	Standardisation
The pen width is always made to achieve highly efficient pinch grip	The product dimensions inform efficient product usage	Maturity
Pens dimensions are optimised to fit most people and provide better performance	Optimised dimensions for better performance	Maturity
Highest utility of the safety pin makes the form continue and be the same	Consistent form defines performance	Maturity
Mosquito bats size informs the portability	Product dimension influences portability	Portability
Wire not dangling in mosquito racquet provides info that it is portable	compact and individual components inform transportability	Portability
Even with essential parts integrated together the vacuum cleaner looks smaller compared to others making it look portable	Compact and light parts make product portable	Portability

Spherical form in dyson vacuum cleaner makes it look it can be rolled	Form of product informs the movability	Portability
Smaller size of table lamp helps us feel its portability and carriability	Small dimensions inform portable and carriable	Portability
Coke glass bottles production got lowered compared to plastic bottles by considering the convenience of user to personally carry them	Materials inform carriability	Portability
The top with ridges can be placed inverted into the bowl to let it carried easily	Collapsible product features for carriability	Portability
In case of emergencies the safety pin can always be found on body without much hassle, as in Indian scenario the safety pin is mostly kept on the people's bodies without a hassle	Carriability is one feature to keep form same	Portability
Unique pin mechanism that keep them together even when they are dropped	Component connection influences durability	Production quality
Iron pipe dimensions are usually similar across many brands as they are procured from outsourcing units, to lower the cost of scale	Standardisation defines production quality	Production quality
Duplicate command can only be used effectively and efficiently by mastering the device	Complex products are made to last long	Production quality
Chromium colours makes the product looks stronger among others	Colours indicate quality	Production quality
Full body soft texture clothing kind smoother material is used to help users feel comfortable	Material smoothness provides comfort	Production quality
The depression at the bottom of the bottle provides adequate strength to the bottle	Structural strength provided while manufacturing makes the product strong	Production quality
Bottle is made with the broken glass and the renewing process is easier as this is a mix of least number of multiple materials	Material complexity to recycle and renew	Production quality
Three legs for more structural strength in minimum structure informs the quality of the lemon juicer	Structure defined production quality	Production quality
Material of the grip feature in the product is made according to the contexts like washroom	Material selection for spaces	Production quality
form of the grip in the door is made according to the surrounding spaces	Form selection for spaces	Production quality
Duplicate command is one of the hidden feature that is embedded into the funtion keys, this can be only be achieved by continuous usage	Hidden product features build in for expert users	Proficiency

Optimised usage of product is achieved through proficient usage of product	Optimisation through proficiency	Proficiency
Razor design's continue across time because of its personal proficiency	Proficiency lets design continue	Proficiency
Most luxurious pens are available in cylindrical forms as they are made for most proficient ones	Shape of the design is influenced by proficiency	Proficiency
Same shape and size on both representing same weight makes it look safe to use without much damage if held in hand	Safety through standardised shapes	Protection
Flat surface to plane on surface and not roll is assumed helps people hold the dumbbell to do floor exercises	Safety through placement	Protection
Slippery of dumbbell handle due to its friction based texture handle	Safety through material	Protection
Torch is covered by fogged translucent surface to spread the light equally and not hurt the eyes	Material property provides protection	Protection
distinguishable status of feature indicating helps preserving its life, by not letting its battery worn out	functional status protects product	Protection
Curvy head of safety razors are made to smoothly move across the face, reducing the possible cuts	Features designed to prevent accidents	Protection
Alexa find the device even if we don't know where it is makes us feel confident	Detectability makes user feel secure	Protection
In most of the personal assistants the microphone switches off feature is provided with positively noticeable physical button	Security feature buttons are made physically tangible	Protection
Buy things online with just a command makes the buying process easier, and being it connected to amazon makes it more secure to order from the amazon instead of any other platforms	Product features for enhanced convenience and security	Protection
A slight textured bottom makes it not to slip on slight inclinations	Textures in product is designed to provide protection from falling	Protection
Straight shaving razors one side of the razor is covered on one side which prevents barber from getting injured	Safety through form features	Protection
Simplicity of the logo makes the logo difficult to counterfeit	Simplicity for protection	Protection
Sole of the shoes are designed for safety of the user	Safety through features	Protection
Rubber grip under the legs provides better grip and least damages the space it is placed in	Protection is considered while designing a feature	Protection

The screw mechanism is provided in the pen mechanism to fit each part makes it attached without accidentally dismantling	Mechanism type informs safety	Protection
Bikes provided with reserve fuel cabins makes the bikes which are made to work for long travels informs importance of back-up mechanism	Back-up mechanisms for fail proof systems	Redundancy
Can be charged using the USB cable from multiple sources helps user comfortably find alternatives to charge in regular	Redundancy helps versatile context needs	Redundancy
Daytime running light is made compulsory by the Indian government in two-wheelers	Regulation based product feature continues across models	Standardisation
most common power source of all the household equipment is used in the table lamp	Standardisation defines adaptability	Standardisation
Most standardised and common seen bulb holders are used in table lamps as each of them are interrelated	Compatible standardised product components sustain better across models	Standardisation
USB-C pins provision across various products like mosquito racquet, Personal assistants, and other inform the common industry standards to make a product	Industry standards through commonly provided features	Standardisation
Commonly used blades across all models and all companies of safety razor, which lets them continue for long in market	Large scale adaptation of feature become standard	Standardisation
Throat of the coke and other products looks same as the bulbs are outsourced	Standardisation to lower production cost	Standardisation
Car door handles are modified according to the demographics they are selling at	Demographic-specific product features for better understanding	Standardisation
Red and Yellow bikes are more popular and bought during marriages	Demographic-specific product colours	Standardisation
In a single car model itself based on the different demographics different clearances are provided	Demographic-specific product features for better understanding	Standardisation
The common wipers are most commonly used across the commonly available cars	Standardised features are commonly used across products and timelines	Standardisation
Autonomous cars are provided with the aesthetics and car forms that are similar to semantics of Volvo buses	Design conventions for similar products	Standardisation

Zaisu cushioned model became popular among Japanese users for being used in tatami rooms that was not meant for	Versatility through diverse contexts	Versatility
Blade adjustability are made according to competent cleaning depth needed in the context	Versatility through adjustable features	Versatility
The shoe colour is usually made to match with different attires of the user	Colours of the product informs versatility in contexts	Versatility
The height of the juicers is made to accommodate juicing from most of the citrus fruits	Versatility through product dimensions	Versatility
The top of the juicer can be placed on most kinds of bowls makes them more useful	Product features for versatility of context	Versatility

## Appendix C.

Table C.1 Survey Sheet provided to identify the prioritisation of factors

Product	Model	Weblink
Earphones	Sony MDR-EX150AP	<a href="https://www.amazon.in/Sony-MDR-EX150AP-Ear-Headphones-Dark/dp/B015ZDGB9U">https://www.amazon.in/Sony-MDR-EX150AP-Ear-Headphones-Dark/dp/B015ZDGB9U</a>
		<a href="https://www.cashify.in/sony-mdr-ex150ap-earbud-price-in-india">https://www.cashify.in/sony-mdr-ex150ap-earbud-price-in-india</a>
		<a href="https://www.flipkart.com/sony-mdr-ex150ap-wired-gaming/p/itm1c1816e132650?pid=ACCEBFSHDCQWY6AB&amp;lid=LSTACCEBFSHDCQWY6ABBUSOL2&amp;marketplace=FLIPKART&amp;cmpid=content_headphone_8965229628_gmc">https://www.flipkart.com/sony-mdr-ex150ap-wired-gaming/p/itm1c1816e132650?pid=ACCEBFSHDCQWY6AB&amp;lid=LSTACCEBFSHDCQWY6ABBUSOL2&amp;marketplace=FLIPKART&amp;cmpid=content_headphone_8965229628_gmc</a>
		<a href="https://www.tatacliq.com/sony-mdr-ex150ap-b-in-the-ear-headphones-with-mic-black/p-mp00000000344362">https://www.tatacliq.com/sony-mdr-ex150ap-b-in-the-ear-headphones-with-mic-black/p-mp00000000344362</a>
		<a href="https://www.jiomart.com/p/electronics/sony-mdr-ex150ap-in-ear-wired-headphones-with-mic-red/598224959">https://www.jiomart.com/p/electronics/sony-mdr-ex150ap-in-ear-wired-headphones-with-mic-red/598224959</a>
		<a href="https://www.moglix.com/sony-mdr-ex150ap-in-ear-wired-earphone/mp/msn75dqqxoxd92?srsltid=AfmBOorv6ThymVSTK0I0VOYO7D-TBCbAamcKXNzmErlj4mJX1Au1Y5kI">https://www.moglix.com/sony-mdr-ex150ap-in-ear-wired-earphone/mp/msn75dqqxoxd92?srsltid=AfmBOorv6ThymVSTK0I0VOYO7D-TBCbAamcKXNzmErlj4mJX1Au1Y5kI</a>
		<a href="https://www.justdial.com/jdmart/Ghaziabad/SONY-In-Ear-Wired-Headphone-Blue-MDR-EX150AP/pid-17676264/011PXX11-XX11-200624174728-U2E2?id=0&amp;jdmid=jdm-1055129-ent-5-3642074&amp;flow=result&amp;searchfrom=b2b_prsltpg">https://www.justdial.com/jdmart/Ghaziabad/SONY-In-Ear-Wired-Headphone-Blue-MDR-EX150AP/pid-17676264/011PXX11-XX11-200624174728-U2E2?id=0&amp;jdmid=jdm-1055129-ent-5-3642074&amp;flow=result&amp;searchfrom=b2b_prsltpg</a>
		<a href="https://www.quora.com/What-is-the-difference-between-a-Sony-MDR-EX150AP-and-a-155-AP">https://www.quora.com/What-is-the-difference-between-a-Sony-MDR-EX150AP-and-a-155-AP</a>

Product	Model	Weblink
		<a href="https://nayejaisa.com/product/sony-mdr-ex150ap-wired-in-ear-headphone-with-mic-blue/?srsltid=AfmBOoqiPgkFDZx-zdtolnmjWTIj1ZgqUOTBeq91o0n_EkfgGcS8bjdL">https://nayejaisa.com/product/sony-mdr-ex150ap-wired-in-ear-headphone-with-mic-blue/?srsltid=AfmBOoqiPgkFDZx-zdtolnmjWTIj1ZgqUOTBeq91o0n_EkfgGcS8bjdL</a>
		<a href="https://www.sony.com.tw/en/electronics/in-ear-headphones/mdr-ex150ap-mdr-ex150ap1">https://www.sony.com.tw/en/electronics/in-ear-headphones/mdr-ex150ap-mdr-ex150ap1</a>
		<a href="https://emibaba.com/product/sony-mdr-ex150ap-wired-in-ear-headphone-with-mic-black/">https://emibaba.com/product/sony-mdr-ex150ap-wired-in-ear-headphone-with-mic-black/</a>
		<a href="https://zoneofdeals.com/product/sony-mdr-ex150ap-wired-in-ear-headphone-with-mic-unboxed-like-new/">https://zoneofdeals.com/product/sony-mdr-ex150ap-wired-in-ear-headphone-with-mic-unboxed-like-new/</a>
		<a href="https://paytmall.com/sony-mdr-ex150ap-wired-in-ear-earphone-black-CMPLXCOMSONY-MDR-EX1O2O-952192578C3CE-pdp?product_id=192505076&amp;discoverability=offline&amp;visibility_origin=offline&amp;src=consumer_grid&amp;svc=-1&amp;tracker=%7C%7C%7C%7C%2Fg%2Fmobile-accessories%2Fmobile-accessories%2Fheadphones-headsets-glpid-78654/catalog%7Cundefined%7C16%7C%7C">https://paytmall.com/sony-mdr-ex150ap-wired-in-ear-earphone-black-CMPLXCOMSONY-MDR-EX1O2O-952192578C3CE-pdp?product_id=192505076&amp;discoverability=offline&amp;visibility_origin=offline&amp;src=consumer_grid&amp;svc=-1&amp;tracker=%7C%7C%7C%7C%2Fg%2Fmobile-accessories%2Fmobile-accessories%2Fheadphones-headsets-glpid-78654/catalog%7Cundefined%7C16%7C%7C</a>
		<a href="https://dukandwar.com/product/sony-mdr-ex150ap-wired-in-ear-headphones/?srsltid=AfmBOopjH33x8gku9nO7qmCbZkuT8COVuciliH6vLhnPAIDaf2NIEKI">https://dukandwar.com/product/sony-mdr-ex150ap-wired-in-ear-headphones/?srsltid=AfmBOopjH33x8gku9nO7qmCbZkuT8COVuciliH6vLhnPAIDaf2NIEKI</a>
		<a href="https://orami.in/Sony-MDR-EX150AP-1">https://orami.in/Sony-MDR-EX150AP-1</a>
	Sennheiser CX 180	<a href="https://www.flipkart.com/sennheiser-cx-180-wired-without-mic/p/itm095b789fae9df?pid=ACCDAW7PJXCC9QF3&amp;cmpid=product.share.pp&amp;_refId=PP.01d5e208-d311-4baf-bf58-48d3dc1171d1.ACCDAW7PJXCC9QF3&amp;lid=LSTACCDAW7PJXCC9QF3IRAYHJ">https://www.flipkart.com/sennheiser-cx-180-wired-without-mic/p/itm095b789fae9df?pid=ACCDAW7PJXCC9QF3&amp;cmpid=product.share.pp&amp;_refId=PP.01d5e208-d311-4baf-bf58-48d3dc1171d1.ACCDAW7PJXCC9QF3&amp;lid=LSTACCDAW7PJXCC9QF3IRAYHJ</a>
		<a href="https://www.justdial.com/jdmart/Chandigarh/SENNHEISER-CX-180-EAR-CANAL-HEADPHONE/pid-2023901503/040PXX40-XX40-180503143119-N5C9?jdtracker=internaljd_b2bplistingcarousel_11781087">https://www.justdial.com/jdmart/Chandigarh/SENNHEISER-CX-180-EAR-CANAL-HEADPHONE/pid-2023901503/040PXX40-XX40-180503143119-N5C9?jdtracker=internaljd_b2bplistingcarousel_11781087</a>
		<a href="https://www.flipkart.com/sennheiser-cx-180-wired-headset-without-mic/p/itm3d4261f8e0e0b?pid=ACCDAW7PJXCC9QF3&amp;fm=organic&amp;ppt=None&amp;ppn=None&amp;ssid=000bmlnezk0000001728506168465">https://www.flipkart.com/sennheiser-cx-180-wired-headset-without-mic/p/itm3d4261f8e0e0b?pid=ACCDAW7PJXCC9QF3&amp;fm=organic&amp;ppt=None&amp;ppn=None&amp;ssid=000bmlnezk0000001728506168465</a>
		<a href="https://channel.com.ph/product/cx-180/7103/">https://channel.com.ph/product/cx-180/7103/</a>
		<a href="https://www.pepperfry.com/product/sennheiser-cx-180-1021814.html">https://www.pepperfry.com/product/sennheiser-cx-180-1021814.html</a>
		<a href="https://www.glowroad.com/pd/sennheiser-cx-180-wired-without-mic-headset-black-grey-in-the-ear/32431562?srsltid=AfmBOoomYZbar6_WFaywXivTaP76W7JUz2m2yt52fMvwusqWcZTc2a-5">https://www.glowroad.com/pd/sennheiser-cx-180-wired-without-mic-headset-black-grey-in-the-ear/32431562?srsltid=AfmBOoomYZbar6_WFaywXivTaP76W7JUz2m2yt52fMvwusqWcZTc2a-5</a>

Product	Model	Weblink
		<a href="https://www.snapdeal.com/product/sennheiser-cx-180-in-ear/686798926341">https://www.snapdeal.com/product/sennheiser-cx-180-in-ear/686798926341</a>
		<a href="https://www.newegg.com/sennheiser-cx-180-earbud/p/N82E16826106507?srsId=AfmBOopxn1w0TdfHcZsO7rEaTGdyHEZp1OXZu_DomDWdlKGGMrYA6AKe">https://www.newegg.com/sennheiser-cx-180-earbud/p/N82E16826106507?srsId=AfmBOopxn1w0TdfHcZsO7rEaTGdyHEZp1OXZu_DomDWdlKGGMrYA6AKe</a>
		<a href="https://www.cashify.in/compare-earbuds/sennheiser-cx-180">https://www.cashify.in/compare-earbuds/sennheiser-cx-180</a>
		<a href="https://www.pricehunt.com/audio/sennheiser-cx-180-in-ear-wired-earphones-without-mic-grey.php">https://www.pricehunt.com/audio/sennheiser-cx-180-in-ear-wired-earphones-without-mic-grey.php</a>
		<a href="https://www.123helpme.com/essay/Analysis-Of-Sennheiser-CX-180-FJ7YGLTD2R">https://www.123helpme.com/essay/Analysis-Of-Sennheiser-CX-180-FJ7YGLTD2R</a>
		<a href="https://fullspecs.net/earphone/sennheiser/cx-180-specifications/">https://fullspecs.net/earphone/sennheiser/cx-180-specifications/</a>
	Shure SE215	<a href="https://www.amazon.in/Shure-SE215-CL-Sound-Isolating-Earphones/dp/B004PO10E2">https://www.amazon.in/Shure-SE215-CL-Sound-Isolating-Earphones/dp/B004PO10E2</a>
		<a href="https://www.headphonezone.in/products/shure-se215-cl?srsId=AfmBOoq_uj2NUx1DN7qrAFjBuerL9TEWiwdXWxyBTPa5fgBSvgrTstNA">https://www.headphonezone.in/products/shure-se215-cl?srsId=AfmBOoq_uj2NUx1DN7qrAFjBuerL9TEWiwdXWxyBTPa5fgBSvgrTstNA</a>
		<a href="https://electronicemporium.in/product/shure-se215-cl-professional-sound-isolating-earphones/?srsId=AfmBOorm3f3WjxfshsKqUR_g0Q5PFD5epXxeKHbosvPgNTHKYyYIvI9X">https://electronicemporium.in/product/shure-se215-cl-professional-sound-isolating-earphones/?srsId=AfmBOorm3f3WjxfshsKqUR_g0Q5PFD5epXxeKHbosvPgNTHKYyYIvI9X</a>
		<a href="https://www.canalsoundlight.com/product/shure-se215-cl/">https://www.canalsoundlight.com/product/shure-se215-cl/</a>
		<a href="https://brisound.com.au/products/shure-se215-cl-stereo-in-ear-clear-earphones-sound-isolating-enhanced-bass-3-5mm-eac64-cable-3?srsId=AfmBOopR8CMrSwfBZ8-M6yitxNI2bb51rRb1LH8jF1jt_u_26VNQye6S">https://brisound.com.au/products/shure-se215-cl-stereo-in-ear-clear-earphones-sound-isolating-enhanced-bass-3-5mm-eac64-cable-3?srsId=AfmBOopR8CMrSwfBZ8-M6yitxNI2bb51rRb1LH8jF1jt_u_26VNQye6S</a>
		<a href="https://factorysound.com/se215-cl/">https://factorysound.com/se215-cl/</a>
		<a href="https://oneroofstore.com/shure-se215-cl.html">https://oneroofstore.com/shure-se215-cl.html</a>
		<a href="https://vintageking.com/shure-se215-cl-sound-isolating-earphones-clear?srsId=AfmBOopNzs9b-eBZUxTwn3oD0RfQ3_9II60LNV9N8LobLL2PrKvzyCS">https://vintageking.com/shure-se215-cl-sound-isolating-earphones-clear?srsId=AfmBOopNzs9b-eBZUxTwn3oD0RfQ3_9II60LNV9N8LobLL2PrKvzyCS</a>
		<a href="https://store.face.be/se215-cl-sound-isolationg-earphones">https://store.face.be/se215-cl-sound-isolationg-earphones</a>
		<a href="https://store.face.be/se215-cl-sound-isolationg-earphones">https://store.face.be/se215-cl-sound-isolationg-earphones</a>
		<a href="https://edmondmusic.com/dynamic-microdriver-earphones-se215cl/">https://edmondmusic.com/dynamic-microdriver-earphones-se215cl/</a>
		<a href="https://goknight.com/shure-se215-cl-single-driver-sound-isolating-earphones-with-detachable-cable-clear/?srsId=AfmBOoo5yFHm0K6DXzmGdFU2VbxfVDihB6Dj5RMDIP9xbQmWZ8fiR4WJ">https://goknight.com/shure-se215-cl-single-driver-sound-isolating-earphones-with-detachable-cable-clear/?srsId=AfmBOoo5yFHm0K6DXzmGdFU2VbxfVDihB6Dj5RMDIP9xbQmWZ8fiR4WJ</a>

Product	Model	Weblink
		<a href="https://www.musicstore.com/en_OT/EUR/Shure-SE215-CL/art-PAH0020295-000">https://www.musicstore.com/en_OT/EUR/Shure-SE215-CL/art-PAH0020295-000</a>
		<a href="https://motorcityguitar.com/products/shure-se215-cl-sound-isolating-earphones?variant=45058059470">https://motorcityguitar.com/products/shure-se215-cl-sound-isolating-earphones?variant=45058059470</a>
		<a href="https://www.fullcompass.com/prod/184681-shure-se215-cl-single-driver-sound-isolating-earphones-with-detachable-cable-clear">https://www.fullcompass.com/prod/184681-shure-se215-cl-single-driver-sound-isolating-earphones-with-detachable-cable-clear</a>
Panasonic RP-	HJE120	<a href="https://www.amazon.in/Panasonic-RP-HJE120-K-in-Ear-Headphone-Black/dp/B003EM8008?th=1">https://www.amazon.in/Panasonic-RP-HJE120-K-in-Ear-Headphone-Black/dp/B003EM8008?th=1</a>
		<a href="https://shop.panasonic.com/products/ergofit-in-ear-earbud-headphones?srsltid=AfmBOorJNJwUPomX-LNiem2-209TcaG11vpaSX0UH-50m9A_dTd5G3Qv">https://shop.panasonic.com/products/ergofit-in-ear-earbud-headphones?srsltid=AfmBOorJNJwUPomX-LNiem2-209TcaG11vpaSX0UH-50m9A_dTd5G3Qv</a>
		<a href="https://help.na.panasonic.com/answers/features-and-specifications-audio-headphones-earbuds-model-rp-hje120">https://help.na.panasonic.com/answers/features-and-specifications-audio-headphones-earbuds-model-rp-hje120</a>
		<a href="https://help.na.panasonic.com/answers/how-to-sanitize-your-panasonic-product">https://help.na.panasonic.com/answers/how-to-sanitize-your-panasonic-product</a>
		<a href="https://www.panasonic.com/sg/support/product-archives/product-archives-consumer/home-entertainment/headphone/rp-hje120.html?srsltid=AfmBOopWk4qToJYHvaEm3AHgFz1Kg-VY6xuzNtC7JJhvVO8u4KP81Hs">https://www.panasonic.com/sg/support/product-archives/product-archives-consumer/home-entertainment/headphone/rp-hje120.html?srsltid=AfmBOopWk4qToJYHvaEm3AHgFz1Kg-VY6xuzNtC7JJhvVO8u4KP81Hs</a>
		<a href="https://www.cnet.com/reviews/panasonic-ergo-fit-review/">https://www.cnet.com/reviews/panasonic-ergo-fit-review/</a>
		<a href="https://www.ohlocal.in/product?detail=product_details&amp;product_id=HE137326PA&amp;srsltid=AfmBOopd9055bz-qgHZBcK3OrvfCSJwe9mKpHmScYU9Vnfv8NWvQv8j6">https://www.ohlocal.in/product?detail=product_details&amp;product_id=HE137326PA&amp;srsltid=AfmBOopd9055bz-qgHZBcK3OrvfCSJwe9mKpHmScYU9Vnfv8NWvQv8j6</a>
		<a href="https://www.rtings.com/headphones/reviews/panasonic/ergofit-rp-hje120">https://www.rtings.com/headphones/reviews/panasonic/ergofit-rp-hje120</a>
		<a href="https://www.91mobiles.com/panasonic-rp-hje120-in-ear-canalphone-headphones-price-in-india">https://www.91mobiles.com/panasonic-rp-hje120-in-ear-canalphone-headphones-price-in-india</a>
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		<a href="https://www.telemedicinesupply.com/products/panasonic-ergofit-in-ear-earbud-headphones-rp-hje120-k-black-no-microphone-dynamic-crystal-clear-sound-ergonomic-comfort-fit">https://www.telemedicinesupply.com/products/panasonic-ergofit-in-ear-earbud-headphones-rp-hje120-k-black-no-microphone-dynamic-crystal-clear-sound-ergonomic-comfort-fit</a>
		<a href="https://www.adorama.com/pcrphje120sl.html">https://www.adorama.com/pcrphje120sl.html</a>

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		<a href="https://www.usacomputerstore.com/product-page/new-panasonic-rp-hje120-in-ear-headphones-black">https://www.usacomputerstore.com/product-page/new-panasonic-rp-hje120-in-ear-headphones-black</a>
	Audio-Technica ATH-CKS550iS	<a href="https://www.flipkart.com/audio-technica-ath-cks550is-bl-wired-headset/p/itm655dcec777b7b?pid=ACCEDSZJCKEBCMJK">https://www.flipkart.com/audio-technica-ath-cks550is-bl-wired-headset/p/itm655dcec777b7b?pid=ACCEDSZJCKEBCMJK</a>
		<a href="https://www.audio-technica.com.hk/index.php?op=productdetails&amp;pid=1027&amp;lang=eng">https://www.audio-technica.com.hk/index.php?op=productdetails&amp;pid=1027&amp;lang=eng</a>
		<a href="https://www.bajaa.com/products/audio-technica-ath-cks550is-solid-bass-in-ear-headphones-with-in-line-mic-control">https://www.bajaa.com/products/audio-technica-ath-cks550is-solid-bass-in-ear-headphones-with-in-line-mic-control</a>
		<a href="https://www.gadgets360.com/audio-technica-ath-cks550is-wired-earphones-price-in-india-86766">https://www.gadgets360.com/audio-technica-ath-cks550is-wired-earphones-price-in-india-86766</a>
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		<a href="https://www.livemusic.com.my/headphone-in-ear-monitor/in-ear-monitors/audio-technica-ath-cks550is-solid-bass-in-ear-headphone-earphone-red-cks550is">https://www.livemusic.com.my/headphone-in-ear-monitor/in-ear-monitors/audio-technica-ath-cks550is-solid-bass-in-ear-headphone-earphone-red-cks550is</a>
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		<a href="https://www.rack85.com.sg/product/audio-technica-ath-cks550is-sound-bass-series/?srsltid=AfmBOopn_zP5yUYhpFZ0jJOjcYGNt1tKe0-fB0pQw3Ew5RUauYYHrni_">https://www.rack85.com.sg/product/audio-technica-ath-cks550is-sound-bass-series/?srsltid=AfmBOopn_zP5yUYhpFZ0jJOjcYGNt1tKe0-fB0pQw3Ew5RUauYYHrni_</a>
		<a href="https://www.pccasegear.com/products/25412/audio-technica-ath-cks550is-in-ear-headphones-black?srsltid=AfmBOorpRW0LErJ96hMzkIB9MQIkjBFpaeBrc72y_wGMe3rR0sEWKhMT">https://www.pccasegear.com/products/25412/audio-technica-ath-cks550is-in-ear-headphones-black?srsltid=AfmBOorpRW0LErJ96hMzkIB9MQIkjBFpaeBrc72y_wGMe3rR0sEWKhMT</a>
		<a href="https://www.lazada.com.my/products/audio-technica-ath-cks550is-solid-bass-earphones-with-mic-and-control-wired-in-ear-i2025670864.html">https://www.lazada.com.my/products/audio-technica-ath-cks550is-solid-bass-earphones-with-mic-and-control-wired-in-ear-i2025670864.html</a>
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	1MORE Triple Driver In-Ear Earp	<a href="https://www.amazon.in/1MORE-Triple-Driver-Earphone-Mic/dp/B01KB9K9Z0">https://www.amazon.in/1MORE-Triple-Driver-Earphone-Mic/dp/B01KB9K9Z0</a>
		<a href="https://www.headphonezone.in/products/1more-triple-driver?srsltid=AfmBOorSLeLdIvwEEb1RkLcsgF_5nWvLLyILb05i3Mf7dCL2nBhqBVU9">https://www.headphonezone.in/products/1more-triple-driver?srsltid=AfmBOorSLeLdIvwEEb1RkLcsgF_5nWvLLyILb05i3Mf7dCL2nBhqBVU9</a>
		<a href="https://www.flipkart.com/1more-triple-driver-earphones-high-resolution-certified-mic-volume-rockers-wired-headset/p/itm5701b8a5160e7">https://www.flipkart.com/1more-triple-driver-earphones-high-resolution-certified-mic-volume-rockers-wired-headset/p/itm5701b8a5160e7</a>
		<a href="https://www.soundguys.com/1more-triple-driver-in-ears-review-16647/">https://www.soundguys.com/1more-triple-driver-in-ears-review-16647/</a>
		<a href="https://hifisoundenthusiast.com/portfolio/1more-triple-driver-in-ear-headphones-quick-review/">https://hifisoundenthusiast.com/portfolio/1more-triple-driver-in-ear-headphones-quick-review/</a>
		<a href="https://www.rtings.com/headphones/reviews/1more/triple-driver">https://www.rtings.com/headphones/reviews/1more/triple-driver</a>
		<a href="https://global.1more.com/products/triple-driver-in-ear-headphones">https://global.1more.com/products/triple-driver-in-ear-headphones</a>
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		<a href="https://www.hifizine.com/2016/08/1more-triple-drivers/">https://www.hifizine.com/2016/08/1more-triple-drivers/</a>
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		<a href="https://1moreuk.co.uk/products/triple-driver-wire-hi-res-in-ear-headphones?srsltid=AfmBOooJVf4dC6Ku8Yzl_DDDc8Dk3AoJskVLpZ9zcozxc3w-jhkPN_YN">https://1moreuk.co.uk/products/triple-driver-wire-hi-res-in-ear-headphones?srsltid=AfmBOooJVf4dC6Ku8Yzl_DDDc8Dk3AoJskVLpZ9zcozxc3w-jhkPN_YN</a>
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		<a href="https://av1group.com.sg/products/1more-triple-driver-in-ear-headphones?srsltid=AfmBOopRI2n8Cty3hH2qVNNpDTRgU7t7qnisHvXJNAEkOpM-85NlwZDU">https://av1group.com.sg/products/1more-triple-driver-in-ear-headphones?srsltid=AfmBOopRI2n8Cty3hH2qVNNpDTRgU7t7qnisHvXJNAEkOpM-85NlwZDU</a>
		<a href="https://www.ubuy.co.in/product/1GB4JKQK8-1more-triple-driver-in-ear-earphones-hi-res-headphones-with-high-resolution-bass-driven-sound-mems-mic-in-line-remote-high-fidelity-for?srsltid=AfmBOorSXcqZKTnbyk_YQMIjRKcjB0nMJGJ_TzUF1yirkbi65VRGSd9R">https://www.ubuy.co.in/product/1GB4JKQK8-1more-triple-driver-in-ear-earphones-hi-res-headphones-with-high-resolution-bass-driven-sound-mems-mic-in-line-remote-high-fidelity-for?srsltid=AfmBOorSXcqZKTnbyk_YQMIjRKcjB0nMJGJ_TzUF1yirkbi65VRGSd9R</a>
		<a href="https://www.vplak.com/1more-triple-driver-premium-in-ear-headphone-with-mic-p363">https://www.vplak.com/1more-triple-driver-premium-in-ear-headphone-with-mic-p363</a>
Keychain LED flashlights	Streamlight Nano Light	<a href="https://www.streamlight.com/products/detail/nano-light">https://www.streamlight.com/products/detail/nano-light</a>
		<a href="https://www.streamlight.com/products/detail/pink-nano-light">https://www.streamlight.com/products/detail/pink-nano-light</a>
		<a href="https://www.streamlight.com/products/detail/blue-nano-light">https://www.streamlight.com/products/detail/blue-nano-light</a>

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		<a href="https://fireandsafety.com/product/streamlight-nano-light-flashlight/">https://fireandsafety.com/product/streamlight-nano-light-flashlight/</a>
		<a href="https://www.outdoortactical.com.sg/products/streamlight-nano-light-4-x-iec-lr41-white-led?srsltid=AfmBOorymzPHOzCrqbZhkip7KPBphMjglpPDjcDaH8jCn3vLcidrz-vF">https://www.outdoortactical.com.sg/products/streamlight-nano-light-4-x-iec-lr41-white-led?srsltid=AfmBOorymzPHOzCrqbZhkip7KPBphMjglpPDjcDaH8jCn3vLcidrz-vF</a>
		<a href="https://gb.jbtools.com/streamlight-73001-nano-light-white-led-black/?srsltid=AfmBOoocJ_wYXg9SiFp0lNoaHNKOjkE4RBrKfusIVOPDIp6InF5KYWbA">https://gb.jbtools.com/streamlight-73001-nano-light-white-led-black/?srsltid=AfmBOoocJ_wYXg9SiFp0lNoaHNKOjkE4RBrKfusIVOPDIp6InF5KYWbA</a>
		<a href="https://www.sosproducts.com/Streamlight-Nano-Light-Keychain-Flashlight-p/54311.htm">https://www.sosproducts.com/Streamlight-Nano-Light-Keychain-Flashlight-p/54311.htm</a>
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		<a href="https://www.tenaquip.com/product/streamlight-nano-light-flashlight-73001-xc392?srsltid=AfmBOop49DL0dpfx71gGNYXy7Nko2R6TwMqQN0FZYqBV64GUu9pODC7M">https://www.tenaquip.com/product/streamlight-nano-light-flashlight-73001-xc392?srsltid=AfmBOop49DL0dpfx71gGNYXy7Nko2R6TwMqQN0FZYqBV64GUu9pODC7M</a>
		<a href="https://theemsstore.com/streamlight-nano-light#!">https://theemsstore.com/streamlight-nano-light#!</a>
		<a href="https://www.bosssafety.com/p-11871-streamlight-nano-light-flashlight.aspx">https://www.bosssafety.com/p-11871-streamlight-nano-light-flashlight.aspx</a>
		<a href="https://www.basspro.com/shop/en/streamlight-nano-light-micro-miniature-key-chain-flashlight">https://www.basspro.com/shop/en/streamlight-nano-light-micro-miniature-key-chain-flashlight</a>
		<a href="https://theemsstore.com/streamlight-nano-light#!">https://theemsstore.com/streamlight-nano-light#!</a>
	Nite Ize Inova Microlight	<a href="http://www.niteize.co.kr/product/INOVA-Microlight.html">http://www.niteize.co.kr/product/INOVA-Microlight.html</a>
		<a href="https://www.nite-ize.eu/wo/products/inova-microlight-black-white-led-bb-w-7376.html">https://www.nite-ize.eu/wo/products/inova-microlight-black-white-led-bb-w-7376.html</a>
		<a href="https://www.ifixit.com/Device/Nite_Ize_Inova_Microlight?srsltid=AfmBOoqIUkJqudWmtxY8c2VTbozhCY8WFU4Tv97m3e9YAmGN8IA5bVY">https://www.ifixit.com/Device/Nite_Ize_Inova_Microlight?srsltid=AfmBOoqIUkJqudWmtxY8c2VTbozhCY8WFU4Tv97m3e9YAmGN8IA5bVY</a>
		<a href="https://www.ebay.com/p/127186411">https://www.ebay.com/p/127186411</a>
		<a href="https://www.campmor.com/products/nite-ize-inova-microlight?variant=32207194685577">https://www.campmor.com/products/nite-ize-inova-microlight?variant=32207194685577</a>
		<a href="https://gooutdoor.com.my/product/nite-ize-inova-sts-microlight/">https://gooutdoor.com.my/product/nite-ize-inova-sts-microlight/</a>
		<a href="https://www.galls.com/inova-microlight-flashlight-led">https://www.galls.com/inova-microlight-flashlight-led</a>
		<a href="https://gatewayace.com/p/nite-ize-inova-lumens-gray-led-micro-light-battery-094664026421">https://gatewayace.com/p/nite-ize-inova-lumens-gray-led-micro-light-battery-094664026421</a>

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		<a href="https://www.digitec.ch/en/s1/product/nite-ize-inova-microlight-sts-16-lm-flashlight-35394769">https://www.digitec.ch/en/s1/product/nite-ize-inova-microlight-sts-16-lm-flashlight-35394769</a>
		<a href="https://flashlightsunlimited.com/inovamicro.htm">https://flashlightsunlimited.com/inovamicro.htm</a>
		<a href="https://www.familycycles.ca/nite-ize-microlight.html">https://www.familycycles.ca/nite-ize-microlight.html</a>
		<a href="https://offbase.co/products/inova-classic-microlight-led-light?srsltid=AfmBOogBEsd4LLn9aFOqjxi0agGtWzcea4oK_cnEi5m3deIcPK7Go6">https://offbase.co/products/inova-classic-microlight-led-light?srsltid=AfmBOogBEsd4LLn9aFOqjxi0agGtWzcea4oK_cnEi5m3deIcPK7Go6</a>
		<a href="https://www.getstorganized.com/product/inova-microlight/">https://www.getstorganized.com/product/inova-microlight/</a>
	Photon Micro-Light II	<a href="https://www.photonlight.com/products/photon-micro-light-ii-led-keychain-flashlight?srsltid=AfmBOorcVNniWt4RqOpntUQhqk-ZFroeCXjh82ywsklop63VNJlfgfjt">https://www.photonlight.com/products/photon-micro-light-ii-led-keychain-flashlight?srsltid=AfmBOorcVNniWt4RqOpntUQhqk-ZFroeCXjh82ywsklop63VNJlfgfjt</a>
		<a href="https://lockpicktools.com/the-photon-micro-light-ii/">https://lockpicktools.com/the-photon-micro-light-ii/</a>
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		<a href="https://www.celestaire.com/product/photon-micro-light-ii/">https://www.celestaire.com/product/photon-micro-light-ii/</a>
		<a href="https://www.solkoasurvival.com/Photon-Micro-Light-II_p_71.html">https://www.solkoasurvival.com/Photon-Micro-Light-II_p_71.html</a>
		<a href="https://www.knivesandtools.com/en/pt/-photon-micro-light-ii.htm">https://www.knivesandtools.com/en/pt/-photon-micro-light-ii.htm</a>
		<a href="https://edcgear.co.uk/collections/photon-microlight?srsltid=AfmBOoo7pMXj70jdY51iGbNKaC34k5UTr0flUMrUnb1VbGmzZRozBhz">https://edcgear.co.uk/collections/photon-microlight?srsltid=AfmBOoo7pMXj70jdY51iGbNKaC34k5UTr0flUMrUnb1VbGmzZRozBhz</a>
		<a href="https://www.bushgear.co.uk/products/photon-micro-light-ii">https://www.bushgear.co.uk/products/photon-micro-light-ii</a>
		<a href="https://heinnie.com/photon-microlight-ii/">https://heinnie.com/photon-microlight-ii/</a>
		<a href="https://www.survivalsupplies.com.au/photon-ii-white-beam">https://www.survivalsupplies.com.au/photon-ii-white-beam</a>
		<a href="https://acwtactical.com/products/photon-micro-light">https://acwtactical.com/products/photon-micro-light</a>
		<a href="https://www.ubuy.co.in/product/46OIR3A-micro-light-ii-white?srsltid=AfmBOooGaLdQvfatWNzb0xKYLacIvXS8qXRvEK56RzZLoVI0yGXfqGnv">https://www.ubuy.co.in/product/46OIR3A-micro-light-ii-white?srsltid=AfmBOooGaLdQvfatWNzb0xKYLacIvXS8qXRvEK56RzZLoVI0yGXfqGnv</a>
		<a href="https://flashlightsunlimited.com/microlight2.htm">https://flashlightsunlimited.com/microlight2.htm</a>
		<a href="https://www.lecomptoiramericain.com/en/pocket-keychain/1294-lampe-photon-micro-light-2.html">https://www.lecomptoiramericain.com/en/pocket-keychain/1294-lampe-photon-micro-light-2.html</a>
		<a href="https://www.shorepowerinc.com/lri-ppk.html">https://www.shorepowerinc.com/lri-ppk.html</a>
	Maglite Solitaire LED	<a href="https://maglite.com/products/solitaire-led-flashlight?srsltid=AfmBOopRCNGnBqccfTLyPaBehz-q1H2pCL-FVoSd6PwJBNv-QCrVhDiS">https://maglite.com/products/solitaire-led-flashlight?srsltid=AfmBOopRCNGnBqccfTLyPaBehz-q1H2pCL-FVoSd6PwJBNv-QCrVhDiS</a>

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		<a href="https://maglite.com/products/maglite-solitaire-led-spectrum-series-warm-white?srsltid=AfmBOoq98hyWTMemsMd2z8TrefRchb9WEZFz4QaxWatZlxFLIkUIrKli">https://maglite.com/products/maglite-solitaire-led-spectrum-series-warm-white?srsltid=AfmBOoq98hyWTMemsMd2z8TrefRchb9WEZFz4QaxWatZlxFLIkUIrKli</a>
		<a href="https://maglite.com/products/maglite-solitaire-led-halo?srsltid=AfmBOorEnJMNams2lyAdINSyJX0EE7ofwKqpUotcHsAIC6oK-PPE4WTE">https://maglite.com/products/maglite-solitaire-led-halo?srsltid=AfmBOorEnJMNams2lyAdINSyJX0EE7ofwKqpUotcHsAIC6oK-PPE4WTE</a>
		<a href="https://www.maglite.eu/en/products/solitaire-led?srsltid=AfmBOooQTZd2LQZ5CHIjHaCeI3OocJnDND3op0EZRCpxDNjXsYBnsunl">https://www.maglite.eu/en/products/solitaire-led?srsltid=AfmBOooQTZd2LQZ5CHIjHaCeI3OocJnDND3op0EZRCpxDNjXsYBnsunl</a>
		<a href="https://www.torchdirect.co.uk/products/maglite-solitaire-1-cell-aaa-led-torch">https://www.torchdirect.co.uk/products/maglite-solitaire-1-cell-aaa-led-torch</a>
		<a href="https://maglite.com/products/maglite-solitaire-led-spectrum-series-red?srsltid=AfmBOorBzWDjaQatB7bW5FO33f6yJXN5uQvuFCoUhRKf7iPzMk2-cmho">https://maglite.com/products/maglite-solitaire-led-spectrum-series-red?srsltid=AfmBOorBzWDjaQatB7bW5FO33f6yJXN5uQvuFCoUhRKf7iPzMk2-cmho</a>
		<a href="https://www.knivesandtools.dk/en/ct/maglite-solitaire.htm">https://www.knivesandtools.dk/en/ct/maglite-solitaire.htm</a>
		<a href="https://www.ubuy.co.in/product/X53ZURGK-maglite-solitaire-led-aaa-flashlight-presentation-box?srsltid=AfmBOoqN6b80gUGIO87BJoMe_BUCJu4Rtd4fNJbbwkbTnaXbVTTEVqlh">https://www.ubuy.co.in/product/X53ZURGK-maglite-solitaire-led-aaa-flashlight-presentation-box?srsltid=AfmBOoqN6b80gUGIO87BJoMe_BUCJu4Rtd4fNJbbwkbTnaXbVTTEVqlh</a>
		<a href="https://www.cart2india.com/handheld-flashlights/maglite-solitaire-led-1cell-aaa-flashlight-blue/0000000004355449078">https://www.cart2india.com/handheld-flashlights/maglite-solitaire-led-1cell-aaa-flashlight-blue/0000000004355449078</a>
		<a href="https://in.rsdelivers.com/product/maglite/sj3a092/maglite-led-keyring-torch-grey-37-1m-81-mm/8998400?srsltid=AfmBOooxF2Wp-Y2_RfdlluUm7LmoRfUylhNCiXZ6xc4zby5uEQ7QMzHO">https://in.rsdelivers.com/product/maglite/sj3a092/maglite-led-keyring-torch-grey-37-1m-81-mm/8998400?srsltid=AfmBOooxF2Wp-Y2_RfdlluUm7LmoRfUylhNCiXZ6xc4zby5uEQ7QMzHO</a>
		<a href="https://www.tanotis.com/products/maglite-solitaire-spectrum-series-led-aaa-blue-flashlight-presentation-box?srsltid=AfmBOooIn2E297g4DzD5wT4u9QTZYoch-ci5UrTwIZfyQDVIGGYe199a">https://www.tanotis.com/products/maglite-solitaire-spectrum-series-led-aaa-blue-flashlight-presentation-box?srsltid=AfmBOooIn2E297g4DzD5wT4u9QTZYoch-ci5UrTwIZfyQDVIGGYe199a</a>
		<a href="https://www.valostore.com/en/product/maglite_solitaire_led_37_lm">https://www.valostore.com/en/product/maglite_solitaire_led_37_lm</a>
		<a href="https://budgetlightforum.com/t/review-maglite-solitaire-led/12127">https://budgetlightforum.com/t/review-maglite-solitaire-led/12127</a>
		<a href="https://www.bhphotovideo.com/c/product/1429291-REG/maglite_sj3amw6_national_breast_cancer_foundation.html">https://www.bhphotovideo.com/c/product/1429291-REG/maglite_sj3amw6_national_breast_cancer_foundation.html</a>
		<a href="https://hpgbrands.com/j3a/maglite-solitaire-led-spectrum/#__bulk-Standard-usd">https://hpgbrands.com/j3a/maglite-solitaire-led-spectrum/#__bulk-Standard-usd</a>
	Coast G19 LED	<a href="https://www.amazon.in/Coast-19490-Inspection-Flashlight-Black/dp/B008X2QMKY">https://www.amazon.in/Coast-19490-Inspection-Flashlight-Black/dp/B008X2QMKY</a>

Product	Model	Weblink
	Keychain	
	Flashlig	
		<a href="https://www.torchdirect.co.uk/products/coast-g19-led-torch">https://www.torchdirect.co.uk/products/coast-g19-led-torch</a>
		<a href="https://in.element14.com/coast/g19/inspection-pen-light-20m-aaa-batt/dp/3127656?srsId=AfmBOooajPvK-gNNVA5Z5hgf8MoZXiXs488RIM2FoTbsdynpIfVLRXWo">https://in.element14.com/coast/g19/inspection-pen-light-20m-aaa-batt/dp/3127656?srsId=AfmBOooajPvK-gNNVA5Z5hgf8MoZXiXs488RIM2FoTbsdynpIfVLRXWo</a>
		<a href="https://www.ubuy.co.in/product/CXSBVM8-coast-19384-coast-g19-inspection-beam-led-penlight-with-adjustable-pocket-clip-and-consistent-edge-to-edge-brightness-black?srsId=AfmBOopU0Z1ZmpxQz64hZeLgOngatj9CGY8atYP7nOP_0cgiPzs-C0fH">https://www.ubuy.co.in/product/CXSBVM8-coast-19384-coast-g19-inspection-beam-led-penlight-with-adjustable-pocket-clip-and-consistent-edge-to-edge-brightness-black?srsId=AfmBOopU0Z1ZmpxQz64hZeLgOngatj9CGY8atYP7nOP_0cgiPzs-C0fH</a>
		<a href="https://pilotshop.co.nz/products/coast-g19-dual-colour-led-inspection-torch?srsId=AfmBOoql4lvDgxtjoYsXWO3cKRIWiDCRApxNOF_6d1JEIXDBHw6GB02">https://pilotshop.co.nz/products/coast-g19-dual-colour-led-inspection-torch?srsId=AfmBOoql4lvDgxtjoYsXWO3cKRIWiDCRApxNOF_6d1JEIXDBHw6GB02</a>
		<a href="https://www.walshengineering.com/coast-g19-led-torch.html">https://www.walshengineering.com/coast-g19-led-torch.html</a>
		<a href="https://www.toolstoreuk.co.uk/coast-g19-inspection-torch/p20556">https://www.toolstoreuk.co.uk/coast-g19-inspection-torch/p20556</a>
		<a href="https://www.flipkart.com/coast-g19-led-inspection-beam-flashlight-torch/p/itm5e4fcc80f5108">https://www.flipkart.com/coast-g19-led-inspection-beam-flashlight-torch/p/itm5e4fcc80f5108</a>
		<a href="https://www.bhphotovideo.com/c/product/1439263-REG/coast_19490_g19_inspection_beam_penlight.html/overview">https://www.bhphotovideo.com/c/product/1439263-REG/coast_19490_g19_inspection_beam_penlight.html/overview</a>
		<a href="https://www.eio.com/products/coast-g19-led-inspection-flashlight?pr_prod_strat=e5_desc&amp;pr_rec_id=9440601b2&amp;pr_rec_pid=1847714414658&amp;pr_ref_pid=1847713005634&amp;pr_seq=uniform&amp;srsId=AfmBOodvWXrnp2oQ5bnQd8WC5CQk5VT_aAraodBPU4kJJdYoUotQgW">https://www.eio.com/products/coast-g19-led-inspection-flashlight?pr_prod_strat=e5_desc&amp;pr_rec_id=9440601b2&amp;pr_rec_pid=1847714414658&amp;pr_ref_pid=1847713005634&amp;pr_seq=uniform&amp;srsId=AfmBOodvWXrnp2oQ5bnQd8WC5CQk5VT_aAraodBPU4kJJdYoUotQgW</a>
		<a href="https://www.aerophoenix.com/COAST-G19-MINI-WHT-LED-INSPECTION-LIGHT">https://www.aerophoenix.com/COAST-G19-MINI-WHT-LED-INSPECTION-LIGHT</a>
		<a href="https://www.sportsmans.com/camping-gear-supplies/lighting/flashlights/coast-g19-led-pen-light-flashlight/p/1528790?srsId=AfmBOoqyVBtvXu6oAFA3RcV18vIJYMfAkri-HVs1Nwej5bRx5-7adbH3">https://www.sportsmans.com/camping-gear-supplies/lighting/flashlights/coast-g19-led-pen-light-flashlight/p/1528790?srsId=AfmBOoqyVBtvXu6oAFA3RcV18vIJYMfAkri-HVs1Nwej5bRx5-7adbH3</a>
		<a href="https://theemsstore.com/coast-g19-led-penlight#/">https://theemsstore.com/coast-g19-led-penlight#/</a>
		<a href="https://www.piratescave.co.uk/coast-g19-penlight.html">https://www.piratescave.co.uk/coast-g19-penlight.html</a>
		<a href="https://www.compasspromos.com/product/coast-aaa-inspection-beam-penlight/g19">https://www.compasspromos.com/product/coast-aaa-inspection-beam-penlight/g19</a>
	ThruNite Ti3	<a href="https://backpackinglight.com/thrunite-ti3-flashlight-review/">https://backpackinglight.com/thrunite-ti3-flashlight-review/</a>
		<a href="https://www.candlepowerforums.com/threads/thrunite-ti3-xp-g2-1xaaa-keychain-light-review-runtimes-beamshots-video.389766/">https://www.candlepowerforums.com/threads/thrunite-ti3-xp-g2-1xaaa-keychain-light-review-runtimes-beamshots-video.389766/</a>

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		<a href="https://tylerwangsgard.com/thrunite-ti3-flashlight">https://tylerwangsgard.com/thrunite-ti3-flashlight</a>
		<a href="https://www.liteshop.com.au/content/thrunite-ti3-v2-120-lumen-aaa-led-keyring-torch/?srsltid=AfmBOoq5HLISiMkCZ8O6yG2P2EznAu7LHYWywBT-4p5c67SgkzA2HRrh">https://www.liteshop.com.au/content/thrunite-ti3-v2-120-lumen-aaa-led-keyring-torch/?srsltid=AfmBOoq5HLISiMkCZ8O6yG2P2EznAu7LHYWywBT-4p5c67SgkzA2HRrh</a>
		<a href="https://miniequipments.com/en/2018/03/12/thrunite-ti3-a-small-flashlight-full-of-qualities/">https://miniequipments.com/en/2018/03/12/thrunite-ti3-a-small-flashlight-full-of-qualities/</a>
		<a href="https://www.desertcart.in/products/47990254-thrunite-ti3-cree-led-120-lumen-key-ring-aaa-flashlight-neutral-white">https://www.desertcart.in/products/47990254-thrunite-ti3-cree-led-120-lumen-key-ring-aaa-flashlight-neutral-white</a>
		<a href="https://boatyardmalaysia.com/products/1001025031?srsltid=AfmBOoqKCzqYWhz098tbw4pH9ObwPulUoh6tINgvjzEj2_cPZMZ2X7qS">https://boatyardmalaysia.com/products/1001025031?srsltid=AfmBOoqKCzqYWhz098tbw4pH9ObwPulUoh6tINgvjzEj2_cPZMZ2X7qS</a>
		<a href="https://www.ebay.com/itm/256658771155">https://www.ebay.com/itm/256658771155</a>
		<a href="https://newnestshop.com/products/thrunite-ti3-v2-keychain-flashlight-cree-xp-g2-led-120-lumens-mini-torch-aaa-battery-edc-pocket-penlight-portable-emergency-light-neutral-white-nw-ti3-v2-nw?variant=40641675624599">https://newnestshop.com/products/thrunite-ti3-v2-keychain-flashlight-cree-xp-g2-led-120-lumens-mini-torch-aaa-battery-edc-pocket-penlight-portable-emergency-light-neutral-white-nw-ti3-v2-nw?variant=40641675624599</a>
		<a href="https://www.myminifactory.com/object/3d-print-thrunite-ti3-flashlight-light-diffuser-253903">https://www.myminifactory.com/object/3d-print-thrunite-ti3-flashlight-light-diffuser-253903</a>
		<a href="https://www.taschenlampen-forum.de/threads/reviewthelight-thrunite-ti3-1xaaa-150-lumens.35854/">https://www.taschenlampen-forum.de/threads/reviewthelight-thrunite-ti3-1xaaa-150-lumens.35854/</a>
		<a href="https://www.uk-preppers.co.uk/forum/viewtopic.php?t=13642&amp;start=10">https://www.uk-preppers.co.uk/forum/viewtopic.php?t=13642&amp;start=10</a>
Emergency radio	Kaito KA500 5-way powered emerg	<a href="https://www.amazon.in/Kaito-Electronics-KA500BLK-Voyager-Emergency/dp/B001F0MNRM">https://www.amazon.in/Kaito-Electronics-KA500BLK-Voyager-Emergency/dp/B001F0MNRM</a>
		<a href="https://kaito.us/products/ka500ylw?srsltid=AfmBOopAXjdXvRZy2x_rGh mh7a7iOgOD-QC9TMkmcQ_xCQdPAgPRbOwb">https://kaito.us/products/ka500ylw?srsltid=AfmBOopAXjdXvRZy2x_rGh mh7a7iOgOD-QC9TMkmcQ_xCQdPAgPRbOwb</a>
		<a href="https://crowcrowcrow.com/products/a000227673usin?srsltid=AfmBOoo5nf uHltFbl9i9UtgUBlf-EGAkzzTkNzHaMbT_9h_MAOkqYFct">https://crowcrowcrow.com/products/a000227673usin?srsltid=AfmBOoo5nf uHltFbl9i9UtgUBlf-EGAkzzTkNzHaMbT_9h_MAOkqYFct</a>
		<a href="https://www.shopclues.com/kaito-ka500-5-way-powered-emergency-am-fm-sw-noaa-weather-alert-radio-with-solar-dynamo-crank-flashlight-and-reading-lamp-color-black.html?srsltid=AfmBOoqB4J-NmMKwyOZRdixBNqVt_hDGSf59BAyZCJNNwPDRWjDqBW4K">https://www.shopclues.com/kaito-ka500-5-way-powered-emergency-am-fm-sw-noaa-weather-alert-radio-with-solar-dynamo-crank-flashlight-and-reading-lamp-color-black.html?srsltid=AfmBOoqB4J-NmMKwyOZRdixBNqVt_hDGSf59BAyZCJNNwPDRWjDqBW4K</a>

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		<a href="https://www.walmart.com/ip/Kaito-KA500-Voyager-5-way-Powered-Emergency-AM-FM-SW-NOAA-Weather-Alert-Radio-with-Solar-Dynamo-Crank-Flashlight-and-Reading-Lamp-Black/55488315">https://www.walmart.com/ip/Kaito-KA500-Voyager-5-way-Powered-Emergency-AM-FM-SW-NOAA-Weather-Alert-Radio-with-Solar-Dynamo-Crank-Flashlight-and-Reading-Lamp-Black/55488315</a>
		<a href="https://www.amazon.com.be/-/en/Powered-Emergency-Weather-Flashlight-Reading/dp/B003A21DQA">https://www.amazon.com.be/-/en/Powered-Emergency-Weather-Flashlight-Reading/dp/B003A21DQA</a>
		<a href="https://www.survivalsupplies.com.au/kaito-voyager-emergency-radio-ka500">https://www.survivalsupplies.com.au/kaito-voyager-emergency-radio-ka500</a>
		<a href="https://www.gigaparts.com/kaito-ka500-5-way-powered-am-fm-noaa-weather-radio-black.html?srsId=AfmBOoqMGYNuzqeusEB2-TR_TjtZtDrH1Z3mszLGCWE7vp1c7026F3h">https://www.gigaparts.com/kaito-ka500-5-way-powered-am-fm-noaa-weather-radio-black.html?srsId=AfmBOoqMGYNuzqeusEB2-TR_TjtZtDrH1Z3mszLGCWE7vp1c7026F3h</a>
		<a href="https://explorersweb.com/kaito-ka500-emergency-radio/">https://explorersweb.com/kaito-ka500-emergency-radio/</a>
		<a href="https://shopsolarpower.com/product/Radios-39/deals/Kaito-KA500-5way-Powered-Emergency-AMFMSW-Weather-Alert-Radio-Yellow-2590">https://shopsolarpower.com/product/Radios-39/deals/Kaito-KA500-5way-Powered-Emergency-AMFMSW-Weather-Alert-Radio-Yellow-2590</a>
		<a href="https://commonsensehome.com/kaito-ka500-review/">https://commonsensehome.com/kaito-ka500-review/</a>
		<a href="https://www.emergencykits.com/emergency-supplies/radios-and-communication/multi-function-radios/voyager-emergency-radio-ka500/">https://www.emergencykits.com/emergency-supplies/radios-and-communication/multi-function-radios/voyager-emergency-radio-ka500/</a>
		<a href="https://www.newegg.ca/p/1B9-00HC-00001">https://www.newegg.ca/p/1B9-00HC-00001</a>
		<a href="https://www.sears.com/kaito-ka500blk-kaito-ka500-5-way-powered-emergency-am-fm-sw-noaa-weather-alert-radio-with-solar-dynamo-crank-flashlight-and-reading/p-A018612791">https://www.sears.com/kaito-ka500blk-kaito-ka500-5-way-powered-emergency-am-fm-sw-noaa-weather-alert-radio-with-solar-dynamo-crank-flashlight-and-reading/p-A018612791</a>
		<a href="https://snapklik.com/en-ca/product/kaito-ka500-5-way-powered-solar-power-dynamo-crank-wind-up-emergency-am-fm-sw-noaa-weather-alert-radio-with-flashlight-reading-lamp-and-cellphone-charger-yellow/05734PA7GGW15?srsId=AfmBOor1GTl2L42yyoW4egRIwT0pUXGkB258-_y1EPJ3CvsdfQnkXARS">https://snapklik.com/en-ca/product/kaito-ka500-5-way-powered-solar-power-dynamo-crank-wind-up-emergency-am-fm-sw-noaa-weather-alert-radio-with-flashlight-reading-lamp-and-cellphone-charger-yellow/05734PA7GGW15?srsId=AfmBOor1GTl2L42yyoW4egRIwT0pUXGkB258-_y1EPJ3CvsdfQnkXARS</a>
Eton FRX3 Emergency Radio		<a href="https://etoncorp.com/products/scorpion-ii?srsId=AfmBOor2KXIOXufngzPYYufJPYvlwUKnoqqHVzEtpYDrVSi_YC-8eaGg">https://etoncorp.com/products/scorpion-ii?srsId=AfmBOor2KXIOXufngzPYYufJPYvlwUKnoqqHVzEtpYDrVSi_YC-8eaGg</a>
		<a href="https://www.amazon.com/Eton-Multipowered-Portable-Emergency-Flashlight/dp/B00WS6SKTM?th=1">https://www.amazon.com/Eton-Multipowered-Portable-Emergency-Flashlight/dp/B00WS6SKTM?th=1</a>
		<a href="https://www.homedepot.com/p/Eton-Scorpion-II-Rugged-Portable-Weather-Alert-Multi-Purpose-Digital-Radio-w-Smartphone-Charging-and-Crank-Power-Back-Up-NSP101WXGR/302684732">https://www.homedepot.com/p/Eton-Scorpion-II-Rugged-Portable-Weather-Alert-Multi-Purpose-Digital-Radio-w-Smartphone-Charging-and-Crank-Power-Back-Up-NSP101WXGR/302684732</a>
		<a href="https://www.dxengineering.com/parts/eon-nsp101wxgr?srsId=AfmBOoq7dq8izB1fBKa9aRjesnhkXcl480V7IGkhaQwwAkteWTO40UQ0">https://www.dxengineering.com/parts/eon-nsp101wxgr?srsId=AfmBOoq7dq8izB1fBKa9aRjesnhkXcl480V7IGkhaQwwAkteWTO40UQ0</a>

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		<a href="https://www.ebay.com/itm/196384766372">https://www.ebay.com/itm/196384766372</a>
		<a href="https://www.networkhardwares.com/en-in/products/eton-nsp101wxgr-eton-scorpion-ii-weather-alert-radio-nsp101wxgr?srsltid=AfmBOoqZ1sWjIE-um_3NCUdQyAnoqM0zwq2EoK5pzlgyG1hsNjHuXL4m">https://www.networkhardwares.com/en-in/products/eton-nsp101wxgr-eton-scorpion-ii-weather-alert-radio-nsp101wxgr?srsltid=AfmBOoqZ1sWjIE-um_3NCUdQyAnoqM0zwq2EoK5pzlgyG1hsNjHuXL4m</a>
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		<a href="https://www.lowes.com/pd/Eton-Eton-Scorpion-II-Rugged-Multipowered-Portable-Emergency-Weather-Radio-and-Flashlight/5000299503">https://www.lowes.com/pd/Eton-Eton-Scorpion-II-Rugged-Multipowered-Portable-Emergency-Weather-Radio-and-Flashlight/5000299503</a>
		<a href="https://www.toolboxsupply.com/products/eaton-nsp101wxgr-scorpion-ii-rugged-multi-powered-weather-radio-flashlight-5v">https://www.toolboxsupply.com/products/eaton-nsp101wxgr-scorpion-ii-rugged-multi-powered-weather-radio-flashlight-5v</a>
		<a href="https://www.rescue-essentials.com/eton-scorpion-ii/">https://www.rescue-essentials.com/eton-scorpion-ii/</a>
		<a href="https://sregear.com/products/eton-scorpion-ii?srsltid=AfmBOor3NvELVTEv0Yr4WHEKE4e291eEV15rTIw7tV2MXke49z78JP7k">https://sregear.com/products/eton-scorpion-ii?srsltid=AfmBOor3NvELVTEv0Yr4WHEKE4e291eEV15rTIw7tV2MXke49z78JP7k</a>
		<a href="https://www.u-buy.com.ng/product/2KBKCFK-eton-rugged-multipowered-portable-emergency-weather-radio-flashlight-green-nsp101wxgr?srsltid=AfmBOopyfQfnLiQnYxjWiOOwwb2WPwIQmWVwmx_egMmAoDT2x6kT4Pvg">https://www.u-buy.com.ng/product/2KBKCFK-eton-rugged-multipowered-portable-emergency-weather-radio-flashlight-green-nsp101wxgr?srsltid=AfmBOopyfQfnLiQnYxjWiOOwwb2WPwIQmWVwmx_egMmAoDT2x6kT4Pvg</a>
		<a href="https://cartoys.com/products/eton-scorpion-ii">https://cartoys.com/products/eton-scorpion-ii</a>
	C. Crane CC Solar Observer	<a href="https://ccrane.com/cc-solar-observer-am-fm-weather-windup-emergency-radio/">https://ccrane.com/cc-solar-observer-am-fm-weather-windup-emergency-radio/</a>
		<a href="https://www.amazon.com/Crane-Observer-Weather-Flashlight-COBS/dp/B005F5II1I">https://www.amazon.com/Crane-Observer-Weather-Flashlight-COBS/dp/B005F5II1I</a>
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		<a href="https://shoptheworld.in/p/b0091jtu84-c-crane-cc-solar-observer-wind-up-solar-emergency-crank-radio-with-am-fm-noaa-weather-built-in-led-flashlight-cellphone-charger-and-ac-adapter?srsltid=AfmBOorJg0XGx8X3m5SDbfmwwLdqQVGfb_jfzzJcLq6BfRqCx8YJYKeX">https://shoptheworld.in/p/b0091jtu84-c-crane-cc-solar-observer-wind-up-solar-emergency-crank-radio-with-am-fm-noaa-weather-built-in-led-flashlight-cellphone-charger-and-ac-adapter?srsltid=AfmBOorJg0XGx8X3m5SDbfmwwLdqQVGfb_jfzzJcLq6BfRqCx8YJYKeX</a>
		<a href="https://radiojayallen.com/crane-cc-radio-solar-emergency-radio/">https://radiojayallen.com/crane-cc-radio-solar-emergency-radio/</a>

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		<a href="https://www.ebay.com/itm/373599568159">https://www.ebay.com/itm/373599568159</a>
		<a href="https://www.radioworld.com/tech-and-gear/product-evaluations/new-solar-radio-is-an-emergency-kit-too">https://www.radioworld.com/tech-and-gear/product-evaluations/new-solar-radio-is-an-emergency-kit-too</a>
		<a href="https://swling.com/blog/2020/12/a-first-look-at-the-new-c-crane-ccradio-solar-portable-sel-powered-am-fm-weather-radio/">https://swling.com/blog/2020/12/a-first-look-at-the-new-c-crane-ccradio-solar-portable-sel-powered-am-fm-weather-radio/</a>
		<a href="https://shopsolarpower.com/product/Radios-39/deals/C-Crane-Co-COBS-CC-Solar-Observer-Wind-Up-Radio-with-AM-FM-Weather-and-built-in-LED-Flashlight-and-AC-Adapter-1008">https://shopsolarpower.com/product/Radios-39/deals/C-Crane-Co-COBS-CC-Solar-Observer-Wind-Up-Radio-with-AM-FM-Weather-and-built-in-LED-Flashlight-and-AC-Adapter-1008</a>
		<a href="https://www.ebay.com/itm/395733611843">https://www.ebay.com/itm/395733611843</a>
		<a href="https://swling.com/blog/tag/c-crane-cc-solar-observer/">https://swling.com/blog/tag/c-crane-cc-solar-observer/</a>
		<a href="https://www.universal-radio.com/catalog/prepare/5767.html">https://www.universal-radio.com/catalog/prepare/5767.html</a>
		<a href="https://www.u-buy.com.ng/product/2M7B6GCW-c-crane-cc-solar-observer-wind-up-radio-with-am-fm-weather-and-built-in-led-flashlight-cobs?srsltid=AfmBOooS-IEDRcuWk6ib_HWip2Z_HSMSG3pUMfb105M2b7aDNjdtyc18">https://www.u-buy.com.ng/product/2M7B6GCW-c-crane-cc-solar-observer-wind-up-radio-with-am-fm-weather-and-built-in-led-flashlight-cobs?srsltid=AfmBOooS-IEDRcuWk6ib_HWip2Z_HSMSG3pUMfb105M2b7aDNjdtyc18</a>
	Sony ICF-S10MK2 Pocket AM FM Ra	<a href="https://www.amazon.in/Sony-ICFS10MK2-Icf-S10Mk2-Sony-Portable-Radio/dp/B00020S7XK">https://www.amazon.in/Sony-ICFS10MK2-Icf-S10Mk2-Sony-Portable-Radio/dp/B00020S7XK</a>
		<a href="https://www.ubuy.co.in/product/103SI8BM-sony-icf-s10mk2-pocket-am-fm-radio-silver?srsltid=AfmBOorTcqvJQMoS4fM8Dqm62NGgsCqr91s_pu2ZaX6x7LghWjia9p0">https://www.ubuy.co.in/product/103SI8BM-sony-icf-s10mk2-pocket-am-fm-radio-silver?srsltid=AfmBOorTcqvJQMoS4fM8Dqm62NGgsCqr91s_pu2ZaX6x7LghWjia9p0</a>
		<a href="https://www.eham.net/reviews/view-product?id=7384">https://www.eham.net/reviews/view-product?id=7384</a>
		<a href="https://www.hsdsonline.com/product/sony-fm-am-pocket-radio-icf-s10mk2/">https://www.hsdsonline.com/product/sony-fm-am-pocket-radio-icf-s10mk2/</a>
		<a href="https://www.newegg.com/p/N82E16882105181?srsltid=AfmBOootQjMpSEr-ZLdkzM1Hs1h0nExk0X-VHqhD-uwxusmhNf811okG">https://www.newegg.com/p/N82E16882105181?srsltid=AfmBOootQjMpSEr-ZLdkzM1Hs1h0nExk0X-VHqhD-uwxusmhNf811okG</a>
		<a href="https://store-outlet.ru/product/265446594463">https://store-outlet.ru/product/265446594463</a>
		<a href="https://www.adorama.com/soicfs10mk2.html">https://www.adorama.com/soicfs10mk2.html</a>
		<a href="https://kuwait.whizzcart.com/product/255272/sony-icf-s10mk2-pocket-am-fm-radio-silver/">https://kuwait.whizzcart.com/product/255272/sony-icf-s10mk2-pocket-am-fm-radio-silver/</a>
		<a href="https://www.tiendamia.cr/p/amz/b00020s7xk/sony-icf-s10mk2-pocket-am-fm-radio-silver">https://www.tiendamia.cr/p/amz/b00020s7xk/sony-icf-s10mk2-pocket-am-fm-radio-silver</a>
		<a href="https://www.bestbuy.com/site/sony-am-fm-pocket-radio-silver/7900612.p?skuId=7900612&amp;intl=nosplash">https://www.bestbuy.com/site/sony-am-fm-pocket-radio-silver/7900612.p?skuId=7900612&amp;intl=nosplash</a>

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	Ambient Weather WR- 111B Emergen	<a href="https://p10.secure.hostingprod.com/@site.ambientweatherstore.com/ssl/Manuals/wr111b.pdf">https://p10.secure.hostingprod.com/@site.ambientweatherstore.com/ssl/Manuals/wr111b.pdf</a>
		<a href="https://www.offgridweb.com/product/ambient-weather-wr-111b-adventurer-emergency-radio/">https://www.offgridweb.com/product/ambient-weather-wr-111b-adventurer-emergency-radio/</a>
		<a href="https://www.ebay.com/itm/135143864175">https://www.ebay.com/itm/135143864175</a>
		<a href="https://shopsolarpower.com/product/Radios-39/deals/Ambient-Weather-WR111B-Emergency-Solar-Hand-Crank-AMFMNOAA-Digital-Radio-Flashlight-Cell-Phone-Charger-with-NOAA-Certified-Weather-Alert-Cables-277">https://shopsolarpower.com/product/Radios-39/deals/Ambient-Weather-WR111B-Emergency-Solar-Hand-Crank-AMFMNOAA-Digital-Radio-Flashlight-Cell-Phone-Charger-with-NOAA-Certified-Weather-Alert-Cables-277</a>
		<a href="https://www.amazon.com/Accessory-USA-Adapter-WR-111-B-AC-Emergency/dp/B072PY9Y1P">https://www.amazon.com/Accessory-USA-Adapter-WR-111-B-AC-Emergency/dp/B072PY9Y1P</a>
		<a href="https://shopsolarpower.com/product/Radios-39/Shortwave-Radios-190/Ambient-Weather-WR111BAC-Emergency-Solar-Hand-Crank-Weather-Alert-Radio-Flashlight-Smart-Phone-Charger-with-AC-Adaptor-542">https://shopsolarpower.com/product/Radios-39/Shortwave-Radios-190/Ambient-Weather-WR111BAC-Emergency-Solar-Hand-Crank-Weather-Alert-Radio-Flashlight-Smart-Phone-Charger-with-AC-Adaptor-542</a>
		<a href="https://camelcamelcamel.com/Ambient-Weather-Emergency-Flashlight-Certified/product/B0071BTJPI">https://camelcamelcamel.com/Ambient-Weather-Emergency-Flashlight-Certified/product/B0071BTJPI</a>
		<a href="https://ausprep.com/thread/1195/ambient-weather-111b-crank-radio">https://ausprep.com/thread/1195/ambient-weather-111b-crank-radio</a>
		<a href="https://athriftymom.com/emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-39-99was-80-ships-free/">https://athriftymom.com/emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-39-99was-80-ships-free/</a>
		<a href="https://delectiblemommies.com/2013/12/ambient-weather-wr-111b-emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-with-noaa-certified-weather-alert-cables-29-99-v-80.html">https://delectiblemommies.com/2013/12/ambient-weather-wr-111b-emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-with-noaa-certified-weather-alert-cables-29-99-v-80.html</a>
		<a href="https://www.lowpricecables.com/cell-phone-cables/cell-phone-cables-other/ambient-weather-wr-111b-emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-with-noaa-certified-weather-alert-cables/">https://www.lowpricecables.com/cell-phone-cables/cell-phone-cables-other/ambient-weather-wr-111b-emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-with-noaa-certified-weather-alert-cables/</a>
		<a href="https://www.eham.net/reviews/view-product?id=10555">https://www.eham.net/reviews/view-product?id=10555</a>
		<a href="http://solar-energy-generators.com/ambient-weather-wr-111b-emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-with-noaa-certified-weather-alert-cables/">http://solar-energy-generators.com/ambient-weather-wr-111b-emergency-solar-hand-crank-amfmnoaa-digital-radio-flashlight-cell-phone-charger-with-noaa-certified-weather-alert-cables/</a>
	Eton FRX2 Emergency Radio	<a href="https://www.amazon.com/Eton-Turbine-Weather-Smartphone-Flashlight/dp/B07TKMMXXR?th=1">https://www.amazon.com/Eton-Turbine-Weather-Smartphone-Flashlight/dp/B07TKMMXXR?th=1</a>

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		<a href="https://etoncorp.com/products/american-red-cross-frx2?srsltid=AfmBOorydZL4UZiLEndZXNVEyTr3IKAB3bkxe0LqWfoG4efEHiai_H_J">https://etoncorp.com/products/american-red-cross-frx2?srsltid=AfmBOorydZL4UZiLEndZXNVEyTr3IKAB3bkxe0LqWfoG4efEHiai_H_J</a>
		<a href="https://www.rescue-essentials.com/eton-frx2-emergency-radio/">https://www.rescue-essentials.com/eton-frx2-emergency-radio/</a>
		<a href="https://www.bhphotovideo.com/c/product/1009049-REG/etoncorp_arcfrx2wxr_am_fm_weather_radio_solar.html/overview">https://www.bhphotovideo.com/c/product/1009049-REG/etoncorp_arcfrx2wxr_am_fm_weather_radio_solar.html/overview</a>
		<a href="https://www.redcross.org/store/eton-emergency-weather-radio-with-led-flashlight/FRX2WXW.html">https://www.redcross.org/store/eton-emergency-weather-radio-with-led-flashlight/FRX2WXW.html</a>
		<a href="https://www.petra.com/eton-arcfrx2wxw-american-red-cross-frx2-compact-weather-radio.html">https://www.petra.com/eton-arcfrx2wxw-american-red-cross-frx2-compact-weather-radio.html</a>
		<a href="https://tacticalasia.com/eton-frx2-hand-turbine-am-fm-weather-emergency-radio-with-smartphone-charger/">https://tacticalasia.com/eton-frx2-hand-turbine-am-fm-weather-emergency-radio-with-smartphone-charger/</a>
		<a href="https://www.bestglide.com/products/eton-frx2-emergency-radio?srsltid=AfmBOook2-RuCuC2pEBL2O54yLPhaFrTSBOItuTGopMAXmopDQNGxMG">https://www.bestglide.com/products/eton-frx2-emergency-radio?srsltid=AfmBOook2-RuCuC2pEBL2O54yLPhaFrTSBOItuTGopMAXmopDQNGxMG</a>
		<a href="https://www.moreprepared.com/eton-frx2-noaa-radio-flashlight">https://www.moreprepared.com/eton-frx2-noaa-radio-flashlight</a>
		<a href="https://www.walmart.com/ip/Eton-FRX2-Radio-2X-AquaLite-Emergency-Kit-Preparedness-Bundle-Two-Features-Crank-Solar-Phone-Chargers-Lantern-Water-Bottle-AM-FM-NOAA-Weather-Radio-S/404610446">https://www.walmart.com/ip/Eton-FRX2-Radio-2X-AquaLite-Emergency-Kit-Preparedness-Bundle-Two-Features-Crank-Solar-Phone-Chargers-Lantern-Water-Bottle-AM-FM-NOAA-Weather-Radio-S/404610446</a>
		<a href="https://shoptheworld.in/p/b007kflv8i-eton-frx2-hand-turbine-am-fm-weather-radio-with-smartphone-charger-black-nfrx2wxb?srsltid=AfmBOorlYndHiSGRfU9YGcnbcTY0T1rVfbzm-A_CL9Uw8IUWEjET6XL0">https://shoptheworld.in/p/b007kflv8i-eton-frx2-hand-turbine-am-fm-weather-radio-with-smartphone-charger-black-nfrx2wxb?srsltid=AfmBOorlYndHiSGRfU9YGcnbcTY0T1rVfbzm-A_CL9Uw8IUWEjET6XL0</a>
		<a href="https://armynavymarinestore.com/products/eton-frx2-red-cross-emergency-radio?srsltid=AfmBOooG4h1mrcWK31WsXooTpPXH2OK5-TkzcmHD1o6puM_Q60qgPiPn">https://armynavymarinestore.com/products/eton-frx2-red-cross-emergency-radio?srsltid=AfmBOooG4h1mrcWK31WsXooTpPXH2OK5-TkzcmHD1o6puM_Q60qgPiPn</a>
		<a href="https://www.universal-radio.com/catalog/wx/5865.html">https://www.universal-radio.com/catalog/wx/5865.html</a>
		<a href="https://www.tiendamia.cr/p/amz/b07tkmmxxr/eton-american-red-cross-frx2-hand-turbine-am-fm-noaa-weather-radio">https://www.tiendamia.cr/p/amz/b07tkmmxxr/eton-american-red-cross-frx2-hand-turbine-am-fm-noaa-weather-radio</a>
		<a href="https://www.crutchfield.com/S-qHjE7DOLYvf/p_710FRX2B/Eton-FRX2.html">https://www.crutchfield.com/S-qHjE7DOLYvf/p_710FRX2B/Eton-FRX2.html</a>
Soundbar	YAMAHA YAS203 SOUNDBAR	<a href="https://usa.yamaha.com/products/audio_visual/sound_bar/yas-203/index.html">https://usa.yamaha.com/products/audio_visual/sound_bar/yas-203/index.html</a>
		<a href="https://www.cnet.com/reviews/yamaha-yas-203-review/">https://www.cnet.com/reviews/yamaha-yas-203-review/</a>
		<a href="https://www.jamsticks.com/products/yamaha-yas-203-sound-bar-with-subwoofer">https://www.jamsticks.com/products/yamaha-yas-203-sound-bar-with-subwoofer</a>

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		<a href="https://slrhut.co.uk/product/ID1885C45/YAS-203_Yamaha-YAS-203-Virtual-Surround-Sound-System_-_Black-/?srsltid=AfmBOooP4un1oxzlamdcGDJCKW1OeAlWEX9sSjuccWpuB7I3og738QkO">https://slrhut.co.uk/product/ID1885C45/YAS-203_Yamaha-YAS-203-Virtual-Surround-Sound-System_-_Black-/?srsltid=AfmBOooP4un1oxzlamdcGDJCKW1OeAlWEX9sSjuccWpuB7I3og738QkO</a>
		<a href="https://paykobo.com/yamaha-yas-203-200w-2-1-channel-soundbar-system-piano-black.html#">https://paykobo.com/yamaha-yas-203-200w-2-1-channel-soundbar-system-piano-black.html#</a>
		<a href="https://avgearshop.com/yamahayas203refurb.html">https://avgearshop.com/yamahayas203refurb.html</a>
		<a href="https://www.avforums.com/reviews/yamaha-yas-203-soundbar-review.11509/">https://www.avforums.com/reviews/yamaha-yas-203-soundbar-review.11509/</a>
		<a href="https://www.techhive.com/article/599568/yamaha-yas-203-sound-bar-with-wireless-subwoofer-review-great-sound-but-light-on-features.html">https://www.techhive.com/article/599568/yamaha-yas-203-sound-bar-with-wireless-subwoofer-review-great-sound-but-light-on-features.html</a>
		<a href="https://ca.yamaha.com/en/products/audio_visual/sound_bar/yas-203/index.html">https://ca.yamaha.com/en/products/audio_visual/sound_bar/yas-203/index.html</a>
		<a href="https://www.digitaltrends.com/home-theater/yamaha-yas-203-review/">https://www.digitaltrends.com/home-theater/yamaha-yas-203-review/</a>
		<a href="https://www.radiotvcentre.pk/product/yas-203-yamaha-soundbar-with-wireless-subwoofer-black/">https://www.radiotvcentre.pk/product/yas-203-yamaha-soundbar-with-wireless-subwoofer-black/</a>
		<a href="https://www.rtings.com/soundbar/reviews/yamaha/yas-209">https://www.rtings.com/soundbar/reviews/yamaha/yas-209</a>
		<a href="https://www.walmart.com/ip/Yamaha-YAS-203-Sound-Bar-with-Bluetooth-and-Wireless-Subwoofer/43257768">https://www.walmart.com/ip/Yamaha-YAS-203-Sound-Bar-with-Bluetooth-and-Wireless-Subwoofer/43257768</a>
		<a href="https://www.luluhypermarket.com/en-sa/yamaha-surround-system-yas-203/p/1036120">https://www.luluhypermarket.com/en-sa/yamaha-surround-system-yas-203/p/1036120</a>
	Sonos Playbar	<a href="https://www.amazon.in/Sonos-Playbar-PBAR1US1BLK-Speaker-Black/dp/B00AEMGGU2">https://www.amazon.in/Sonos-Playbar-PBAR1US1BLK-Speaker-Black/dp/B00AEMGGU2</a>
		<a href="https://support.sonos.com/en-in/article/wall-mount-your-playbar">https://support.sonos.com/en-in/article/wall-mount-your-playbar</a>
		<a href="https://www.flipkart.com/sonos-playbar-tv-soundbar-wireless-streaming-music-speaker-watts-100-w-bluetooth/p/itm7gpjacth9gmh">https://www.flipkart.com/sonos-playbar-tv-soundbar-wireless-streaming-music-speaker-watts-100-w-bluetooth/p/itm7gpjacth9gmh</a>
		<a href="https://www.rtings.com/soundbar/reviews/sonos/playbar">https://www.rtings.com/soundbar/reviews/sonos/playbar</a>
		<a href="https://www.vplak.com/sonos-playbar-soundbar-p3041">https://www.vplak.com/sonos-playbar-soundbar-p3041</a>
		<a href="https://www.sonos.com/support/help/12.0/en-us/index.html#t=sonos-user-guide%2Fplaybar%2Fplaybar.htm">https://www.sonos.com/support/help/12.0/en-us/index.html#t=sonos-user-guide%2Fplaybar%2Fplaybar.htm</a>
		<a href="https://www.cnet.com/deals/best-october-prime-day-sales-2024-10-11/">https://www.cnet.com/deals/best-october-prime-day-sales-2024-10-11/</a>
		<a href="https://www.whathifi.com/sonos/playbar/review">https://www.whathifi.com/sonos/playbar/review</a>
		<a href="https://elcytec.com/product/sonos-playbar-tv-soundbar-wireless-streaming-tv-and-music-speaker-100w-soundbar-with-wi-fi-and-optical-input-black-and-gray-open-box/">https://elcytec.com/product/sonos-playbar-tv-soundbar-wireless-streaming-tv-and-music-speaker-100w-soundbar-with-wi-fi-and-optical-input-black-and-gray-open-box/</a>
		<a href="https://www.sonos.com/en-in/newsroom/introducing-sonos-playbar">https://www.sonos.com/en-in/newsroom/introducing-sonos-playbar</a>
		<a href="https://www.sonology.shop/product/playbar.html">https://www.sonology.shop/product/playbar.html</a>

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		<a href="https://epicavu.ca/product/sonos-playbar-wireless-soundbar-for-home-theatre-and-streaming-music/">https://epicavu.ca/product/sonos-playbar-wireless-soundbar-for-home-theatre-and-streaming-music/</a>
		<a href="https://audiolab.com/product/sonos-playbar-mountable-wireless-soundbar-speaker/?srsltid=AfmBOopfjOeXhrJrA4aIQWHJzRwh28ONpy6oGG048SLstzd6Pw53KUpy">https://audiolab.com/product/sonos-playbar-mountable-wireless-soundbar-speaker/?srsltid=AfmBOopfjOeXhrJrA4aIQWHJzRwh28ONpy6oGG048SLstzd6Pw53KUpy</a>
		<a href="https://www.ukelectricalsupplies.com/sonos-playbar-specifications.htm">https://www.ukelectricalsupplies.com/sonos-playbar-specifications.htm</a>
		<a href="https://www.dimensions.com/element/sonos-playbar-tv-soundbar">https://www.dimensions.com/element/sonos-playbar-tv-soundbar</a>
	Samsung HW-F450 Soundbar	<a href="https://www.bhphotovideo.com/c/product/944885-REG/samsung_hw_f450_zs_hw_f450_2_1_soundbar.html/overview">https://www.bhphotovideo.com/c/product/944885-REG/samsung_hw_f450_zs_hw_f450_2_1_soundbar.html/overview</a>
		<a href="https://www.comx-computers.co.za/SAMSUNG-HW-F450-specifications-80727.htm">https://www.comx-computers.co.za/SAMSUNG-HW-F450-specifications-80727.htm</a>
		<a href="https://www.snapdeal.com/product/samsunghwf450-f-series-soundbar/1370632">https://www.snapdeal.com/product/samsunghwf450-f-series-soundbar/1370632</a>
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	LG NB3530A Soundbar	<a href="https://www.lg.com/uk/speakers/soundbars/nb3530a/?srsltid=AfmBOooLZ354YL9cdk5XdRjsFLSHrIC6EA2UhX12FiFYPHYzaodH9I9j">https://www.lg.com/uk/speakers/soundbars/nb3530a/?srsltid=AfmBOooLZ354YL9cdk5XdRjsFLSHrIC6EA2UhX12FiFYPHYzaodH9I9j</a>
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Polk Audio N1 Gaming Sounbar		<a href="https://www.whathifi.com/polk-audio/n1/review">https://www.whathifi.com/polk-audio/n1/review</a>
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	Philips	
Electric Toothbrush	Sonicare DiamondClean	<a href="https://www.amazon.in/Philips-Sonicare-Diamondclean-Toothbrush-Bluetooth/dp/B06XT19TYD">https://www.amazon.in/Philips-Sonicare-Diamondclean-Toothbrush-Bluetooth/dp/B06XT19TYD</a>
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	Oral-B Genius 8000	<a href="https://www.amazon.in/Oral-8000-Electronic-Rechargeable-Connectivity/dp/B01KTH3DS">https://www.amazon.in/Oral-8000-Electronic-Rechargeable-Connectivity/dp/B01KTH3DS</a>
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		<a href="https://www.shavershop.com.au/oral-b/genius-8000-electric-toothbrush-with-3-replacement-brush-head-refills--and-travel-case-009481.html">https://www.shavershop.com.au/oral-b/genius-8000-electric-toothbrush-with-3-replacement-brush-head-refills--and-travel-case-009481.html</a>
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		<a href="https://kiwla.com/products/oral-b-genius-pro-8000-electronic-power-rechargeable-battery-electric-toothbrush-with-bluetooth-connectivity-dash-replenishment-enabled?srsId=AfmBOooH2EIcq4NsWJ9MW0Y3T5xjRs4lKKnA56ifiKlKLBnZ7w4ToBas">https://kiwla.com/products/oral-b-genius-pro-8000-electronic-power-rechargeable-battery-electric-toothbrush-with-bluetooth-connectivity-dash-replenishment-enabled?srsId=AfmBOooH2EIcq4NsWJ9MW0Y3T5xjRs4lKKnA56ifiKlKLBnZ7w4ToBas</a>
		<a href="https://www.amazon.com/Oral-B-Electronic-Rechargeable-Toothbrush-Connectivity/dp/B0752VRPWW/ref=as_li_ss_tl?ref_=Oct_DLandingS_D_f2ac4420_73&amp;smid=ATVPDKIKX0DER&amp;linkCode=s11&amp;tag=amazon0808ad-20&amp;linkId=bc8cdc9302d10141a3960a56a5a144be&amp;language=en_US">https://www.amazon.com/Oral-B-Electronic-Rechargeable-Toothbrush-Connectivity/dp/B0752VRPWW/ref=as_li_ss_tl?ref_=Oct_DLandingS_D_f2ac4420_73&amp;smid=ATVPDKIKX0DER&amp;linkCode=s11&amp;tag=amazon0808ad-20&amp;linkId=bc8cdc9302d10141a3960a56a5a144be&amp;language=en_US</a>
		<a href="https://www.braun.net.nz/product/oral-b-genius-8000-electric-toothbrush/">https://www.braun.net.nz/product/oral-b-genius-8000-electric-toothbrush/</a>
		<a href="https://skinsociety.me/products/oral-b-genius-8000-electric-toothbrush-braun?srsId=AfmBOopIQYTtcfIcnDeoGb_TBGYKH-AqK0uSZ0lsCUGSWUQZBoPJBmGp">https://skinsociety.me/products/oral-b-genius-8000-electric-toothbrush-braun?srsId=AfmBOopIQYTtcfIcnDeoGb_TBGYKH-AqK0uSZ0lsCUGSWUQZBoPJBmGp</a>
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		<a href="https://tetodental.com/product/oral-b-pro-8000-bonus-package/">https://tetodental.com/product/oral-b-pro-8000-bonus-package/</a>
		<a href="https://cosmetis.com/en/oral-b-genius-electric-brush-8000-1un?srsId=AfmBOoobiMak2PGJrHiy-FkxNHppLh0tEz_rUZMxLb5asJgKEe9FCm27">https://cosmetis.com/en/oral-b-genius-electric-brush-8000-1un?srsId=AfmBOoobiMak2PGJrHiy-FkxNHppLh0tEz_rUZMxLb5asJgKEe9FCm27</a>
	Philips Sonicare Essence+	<a href="https://www.amazon.in/Philips-Sonicare-rechargeable-toothbrush-HX3211/dp/B019K7DPG4">https://www.amazon.in/Philips-Sonicare-rechargeable-toothbrush-HX3211/dp/B019K7DPG4</a>
		<a href="https://www.usa.philips.com/c-p/HX3211_02/sonicare-essence-plus-sonic-electric-toothbrush">https://www.usa.philips.com/c-p/HX3211_02/sonicare-essence-plus-sonic-electric-toothbrush</a>

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		<a href="https://www.bestbuy.com/site/philips-sonicare-essence-electric-rechargeable-toothbrush-hx3211-62-with-simply-clean-brush-head-dark-blue/6483364.p?skuId=6483364">https://www.bestbuy.com/site/philips-sonicare-essence-electric-rechargeable-toothbrush-hx3211-62-with-simply-clean-brush-head-dark-blue/6483364.p?skuId=6483364</a>
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		<a href="https://moo.review/philips-sonicare-essence-plus/">https://moo.review/philips-sonicare-essence-plus/</a>
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	Waterpik Complete Care	<a href="https://www.dentalmart.in/water-flossers/1007-waterpik-complete-care-50-wp861e2.html">https://www.dentalmart.in/water-flossers/1007-waterpik-complete-care-50-wp861e2.html</a>
		<a href="https://www.amazon.in/Waterpik-Complete-Toothbrush-Water-Flosser/dp/B01CRZ939Y">https://www.amazon.in/Waterpik-Complete-Toothbrush-Water-Flosser/dp/B01CRZ939Y</a>
		<a href="https://www.waterpik.com/products/complete-care/WP-861/">https://www.waterpik.com/products/complete-care/WP-861/</a>
		<a href="https://www.dentalkart.com/waterpik-complete-care-5-0-wp-861w.html?srsltid=AfmBOopaixnJCaj31ETkoKGfV2jF0CZwMYOB4LEJ-u-8c23i9R-g2Bf0T">https://www.dentalkart.com/waterpik-complete-care-5-0-wp-861w.html?srsltid=AfmBOopaixnJCaj31ETkoKGfV2jF0CZwMYOB4LEJ-u-8c23i9R-g2Bf0T</a>
		<a href="https://www.waterpik.com/products/complete-care/CC-04CD010-1/">https://www.waterpik.com/products/complete-care/CC-04CD010-1/</a>

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		<a href="https://www.dentalstores.in/product/waterpik-complete-care-50-wp-861w.html?srsId=AfmBOopWr112Urf6hyo2TZ8BMHQZ62fiqyAROdGgIM3T5VUaHUitOS7">https://www.dentalstores.in/product/waterpik-complete-care-50-wp-861w.html?srsId=AfmBOopWr112Urf6hyo2TZ8BMHQZ62fiqyAROdGgIM3T5VUaHUitOS7</a>
		<a href="https://www.bestbuy.com/site/waterpik-complete-care-5-0-water-flosser-and-triple-sonic-toothbrush-black/4825000.p?skuId=4825000">https://www.bestbuy.com/site/waterpik-complete-care-5-0-water-flosser-and-triple-sonic-toothbrush-black/4825000.p?skuId=4825000</a>
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		<a href="https://aroraelectric.com/products/waterpik-complete-care-5-0-series">https://aroraelectric.com/products/waterpik-complete-care-5-0-series</a>
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		<a href="https://www.dentalworldofficial.com/product/waterpik-complete-care-5-0-wp-861w/">https://www.dentalworldofficial.com/product/waterpik-complete-care-5-0-wp-861w/</a>
		<a href="https://www.kohls.com/product/prd-2488475/waterpik-complete-care-50-toothbrush-water-flosser.jsp">https://www.kohls.com/product/prd-2488475/waterpik-complete-care-50-toothbrush-water-flosser.jsp</a>
		<a href="https://nliolutions.com/product/waterpik-complete-care-5-0-water-flosser-white/">https://nliolutions.com/product/waterpik-complete-care-5-0-water-flosser-white/</a>
	SONICARE Philips Protectiveclea	<a href="https://www.amazon.in/Philips-ProtectiveClean-Rechargeable-toothbrush-HX6850/dp/B078GVH2VJ">https://www.amazon.in/Philips-ProtectiveClean-Rechargeable-toothbrush-HX6850/dp/B078GVH2VJ</a>
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		<a href="https://www.ubuy.co.in/product/5J9V3LK-protectiveclean-5100?srsId=AfmBOoqjXUXAKonRVCPvktvEOSbJWkbo8bhJ6IqT_8_1H7dOi1OIzAi">https://www.ubuy.co.in/product/5J9V3LK-protectiveclean-5100?srsId=AfmBOoqjXUXAKonRVCPvktvEOSbJWkbo8bhJ6IqT_8_1H7dOi1OIzAi</a>
		<a href="https://www.ubuy.co.in/product/1ARKQ6UU0-philips-sonicare-protective-clean-5100-rechargeable-">https://www.ubuy.co.in/product/1ARKQ6UU0-philips-sonicare-protective-clean-5100-rechargeable-</a>

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		<a href="https://www.walmart.com/ip/Philips-Sonicare-ProtectiveClean-5100-Adult-Rechargeable-Electric-Toothbrush-White-Mint-HX6857-11/761982855">https://www.walmart.com/ip/Philips-Sonicare-ProtectiveClean-5100-Adult-Rechargeable-Electric-Toothbrush-White-Mint-HX6857-11/761982855</a>
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Luxury Watch	Rolex Submariner	<a href="https://www.rolex.com/watches/submariner">https://www.rolex.com/watches/submariner</a>
		<a href="https://www.ethoswatches.com/rolex/watches/submariner">https://www.ethoswatches.com/rolex/watches/submariner</a>
		<a href="https://www.kapoorwatch.com/rolex-watch/collection/submariner">https://www.kapoorwatch.com/rolex-watch/collection/submariner</a>
		<a href="https://en.wikipedia.org/wiki/Rolox_Submariner">https://en.wikipedia.org/wiki/Rolox_Submariner</a>
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		<a href="https://luxury.tatacliq.com/rolex-submariner-automatic-watch-for-men/p-mp000000020716875?srsltid=AfmBOoqYofly6Qg_nqLYIGmhEekCd1_xURZM875pIeyZCoWpdblxd0">https://luxury.tatacliq.com/rolex-submariner-automatic-watch-for-men/p-mp000000020716875?srsltid=AfmBOoqYofly6Qg_nqLYIGmhEekCd1_xURZM875pIeyZCoWpdblxd0</a>
		<a href="https://www.goldsmiths.co.uk/rolex/submariner">https://www.goldsmiths.co.uk/rolex/submariner</a>

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		<a href="https://www.luxuryofwatches.com/categories/rolex/mens/submariner?srsltid=AfmBOorU12Thj5wnczgrD3Gz_ZfyYwD8HNso2n6v-mrQv5Ufmfi8fuWP">https://www.luxuryofwatches.com/categories/rolex/mens/submariner?srsltid=AfmBOorU12Thj5wnczgrD3Gz_ZfyYwD8HNso2n6v-mrQv5Ufmfi8fuWP</a>
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		<a href="https://www.gq.com/story/rolex-submariner-buying-guide">https://www.gq.com/story/rolex-submariner-buying-guide</a>
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		<a href="https://rolex.kennedy.com.au/products/rolex-submariner-date-m126610ln-0001">https://rolex.kennedy.com.au/products/rolex-submariner-date-m126610ln-0001</a>
		<a href="https://www.blowers-jewellers.co.uk/rolex-watches/submariner/">https://www.blowers-jewellers.co.uk/rolex-watches/submariner/</a>
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		<a href="https://www.patek.com/en/company/news/calatrava-24-hour-display-travel-time-ref-5224r-001">https://www.patek.com/en/company/news/calatrava-24-hour-display-travel-time-ref-5224r-001</a>
		<a href="https://www.patek.com/en/collection/complications/5212A-001">https://www.patek.com/en/collection/complications/5212A-001</a>
		<a href="https://www.patek.com/en/company/news/calatrava-ref-6007a">https://www.patek.com/en/company/news/calatrava-ref-6007a</a>
		<a href="https://en.wikipedia.org/wiki/Patek_Philippe_Calatrava">https://en.wikipedia.org/wiki/Patek_Philippe_Calatrava</a>
		<a href="https://www.aviandco.com/patek-philippe-calatrava?srsltid=AfmBOoo2ay3x8fL71bi4Ilks9kMvQODYNWKCsp7TRZ0eVryHn13pv4Q">https://www.aviandco.com/patek-philippe-calatrava?srsltid=AfmBOoo2ay3x8fL71bi4Ilks9kMvQODYNWKCsp7TRZ0eVryHn13pv4Q</a>
		<a href="https://www.patek.com/en/company/news/new-calatrava-pilot-travel-time">https://www.patek.com/en/company/news/new-calatrava-pilot-travel-time</a>
		<a href="https://www.laingsuk.com/brands/watches/patek-philippe/calatrava">https://www.laingsuk.com/brands/watches/patek-philippe/calatrava</a>
		<a href="https://www.cortinawatch.com/en/patek-philippe/calatrava/">https://www.cortinawatch.com/en/patek-philippe/calatrava/</a>
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	Jaeger- LeCoultre Reverso	<a href="https://artoftimeindia.com/collections/jaeger-lecoultre?srsltid=AfmBOopcA9otuXdSFiDeWh724W-Det6L5HWv9cvm7rjKMyZz_xmsZYkf">https://artoftimeindia.com/collections/jaeger-lecoultre?srsltid=AfmBOopcA9otuXdSFiDeWh724W-Det6L5HWv9cvm7rjKMyZz_xmsZYkf</a>
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Breitling	Navitimer	<a href="https://www.breitling.com/in-en/watches/navitimer/navitimer-b19-chronograph-43-perpetual-calendar/RB19101A1H1/">https://www.breitling.com/in-en/watches/navitimer/navitimer-b19-chronograph-43-perpetual-calendar/RB19101A1H1/</a>
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		<a href="https://amjwatches.co.uk/breitling/navitimer">https://amjwatches.co.uk/breitling/navitimer</a>
	IWC Portugieser	<a href="https://www.iwc.com/en/introduction-iwc-collections/portugieser.html">https://www.iwc.com/en/introduction-iwc-collections/portugieser.html</a>
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Gaming Keyboard	Cherry G80- 3000 Wired	<a href="https://in.rsdelivers.com/product/cherry/g80-3000lscgb-0/cherry-cherry-g80-3000-wired-usb-keyboard-qwerty/2819244?srsId=AfmBOopWjLq7Rzy0zT658ym6wsUhb_0btplN1FL7tCzcxliGy-2CPKnd">https://in.rsdelivers.com/product/cherry/g80-3000lscgb-0/cherry-cherry-g80-3000-wired-usb-keyboard-qwerty/2819244?srsId=AfmBOopWjLq7Rzy0zT658ym6wsUhb_0btplN1FL7tCzcxliGy-2CPKnd</a>
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Happy Hacking Keyboard Professi		<a href="https://www.hhkeyboard.com/uk/products/pro2">https://www.hhkeyboard.com/uk/products/pro2</a>
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	Honeywell 5808W3	<a href="https://buildings.honeywell.com/us/en/products/by-category/sensors/smoke-detectors/5808w3-photoelectric-smoke-and-heat-detector">https://buildings.honeywell.com/us/en/products/by-category/sensors/smoke-detectors/5808w3-photoelectric-smoke-and-heat-detector</a>
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	System Sensor 2W-B	<a href="https://www.amazon.in/System-Sensor-2W-B-Photoelectric-Detector/dp/B0015Q7RFE">https://www.amazon.in/System-Sensor-2W-B-Photoelectric-Detector/dp/B0015Q7RFE</a>
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	Nest Protect (1st Gen)	<a href="https://en.wikipedia.org/wiki/Google_Nest">https://en.wikipedia.org/wiki/Google_Nest</a>
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Translator	Pocketalk Classic	<a href="https://www.amazon.in/Pocketalk-Language-Translator-Device-Translations/dp/B07KQCL7D3?th=1">https://www.amazon.in/Pocketalk-Language-Translator-Device-Translations/dp/B07KQCL7D3?th=1</a>
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	ili Wearable Translator	<a href="https://www.amazon.in/Illy-Japanese-Pocket-Translator-LM11/dp/B078R2HZ3N/ref=sr_1_1?dib=eyJ2IjoiMSJ9.6MwM1WtZsl3pbivVeivtJ_gvM1QhYmwjU22hJxfNYoYr52UT1_R9xfINJjgbRfiFAnnTszUeWmxvVurqG2jNXHGemldPKOu3A2RTKItQj8B-hc4kxhxdtgudFtfHwPvy-iV4ga7WiV5lg9T5fkqcB3MrhRGpfQThYGS37dw1kTZNTj3YugbScVH6Vq-Ei2Kb6GA2cB-yDvE3bYRmTVDlm_KqIW2Nkrrclv7kb_HWtmADA.2vMSRvQdn2Ls4W0MTfmVXIx0D3Z-mGN04oMddrPWK5w&amp;dib_tag=se&amp;keywords=ili+translator&amp;qid=1728691132&amp;sr=8-1">https://www.amazon.in/Illy-Japanese-Pocket-Translator-LM11/dp/B078R2HZ3N/ref=sr_1_1?dib=eyJ2IjoiMSJ9.6MwM1WtZsl3pbivVeivtJ_gvM1QhYmwjU22hJxfNYoYr52UT1_R9xfINJjgbRfiFAnnTszUeWmxvVurqG2jNXHGemldPKOu3A2RTKItQj8B-hc4kxhxdtgudFtfHwPvy-iV4ga7WiV5lg9T5fkqcB3MrhRGpfQThYGS37dw1kTZNTj3YugbScVH6Vq-Ei2Kb6GA2cB-yDvE3bYRmTVDlm_KqIW2Nkrrclv7kb_HWtmADA.2vMSRvQdn2Ls4W0MTfmVXIx0D3Z-mGN04oMddrPWK5w&amp;dib_tag=se&amp;keywords=ili+translator&amp;qid=1728691132&amp;sr=8-1</a>
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Product	Model	Weblink
		<a href="https://www.ideaconnection.com/new-inventions/ili-wearable-translator-11676.html">https://www.ideaconnection.com/new-inventions/ili-wearable-translator-11676.html</a>
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		<a href="https://hivelife.com/ili-instant-translator/">https://hivelife.com/ili-instant-translator/</a>
		<a href="https://www.bhphotovideo.com/c/product/1463689-REG/logbar_lm11_en002a_ili_instant_offline_language.html/overview">https://www.bhphotovideo.com/c/product/1463689-REG/logbar_lm11_en002a_ili_instant_offline_language.html/overview</a>
		<a href="https://theindexproject.org/award/nominees/1926">https://theindexproject.org/award/nominees/1926</a>
		<a href="https://futurism.com/meet-ili-first-real-time-wearable-translator-world">https://futurism.com/meet-ili-first-real-time-wearable-translator-world</a>
		<a href="https://averagejoes.co.uk/home-tech/tech-blog/ili-wearable-translator/">https://averagejoes.co.uk/home-tech/tech-blog/ili-wearable-translator/</a>
		<a href="https://ek-mag.com/ili-wearable-translator/">https://ek-mag.com/ili-wearable-translator/</a>
	Vasco Mini 2	<a href="https://www.amazon.in/Vasco-Mini-Voice-Translator-Device/dp/B07NNDQSJP">https://www.amazon.in/Vasco-Mini-Voice-Translator-Device/dp/B07NNDQSJP</a>
		<a href="https://www.ubuy.co.in/product/2MTTFCMO-vasco-mini-2-voice-translator-device-supports-50-languages-understands-2-way?srsId=AfmBOou2thxLPPzpXGqd_4irBvQaGsf2mOUjrwLmm4SE4nomT5SZ3f">https://www.ubuy.co.in/product/2MTTFCMO-vasco-mini-2-voice-translator-device-supports-50-languages-understands-2-way?srsId=AfmBOou2thxLPPzpXGqd_4irBvQaGsf2mOUjrwLmm4SE4nomT5SZ3f</a>
		<a href="https://ru.vasco-electronics.com.ua/translator/vasco-mini2.html">https://ru.vasco-electronics.com.ua/translator/vasco-mini2.html</a>
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		<a href="https://peachimports.com/products/vasco-mini-2-translator-device-multi-language-portable-voice-translator-supports-50-languages-enables-instant-two-way-conversation-no-wifi-needed-european-brand">https://peachimports.com/products/vasco-mini-2-translator-device-multi-language-portable-voice-translator-supports-50-languages-enables-instant-two-way-conversation-no-wifi-needed-european-brand</a>
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	Franklin TG9-450	<a href="https://www.amazon.ae/Franklin-TG-450-12-Language-Translator/dp/B00006IFTJ">https://www.amazon.ae/Franklin-TG-450-12-Language-Translator/dp/B00006IFTJ</a>
		<a href="https://shoptheworld.in/p/b00006iftj-franklin-tg-450-12-language-translator?srsId=AfmBOopH0v_w3AW3AQu5PByHaGDX3DFV7BMMF5IXDvIVv8n2tZZ3PUge">https://shoptheworld.in/p/b00006iftj-franklin-tg-450-12-language-translator?srsId=AfmBOopH0v_w3AW3AQu5PByHaGDX3DFV7BMMF5IXDvIVv8n2tZZ3PUge</a>

Product	Model	Weblink
		<a href="https://www.ubuy.co.in/product/15MXVGZQK-franklin-tg-450-12-language-translator?srsltid=AfmBOor2fWUQRO49dCpCVWZSXLmvLD8GJtSTS7Bez44RQKDtyluof7GV">https://www.ubuy.co.in/product/15MXVGZQK-franklin-tg-450-12-language-translator?srsltid=AfmBOor2fWUQRO49dCpCVWZSXLmvLD8GJtSTS7Bez44RQKDtyluof7GV</a>
		<a href="https://shoptheworld.in/p/b00006iftj-franklin-tg-450-12-language-translator?srsltid=AfmBOoomizfR3COG3mUS5xSi7R1G7_IoRd0myMoXgS-sApUsGdzYuEx6">https://shoptheworld.in/p/b00006iftj-franklin-tg-450-12-language-translator?srsltid=AfmBOoomizfR3COG3mUS5xSi7R1G7_IoRd0myMoXgS-sApUsGdzYuEx6</a>
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	Pilot translation earpiece	<a href="https://www.cnet.com/reviews/waverly-labs-pilot-translation-kit-preview/#google_vignette">https://www.cnet.com/reviews/waverly-labs-pilot-translation-kit-preview/#google_vignette</a>
		<a href="https://www.thinkingtech.in/featured/waverly-developed-pilot-earpiece/">https://www.thinkingtech.in/featured/waverly-developed-pilot-earpiece/</a>
		<a href="https://newatlas.com/waverly-labs-pilot-in-ear-translator-translation/43359/">https://newatlas.com/waverly-labs-pilot-in-ear-translator-translation/43359/</a>
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Factor	Medium										High									
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15	Factor 16	Factor 17	Factor 18	Factor 19	Factor 20
Factor 1																				
Factor 2																				
Factor 3																				
Factor 4																				
Factor 5																				
Factor 6																				
Factor 7																				
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Factor 18																				
Factor 19																				
Factor 20																				

Figure C.1 Survey Sheet provided to identify the prioritisation of factors




		Name:	Occupation:					
		Design-Durability: Lasting relevance of specific design features across different product iterations			Provide score to the factors influence of making			
Product	Product code	Product Image	Accessibility	Aesthetic continuity	Affordance	Engaging Conversations	Evolvability	
			Accessibility ensures a product can be effectively used by individuals with varied abilities, accommodating diverse users. An example is the spin mop handle, designed to be lightweight and easy to hold for those with limited strength.	Aesthetic continuity refers to a product's ability to maintain a consistent and timeless design. For instance, the Porsche 911 has sustained its market presence since 1963 by staying true to its design language.	Affordance involves the cues a product provides about its usage. Natural affordance refers to inherent features, like the zap button on a mosquito bat, while perceived affordance is based on prior experiences, such as viewing a fountain pen as a tool for precise writing.	This factor pertains to the interaction between a product and the user, facilitated by responsive feedback mechanisms. An example is table lamps adjusting brightness based on ambient light.	Evolvability concerns and upgradable products to changing needs. Haines-G photo display, a preferred image exemplifies this.	
1 products Goods	Staple Goods	USB Wire	1					
		Earphone	2					
		Portable Phone Adapter	3					

Figure C.2 Survey Sheet provided to identify the prioritisation of factors (partial view)

