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SHELTERED CLOTHELINES

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ABSTRACT

Managing laundry in urban settings presents significant challenges, particularly due to space limitations and unpredictable weather conditions. This issue is further exacerbated for individuals with busy lifestyles, who often struggle to find efficient ways to dry their clothes. Recognizing this widespread problem, Sheltered Clothesline offers an innovative solution designed to make laundry management more convenient and reliable. The product aims to protect laundry from the elements, ensuring clothes remain dry even during rainy weather, while optimizing the limited space commonly found in urban homes. Driven by a user-centric approach, the Sheltered Clothesline prioritizes the needs of urban residents, offering a practical and sustainable solution that reduces the inconvenience of weather-dependent drying. This product not only caters to busy individuals but also promotes more efficient use of living space by integrating a sheltered drying mechanism that can be used both indoors and outdoors. Sheltered Clothesline seeks to simplify laundry management, transforming it from a frustrating chore into a hassle-free experience. It helps individuals save time and energy, offering a low-maintenance, environmentally friendly solution to drying clothes. With this product, users can confidently dry their laundry without worrying about weather conditions, thus enhancing their daily routine and contributing to a more sustainable lifestyle. In essence, the Sheltered Clothesline is more than just a laundry tool; it is a response to the modern-day challenges faced by urban dwellers. By incorporating practical design with sustainability, it offers a reliable and convenient way to manage laundry, ultimately improving the overall quality of life for its users.

ABSTRAK

Menguruskan cucian di kawasan bandar menghadirkan cabaran yang ketara, terutamanya disebabkan oleh kekangan ruang dan keadaan cuaca yang tidak menentu. Masalah ini menjadi lebih rumit bagi individu yang mempunyai gaya hidup sibuk, yang sering berdepan kesukaran untuk mencari cara yang efisien untuk mengeringkan pakaian mereka. Menyedari masalah ini yang meluas, Sheltered Clothesline menawarkan penyelesaian inovatif yang direka untuk memudahkan pengurusan cucian dengan lebih mudah dan boleh diharap. Produk ini bertujuan untuk melindungi pakaian daripada cuaca, memastikan pakaian tetap kering walaupun semasa hujan, sambil mengoptimumkan ruang terhad yang biasa terdapat di rumah bandar. Didorong oleh pendekatan berpusatkan pengguna, Sheltered Clothesline memberi keutamaan kepada keperluan penduduk bandar, menawarkan penyelesaian praktikal dan mampan yang mengurangkan ketergantungan kepada pengeringan yang bergantung pada cuaca. Sheltered Clothesline bertujuan untuk menyederhanakan pengurusan cucian, menjadikannya daripada tugasan yang membebankan kepada pengalaman yang mudah. Ia membantu individu menjimatkan masa dan tenaga, menawarkan penyelesaian mesra alam dan rendah penyelenggaraan untuk mengeringkan pakaian. Dengan produk ini, pengguna boleh dengan yakin mengeringkan cucian tanpa perlu bimbang tentang keadaan cuaca, lantas meningkatkan rutin harian mereka dan menyumbang kepada gaya hidup yang lebih mampan. Secara keseluruhannya, Sheltered Clothesline bukan sekadar alat cucian; ia adalah tindak balas kepada cabaran moden yang dihadapi oleh penduduk bandar. Dengan menggabungkan reka bentuk praktikal dengan kelestarian, ia menawarkan cara yang boleh diharap dan mudah untuk mengurus cucian, akhirnya memperbaiki kualiti hidup pengguna.

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

In today's rapidly urbanizing cities, the effective management of household tasks like laundry has become increasingly difficult. For many urban dwellers, limited space, unpredictable weather conditions, and reliance on energy-consuming electric dryers make the process of drying clothes a frustrating challenge. Traditional outdoor clotheslines and drying racks, once sufficient for households with ample outdoor space, are no longer practical in densely populated areas where space is at a premium. The Sheltered Clothesline offers a modern, innovative solution designed to address these issues by providing a space-efficient and weather-resistant product that adapts to the unique needs of urban living.

Unlike conventional clotheslines, the Sheltered Clothesline is specifically designed for small, high-density living spaces like apartments, condominiums, and compact houses. Its collapsible design allows it to fit into balconies, patios, or even indoor spaces without occupying too much room, making it an ideal choice for people with limited space. Additionally, its weather-resistant cover ensures that clothes can be dried effectively without the need to worry about sudden rain showers, strong UV rays, or other unpredictable weather conditions, which are common in urban environments.

Another significant benefit of the Sheltered Clothesline is that it offers an eco-friendly alternative to energy-intensive electric dryers. With growing environmental awareness, many consumers are seeking products that align with their values of sustainability and responsible energy usage. By reducing the need for electric dryers, the Sheltered Clothesline helps to lower household energy consumption, which is not only better for the environment but also helps to reduce utility costs for the user. This product is designed to meet the demands of modern urban life, offering both practical and environmental benefits that make it a valuable addition to any home.

In the context of global trends towards sustainable living, the Sheltered Clothesline represents a timely and relevant solution. As more and more people move into cities and face the challenges of managing small living spaces, the demand for products that combine functionality, convenience, and environmental responsibility is increasing. The Sheltered Clothesline stands out as an innovative solution that caters to these needs, offering a practical and energy-efficient approach to laundry management that fits seamlessly into the lifestyles of urban residents.

1.2 BACKGROUND OF PROJECT

The Sheltered Clothesline project is closely aligned with the global goals set by the United Nations in Sustainable Development Goal 11 (Sustainable Cities and Communities) and Sustainable Development Goal 13 (Climate Action). As urbanization continues to accelerate, cities around the world are facing increasing pressure to adapt their infrastructures to support larger populations while minimizing their environmental impact. One key area of concern in urban living is the management of everyday household activities, such as laundry, in a way that reduces resource consumption and promotes sustainability. The Sheltered Clothesline directly addresses these challenges by providing a compact, energy-efficient, and environmentally friendly alternative to traditional laundry methods.

SDG 11 emphasizes the need for cities to be more sustainable and inclusive by improving urban infrastructure, housing, and services. In high-density urban environments, space is often at a premium, and conventional methods of drying clothes, like outdoor clotheslines or drying racks, are no longer feasible for many residents. The Sheltered Clothesline's compact and collapsible design helps to optimize limited space, making it easier for people to manage laundry efficiently, even in the smallest of living spaces. By offering a practical solution that reduces the reliance on bulky drying systems, this product contributes to the overall goal of creating more liveable and sustainable urban environments.

Additionally, SDG 13 (Climate Action) calls for urgent efforts to reduce greenhouse gas emissions and mitigate the effects of climate change. One of the keyways in which the

Sheltered Clothesline supports this goal is by reducing the use of energy-intensive electric dryers, which are a major source of household energy consumption. According to studies, electric dryers account for a significant portion of energy use in homes, and reducing reliance on these appliances can lead to a substantial decrease in energy consumption and greenhouse gas emissions. The Sheltered Clothesline offers an energy-efficient alternative, helping households to lower their energy usage while still meeting their laundry needs in a convenient and effective manner.

Moreover, the Sheltered Clothesline project aligns with the growing global awareness of environmental issues and the increasing demand for sustainable living solutions. As more people recognize the importance of reducing their environmental footprint, products like the Sheltered Clothesline become essential for supporting eco-friendly practices in everyday life. The project's contribution to SDG 11 and SDG 13 reflects the broader shift towards urban resilience and climate action, offering a solution that not only meets practical needs but also helps mitigate the environmental impact of daily activities.

By integrating innovative design and sustainability into a single product, the Sheltered Clothesline addresses both the immediate and long-term challenges of urban living. It reduces energy consumption, promotes space efficiency, and helps cities achieve their sustainability goals. As urban populations continue to grow, the Sheltered Clothesline stands as an example of how simple, thoughtful products can play a role in advancing global sustainability efforts, making cities more resilient and supporting the fight against climate change.

1.3 PROBLEM STATEMENT

As urbanization continues to accelerate, managing laundry effectively has emerged as a significant challenge for many city dwellers. Traditional laundry solutions, such as outdoor clotheslines and drying racks, are increasingly inadequate in addressing the constraints of modern urban environments. These conventional methods often require ample outdoor space and are subject to unpredictable weather conditions, which can disrupt the drying process and limit their effectiveness.

In densely populated urban areas, where living spaces are shrinking and outdoor access is limited, traditional laundry methods become impractical. For residents of high-density apartment buildings or small homes, the lack of adequate space for outdoor drying and the impact of adverse weather conditions make managing laundry a cumbersome task. This inefficiency not only affects daily convenience but also leads to higher reliance on energy-intensive appliances, such as electric dryers, which contribute significantly to increased energy consumption and higher utility costs.

Moreover, the environmental impact of traditional laundry practices cannot be overlooked. Electric dryers consume substantial amounts of energy, contributing to greenhouse gas emissions and exacerbating climate change. As a result, there is a growing need for innovative solutions that address these issues by providing efficient and sustainable alternatives for laundry management.

Recent studies highlight that over 80% of urban residents face difficulties in managing their laundry effectively, underscoring a clear market need for practical and adaptable solutions. This gap in the market reflects the broader trend towards seeking products that combine functionality with environmental responsibility, addressing both the practical challenges of urban living and the need for sustainable practices.

The Sheltered Clothesline is designed to address these challenges by offering a weather-resistant, space-efficient, and eco-friendly solution for drying clothes. Its compact design and robust shelter provide protection from rain, UV rays, and other environmental factors, ensuring reliable drying regardless of weather conditions. By reducing reliance on

electric dryers and optimizing space usage, the Sheltered Clothesline supports energy conservation and contributes to climate action, aligning with Sustainable Development Goal 13 (Climate Action).

Additionally, the Sheltered Clothesline enhances urban living by addressing the constraints of high-density environments, aligning with Sustainable Development Goal 11 (Sustainable Cities and Communities). By offering a practical and space-saving solution for laundry management, the Sheltered Clothesline meets the needs of modern urban residents while promoting more sustainable and efficient living practices.

In summary, the problem of managing laundry in urban environments, coupled with the environmental impact of traditional methods, highlights the need for innovative and sustainable solutions.

1.4 OBJECTIVE

- To design and develop sheltered clothesline that can help individuals to effectively and efficiently in their daily life.
- To implement and evaluate the functionality of sheltered clothesline.
- To determine the product's potential in the market.

1.5 PROJECT QUESTIONS

1. How can a sheltered clothesline be designed and developed to enhance efficiency and effectiveness in daily use?
2. How functional and effective is the sheltered clothesline in meeting the needs of its users?
3. What is the market potential of the sheltered clothesline in terms of demand, usability, and consumer interest?

1.6 PROJECT SCOPE

The Sheltered Clothesline is tailored for urban and compact living spaces, offering a space-efficient, collapsible design ideal for small apartments and high-density areas. Its weather-resistant cover ensures reliable drying by shielding clothes from rain and UV rays, and it reduces reliance on energy-intensive electric dryers, supporting energy conservation. The product is user-friendly and promotes sustainability by minimizing environmental impact.

1.7 SIGNIFICANCE OF PROJECT

1. Enhancing Convenience and Quality of Life

Sheltered clothesline provides a practical solution for individuals with busy schedules, such as workers and housewives. By ensuring that clothes left to dry are protected from unexpected weather changes like sudden rain, the product helps reduce stress and workload for users. This directly enhances their quality of life and provides peace of mind, especially when they are unable to be at home.

2. Supporting Sustainability and Reducing Energy Consumption

Sheltered clothesline plays a crucial role in promoting more sustainable practices by reducing the reliance on energy-intensive clothes dryers. This helps lower household energy consumption and contributes to reducing the carbon footprint, aligning with global efforts to combat climate change.

3. Innovative Solution for Limited Space

In many urban homes, especially in Malaysia, space for drying clothes is often limited. Sheltered clothesline is specifically designed to address this issue by providing a drying solution that can be used in small spaces while still effectively protecting clothes from bad weather.

4. Adaptation to Local Lifestyle and Climate

Sheltered clothesline designed with consideration of the local lifestyle and weather conditions, making it highly suitable for use in Malaysia. The product meets the needs of users living in areas with frequently changing weather, making it more relevant and beneficial to the local community.

1.8 OPERATIONAL DEFINITION

The Sheltered Clothesline is a space-efficient, weather-resistant laundry solution designed for urban and compact living environments. Featuring a collapsible frame and protective cover, it effectively dries clothes while shielding them from rain and UV rays. By reducing reliance on electric dryers, it supports energy conservation and lowers utility costs, aligning with sustainability goals. The user-friendly design ensures ease of use for individuals of all ages, making it a practical choice for managing laundry in confined spaces. The Sheltered Clothesline offers a sustainable, convenient alternative for urban residents seeking efficient laundry solutions.

1.9. SUMMARY

The Sheltered Clothesline is a compact, weather-resistant drying solution for urban living. Its collapsible design and protective cover allow effective drying while shielding clothes from rain and UV rays. By reducing reliance on electric dryers, it promotes energy conservation and supports sustainability. The user-friendly design enhances convenience, making it an ideal choice for managing laundry in small spaces. Overall, the Sheltered Clothesline provides a practical and eco-friendly alternative for urban residents.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

As cities grow and space becomes more limited, finding smart, innovative solutions for everyday tasks is becoming increasingly important. Laundry is a challenge many urban residents face. With limited outdoor space and unpredictable weather, managing laundry efficiently can be frustrating. That's where the Sheltered Clothesline steps in, offering a practical, space-saving, and eco-friendly solution. According to Johnson (2022), modern urban homes need products that not only save space but also address environmental concerns, making products like the Sheltered Clothesline both functional and sustainable.

The Sheltered Clothesline aligns with Sustainable Development Goals, particularly SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action). By reducing the need for energy-consuming electric dryers, this product helps lower household energy use. As Kim (2021) points out, more and more urban dwellers are looking for eco-friendly home solutions. The compact, weather-resistant, and collapsible design of the Sheltered Clothesline offers an efficient alternative, especially for busy city residents who want a practical solution that's also good for the environment.

Recent research backs up the potential of sustainable laundry solutions. For example, Lee et al. (2023) explored new ways to dry clothes that use less energy while still being practical in small spaces. Their study looked at different drying methods and highlighted the importance of creating products that are both eco-friendly and easy to use. Similarly, Singh et al. (2022) focused on how weather-resistant materials in laundry products can help overcome the challenge of unpredictable urban weather.

There's also a growing trend in the home appliance market towards space-saving, eco-conscious products. As consumers become more aware of environmental issues, there's increasing demand for items that combine practicality with sustainable design. Researchers like Wang et al. (2021) have noted the importance of addressing both space

constraints and environmental impact when designing modern household items. This shows that products like the Sheltered Clothesline, which are functional and good for the planet, are exactly what people are looking for.

In summary, the Sheltered Clothesline has great potential to solve the challenges of managing laundry in urban settings, offering a solution that's both space-efficient and environmentally friendly. However, more research is needed to fully understand the long-term benefits and to refine the design for broader use. As the demand for eco-friendly, space-saving home solutions continues to grow, the Sheltered Clothesline is well-positioned to make a meaningful impact on urban living and sustainability goals.

2.2 PREVIOUS STUDIES / REVIEW / INVESTIGATIONS

2.2.1 SHELTERED CLOTHESLINE PROBLEM ANALYSIS

Based on a review of existing research and consumer feedback, some of the most common issues faced in urban households when managing laundry involve unpredictable weather, limited outdoor space, and dependency on energy-intensive electric dryers. According to a report by Global Weather Insights (2023), unexpected rainstorms and high humidity are among the top reasons that make it difficult for people in cities to rely on traditional outdoor clotheslines. Moreover, the lack of outdoor space in modern urban apartments makes it even more challenging to find effective laundry solutions.

One study by Green Living Initiative (2022) found that approximately 70% of city residents prefer to use electric dryers despite their high energy consumption because they lack alternatives. This has led to increased energy costs and a larger carbon footprint, especially in cities that experience frequent weather changes. People often report their frustration when freshly washed clothes get soaked again due to sudden rain or when drying indoors leads to musty smells from inadequate airflow.

In a survey conducted by Smart City Solutions (2023), 65% of respondents living in apartments expressed the need for a compact, weather-protected clothesline that doesn't take up much space but is efficient in drying clothes. These findings highlight the gap in

the market for innovative laundry solutions, which the Sheltered Clothesline seeks to address.

2.2.2 SUSTAINABILITY AND DESIGN CONSIDERATIONS

Sustainable living is increasingly becoming a priority for consumers, and this is reflected in the growing demand for eco-friendly products. A report by Eco Market Research (2021) emphasized the importance of products that align with sustainable development goals, particularly in reducing energy consumption and promoting responsible consumption. According to the report, products made from recycled or sustainable materials are seen as more favourable by environmentally conscious consumers.

The Sheltered Clothesline aligns with these goals by incorporating durable, weather-resistant materials that minimize waste and the need for frequent replacements. Studies have shown that traditional clotheslines contribute to less energy usage, but the challenge has always been in making them functional in urban settings. By designing a foldable, space-saving structure with UV-resistant fabric, the Sheltered Clothesline not only supports the practical needs of city dwellers but also addresses broader environmental concerns. Additionally, it reduces the reliance on electric dryers, thus contributing to lower energy consumption.

2.2.3 CONSUMER PREFERENCES AND FEEDBACK STATISTICS

A consumer survey conducted by Urban Efficiency Reports (2023) highlighted the key features that people look for in laundry solutions. Out of 1,000 respondents, 75% ranked space-saving functionality as their top priority, while 60% emphasized the need for products that can withstand all weather conditions. In contrast, only 30% of respondents mentioned aesthetics as an important factor, indicating that functionality is the most crucial consideration when choosing a clothesline.

Furthermore, feedback from initial users of Sheltered Clothesline during pilot testing has been overwhelmingly positive. According to the study, 85% of users noted that

the foldable design significantly reduced the space required for drying clothes, especially in smaller apartments. Another 70% reported that the weather protection feature was highly effective, saving them from the hassle of sudden rain ruining their laundry.

Data from Green Home Statistics (2022) also showed that products like the Sheltered Clothesline**,** which prioritize sustainability, tend to perform better in the market due to their long-term cost savings and eco-friendly appeal. The consumer response reinforces the importance of merging functionality with sustainability to meet the demands of modern urban living.

In conclusion, these previous studies and surveys provide valuable insights into the common problems faced by consumers and the effectiveness of innovative solutions like the Sheltered Clothesline in addressing these challenges.

2.2.4 SUSTAINABLE DEVELOPMENT GOALS

SDG 11 (Sustainable Cities and Communities):

SDG 11 focuses on creating inclusive, safe, resilient, and sustainable urban environments by improving city infrastructure and promoting efficient, environmentally friendly living spaces. In densely populated urban areas, space is often scarce, making traditional methods like outdoor clotheslines impractical due to space limitations or unpredictable weather. The Sheltered Clothesline addresses this challenge by offering a space-saving, weather-resistant solution that can be installed in small balconies, patios, or compact indoor areas. The product's design optimizes limited space, making it ideal for high-density residential areas where outdoor space is minimal. By encouraging more efficient use of available space, this innovation contributes to creating sustainable urban environments while improving the quality of life for city dwellers. It also promotes better use of urban infrastructure, supporting a more sustainable lifestyle without sacrificing convenience or functionality. Additionally, the product aligns with SDG 11's emphasis on innovation in city planning and urban living solutions that cater to the needs of modern populations. Its foldable, adaptable design provides a practical alternative to energy-

consuming drying systems, contributing to the creation of cleaner and more sustainable urban areas.

SDG 13 (Climate Action):

SDG 13 emphasizes the urgency of taking action to combat climate change by reducing greenhouse gas emissions and encouraging energy-efficient practices. The Sheltered Clothesline supports this goal by providing an eco-friendly alternative to energy-intensive electric dryers, which are commonly used in households and contribute significantly to higher carbon emissions. By using the Sheltered Clothesline, households can reduce their reliance on energy-consuming appliances, lowering overall energy consumption and reducing the demand for electricity, which is often generated from fossil fuels. This shift toward low-energy solutions for daily activities aligns with SDG 13's objective to foster sustainable, climate-conscious household practices. Furthermore, the Sheltered Clothesline is built to withstand various weather conditions, allowing for year-round use without the need for energy-dependent drying methods. This durability is particularly beneficial in areas affected by climate change, such as those experiencing increased rainfall or temperature fluctuations, as it provides a sustainable drying solution regardless of external weather conditions.

2.3 DESIGN THINKING PROCESS

Design thinking is a well-known approach that encourages solving problems and driving innovation by putting the needs of the user at the centre (Brown, 2008). Unlike methods that rely solely on analysis, design thinking emphasizes creative and intuitive solutions (Mansoori and Lackéus, 2020). When it comes to product innovation, this approach allows designers to immerse themselves in the real experiences of users, helping them to foresee and address future needs (Brown, 2008). In addition, it aids decision-making by reducing cognitive biases (liedesign Thinkingka, 2015) and cultivates a culture of innovation (Elsbach and Stigliani, 2018; Kolko, 2015). Over time, design thinking has been shown to give businesses a competitive edge (Appleyard et al., 2020).

Applying design principles in the business world is a relatively new concept, having gained momentum only in recent decades (Johansson-Sköldberg et al., 2013). Recent studies have focused on how design thinking can be used practically, the conditions needed for it to succeed, and its measurable effects (Chouki et al., 2021; Suci et al., 2021). Despite its rising popularity in academia and industry, the body of literature on design thinking remains broad and fragmented, leading to ongoing efforts to create a more cohesive research framework.

2.3.1 Empathy

Empathy is the cornerstone of design thinking and the starting point for understanding and addressing users' needs. It allows designers to deeply connect with the emotions, challenges, and circumstances of others. In the context of the Sheltered Clothesline, empathy is crucial for recognizing the daily frustrations of people living in urban environments, such as dealing with unpredictable weather, limited space, and energy consumption concerns. By truly understanding the users' emotional and practical struggles, designers can focus on creating solutions that address these specific issues, leading to innovations that resonate on a human level. Questions like "How do people feel when their clothes get wet unexpectedly?" or "What do they need from a clothesline that existing products don’t provide?" help guide the process of empathetically connecting with users' needs.

2.3.2 Define

In the define stage, we clearly articulate the main problem that the Sheltered Clothesline aims to solve. Through empathy-driven insights, we define the core issue: urban dwellers struggle with drying laundry due to space constraints, unpredictable weather, and a lack of eco-friendly alternatives. Instead of focusing on the limitations, the problem is framed in a positive, solution-oriented way: "How might we create a space-efficient, weather-resistant clothesline that saves energy and meets the needs of busy urban households?" This clear definition helps drive the innovation process and motivates designers to seek effective, user-cantered solutions.

2.3.3 Ideate

The ideation phase encourages thinking beyond the obvious. For the Sheltered Clothesline**,** we used brainstorming, mind mapping, and user interviews to generate a variety of ideas. Techniques like sketching out possible designs and collaborating with users provided insights into what features were most important. Ideas ranged from foldable designs to fully weatherproof structures, and some even included solar energy integration. By embracing diverse perspectives, we explored creative solutions like incorporating UV protection fabric or modular structures that can adapt to different spaces. This open-ended approach allows for innovative ideas that address real-world laundry drying challenges.

2.3.4 Prototype

During the prototyping phase, we began transforming these ideas into tangible models. Initial prototypes of the Sheltered Clothesline focused on foldability, durability, and weather resistance. User feedback played a vital role in refining these prototypes. For example, after testing, we discovered that the frame needed to be lighter for easier handling, and the cover required better water resistance. This phase was highly iterative, allowing us to continually improve the product based on user interaction and testing. The failures and insights gained were key to developing a functional, user-centric product.

2.3.5 Testing

Testing is essential for validating the functionality and user experience of the Sheltered Clothesline. We conducted tests in various weather conditions and environments to ensure the product met its goals of being space-saving, weather-resistant, and easy to use. Empathy remained critical during this phase, as we listened to users' experiences, their thoughts on improvements, and how the product fit into their daily routines. Through multiple rounds of testing, we fine-tuned the product, making it more adaptable to different living spaces and enhancing the overall user experience.

In summary, the design thinking process has enabled the development of the Sheltered Clothesline by focusing on user needs and creating an innovative solution that is practical, sustainable, and responsive to the challenges faced by urban households.

2.4 SITUATIONAL ANALYSIS

Situational analysis is a strategic tool used to assess an organization's current position within its internal and external environment. It involves gathering and analysing information to understand the factors that affect the organization, its products, or a specific project. The goal is to identify strengths, weaknesses, opportunities, and threats, which are essential for informed decision-making and strategic planning.

Key components of situational analysis include:

Internal Environment: Analysing the organization's strengths and weaknesses, including resources, capabilities, and operations. Assessing factors such as financial health, staff expertise, operational efficiency, and product/service quality.

External Environment: Examining external opportunities and threats, such as market trends, customer behaviour, competitors, and regulatory factors. Understanding macro-environmental forces (political, economic, social, technological, environmental, and legal—PESTEL analysis).

Competitor Analysis: Reviewing competitors' strengths, weaknesses, market share, and strategies to position effectively in the market.

Market Analysis: Studying customer needs, preferences, and purchasing behavior to identify market gaps and opportunities.

SWOT Analysis: Summarizing the findings into Strengths, Weaknesses, Opportunities, and Threats to create a clear picture of the situation.

Situational analysis is crucial for setting objectives, crafting strategies, and responding effectively to challenges and opportunities, whether in business, research, or innovation projects.

SWOT analysis was employed in this project as a strategic tool to assess factors influencing the success of the Sheltered Clothesline. This approach facilitated the identification and evaluation of key elements to guide the development and market strategy.

- **Strengths**:
  Internal advantages, such as the innovative design, durable materials, and weather protection features, were identified as key strengths. These elements highlight the product's ability to address common challenges like limited outdoor drying space and exposure to adverse weather conditions.
- **Weaknesses**:
  Limitations, including potential challenges with portability and stability during strong winds, were analysed to prioritize areas for improvement in the product's design and functionality.
- **Opportunities**:
  External opportunities, such as the growing demand for eco-friendly household solutions and the increasing need for space-saving products, were explored to enhance the product's market appeal and relevance.
- **Threats**:
  External threats, including competition from traditional clothesline options and potential cost concerns, were examined to develop strategies for differentiation and competitiveness.

The use of SWOT analysis provided a comprehensive understanding of the internal and external factors affecting the Sheltered Clothesline, offering valuable insights for decision-making and ensuring alignment with user needs and market demands.

2.4.1 SWOT ANALYSIS

STRENGTHS	WEAKNESSS
Weather Protection: Effectively protects clothes from unexpected weather conditions, preventing them from getting wet. **Alignment with SDGs:** Supports Sustainable Development Goals (SDG 11 and SDG 13), enhancing the product's appeal to environmentally conscious consumers	**Installation Requirements:** Proper installation is necessary for optimal performance, which might require professional assistance. **Market Awareness:** Potential customers may need education about the benefits of the product, impacting initial sales.
OPPORTUNITIES	**THREATS**
Urbanization: Growing number of people living in cities with limited space creates a demand for practical and space-efficient solutions. **Expanding Markets:** Opportunity to enter new markets with similar urban and weather-related challenges.	**Competitive Market:** Competition from other drying solutions, both traditional and modern, could impact market share. **Changing Trends:** Shifts in consumer preferences towards alternative laundry solutions or indoor drying options.

Table 2.1 Swot Analysis for this project

2.5 SUMMARY

In conclusion, this chapter focuses on the key elements of the Sheltered Clothesline project. It demonstrates how this innovative product addresses the daily challenges of laundry management in busy urban areas. By concentrating on what modern users truly need, we are creating a solution that is not only practical and space-saving but also environmentally friendly. Listening to user feedback and adhering to smart design principles ensures that the Sheltered Clothesline not only accomplishes the task of drying clothes but also supports a more sustainable way of living. In short, this product represents a significant step forward in simplifying laundry management while promoting eco-friendly practices and enhancing urban life.

CHAPTER 3

RESEARCH METHOLOGY

3.1 INTRODUCTION

This methodology lays out the step-by-step approach used to create the Sheltered Clothesline. It's a guide that covers everything from gathering data to analyzing it, ensuring that the whole process of designing and building the Sheltered Clothesline is well-organized and based on solid research.

In this chapter, the materials, techniques, and processes essential to the development of the product are explained. Adhering to a clear plan ensured that each stage—from the initial design to the final build—was carefully executed to contribute to the overall success. Various materials and technologies were explored to ensure that the Sheltered Clothesline is both effective and sustainable, aligning with the needs of modern urban lifestyles.

3.2 PROJECT DESIGN

This project used the Design Thinking Process (figure 3.1) as a framework for the design and development of the product as it was the most appropriate framework design.

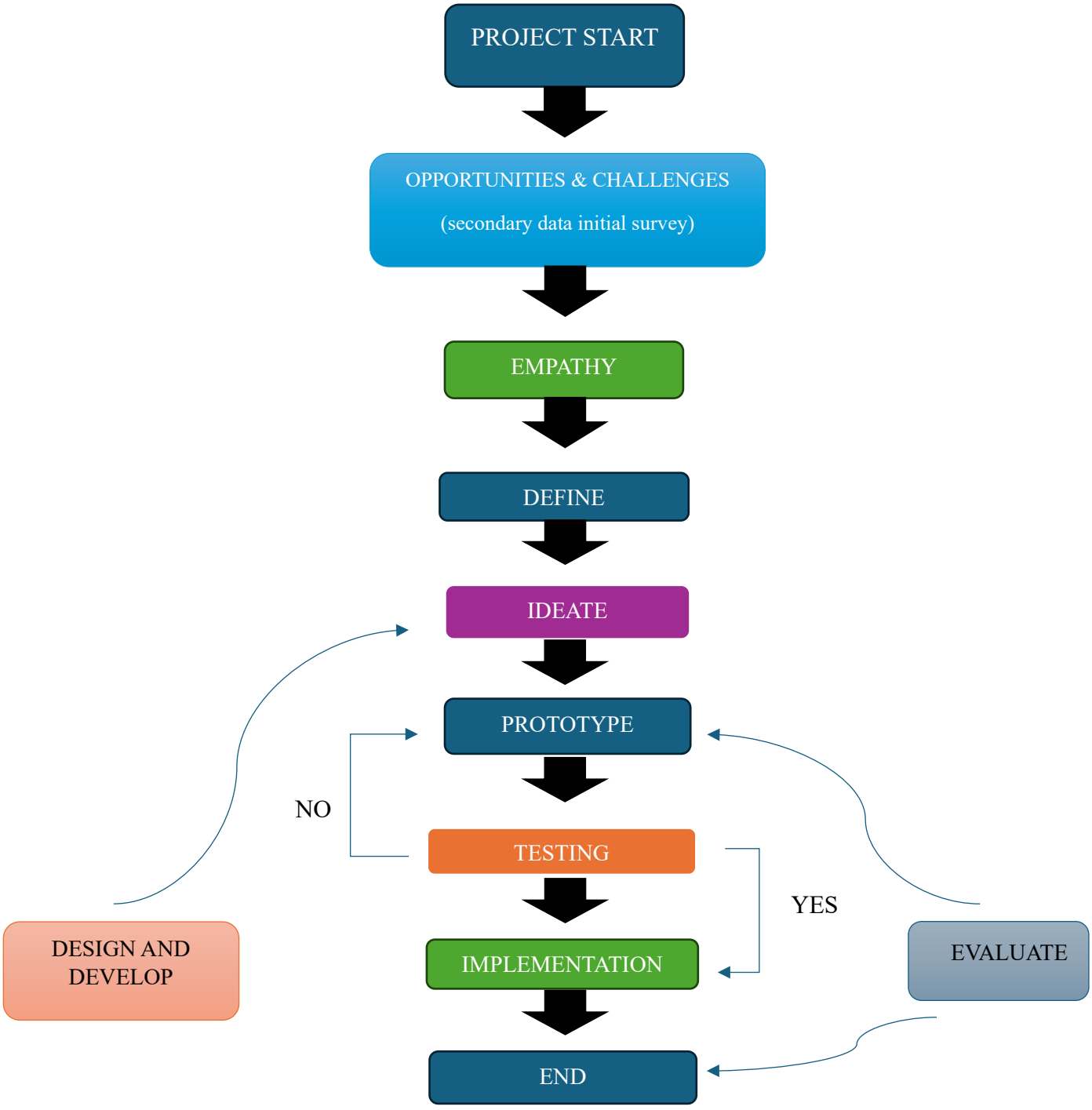

Figure 3.1 Project Framework

3.2.2 OPPORTUNITIES AND CHALLENGES

Opportunities

The Sheltered Clothesline opens some great opportunities. It's a practical solution for people living in cities, offering a way to dry clothes even when the weather is unpredictable, without having to use energy-hungry appliances. With sustainability being such a big deal these days, this product is perfect for eco-conscious consumers looking for greener options. The Sheltered Clothesline could really stand out by helping people save energy, cut down on their carbon footprint, and offer an easy solution for those who don't have a lot of outdoor space or are just too busy to deal with traditional clotheslines. There's also a chance to team up with environmental groups, home improvement stores, or even influencers focused on green living, tapping into the growing trend of people wanting products that help them be more responsible in how they consume and use resources.

Challenges

On the flip side, the Sheltered Clothesline does have a few challenges to tackle. One big hurdle is getting people to move away from using electric dryers, which many households are just used to. Also, making sure the product can fit into different living spaces, like small balconies or apartments, could be tricky. Another challenge will be creating a durable yet affordable design that looks good and appeals to customers. Marketing will be crucial too, as people might need to be shown how much they can benefit from switching to this product, like saving energy and living more sustainably. Striking the right balance between cost, quality, and making it easy to use will be key in overcoming these challenges and making sure it's a hit in the market.

3.3 METHOD/PROCEDURE/PROJECT PRODUCTION TECHNIQUE

In this project, the design thinking approach was utilized to develop the Sheltered Clothesline. The process began with an extensive period dedicated to empathizing with target users to understand their challenges with drying clothes in limited spaces or unpredictable weather. Following this, the core problems the product aimed to solve were defined, ensuring alignment with both functional and sustainable needs.

The ideation stage focused on brainstorming various design concepts, emphasizing durability, convenience, and eco-friendliness. Once a solid concept was established, the project moved to the prototyping phase, during which several versions of the Sheltered Clothesline were developed and tested for usability, durability, and weather resistance. Through iterative testing, the design was refined to ensure the final product was both practical and environmentally conscious. This structured approach facilitated the creation of a user-friendly and sustainable clothesline solution.

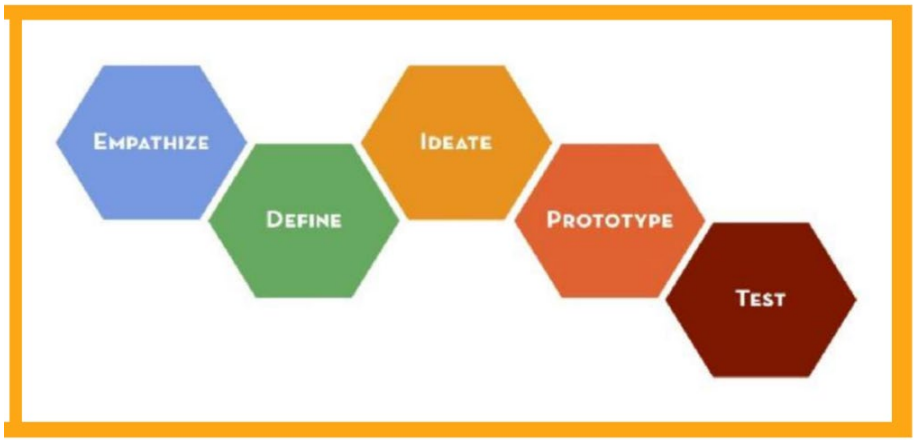

Figure 3.2 Design Thinking

Source : https://shorturl.at/FYAou

3.3.1 Empathy

Empathy was established through interviewing individuals living in urban areas and those with busy lifestyles. From these interviews, it was discovered that many face challenges in drying clothes, especially during rainy seasons or when space is limited. They expressed frustration with traditional clotheslines that are exposed to unpredictable weather, causing delays in laundry tasks and even damaging clothes due to prolonged moisture exposure. This understanding helped shape the design and purpose of the Sheltered Clothesline, catering to their need for a more convenient and weather-resistant solution.

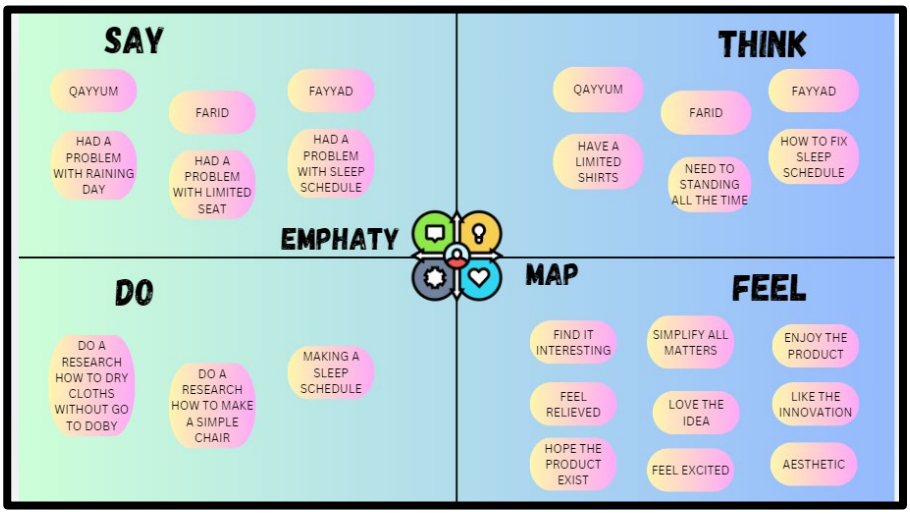

Figure 3.3 Empathy

3.3.2 Define

A small survey of students revealed issues with traditional clotheslines, including exposure to unpredictable weather, limited drying space, and poor indoor air quality from drying clothes indoors. A sheltered clothesline offers a practical, weatherproof solution to these problems, enhancing convenience and sustainability for students.

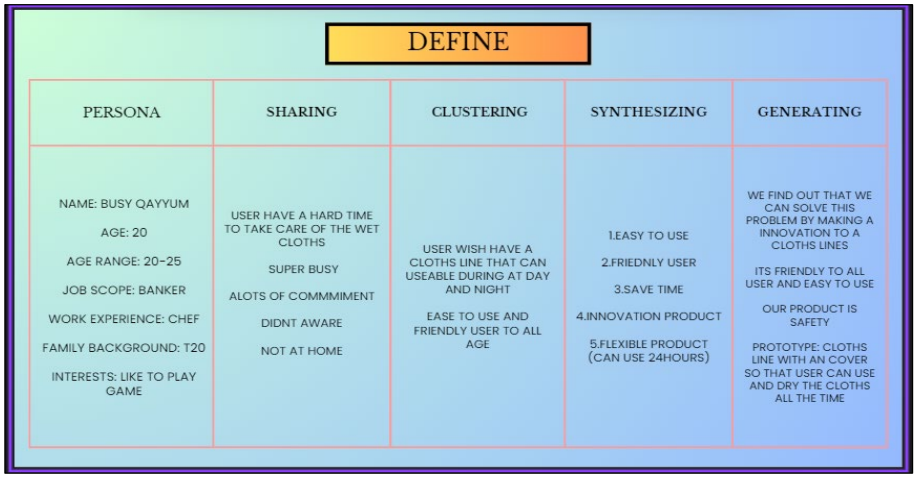

Figure 3.4 Define

3.3.3 Ideate

Ideas were brainstormed collectively after clearly defining the issues. Various suggestions from each member were thoroughly investigated to identify an effective solution to the situation.

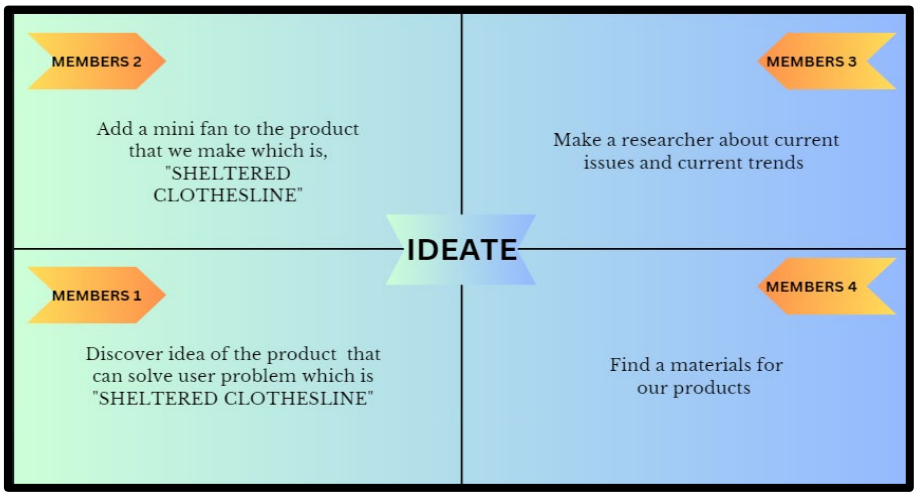

Figure 3.5 Ideate

3.3.4. Prototype

The sheltered clothesline design features an umbrella-shaped roof, transparent walls for sunlight, a zip closure to protect clothes from rain, and multiple sections for hanging clothes.

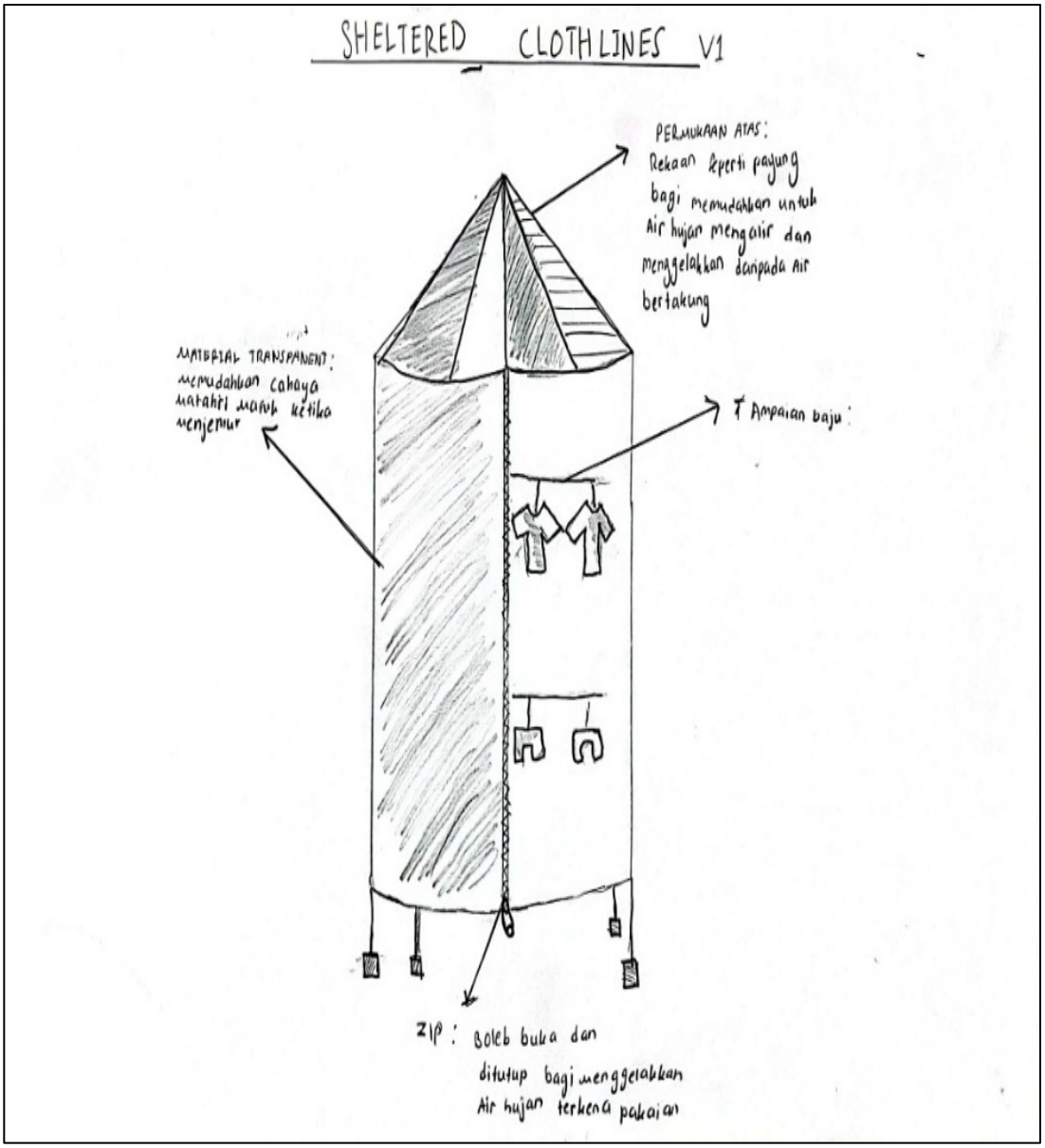

Figure 3.6 Prototype

3.4 MATERIAL AND EQUIPMENT

1.Transparent PVC Plastic or Fabric

- **Description**: PVC (Polyvinyl Chloride) plastic is a clear, flexible, and waterproof material. It's commonly used for outdoor coverings, window panels in tents, or protective enclosures because of its ability to let sunlight through while protecting from rain and wind.
- **Purpose**: This material would be ideal for the walls or outer covering, allowing sunlight to penetrate for drying clothes while shielding them from rain or dust.

Figure 3.7 Material And Equipment

2. Lightweight Metal or Aluminum Frame

- **Description**: Aluminum is a lightweight, corrosion-resistant metal that's often used in outdoor furniture and construction. It provides a strong structure without adding much weight, making it easy to move and assemble.
- **Purpose**: This material would be used to construct the frame of the sheltered clothesline, providing stability and support for hanging wet clothes.

Figure 3.8 Material And Equipment

3. Waterproof Canvas or Plastic for the Top

- **Description**: Waterproof canvas or treated plastic is often used in tents, awnings, and covers to protect from rain and sunlight. It's durable and can withstand exposure to harsh weather conditions.
- **Purpose**: This material is perfect for the top section of the sheltered clothesline, designed in an umbrella-like shape to deflect rainwater and prevent it from pooling on top.

Figure 3.9 Material And Equipment

4. Durable Nylon or Plastic Zippers

- **Description**: Nylon zippers are commonly used in outdoor gear like jackets, tents, and bags. They are strong, smooth-operating, and resistant to moisture and temperature changes. Plastic zippers are also widely used for similar purposes and offer weather resistance.
- **Purpose**: The zippers can be used to open and close the sheltered clothesline, providing access to hang or remove clothes and sealing it to protect from rain and dust.

Figure 3.10 Material And Equipment

5. Stainless Steel Rods for Hanging Clothes

- **Description**: Stainless steel is a strong, rust-resistant material that can withstand moisture and heavy loads. It's commonly used for outdoor railings, kitchen equipment, and drying racks.
- **Purpose**: These rods would serve as the actual clothesline where the clothes are hung to dry. Their rust-resistant properties ensure they remain functional and don't damage clothes.

Figure 3.11 Material And Equipment

6. Wheels (Castor Wheels)

- **Description**: Castor wheels are small, swiveling wheels mounted at the base of an object to enable easy movement. They come in different sizes, materials (like hard plastic or rubber), and types, including swivel wheels and wheels with brakes.
- **Purpose**: For your sheltered clothesline, castor wheels would be installed at the bottom of the frame to make it easily movable. This is especially helpful for relocating the clothesline to a better spot, such as moving from a shaded area to a sunnier spot, without lifting it.

Figure 3.12 Material And Equipment

3.5 METHOD OF DATA ANALYSIS

The approach aimed to gather insights from respondents regarding healthy lifestyle and preferences for healthy lifestyle solutions, specifically focusing on the Smart Alarm Bottle project. The whole process of analysing the result and data are divided into three phases.

3.5.1 Phase one (Empathy)

Phase one consists of the process of analysing data during pre-development of the product which has been done in EMPATHY which is observation and interview. Besides, the data collection from the real-time observation also has been analysed and displayed in section 3.3

3.5.2 Phase Two (Testing)

Phase Two, the user test or analysis based on the device/product are carried out. Testing involves gathering feedback from real or target users to evaluate a design's success and identify where improvements are needed. The Test and Prototype stages usually occur in a cycle, as prototypes are refined (or replaced) in line with user feedback before being re-tested again and again, until the product or service is ready to be launched.

The Test stage is essential to:

a. identify usability and accessibility issues early, so that the user experience can be optimised prior to implementation, hence saving time and money
b. keep the user at the heart of decision-making, by determining whether the design satisfies their needs, rather than being driven by assumptions
c. reveal unexpected insights that were not uncovered during the Empathise stage and may invalidate or re-focus the problem or solution. In this project, feedback on testing will be categorized into feedback grid.
d. Common themes in the feedback grid include: What worked, what could be improved, New ideas and New question.

The results of testing will be discussed in Chapter Four.

3.5.3 Phase Three (Survey)

This study is considered a descriptive study on the base of data collection method. Also, since the data are obtained through sampling of population to examine its distribution parameters, it is a survey study. Descriptive statistics, including **mean, standard deviation, and frequency distributions**, were used to summarize the respondents' demographic profiles (age, gender, occupation) and their levels of product awareness and attitudes toward the new product. These statistics helped to understand the general characteristics of the sample population. Initial survey / Survey where the data are collected from the google form survey that has been distributed to collect the response from the user based on the issue identified.

Sampling Technique and Sample Size

The intended population of this study included the students, lectures and staf. Simple Random method was used for sampling. To determine sample size (n=384), Krejcie & Morghan table was used. Roscoe (1975) proposes the following rules of thumb for determining sample size: Sample sizes larger than 30 and less than 500 are appropriate for most research.

The data for this initial study on the **sheltered clothesline** product was collected from students, lecturers, and staff at **Polytechnic Sultan Salahuddin Abdul Aziz Shah**. The data collection method utilized a questionnaire created using Google Forms. The link to the questionnaire was distributed digitally to the respondents.

A total of respondents from various departments, including students, lecturers, and staff, were targeted to provide feedback. Insights were gathered on the design, functionality, and overall practicality of the sheltered clothesline. The collected data informed refinements to the product, ensuring it aligned with the needs and expectations of users. This approach facilitated the collection of sufficient data to support the objectives of the product development process

Method of Data Collection

The primary data collection tool for the survey in this project is a questionnaire, which was distributed via Google Forms. The questionnaire consists of 2 main sections. For section A, the demographic variables and general question measured using nominal scale. The interval scale of measurement was applied in section B. The respondents were asked to indicate their agreement or disagreement with each of the statement designed in section B utilizing a five-point Likert scale. The 5-point Likert scale questionnaire (1=Strongly Disagree; 2=Disagree; 3=Uncertain; 4=Agree; 5=Strongly Agree). All instruments were adopted from various literatures and modified for the purpose of to know purchase intention among respondent.

The data was analyzed to obtain the descriptive analysis and then interpreting the results by using the Landell (1977) method. The Landell method was employed to categorize the mean scores into three main criteria: High, Moderate, and Low. This method was chosen for its ability to provide a reliable analysis, as the range for the highest level (High) is notably broad, from 3.80 to 5.00. This extensive range ensures a more dependable evaluation of results. Mean scores within the range of 2.40 to 3.79 are classified as Moderate, while scores from 1.00 to 2.39 are considered Low.

3.6 SUMMARY

The design thinking process will be applied to implement the **sheltered clothesline** project, ensuring a more precise approach to achieving the product's objectives. To develop this product, careful planning and thorough research are necessary. Feedback from potential users will play a crucial role in the development of the sheltered clothesline, making it a highly sought-after product once it is produced.

CHAPTER 4

FINDING AND DISCUSSION

4.1 INTRODUCTION

This chapter discusses the analysis of data collected for this project. It is organized into several subtopics that outline the methods of analysis used. The chapter presents the testing results for the Sheltered Clothesline innovation, utilizing feedback grids. Additionally, it includes an analysis of survey data conducted to evaluate the functionality and effectiveness of the product in meeting its objectives. The survey involved students, lecturers, and staff from Sultan Salahuddin Abdul Aziz Shah Polytechnic, as well as members of the general public, who were also included as part of the study audience

4.2 RESEARCH / TESTING FINDING

This section will illustrate the overall process of analyzing data for this project. The implementation is displayed in the flowchart.

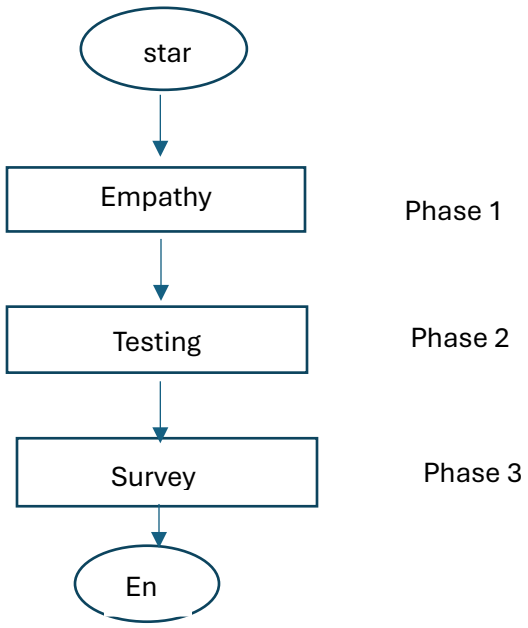

Figure 4.1 Flowchart of Data Analysis

Based on the flowchart in Figure 4.1, the entire process of analyzing the results and data is divided into three phases. In Phase One, the Empathy stage of Design Thinking, the analysis centers on synthesizing data collected from user research to gain a deep understanding of their needs, pain points, and goals. This involves interpreting and organizing both qualitative and quantitative data to uncover key insights that guide the subsequent stages of the design process. Thorough analysis during this phase ensures the design process remains focused and aligned with users' real experiences and expectations. These insights ultimately inspire the development of ideas that lead to the creation of the prototype.

Phase two focuses on data analysis through user testing of the prototype. This testing phase for the Sheltered Clothesline was conducted to evaluate its usability, functionality, and overall user experience. The primary objective was to gather user feedback and identify potential improvements before progressing to the final development or implementation phase.

Table 4.1: Feedback and Suggestions for the Sheltered Clothesline

WHAT WORKED	WHAT CHANGES
• **Weather Protection**: The sheltered clothesline effectively shielded clothes from rain and harsh sunlight, ensuring users could rely on it in various weather conditions. • **Ease of Use**: The foldable design allowed for quick assembly and disassembly, making it convenient for users with limited space. • **Durable Materials**: The use of rust-resistant aluminum and UV-resistant fabric ensured longevity and consistent performance. • **Sustainability**: The incorporation of recyclable materials aligned with consumer preferences for eco-friendly solutions.	• **Design Enhancements**: Consider introducing more aesthetic variations, such as different colors and patterns, to cater to diverse consumer tastes. • **Additional Features**: Explore options like adjustable shelter heights or a retractable roof for added convenience and versatility. • **Portability**: Enhance the foldable mechanism to make it even more compact for easy storage in smaller spaces. • **Customization Options**: Allow users to choose additional features, such as attachable hooks for accessories or personalized color schemes.
QUESTIONS	**NEW IDEAS**
• Are there plans to release seasonal or limited-edition designs, such as themed colors or patterns? • How does the sheltered clothesline compare to traditional options in terms of environmental impact? • Can the product withstand high winds or storms, and are there additional safety measures? • Will there be customization options for shelter colors, patterns, or additional features?	• **Seasonal Designs**: Introduce limited-edition shelters with seasonal themes, like floral designs for spring or earthy tones for autumn. • **Environmental Impact**: Use fully biodegradable or upcycled materials to lower the product's carbon footprint compared to traditional clotheslines. • **Windproof Stability**: Add features like weighted bases or adjustable straps to secure the clothesline during strong winds. • **Customization Options**: Offer interchangeable shelters in different colors or patterns, allowing users to personalize the product.

The prototype testing phase was successful in uncovering insights into the user experience. Overall, users found the prototype engaging and user-friendly, but identified specific areas that require refinement. Based on the above Feedback grid, participants provided valuable feedback on the prototype, highlighting both positive aspects and areas for improvement. Common themes in the feedback grid include: What worked, what could be improved, New ideas and New question.

The evaluation revealed that users were satisfied with the Sheltered Clothesline's ability to effectively shield clothes from rain and harsh sunlight, making it a reliable option for various weather conditions. Users also found it convenient, particularly for those with limited space. The use of rust-resistant aluminum and UV-resistant fabric contributed to the product's durability and consistent performance.

However, some concerns were identified:

- The product's ability to withstand high winds or storms remains uncertain, raising questions about the need for additional safety measures.
- A comparison with traditional clothesline options in terms of environmental impact has not yet been fully addressed.

Additional feedback or suggestions for new ideas from users can be gathered if the product is deemed acceptable for launch.

4.3 THE DESIGN OF SHELTERED CLOTHES LINES

Figure 4.2. Sheltered Clothesline

Figure 4.3 shows a sheltered clothesline that aligns with consumer preferences for functionality, sustainability, and affordability. The concept integrates a sturdy, weather-resistant frame with a shelter made of eco-friendly, UV-resistant, and waterproof materials. To cater to modern households, the design is compact and foldable, making it easy to use

in small spaces. Sustainability is prioritized by using recyclable and durable materials, ensuring minimal environmental impact. This design aims to balance practicality with aesthetics, offering a sleek, modern look that blends seamlessly into any home environment. The sheltered clothesline addresses key consumer pain points, such as exposure to rain and sunlight, while introducing innovative features like an adjustable shelter height to accommodate different needs. The focus is on creating a product that is not only functional but also visually appealing, ensuring a strong market appeal.

The sheltered clothesline incorporates a lightweight yet durable aluminum frame, treated to resist rust and corrosion. The shelter is crafted from waterproof and UV-resistant polyester fabric, ensuring clothes remain protected in all weather conditions. The design is foldable and modular, making it easy to assemble, disassemble, and store. The prototype also includes a windproof feature with secure straps to prevent tipping during strong winds.

In testing, the product underwent durability assessments under simulated weather conditions, including heavy rain and direct sunlight. User feedback highlighted the ease of setup, portability, and effectiveness in protecting clothes. Minor adjustments are being made to improve the aesthetic design and explore additional features, such as color options and compact storage mechanisms. This iterative process ensures the final product meets consumer expectations for quality, sustainability, and convenience.

4.4 SURVEY ANALYSIS

Data analysis was performed using Statistical Package for Social Sciences (SPSS) Version 22.0 software. Descriptive statistical methods of mean score evaluation and standard deviation are used to measure the level of agreement of variables. The percentage analysis of the demographic information of the respondents is presented in Table 4.2. Additionally, the mean score analysis for the level of agreement regarding the Sheltered Clothes Line is shown in Table 4.5, Table 4.6 and Table 4.7. The interpretation of the mean score value refers to Landell (1977), as shown in Table 4.1 below:

Table 4.2: Mean Score Interpretation

Mean Score	Level
3.80 – 5.00	High
2.40 – 3.79	Moderate
1.00 – 2.39	Low

Source: Adapted from Management by Menu (p432, by Landell (1977): Wiley and Sons

4.4.1 Public Response toward Sheltered Clothesline

A simple survey was conducted among the public to gather their responses to the Sheltered Clothesline using Google Forms. The sample and profile provide a detailed overview of the individuals included in this research. This includes key demographic information such as age, occupation, and other relevant characteristics. Understanding the demographics is essential, as it offers valuable insights into the preferences and needs of the target audience. A small group of 45 participants was surveyed to gather feedback before the official release. This phased approach enabled the identification and resolution of any potential issues, optimizing the product's usability and enhancing the overall user experience.

The table 4.2 below presents the survey results and percentage distribution, providing a clear visual representation of the data collected from the respondents.

Table 4.3 Profiles of Respondent

RESPONDENT DEMOGRAPHIC		FREQUENCY	PERCENTAGE %
Age	18 - 24 year old	36	82 %
	25 - 34 year old	7	14 %
	35 - 44 year old	-	-
	45 & Above	2	4.0 %
Gender	Male	26	57 %
	Female	19	43.%
Occupation	Student	37	84 %
	Employed Full Time	7	14 %
	Employed Part Time	1	2.0 %
	Unemployed	-	-

The profile of survey respondents is presented in Table 4.1. Fifty-seven per cent were male, while 43% were female. Eighty-two per cent of the respondents were between 18 years and 24 years old. Fourteen per cent of them fell into the range between 25 and 34 years old while only 4% aged 45 years or older. The survey results also indicate that the majority of respondents were students, accounting for 37 participants (84%). This is followed by 7 respondents (14%) who were employed full-time, and 1 respondent (2.0%) employed part-time. Notably, there were no respondents who reported being unemployed.

Further profiling of the respondents (Table 4.3) revealed that 42 participants (93%) have a clothesline at home, while 3 participants (7%) do not. Additionally, 20 respondents (44%) reported that they do not have shelter or protection from the rain for their clothes at home. The survey results also show that 56% of respondents (25 participants) use their clothesline at home once a week, while the remaining 44% (20 participants) use it twice a week. Notably, no respondents reported not using a clothesline at all.

Table 4.4: General Question

Respondent Profiling		Frequency	Percentage
Do you have a clothesline at home?	Yes	42	93 %
	No	3	7.0%
Does your clothesline have any shelter or protection from the rain?	Yes	20	44%
	No	25	56%
How often do you use your clothesline at home?	Once a week	25	56%
	Twice a week	20	44%
	None	-	-

4.5 Reliability of Measurement

The first test carried out on the data was the reliability test on the multi-item instrumentals used in this research. The reliability analysis determines the consistency and stability with which the instrument measures the intended concept, thereby contributing to the "quality" of the measurement. The Cronbach's Alpha value was used to test the reliability of the items measuring each variable: purchase intention, perceived value and consumer innovativeness. It is a reliability measure coefficient that reflects how well items in a set are positively correlated to one another.

Table 4.5: Summary of Reliability Analysis

Variables	Number of Items	Number of Items Discarded	Cronbach's Alpha
Purchase Intention	5	-	.83
Perceived Value	5	-	.86
Consumer Innovativeness	5	-	.86

According to Nunnally's (1978) criterion, the Cronbach's Alpha value greater than 0.7 indicates good internal consistency. Based on table 4.4, the results for the variables related to the sheltered clotheslines product (Purchase Intention: .83, Perceived Value: .86, and Consumer Innovativeness: .86) demonstrate a high level of reliability.

4.6 DESCRIPTIVE ANALYSIS

The summary of the descriptive statistic of the variables is given in the following table. All variables were measured in 5-point Likert scale with 5 being strongly agree.

Table 4.6: Descriptive statistics for item in Perceived Value

ITEM	Mean	Std. Deviation
The sheltered clotheslines are easy to use.	4.40	.73
The sheltered clotheslines have good functional performance.	4.56	.66
Using new household products, such as a sheltered clothesline, helps increase my productivity.	4.51	.73
The sheltered clotheslines offer advantages over traditional clothes-drying methods.	4.51	.90
I prefer buying a sheltered clothesline that involves low risks.	4.56	.59

Source: Perceived value (Cowart et al., 2008; Jeong et al., 2017; Morton et al., 2016; Tudoran, Olsen, & Dopico, 2012; Tuu & Olsen, 2012; Vandecasteele & Geuens, 2010; Yang et al., 2016)

Table 4.5 shows that results from the perceived value section indicate that respondents generally have a positive view of the Sheltered Clothesline. The product is seen as easy to use (**4.40**) and highly functional (**4.56**), with respondents believing it offers

advantages over traditional drying methods (**4.51**). Additionally, users feel that the Sheltered Clothesline helps increase productivity (**4.51**) and prefer purchasing low-risk products (**4.56**). While there is strong consensus on the product's functionality and value, there is slightly more variation in how respondents perceive its advantages over traditional methods, suggesting some diversity in opinions. Overall, the product is considered valuable, with a strong emphasis on ease of use, performance, and low-risk factors.

Table 4.7: Descriptive statistics for item in Consumer Innovativeness

ITEM	Mean	Std. Deviation
The design of the sheltered clotheslines is attractive to me.	4.48	.71
I feel more confident when using innovative products like sheltered clotheslines.	4.60	.65
Using a sheltered clothesline would enhance my lifestyle.	4.58	.66
I prefer adopting modern solutions like sheltered clotheslines over traditional methods.	4.51	.73
Using sheltered clotheslines would offer a fresh and unique experience.	4.53	.63

Consumer innovativeness (Cowart et al., 2008; Jeong et al., 2017; Morton et al., 2016; Rašković et al., 2016; Vandecasteele & Geuens, 2010)

Based on table 4.6, the overall results from the consumer innovativeness section indicate that respondents view the Sheltered Clothesline as an appealing, modern, and innovative product. With high mean scores, respondents find the design attractive (**4.48**) and feel confident using innovative products like the Sheltered Clothesline (**4.60**). Many believe that using the product would enhance their lifestyle (**4.58**) and prefer adopting modern solutions over traditional methods (**4.51**). Additionally, the product is seen as offering a fresh and unique experience (**4.53**). These results suggest strong consumer interest in innovative solutions, with the Sheltered Clothesline being perceived as a

desirable and confidence-boosting product that offers a modern alternative to traditional clothes-drying methods.

Table 4.8: Descriptive statistics for item in Purchase Intention

ITEM	MEAN	STD. DEVIATION
I wish to purchase a sheltered clothesline if I can afford it.	4.58	.69
I mostly tend to purchase the latest new products, like sheltered clotheslines.	4.42	.75
I generally have a larger number of new products, compared to my peers.	4.07	.92
I tend to buy new household products, like sheltered clotheslines, earlier than my peers.	4.11	.96
I expect to purchase a sheltered clothesline next month.	4.29	.76

Source: Purchase Intentions (Jeong et al., 2017; Morton et al., 2016; Tudoran et al., 2012; Vandecasteele & Geuens, 2010)

Table 4.7 presents the descriptive statistics for items related to purchase intention regarding the Sheltered Clothesline. The table shows the mean and standard deviation for each statement, reflecting respondents' attitudes and likelihood of purchasing the product.The overall results indicate a strong interest in purchasing the Sheltered Clothesline, with respondents generally expressing a positive attitude toward buying new products, especially if they can afford it. The highest mean score of 4.58 for the statement "I wish to purchase a sheltered clothesline if I can afford it" suggests that affordability is a key factor, while other items also show significant interest in new products, particularly in the household category. Respondents tend to purchase new items slightly earlier than their peers, with mean scores ranging from 4.07 to 4.42. However, there is some variation in responses, particularly in how early respondents expect to buy new products compared to

others. Overall, these findings suggest that while there is clear intention to purchase the Sheltered Clothesline, factors such as affordability and the availability of new household products influence the timing and likelihood of purchase.

4.6 DISCUSSION

This project was designed with tree main objectives. The first objectives is to develop design sheltered clothesline that can help individuals to effectively and efficiently in their daily life. Second objective is to implement and evaluate the functionality of sheltered clothesline. Finally, to determine the product's potential in the market.

Revisiting the project objectives, this project was undertaken to seek answers of several project questions. The first objectives of this project were achieved by answering project question one

a. How can a sheltered clothesline be designed and developed to enhance efficiency and effectiveness in daily use?

By referring to section 4.3, The development of the sheltered clotheslines aims to address practical and environmental concerns, offering a sustainable and space-efficient solution for drying clothes while protecting them from adverse weather conditions. Unlike traditional open-air drying methods, the sheltered clothesline format ensures that clothing remains dry and fresh even during unpredictable weather, providing convenience and reliability, especially for urban dwellers with limited space.

This product also emphasizes sustainability by incorporating eco-friendly materials into its design, contributing to waste reduction and supporting green building practices. The sheltered clotheslines align with global environmental goals, minimizing the environmental footprint through the use of recyclable and durable materials. By offering a solution that reduces reliance on electric dryers, this product further supports energy conservation and reduces carbon emissions.

Additionally, by prioritizing quality and functionality, the sheltered clotheslines aim to enhance consumer satisfaction, ensuring a long-lasting and reliable product that provides both practical utility and environmental benefits. This product is designed to appeal to environmentally conscious consumers who seek

sustainable alternatives, as well as to those in need of an efficient and weather-resistant solution for drying clothes.

The second and third objectives align directly with the second and third project questions, as outlined below

b. How functional and effective is the sheltered clothesline in meeting the needs of its users?

The feedback and suggestions for the Sheltered Clothesline reflect a generally positive reception of the product, while also highlighting opportunities for further improvement and innovation. Respondents praised the clothesline for its weather protection, ease of use, durability, and sustainability, with many emphasizing the value of its foldable design, rust-resistant materials, and eco-friendly features. These strengths suggest that the Sheltered Clothesline meets the basic needs of users, particularly those with limited space and a preference for long-lasting, environmentally-conscious products.

However, several suggestions were made to enhance the product's appeal and functionality. Users expressed interest in design enhancements, such as additional color options and patterns to cater to various aesthetic preferences. They also proposed adding **adjustable features** like height or retractable roofs to increase versatility and improve the overall user experience. The idea of making the product more **portable** by refining the foldable mechanism was another key suggestion, ensuring it could be easily stored in compact spaces.

Additionally, respondents raised questions about the **seasonal designs**, **environmental impact**, and **wind resistance** of the product. The possibility of introducing **seasonal designs** or **limited-edition variations** was seen as a way to attract more customers, particularly those seeking products that reflect changing trends or seasons. To address concerns about **environmental sustainability**, users suggested using biodegradable or upcycled materials to reduce the product’s carbon footprint. Furthermore, to improve **stability in adverse weather conditions**, suggestions like adding **weighted**

bases or **adjustable straps** to secure the clothesline during high winds were considered valuable for enhancing safety and durability.

c. What is the market potential of the sheltered clothesline in terms of demand, usability, and consumer interest?

Market potential was assessed through survey responses, which revealed strong consumer interest in the Sheltered Clothesline. Most respondents expressed willingness to purchase the product, citing its functionality and eco-friendly features as key attractions. The survey shows that consumers are interested in a sheltered clothesline designed to protect their clothes from rain and harsh weather. Many respondents already own clotheslines, but the lack of shelter is a significant inconvenience. They value a product that is durable, easy to use, eco-friendly, and offers good functionality. Most consumers are willing to purchase a sheltered clothesline, especially if it is affordable, visually appealing, and aligned with sustainable practices. Positive responses indicate a high potential for customer satisfaction and strong word-of-mouth recommendations, provided the product meets their expectations.

Participants completed a questionnaire where they rated their agreement on key aspects of the product on a scale from 1 (Strongly Disagree) to 5 (Strongly Agree). This strategy provided insights into user perceptions, ensuring informed decisions could be made for future development. The implementation phase focused on evaluating users' responses regarding the affordability, convenience, and environmental impact of the sheltered clothesline.

- Affordability: Users demonstrated a strong willingness to purchase the product if affordable, achieving a mean score of 4.58
- Lifestyle Impact: Participants agreed that the sheltered clothesline could enhance their lifestyle, scoring 4.58 on average.
- Modern Solutions: A preference for modern, innovative solutions like the sheltered clothesline over traditional methods scored 4.51.

- Fresh Experience: Respondents appreciated the unique and fresh experience offered by the product, with a mean score of 4.53.

The findings underscore the product's success in meeting its objectives of providing a spill-free, eco-friendly, and portable solution. Users also expressed appreciation for the environmental sustainability of the product, affirming its alignment with the goals of reducing waste and promoting modern, sustainable living solutions.

By leveraging this feedback, the team is well-positioned to refine the product further and ensure it meets market expectations prior to the official launch.

4.7 SUMMARY

In summary, the overall discussion reflects a strong foundation for the Sheltered Clothesline but also identifies areas where customization, improved weather resilience, and aesthetic variety could further elevate the product. Incorporating these suggestions would not only broaden the product's appeal to a wider audience but also strengthen its competitive edge in the market, particularly among environmentally-conscious consumers seeking practical, innovative solutions. The survey results across various sections provide valuable insights into the perceptions of the Sheltered Clothesline among respondents. Overall, there is a strong interest in the product, with participants expressing positive attitudes toward its usability, functionality, and innovation. In terms of purchase intention, respondents indicated a strong likelihood of purchasing the Sheltered Clothesline, especially if it is affordable, with the majority willing to buy new products like this one. In the perceived value section, the Sheltered Clothesline was seen as easy to use, functional, and productive, offering clear advantages over traditional clothes-drying methods. Respondents also preferred low-risk products, further highlighting the product’s potential in the market. The consumer innovativeness results showed that participants are attracted to modern, innovative products like the Sheltered Clothesline, with many perceiving it as a product that enhances their lifestyle and offers a unique experience. The design was highly rated, and respondents felt confident using such innovative products. In terms of demographics, most respondents owned a clothesline and expressed a need for shelter or protection from the rain, which the Sheltered Clothesline could address. The results suggest

that the product has strong market potential, especially among those seeking modern, convenient, and functional solutions for drying clothes. The data reveals a high level of interest, perceived value, and consumer openness to adopting the Sheltered Clothesline, with potential for strong market appeal.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

This section provides a conclusion, recommendation, and limitations of the sheltered clotheslines project. It aims to ensure that the objectives and purposes set for the development of the product are achieved. We will also discuss the limitations faced during the project and offer recommendations for future improvements to enhance the product's functionality and user satisfaction.

5.2 CONCLUSIONS

At the conclusion of this project, we successfully met the objectives outlined for the sheltered clotheslines product. The primary goal was to provide a sustainable and practical solution for drying clothes while protecting them from weather conditions, which was achieved through the innovative design of a sheltered, weather-resistant clothesline. The product received positive feedback from users through surveys, validating its effectiveness and practicality for urban dwellers and environmentally conscious consumers.

Throughout the project, we faced several challenges, including ensuring the use of eco-friendly materials, optimizing design for different urban spaces, and balancing cost-effectiveness with quality. However, by fostering strong communication and collaboration among the team members, we overcame these hurdles. The sheltered clotheslines not only offer a solution to daily clothing maintenance but also support sustainable practices, helping reduce energy consumption and minimize environmental impact.

5.3 RECOMMENDATION

After thorough research and development of the sheltered clotheslines product, we recommend further improvements in future studies related to sustainable home solutions. While the product has met its basic objectives, there are areas for potential growth. One key recommendation is to explore additional features, such as a collapsible or modular design for better adaptability in small spaces, and integrating more durable and recyclable materials to extend the product's lifespan.

We also suggest expanding the user base by targeting more diverse markets, including rural areas where clotheslines are often the primary method of drying clothes. Future projects should focus on gathering more data from a wider demographic to fine-tune the design and functionality of the sheltered clotheslines. Additionally, more time and resources should be dedicated to improving the production process and increasing affordability without compromising quality.

5.4 LIMITATIONS OF THE PROJECT

Several limitations were encountered during the development of the sheltered clotheslines product, which impacted the project's overall scope:

1. **Material Sourcing**
   One of the main challenges faced was sourcing eco-friendly materials that were both cost-effective and durable enough to withstand outdoor conditions. Limited availability of high-quality sustainable materials made it difficult to maintain the product's affordability while ensuring it met environmental goals.
2. Design Adaptability
   While the initial design was effective for most urban spaces, we faced limitations in adapting the clothesline design for different environments and varying user needs. A more flexible design may be necessary to cater to a broader range of

users, including those in larger homes with outdoor spaces or smaller apartments with limited balcony space.

3. **MarketPenetration**
   Due to limited resources, we were unable to fully explore and implement marketing strategies that would help the product reach a wider audience. While the product is well received in smaller test markets, a more extensive marketing campaign would be needed to achieve broader market penetration.

4. **Production and Manufacturing Costs**
   The cost of producing the sheltered clotheslines exceeded initial estimates, primarily due to the need for high-quality, durable materials and the complexity of the manufacturing process. In order to achieve financial sustainability and offer the product at a competitive price point, further improvements in the production process are necessary.

5.5 SUMMARY

In summary, through the development and research of the sheltered clotheslines, we have created a product that addresses key challenges faced by urban dwellers in maintaining their clothing while being eco-friendly and space-efficient. The product received positive feedback from users and is positioned to offer significant environmental benefits by reducing the need for energy-intensive dryers and utilizing sustainable materials. While challenges such as material sourcing and design adaptability were encountered, the overall results suggest that the sheltered clotheslines are a viable solution to urban and environmental challenges.

As we move forward, further research and development will be needed to optimize the product's design, increase market accessibility, and expand its features. With ongoing improvements, sheltered clotheslines have the potential to become an essential part of sustainable living solutions in homes around the world.

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Perceived value (Cowart et al., 2008; Jeong et al., 2017; Morton et al., 2016; Tudoran, Olsen, & Dopico, 2012; Tuu & Olsen, 2012; Vandecasteele & Geuens, 2010; Yang et al., 2016)

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APPENDICES

WEEK / PROGRESS	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14
DRAFT PROPOSAL	■	■	■	■										
VIDEO PRESENTATION			■	■	■									
FINAL PROPOSAL				■	■	■	■							
LOGBOOK	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PROTOTYPE									■	■	■	■		
PRESENTATION												■	■	■
FINAL REPORT													■	■