

Transformation of Skincare Plastic Waste into Stationery: Innovation in the Circular Economy

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ABSTRACT

The beauty industry in Indonesia is experiencing rapid growth, marked by a 21.9% increase in the number of cosmetic companies in 2023 and a surge in skincare product sales through e-commerce platforms. However, this trend has also led to a rise in plastic waste from cosmetic product packaging, contributing to Indonesia's position as the world's second-largest producer of plastic waste. This research aims to provide a solution for repurposing skincare plastic waste by identifying innovations and designing new product variants from this waste. The initiative involves collaboration with Olah Plastic to enable mass production and distribution through their sales channels. The methodology employed is the Double Diamond approach, which consists of four key phases: Discover, Define, Develop, and Deliver. The findings identify key innovations, including material recycling, sustainable product design, eco-friendly production processes, and consumer education. The research also delivers specific designs for modular and multifunctional stationery prototypes made from PVC board materials. The outcomes of this study contribute to reducing skincare plastic waste and developing eco-friendly products that appeal to consumers.

KEYWORDS

Recycling, Plastic Waste, Beauty Industry, Skincare, Stationery

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INTRODUCTION

Over time, consumption patterns in society have evolved due to the increasingly complex needs of human life. Today, needs are no longer limited to basic necessities; beauty and skincare products have also become essential for adolescent girls (Apriana et al., 2010). The beauty industry in Indonesia has experienced significant growth. Ekon, (2024) reported a 21.9% increase in the number of cosmetic companies within a year, from 913 companies in 2022 to 1,010 companies by mid-2023. The national market potential for cosmetic products in 2023 was estimated to reach 467,919 products, showcasing an extraordinary growth of over tenfold in the past five years. Moreover, the sales of skincare and cosmetic products have surged in recent years. Between 2018 and 2022, skincare and cosmetic products were consistently ranked among the top three sales categories in online markets.

The rapid product launches aimed at meeting changing market demands have given rise to the "fast beauty" trend, which negatively impacts the environment. According to research by (Ningrum & Risa, 2023), this trend is one of the main causes of increased waste in the beauty industry. Indonesia is currently ranked as the second-largest producer of plastic waste globally, generating approximately 3.21 million metric tons per year. This waste includes packaging from skincare and cosmetic products.

According to data from waste4change.com (Defitri, 2022), the beauty industry produces 6.8 million tons of plastic waste annually, 70% of which is not properly managed. Rarastry, (2016) highlights that unmanaged waste accumulation leads to the release of methane and carbon dioxide gases, contributing to greenhouse gas emissions. This increase in emissions exacerbates global warming, which ultimately leads to climate change worldwide. Furthermore, a shocking statistic reveals that the beauty industry generates 120 billion packaging units annually, equivalent to the loss of 18 million hectares of forest (C. N. Putri, 2022).

The growing environmental concerns have spurred increased public awareness, influencing changes in consumption behavior. Consumption behavior is reflected in purchasing activities aimed at fulfilling needs. In the context of environmental sustainability, consumption activities are not only intended to meet needs but are also expected to reduce negative environmental impacts. As noted by (Moslehpour et al., 2021), consumers are increasingly shifting towards eco-friendly products. Additionally, 88% of consumers tend to remain more loyal to brands that demonstrate positive environmental commitments (Kusumawati & Tiarawati, 2022).

It is known that 61% of beauty product packaging in Indonesia is made of plastic (Dinda Utami et al., 2022). Generally, skincare and cosmetic product packaging are made of PET (polyethylene terephthalate) or HDPE (high-density polyethylene) plastics, as they help preserve product quality, as reported by Alodokter. If the plastic waste from skincare and cosmetic products is not managed properly, it could lead to significant environmental damage.

The good news is that efforts to mitigate environmental damage have already been initiated by several companies and beauty brands. For instance, Sociolla and Sukin collaborated with Waste4Change in the "Waste Down Beauty Up" campaign on March 1, 2022. After running for a year, the campaign was rebranded as "Waste Down Kindness Up." This campaign successfully collected 25 tons of beauty waste with the participation of 24,000 beauty enthusiasts through recycling stations located at 50 Sociolla outlets across 30 cities in Indonesia (Dian, 2023).

While the "Waste Down Kindness Up" campaign has proven that consumers are increasingly concerned about environmental issues, the collaboration between Kahf, Precious Plastic Bandung, and Paragon has demonstrated how product design innovations can transform waste into valuable materials. This initiative involved producing school supplies in Sukabumi, applying the principles of a circular economy. This approach emphasizes optimizing product design to minimize waste and maximize recycling potential, thereby creating more effective sustainability solutions (Pambudi et al., 2022).

The collaboration between Kahf, Precious Plastic Bandung, and Paragon serves as a tangible example of implementing circular economy principles, specifically the "cradle to cradle" approach, which focuses on recovery and sustainability rather than end-of-life disposal (McDonough & Braungart, 2002). This involves utilizing eco-friendly energy, avoiding harmful chemicals, and reducing waste. To achieve this, design must consider closed-loop systems that enable synthetic materials to be reused continuously without losing quality, and organic materials to return to nature without causing harm (McDonough & Braungart, 2002).

This research focuses on Olah Plastic, a recycling company in Bandung that transforms plastic waste into new products. Originating from the production of plastic packaging that generated waste, the CEO of Olah Plastic innovated to process this waste, establishing the company as a leader in creative and sustainable plastic waste management.

The design approach in this research applies the theory of Circular Economy (CE), defined as an economic model aimed at resource efficiency through waste utilization, creating long-lasting products, and enhancing socio-economic benefits that align with environmental conditions (Morsetto, 2020).

To clarify the position and direction of this study, previous related research findings are reviewed. One such study, "Sustainable Beauty: Readiness of Indonesian Consumers to Integrate Sustainability Concepts in Managing Plastic Packaging Waste from Beauty Products," highlights the low readiness of Indonesian consumers in managing plastic packaging waste from beauty products. The findings indicate that waste management policies in South Korea are more integrated compared to Indonesia, with strong roles played by the government, private sector, and society. This contrasts

with the situation in Indonesia, where the reuse of plastic packaging as lifestyle products remains underutilized. The study provides insights into implementing conscious consumption and raises consumer awareness and responsibility regarding beauty product waste management (Shalmon, 2020).

Another study, "Sustainable Beauty: 'Waste Down Kindness Up Sociolla' Collaboration with Sukin and Waste4Change," offers insights into minimizing beauty product waste to reduce environmental pollution (Ningrum & Risa, 2023). This research focuses on waste management through recycling but does not address the lack of circular design applications for repurposing beauty packaging waste into lifestyle products.

Research by Ramadhani et al., (2019) found that consumers have positive attitudes toward attributes such as product safety, performance, the use of natural ingredients, price-quality alignment, cruelty-free practices, and brand image. While this study focuses on consumer attitudes toward green skincare attributes, the present research emphasizes applying circular design to manage plastic packaging waste from beauty products into sustainable lifestyle products.

Overall, this research explores the potential for innovation in repurposing plastic waste from skincare packaging into new products as part of the circular economy. Given the limited studies addressing the management of skincare plastic waste, including its material types, this research aims to provide a tangible contribution to plastic waste management. It also seeks to inspire further innovative actions, such as transforming skincare plastic waste into useful products, including stationery storage solutions for writing tools.

METHOD

The scientific method is a systematic approach of reasoning that produces rational, tested, and reliable scientific knowledge. This method is utilized by science to construct accurate and valid knowledge (D. W. Soewardikoen, 2021). The approach adopted in this research is a design approach aimed at exploring and developing innovative solutions to address the issue of plastic waste from skincare products. This approach follows the workflow of the Double Diamond method, which consists of four main phases: Discover, Define, Develop, and Deliver (Design Council, 2005).



Figure 1. The Double Diamond Framework (Design Council, 2005)

In the Discover phase, data is collected through surveys, interviews, and field observations to understand the environmental impact of plastic waste from skincare products. The Define phase involves in-depth analysis to specifically define the problem and formulate clear design objectives. Design plays a crucial role in reducing environmental pollution, as decisions made by designers during the design process significantly influence the product's environmental impact (A. W. A. Putri & Kristi, 2020). It is estimated that approximately 80% of a product's environmental impact is determined during the early stages of development (Gumulya et al., 2022).

In the Develop phase, various concepts and prototypes of stationery made from skincare plastic waste are developed and tested. The Deliver phase focuses on the implementation and launch of the final product, as well as educational campaigns about the importance of recycling and circular economy principles.

Data collection methods are based on the 360° data object theory, involving direct observations at Olah Plastic's office, semi-structured interviews with the Olah Plastic team, document studies, and online surveys. The research was conducted at Olah Plastic, a micro, small, and medium enterprise (MSME) specializing in plastic waste processing located in Bandung. Primary data was obtained

from observations and interviews, while secondary data was derived from literature studies and related documentation.

360° DATA OBJEK PENELITIAN



Figure 2. 360° Research Object Data (D. Soewardikoen, 2024)

Data analysis employs the PEST and SWOT analysis methods. PEST analysis evaluates external factors influencing the organization, including political, economic, social, and technological factors (Yoseffane, 2022). SWOT analysis identifies strengths, weaknesses, opportunities, and threats (Arfa et al., 2023). Problem selection based on the results of this analysis is measured in terms of priority, advantages, resources, and risks.

This design approach focuses not only on technical solutions but also integrates social, economic, and environmental aspects. This aligns with the principles of the circular economy, which aim to reduce waste and sustainably reuse resources, thereby providing a tangible contribution to plastic waste management and the implementation of a circular economy.

RESULT AND DISCUSSION

1. Discover

The *Discover* stage is carried out with the aim of thoroughly understanding the problems or challenges faced (Jauhari & Prayudi, 2023). In this study, the focus is on data collection and an in-depth understanding of the issue of plastic waste from skincare products. The first step involves conducting observations to gather data through direct observation of the object under study to obtain detailed and accurate information about the phenomena occurring in the field (Sugiyono, 2020). Observations were conducted at the office of Olah Plastic, a small and medium enterprise (SME) that processes plastic waste into new products. These observations aimed to understand the work processes and facilities at Olah Plastic, including the molding and pressing techniques used, as well as policies and programs implemented to reduce plastic waste.

The profile of Olah Plastic reveals that the company originated from the production of custom plastic packaging and has evolved into a plastic waste processing enterprise since 2020. With a vision to minimize plastic waste by transforming it into lifestyle and furniture products, Olah Plastic is committed to the principles of a circular economy.

This research employs the circular economy theory, which aims to reduce waste and sustainably reuse resources. One application of this principle is reflected in the modular product designs they produce, particularly in furniture. Modular design is a concept used to develop products using similar components. These components are designed to be connected to one another, enabling the formation of more complex systems. They can be disassembled, modified, replaced, or swapped with other modules or systems (Kamrani & Salhieh, 2000). This approach facilitates users in upgrading and repairing products. If a component is damaged, the modular system allows for the repair of only the problematic part, thereby reducing repair costs. Additionally, the company offers a variety of other products, such as coasters and lifestyle accessories, with raw materials sourced

from factories, waste collectors, and cafes.

Observation data revealed that Olah Plastic is strategically located in the heart of Bandung City, providing easy access for clients and operational activities. Its production facility is situated in Gedebage, an industrially suitable area with minimal environmental disturbances. The workflow at Olah Plastic involves several stages, from material collection to melting and pressing, utilizing post-consumer and post-industrial raw materials.

In addition to observations, interviews were conducted with the CEO and the Olah Plastic team to gain deeper insights into participants' perspectives, experiences, and understanding of the phenomena under investigation (John W. Creswell, 2018). Data analysis from the observations and interviews provided valuable insights into the operational dynamics and challenges faced by Olah Plastic. This research identifies opportunities for recycling skincare plastic waste and developing innovative solutions to address the increasing problem of skincare plastic waste in Indonesia.

2. Define

The *Define* phase in this research focuses on an in-depth analysis of the data collected during the *Discover* phase to specifically define the problem. A PEST analysis, internal analysis, and SWOT analysis of Olah Plastic were conducted to understand the strengths, weaknesses, opportunities, and threats faced by the company in its efforts to process plastic waste into valuable products.

The PEST analysis examines political, economic, social, and technological factors, both present and future, assisting the company in aligning its business strategies with external environmental conditions to gain a competitive advantage (Yoseffane, 2022). The political discussion includes government regulations supporting plastic waste reduction and public-private partnerships. Economically, supportive fiscal policies and projected growth in the recycling market present positive prospects. Social trends indicate an increasing awareness of environmental issues and a preference for reusable products. Technologically, innovations in production machinery and digitalization in promotion and sales offer competitive advantages. However, the company faces threats such as political instability, fluctuations in raw material prices, changing consumer preferences, and rising production costs associated with new technologies.

Table 1. PEST Analysis (Political, Economic, Social, and Technological)

	Opportunities	Threats
Political	Government Regulations: - Indonesia Clean Waste 2025 (KLHK, 2017) - Reduction of single-use plastics - Restriction on the use of specific types of plastics Public-Private Partnerships	Political instability threatening business activities
Economic	- Fiscal or tax policies supporting recycling businesses - The plastic recycling market is projected to grow by 7.1% between 2024 and 2030 (Industry ARC, 2024)	Fluctuations in raw material prices and plastic waste supply may affect production costs
Social	Social trends such as the reuse of products and environmental consciousness	Changes in consumer behavior and preferences towards recycled products.
Technologic al	Technological innovations such as advanced machinery in the production process	Increase in production costs due to technological advancements

- Access to the latest technologies that can enhance Olah Plastic's ability to produce high-quality products
- Digitalization in promotion, sales, and communication

The internal analysis of Olah Plastic reveals strengths such as ownership of assets, including office and factory spaces, a company culture that fosters innovation and collaboration, and a reliable human resources team with backgrounds suited to their respective roles. The company also benefits from a strong marketing and distribution network, as well as a solid reputation. Financial stability is ensured through steady B2B projects, and relationships with regular suppliers, including waste collectors and large companies, help maintain a steady supply of raw materials. However, the company also faces several weaknesses, such as limited types of machinery, lack of human resource development, instability in the availability of raw materials, and a financial system still managed by a single individual.

Furthermore, a SWOT analysis was conducted to systematically examine the factors influencing the company, aiding in the development of a well-structured plan to achieve both short-term and long-term objectives (Huddin Misba, 2021).



Figure 3. SWOT Analysis (Sari, 2024)

The conclusion from the SWOT analysis is that Olah Plastic has strengths in its custom finishing capabilities and its flagship product, plastic boards, which are already well-known. Identified opportunities include government regulations supporting the reduction of plastic waste. Therefore, the proposed strategy is product innovation, utilizing the company's custom finishing capabilities and flagship products to create high-quality and environmentally friendly stationary products, such as storage solutions, in line with government regulations on plastic waste reduction.

This define phase specifically formulates the problem or challenge to be solved and identifies the main opportunities for Olah Plastic (Jauhari & Prayudi, 2023). By leveraging the company's strengths in product innovation and marketing, along with the opportunities presented by government regulations, Olah Plastic can develop products that are not only environmentally friendly but also meet the growing market demand for solutions aligned with environmental concerns.

3. Develop

The develop phase is carried out as the process of developing ideas and prototypes for solutions to explore possible realistic design concepts (Jauhari & Prayudi, 2023). This phase involves creating a mind map to visually organize information, using diagrams that connect related ideas and concepts. Mind mapping helps in organizing and mapping complex information into a structure that is easier to understand and remember (Buzan, 2018). Additionally, alternative sketches were created as an initial idea for product development.

Based on the results of the mind mapping, the product chosen for design is a storage stationary item with several key considerations: stable and continuously increasing daily demand, long product

lifespan, and appealing design and functionality. Stationery is used by various groups, from students to office workers, making its economic demand promising. The storage product has a long lifespan and can be used in various contexts, making it more sustainable. Furthermore, stationery made from recycled plastic can be designed with both aesthetic appeal and high functionality, attracting environmentally conscious consumers.



Figure 4. Mind Mapping (Sari, 2024)

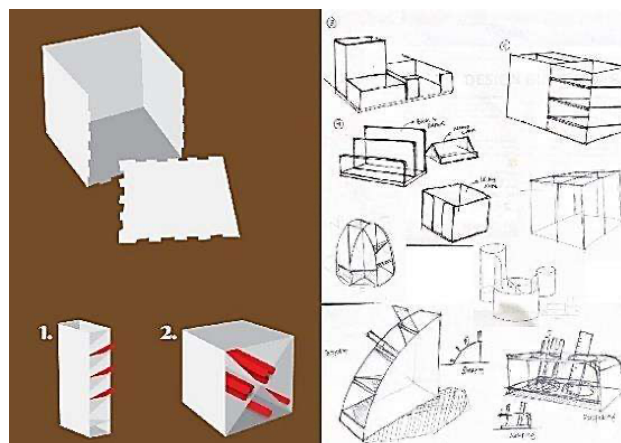


Figure 5. Alternative Sketches (Sari, 2024)

The design of the storage stationary product was created with consideration of the limitations and capabilities of Olah Plastic's recycling process. After undergoing several design evaluation stages, Sketch 9 was selected as the final design. This design features a simple yet efficient cylindrical shape, with adjustable placement features to accommodate various storage needs for stationery items.

Table 2. Results of Alternative Sketch Scoring

Indicator	Sketch 2	Sketch 7	Sketch 9
Ease of Production	5	5	5
Aesthetics	3	4	4
Durability	4	4	4
Function	3	3	5
Recycling	4	4	4
Total Score	19	20	22

Sketch 9 was selected based on a comparative analysis using a score table (Table 2), which compared sketches 2, 7, and 9. Sketch 9 was chosen because it meets several key criteria, such as: Simple Cylindrical Shape: This shape facilitates both the production process and everyday use. Adjustable Placement: The modular design allows the tube to be used separately or as a whole,

providing flexibility in adjusting to the user's needs (Pambudi et al., 2024) for stationery storage. Sketch 9 is also considered to have a harmonious form, which enhances its expressive content and conveys a deeper message through its design (Simbolon et al., 2021).

4. Deliver

In the Deliver phase, the solutions obtained in the Develop phase are implemented, designed, and tested (Jauhari & Prayudi, 2023). The researcher will enter the prototyping and testing phase. Prototyping is a crucial stage in the design process that allows designers to realize ideas in a tangible form. Through the creation of a 1:1 scale prototype, designers can test the functionality, ergonomics, and aesthetics of the product before mass production (Ulrich & Eppinger, 2015). In this phase, the researcher will use PVC board material to produce the prototype at a 1:1 scale because this material is lightweight, easy to shape, and economical (Ashby, 2012). The result can be seen in the documentation in Figure 5 below.

The prototype below is a stationery storage solution with several characteristics, consisting of three cylindrical tube-shaped containers of varying heights. Each tube has a basic cylindrical shape and is supported by a half-circle-shaped support at the back. The three tubes are of different sizes: the tallest tube is on the left, the medium tube is in the middle, and the shortest tube is on the right. The tallest tube is sufficiently tall to accommodate long brushes. The medium and shortest tubes are more suitable for pencils, pens, or other smaller items.



Figure 5. Prototype Stationery (Sari, 2024)

Next, the testing phase is conducted to evaluate the performance and practicality of the prototype that has been created. Although this testing phase is not yet fully completed, the preliminary observations and discussions with the Olah Plastic team indicate that the product has great potential for further development. Several aspects were tested, including material durability, ease of use, and the aesthetic appeal of the stationery product. Preliminary results from this testing provide positive indications that the product can meet market needs and offer a sustainable solution to reduce plastic waste.

To reach end consumers, the researcher and the Olah Plastic team are considering various sales channels. The product can be sold through Olah Plastic's official website as well as through various popular marketplaces. This strategy is expected to expand market reach and make it easier for consumers to obtain the product. With a combination of attractive design, high functionality, and effective sales strategies, this stationery product made from skincare plastic waste has the potential to become an innovative solution in the recycling industry and help reduce the negative environmental impact of plastic waste.

CONCLUSION

The conclusion of this entire research process demonstrates that innovation in utilizing skincare plastic waste into stationery products, specifically storage solutions, holds significant potential. Starting from the identification of daily needs and long product lifespan, to the development of an attractive and functional design, this research successfully produced a promising prototype. PVC board material was used to create a 1:1 scale prototype, and the initial testing phase showed positive results. Discussions with the Olah Plastic team further reinforced the belief that this

product is viable for development and marketing, both through the official website and various marketplaces. With support from government regulations and growing consumer awareness of environmentally friendly products, this stationery product made from recycled plastic is expected to provide a sustainable solution for reducing skincare plastic waste and create added value from previously useless materials.

Suggestions for future research include continuing with more in-depth and comprehensive testing, including long-term durability tests, functionality testing under various usage conditions, and life cycle analysis to assess the overall environmental impact. Additionally, further research could explore the potential use of other recycled materials and innovations in more efficient and eco-friendly production techniques. Developing effective marketing strategies to raise consumer awareness and interest is also crucial, including collaborations with communities and environmental organizations to strengthen campaigns promoting the use of eco-friendly products. This research could also be expanded by involving consumers in the design phase to ensure that the product developed truly meets user needs and preferences.

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