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Revaluing Jewelry Made from Recycled Copper and Brass

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Abstract.
Metal is a material that can be processed in a sustainable manner without degrading or losing its original properties. The composition of metal waste in Indonesia alone is expected to reach 6.86% by 2021 and is ranked fifth as the largest waste composition in Indonesia, which has the potential to damage the ecosystem if not handled properly. Several companies are trying to respond to the concerns about metal waste in Indonesia, namely by revalue metal waste into products such as jewelry, home decor, and furniture. However, recycled metal waste still has a low value in the eyes of society, causing its sparse usage as a product material. This research focuses on the use of brass and copper waste, presented in the form of stories. This research also was carried out through several methods such as literature study, market research, brainstorming, and product development to produce jewelry that connects metal and copper waste materials with the concept of rebirth.

Keywords: metal, waste, jewelry, recycle, revalue

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1. Introduction

Nowadays, the topic of environmental damage generated by humans is being widely discussed. Climate change, deforestation, floods, and water contamination are some examples of environmental damage faced by several countries, especially in Indonesia which occurs due to a lack of awareness about the damage caused by some people from producing waste in their daily lives. According to Ministry of Environment and Forestry (KLHK) data, by 2021, the volume of waste accumulated from all districts and cities in Indonesia could reach a total of 18.2 million tons/per year with 13.2 million or around 72.95% of the total are a manageable waste while the rest are impossible to handle, for instance, solid waste will only become a source of damage to the environment including their ecosystem such as metal. Metal waste is indecomposable and usually found in waste residues produced by metal-based industries. Metal can become toxic due to

its oxidation process that causes the metal surface to corrode and rust, which can be dangerous for the ecosystem when interacting directly. In the prior issue, metal waste processing in Indonesia itself was recorded as still very low. Village Potential Survey Data in 2018 stated that 41,073 units of MSMEs or micro, small, and medium businesses engaged in processing metal into handcrafts in Indonesia alone, which reached 0.2% of the 26 million other MSMEs in Indonesia alone. This shows the low usage of metal waste as craft materials in Indonesia.

To respond about the issue of metal waste in Indonesia, several companies have implemented the concept of recycling metal residues into a brand new product by using certain approaches in processing their metal waste to have various shapes and finishes, such as jewelry products. Aside from environmental impact, metal waste jewelry is also portrayed as its user's identity. With the advancement of the jewelry industry and people's lifestyles, the development of jewelry designs aimed at different individuals increased and led to the emergence of many styles and types of jewelry.

2. Literature Review

2.1. Metal Waste

Metal waste, also known as scrap metal, is the residual material that remains after metal production and usage. It is distinct from other types of waste due to its unique properties [1]. The remarkable attribute of metal waste is that it can be recycled or processed numerous times without compromising its original characteristics [1]. The process of recycling metal waste typically involves melting it down to create valuable products. This method is a common practice in the metal industry, and it helps to reduce environmental pollution while conserving natural resources.

Metal waste can be classified into two main types ferrous and non-ferrous. Ferrous metal, which consists of iron and other elements, is magnetic and can easily corrode due to its high carbon content. On the other hand, non-ferrous metal is much lighter, more resistant to corrosion and oxidation, and can be recycled with greater ease [2]. Due to these favorable attributes, non-ferrous metal is more commonly utilized for reprocessing purposes. Additionally, it is widely available in the market, making it a popular choice among manufacturers and consumers.

2.2. Metal Scrap Jewelry

Crafting jewelry from metal waste is a creative and environmentally conscious approach to producing one-of-a-kind pieces. This technique involves utilizing metals that can be recycled or repurposed without losing their inherent properties, ensuring that each creation is both unique and sustainable [1]. By using discarded electronic elements, designers can transform what was once considered waste into beautiful and contemporary works of art [3]. Not only is this type of jewelry visually appealing, but it also promotes sustainability and reduces environmental waste. Also it can create a way to express individual style while also being mindful of the planet.

2.3. Jewelry

Throughout history, jewelry has played a significant role in showcasing one's cultural, religious, and racial identity as well as their wealth and social status. However, over time, the purpose of jewelry has evolved from being an asset or wealth to becoming a decorative ornament, serving as a means of creative expression and adornment [3].

In addition to reflecting a person's social standing, jewelry is also a medium for self-expression for some individuals, serving as a fashion accessory. With jewelry, one can display their desired style or mood, ranging from a contemporary statement to a simple modern look. Jewelry can also be transformed into contemporary art, using everyday materials such as metal from electronic elements [3].

2.4. Hypotheses

Metal waste has immense potential to be repurposed into jewelry due to its unique properties and characteristics. By utilizing methods like melting, forming, and shaping, the waste can be transformed into modern and organic shapes with intricate details added through the forging process. The utilization of metal waste during the production process is an advantageous approach that can yield significant cost savings while also promoting environmental sustainability. By incorporating this waste material into the production process, companies can effectively reduce their expenses while also minimizing their carbon footprint.

3. Methodology Research

The following are the process stages carried out in this research using Double Diamond Methods :

1. Discover

During this stage, observations are made through literature studies of related media sources to identify phenomena and problems. by searching for data from various sources, and research through journals or articles. To gain a deeper understanding of the problem, in-depth interviews were conducted with owners of metal waste companies to discuss the issues at hand. These interviews were aimed at learning more about the partners' backgrounds, production processes, and market opportunities. Additionally, we utilized the empathy process by conducting in-depth interviews and shadowing methods with target users of related products to better understand how users interact with the product.

2. Define

During the discovery phase, any identified issues are filtered to gain a better understanding of the target users' problems and goals for the product also enabled to pinpoint the main problems and outline the product goals for users using an Empathy Map and Customer Journey Mapping method.

3. Develop

After identifying critical concerns and objectives, various solutions can be generated into multiple potential solutions. Additionally, The writer also considers the needs of the target audience using the value proposition canvas methodology to determine how the product can provide value to consumers.

4. Deliver

The obtained ideas were turned into visuals to solve previous problems. This process, known as ideation, involves crafting potential solutions to the problem at hand and then testing these solutions with users to make necessary adjustments.

3.1. Tables and Figures

a. Market Analysis

Our target audience is the industrial sector with an appreciation for art and sustainability. In order to assess our brand's standing in the market, we conducted a thorough

comparison with our competitors (see Figure 1). During this analysis, we emphasized the shared environmental values and the utilization of sustainable materials that set us apart from the rest. Such a strategy allowed us to gain a better understanding of our strengths and weaknesses and helped us to further refine our approach towards sustainable business practices. We plan to incorporate non-precious metal waste like copper and brass into our production process to support sustainability efforts. Our brand's unique aesthetic is a perfect blend of understated minimalism and bold, unconventional design, making us stand out in the market.

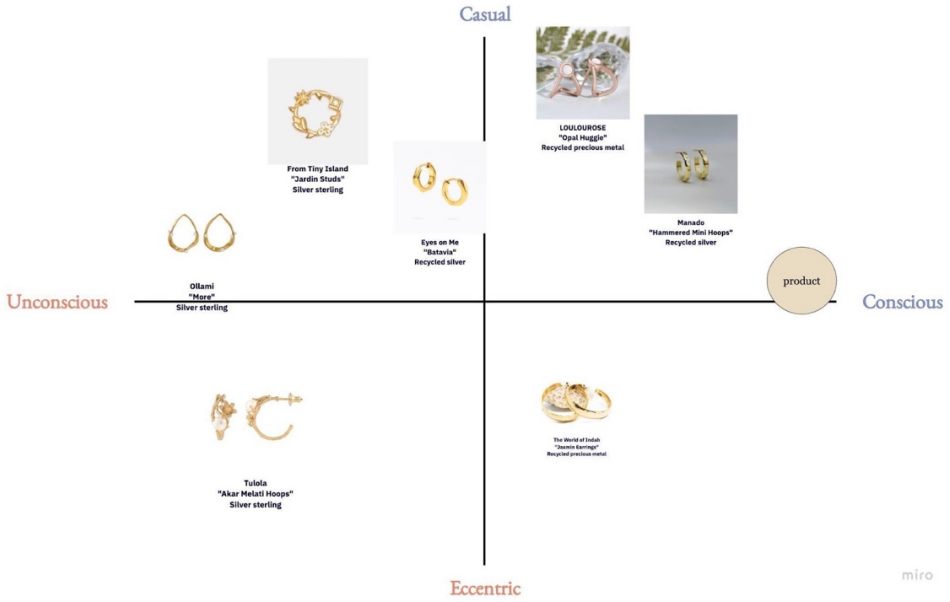

Figure 1: Product Positioning. Source: (Personal Documentation, 2022).

b. Metal Waste Experimenting

The plates used in the experiment were copper and brass with a thickness of 0.4 mm (see Figure 2). Six textures were achieved through texturing techniques, and two were chosen that fit the product designs. Factors considered included compatibility with modern and contemporary styles and the availability of tools for craftsmen to use.

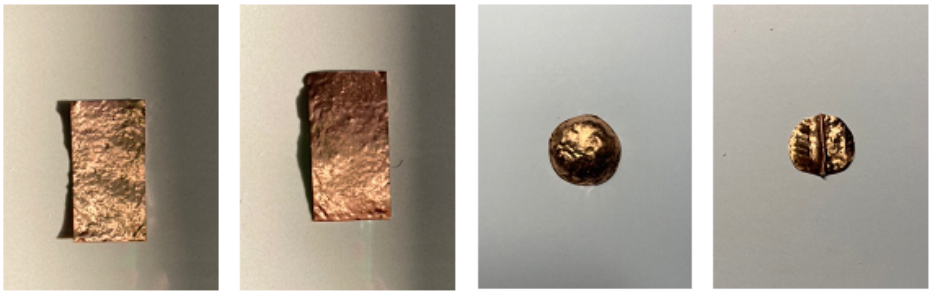

Figure 2: Result of Metal Experimenting. Source: (Personal Documentation, 2023).

c. Product Development

The initial step in product development is ideation sketches, preceded by a mood board to set the design's tone (see Figure 3). Based on previous analysis, the keywords for this product are modernist, contemporary, and textured.

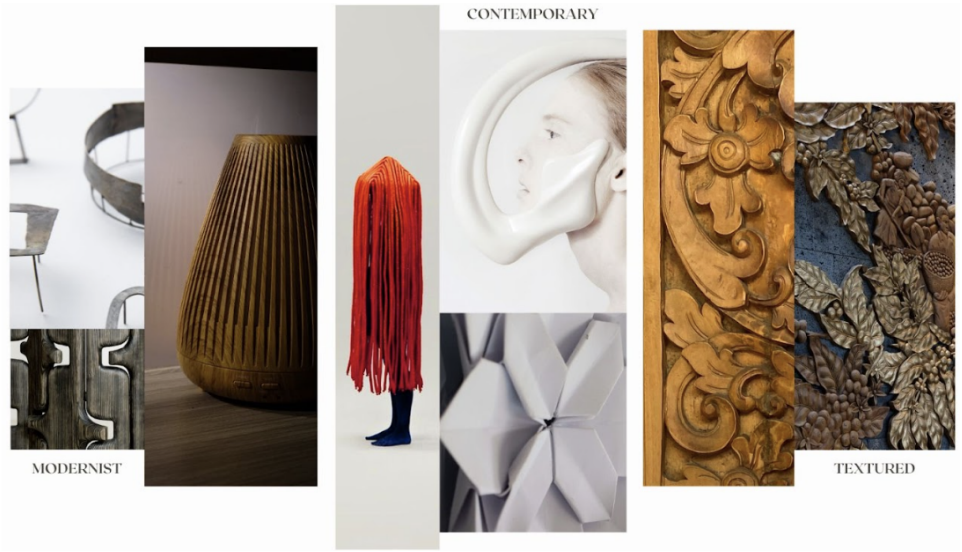

Figure 3: Mood Board. Source: (Personal Documentation, 2023).

In order to move forward, design choices should be narrowed down. This will involve developing alternative designs and detailed models that align with the predetermined concept with 3D modeling of the selected design concepts (see Figure 4).

Figure 4: 3D Model Jewelry Series. Source: (Personal Documentation, 2023).

d. Prototype

For the final design prototype, we utilized discarded copper and brass materials to create plates or slabs. Applying shape exploration and texturing techniques to the metal surface resulted in a visually appealing and unique final product (see Figure 5).

Figure 5: 3D Model Jewelry Series. Source: (Personal Documentation, 2023).

4. Results and Discussion

a. Market Analysis

To identify the ideal consumers for our design, we conducted a thorough interview with our partner a metal waste-based jewelry company in Denpasar, Bali. Our goal was to understand the process of transforming metal waste into finished products and to identify existing market opportunities for metal waste-based jewelry in Indonesia. With this information, we can better understand the target audience for the products we plan to design. An in-depth interview was conducted with urban women aged 21-25 who are interested in jewelry products. We also observed their lifestyles and interactions with jewelry products. These findings were used to understand this specific demographic and improve our approach to them.

Once the initial stage is completed, potential users are carefully selected and analyzed to determine which demographic best represents the target consumer. In this case, the selected demographic is a 25-year-old urban woman who has experience working and a keen interest in jewelry. After understanding the target consumers and their needs, the next step in the design process is market analysis. The goal is to determine the target market using the Segmenting, Targeting, and Positioning method. Based on our research, our product's typical user is a 25-year-old woman with a permanent job living in a large city. She appreciates art and has an idealistic, creative personality. She values sustainability in products and brands that prioritize it. Her lifestyle involves keeping up with trends and paying attention to her clothing style, preferring products that enhance her appearance and can be used every day.

After analyzing the data, we've determined that our target audience is the industrial sector that values art and sustainability. We've compared our brand to competitors

who prioritize environmental values and use sustainable materials. We've also found an untapped market for using non-precious metal waste like copper and brass in our production process to support sustainability (refer to **Figure 1**). Our brand has a distinctive style that combines casual minimalism with an eccentric flair.

b. Metal Waste Experimenting

We started developing our product by experimenting with copper and brass metal waste material in the form of plate sheets. Before starting, we sorted the plates by metal classification. The plates used in the experiment were copper and brass with a thickness of 0.4 mm. To create a specific texture, we used texturing techniques to forge the surface of the plates. From 6 textures, we selected 2 that were suitable for our product designs (refer to Figure 2). To consider factors like the availability of tools for the craftsmen to use while making the products.

During the experiment, metal was used with forming, pressing, and sheet bending techniques to create organic shapes. Out of the 7 experimental results, 2 were selected based on the availability of tools such as doming blocks, and the craftsman's ability to make the shapes using folding techniques.

c. Product Development

The design concept is inspired by the idea of reincarnation, where karma determines one's rebirth. The product involves reprocessing metal waste to create a new item, promoting mindful actions towards the environment and our creations. The jewelry set draws inspiration from the process of recycling metal waste and the process of reincarnation are closely related and serve as a philosophical concept for the jewelry set being designed, including the seed of life or spirit (Jiva), the impact of our actions (Karma), and the cycle of rebirth (Samsara). The initial step in product development is ideation sketches, preceded by a mood board to set the design's tone. Based on previous analysis, the keywords for this product are modernist, contemporary, and textured, influencing the jewelry style, design concept, and details (refer to Figure 3).

In order to move forward, design choices should be narrowed down. This will involve developing alternative designs and detailed models that align with the predetermined concept. We will integrate the concepts of Jiva, Karma, and Samsara into an alternative jewelry set. Product visualization will continue with 3D modeling of the selected design concepts to determine the jewelry's scale and shape, which cannot be achieved through sketches alone (refer to Figure 4).

d. Prototype

For the final design prototype, we utilized discarded copper and brass materials to create plates or slabs. Applying shape exploration and texturing techniques to the metal surface resulted in a visually appealing and unique final product (refer to Figure 5).

e. User Test

The YAĀTRA Collection (Jiva, Karma, Samsara) jewelry prototype was tested users for one hour to gather some feedback, which was provided in the form of feedback:

*Symbols: (+) Positive Feedback, (-) Negative Feedback, (=) Input

1. Design

(+) The Karma and Samsara series earrings have a captivating design that adds a bold and impactful touch to any outfit. They are an essential accessory in a collection with a distinctive style that effortlessly captures attention.

(+) A combination of copper and brass can enhance jewelry's appearance and convey elegance.

(-) Certain pieces of jewelry may appear too noticeable and can be uncomfortable when worn.

(=) The input requested adding a bracelet that can be adjusted to function as a chain or rope on the wrist.

2. Ergonomics

(+) Pendants, earrings, and rings are comfortable to wear due to their lightweight.

(+) The size of the earring may seem quite substantial at first glance, but upon further inspection, users find that it fits quite comfortably and becomes the focal point of any jewelry ensemble.

(-) Some bracelets on Jiva and Samsara look awkward on the wrist due to their large diameter.

3. Others

(+) Incorporating a textured finish onto the surface of jewelry pieces can significantly heighten their visual appeal and allure.

(+) When copper is exposed to light, it takes on a beautiful rose gold hue. This gives it an elegant and trendy appearance, perfect for any style-conscious individual.

5. Conclusion

Based on the results of the research that has been carried out, it can be concluded that metal waste, especially copper and brass has the potential to be an alternative for sustainable material jewelry. Metal waste can be transformed into limitless possibilities through precise techniques like metal forming. Using the forging process, one can create unique organic shapes and achieve a contemporary to modern style concept. This also allows for intricate details to be added to the surface, resulting in innovative designs. Apart from that, metal waste also gives benefits such as decreasing production costs in terms of materials, which are affordable compared to other materials such as precious metals.

According to the survey of jewelry users, the ideal target consumer demographic is active women aged 21-25 who are interested in the fashion and jewelry field and seeking sustainable products. Based on the data collected, it appears that potential customers are drawn to a casual style design with a modern and contemporary twist. This has inspired the jewelry concept, which is tailored to the lifestyles and activities of the target consumers, specifically those who live in urban areas. These customers are interested in products that can be used every day, as they go about their daily routines, and they want these products to reflect their style.

Assigning philosophical value to the concept can be impactful in developing innovative approaches to storytelling about the production process of a product. This can convey information about the source of the materials used in the production and their connection to the philosophy of rebirth or renewal, which is adopted as a jewelry concept.

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