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From Global Waste Crisis to a Guide for Jewellery Design Using Bio-Circular Green (BCG) Economy

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Abstract

Today's world is full of man-made waste, leading to a great impact on the environment and people's livelihood. Many businesses around the world have realized the environmental impact, including the gem and jewellery industry. They have adopted the concept of a circular economy system, which belongs to the holistic economic development model, or the BCG Model, as a solution to solve environmental problems, considering the use of resources to achieve the most value and longest possible time. Those consist of full product utilization, recycling, and designing products and manufacturing processes to reduce waste using the 9 R strategy as a guideline. In Thailand, there are jewellery manufacturers who care about the environment and operate in accordance with the principles of the circular economy concept. This can be used as a guideline to create jewellery that reduces negative impacts and is environmentally friendly, leading to sustainable development. This also includes cooperation from the private sector and promotion of environmental policies by the government. This also includes cooperation from the private sector, promotion of environmental policies from the government sector, and consumers who are part of strict policies in supporting environmentally friendly products.

Keywords: Waste Crisis, Bio-Circular Green (BCG) Economy, Jewellery Design

Introduction

Each year, the world generates municipal solid waste (MSW), including waste from companies, buildings, homes, and small businesses with the nearly amount of two billion tons. The volume of waste produced continues to increase with the growing global population. Furthermore, waste is expected to increase by 70% from 2016 to 2050 (Buchholz, 2022). The waste problem in Thailand is becoming increasingly severe, especially the issue of waste lingering in the environment. According to a report by the Pollution Control Department, Ministry of Natural Resources and Environment (2024), in 2023, the amount of municipal solid waste generated was 26.95 million tons, an increase of 5% from 2022 (25.7 million tons). It was found that 7.47 million tons, or 27.7%, of this waste was not properly disposed of. Waste management practices such as dumping waste in landfills, using small incinerators, or open burning produce greenhouse gases, all of which directly impact the ecosystem. Thus, global waste has become one of the environmental issues of utmost importance worldwide. The daily volume of waste generated on Earth is so immense that it cannot be disposed of, destroyed, or decomposed by natural methods, leading to significant environmental and natural resource issues and affecting the health of the global population.

From the global waste problem, the public has become aware of the resulting impact. The trend of social and environmental responsibility is becoming increasingly important in the purchasing decisions of the younger generation worldwide. Many industries are adapting and moving towards sustainable business development practices (Gem and Jewellery Information Centre, 2020). The gemstone and jewellery industry, is important for Thailand, as its export value, over the preceding years, has ranked third. It is also one of the top 10 export industries that generate the highest revenue for the country for decades. Nonetheless, currently, Thailand's gemstone and Jewellery production is facing a shortage of domestically produced raw materials, necessitating imports from abroad (Puey Ungphakorn Institute for Economic Research, 2020).

The concept of a Bio-Circular Green (BCG) Economy is an important alternative that many countries use to address environmental issues, focusing on the efficient use of resources under the new economic model, or BCG Model (National Science and Technology Development Agency (NSTDA), 2019). This concept can be applied to improve and develop production processes in the Jewellery and accessories industry, leading to the production and design of environmentally friendly jewellery that reduces environmental impact and ultimately achieves sustainability.

The gemstone and jewellery industry

Jewellery serves to decorate the human body and has been a symbol of cherished memories for centuries. However, the beauty of traditional jewellery often comes with hidden costs. Therefore, large-scale mining and the processing of raw materials used in jewellery can significantly have an effect on the environment, from resource depletion and the release of harsh chemicals to pollution from manufacturing processes and greenhouse gas emissions. Nowadays, new innovations and the concept of sustainable jewellery are gaining attention and playing an important role in the jewellery industry, emphasizing environmentally friendly practices to achieve sustainability that is not just a trend.

The issues with traditional jewellery production that have an effect on the environment are found to have the following key points.

1. Mining and the sourcing raw materials

Gemstones and precious metals often come from large-scale mining operations, causing environmental damage, deforestation, soil erosion, and chemical contamination of water sources. Mining and the sourcing raw materials for gemstones and precious metals often originated from large-scale mines, causing environmental damage, deforestation, soil erosion, and the contamination of water sources.

2. The use of chemicals in processing and finishing

The production process often involves the use of hazardous chemicals, which cause water and air pollution, as well as other health hazards having an effect on workers in jewellery factories.

3. Waste generation and disposal

Traditional production creates a lot of waste of various kinds, from the initial production process through to the final consumer (Royi sal, 2024).

Circular economy

Since the Industrial Revolution, the economy has been driven in a linear manner, which means resources are used in one direction through the production process, leading to usage and disposal (single-use products). This has resulted in massive amounts of waste, both from garbage and surplus goods, creating pollution and accumulating greenhouse gases at waste disposal sites. There has been no consideration for reusing waste, leading to resource shortages while the demand for resources has significantly increased. The European

Union has recognized the problem of resource scarcity from this situation and has designed an economy focused on maximizing resource use, reusing raw materials, and minimizing waste or by-products. This has led to a circular economy where waste or garbage from the system is minimized to zero waste (Thailand institute of scientific and technological research (TISTR), 2019). The comparison of the two systems is shown in Figure 1.

In driving the circular economy, there are three key principles (National Science and Technology Development Agency (NSTDA), 2019) as follows

1. Using the product throughout its entire life cycle by extending its lifespan.
2. Transformation for reuse through the recycling of raw materials and products Transformation for reuse through the recycling of raw materials and products
3. Designing products and production processes to minimize waste or garbage.

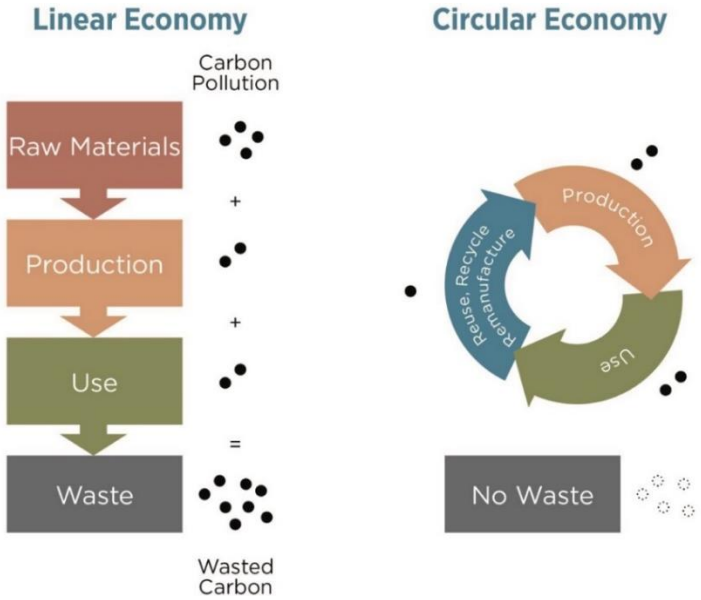

Figure 1 Comparison of linear economy and circular economy
Source: LMN Architects, 2022

Designing jewellery using the circular economy

The Gem and Jewellery Information Center (2021) stated that in the jewellery and gemstone industry, circular economy models are being used. Currently, several global entrepreneurs and renowned brands operate under this concept, from the product design and development process to the production process. Traditionally, design was based primarily on the aesthetics of the jewellery and customer needs. These ornaments are often disposed of and later become waste. Nevertheless, sustainable design helps reduce the environmental impact of products by considering environmental friendliness from the sourcing of raw materials, controlling energy use in the production process, and minimizing waste or leftover materials. Packages made from materials that do not harm nature, and the final products can be reprocessed into new raw materials

Strategies for circular economy

The concept of reducing waste and promoting the efficient use of resources, known as the 3R concept, has been popular for a long time. It consists of Reduce, which means using fewer resources; Reuse, which means using products again; and Recycle, which means processing waste materials for reuse. This concept has evolved into the 9R strategy for a circular economy to enhance efficiency and promote resource circulation in all aspects. The strategies for building a circular economy can be divided into three phases: 1) Design phase,

focusing on planning the use of raw materials and production processes wisely; 2) Usage or consumption phase, focusing on extending the lifespan of parts and products; and 3) End-of-life phase, focusing on maximizing the utility of waste materials. The strategies are ranked as follows: R0 Refuse is the strategy closest to a circular economy, while R9 Recover is at the end of the list as it is the method closest to a linear economy. Higher-ranked strategies create more positive impacts and sustainability (as shown in Figure 2). Accordingly, it can be said that R0 Refuse is the ideal strategy for a circular economy aimed at making the world free of waste or achieving zero waste. (Malooly and Daphne, 2023)

Therefore, the concept of using raw materials and production wisely from the very beginning of the design process, with the main strategies being R0 Refuse along with R1 Rethink and R2 Reduce, is significant in developing a circular economy. Producers should adhere to these principles as their main practices to create the best outcomes for the environment.

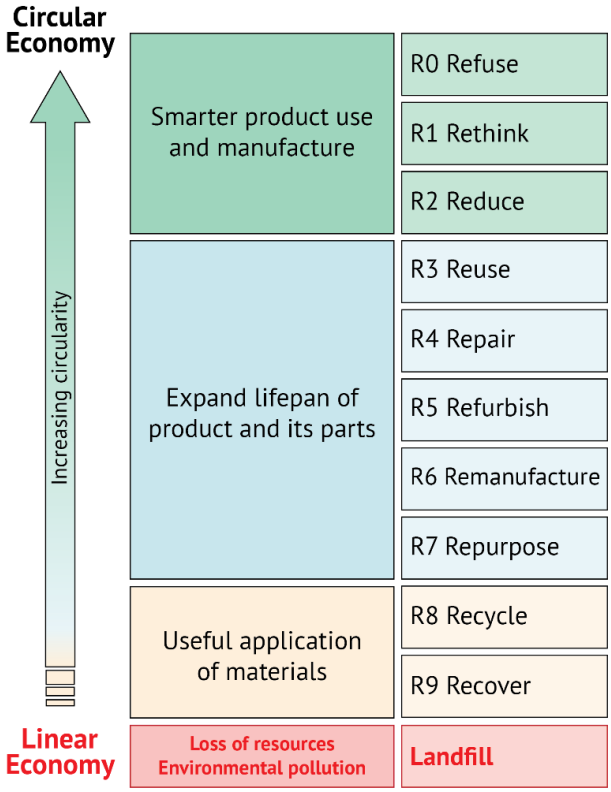

Figure 2 9R Strategies for circular economy
Source: Adapted from Malooly and Daphne, 2023

9R Strategies

The principles of the 9R strategy (Malooly and Daphne, 2023) and guidelines for application in jewellery are as follows.

R0 Refuse: Not introducing new raw materials into the system, not using toxic raw materials, discontinuing hazardous production processes or ceasing the production of goods or products harmful to the environment. Switching to more environmentally friendly methods or processes, such as choosing alternative materials, discontinuing or controlling the use of materials and tools containing hazardous chemicals like mercury and cadmium.

R1 Rethink: Reconsidering the use of products by making them versatile or compatible with various other products. For example, designing jewellery to be useful beyond just decoration for beauty.

R2 Reduce: Reducing the use of natural resources or materials while increasing efficiency in both the production process and product usage, such as reducing unnecessary product parts or packaging, and using materials wisely.

R3 Reuse: The act of bringing back products that are still in good condition for use in their original form without undergoing the production process again, such as using parts of old jewellery together with new jewellery.

R4 Repair: Maintenance and repair of damaged products to keep them in good condition for long-term use instead of discarding them, such as designing jewellery to be easily maintainable.

R5 Refurbish: The process of upgrading or restoring old products to make them modern and usable again, such as refurbishing old jewellery to look like new again.

R6 Remanufacture: The process of integrating intact components of a product with new products without changing the intended use of the product. For example, repurposing used parts or components of jewellery to restore them for their original use.

R7 Repurpose: The process of integrating leftover components with new products to serve a different purpose than originally intended. For example, using old parts or components of jewellery to create new jewellery that meets a different functional need.

R8 Recycle: The process of transforming waste materials for reuse by converting them into products of the same quality or lower quality (Downcycle). For example, taking damaged or worn-out materials or jewellery before disposal and processing them to create new products.

R9 Recover: The proper disposal of waste or garbage and its conversion into energy, such as promoting waste separation before disposal and sending waste for proper disposal.

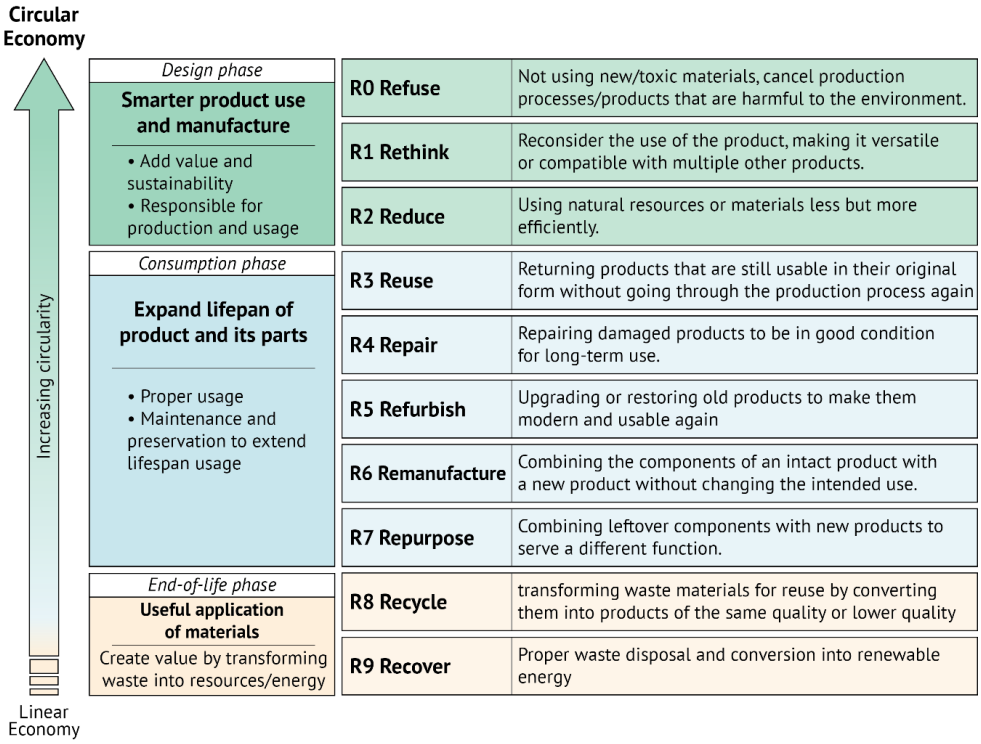

Figure 3 An overview of 9R Strategies
Source: Adapted from Malooly and Daphne, 2023

However, the above strategies can be adapted to fit the surrounding context or follow the guidelines of each organization. Most of the time, it involves selecting multiple strategies simultaneously to achieve maximum efficiency.

Jewellery in Thailand

Jewellery trends in Thailand are moving towards an eco-friendly concept, with a greater emphasis on environmentally conscious designs and development. This corresponds with the circular economy concept, as shown in the following examples of jewellery manufacturers with the above concept.

Pranda group

The Pranda Group are Thai jewellery and gemstone manufacturers committed to conducting business responsibly as a good member of our community, society, and world. They adhere to sustainable development practices that cover all dimensions, especially in the environmental aspect, setting a goal to achieve net-zero greenhouse gas emissions within the organization by the year 2050. They follow operational guidelines such as efficient energy management, water management, standardized waste and pollution management, and measures to reduce greenhouse gas emissions from the production process (Pranda group, 2023)

Figure 4 Sustainable development from Panda Group
Source: Pranda group, 2023

Qualy brand

Qualy has a policy of conducting business in line with sustainable development, aiming to reduce environmental problems from the product design stage under the commitment and desire to take serious action. This requires cooperation with government agencies, business partners throughout the value chain, and consumers. This is done by using the potential of creativity, innovation, production, communication channels and trade channels to drive towards sustainable development goals (Qualy design, 2022). The brand's products focus on using waste materials, particularly through upcycling, which involves transforming waste or unused materials into valuable and useful items.

Creating jewellery works in collaboration with other brands such as Cherinadded and Jiira. Cherinadded blends cultural stories with functionality, using flower parts made from recycled plastic and ceramic pollen at the core, hand-painted by skilled artisans. The design is rich in stories and intricate details that reflect lifestyle and sustainability (Qualy, 2024a). Additionally, Jiira, elevates jewellery to become art pieces that incorporate the lifestyle of the Karen community. The piece named "Care Curve Cave" is inspired by the Mae Sa Cave in the Samoeng District of Chiang Mai Province, made from recycled plastic waste found in natural tourist areas (Qualy, 2024b).

Figure 5 Jewellery from Qualy in collaboration with Cherinadded (left) and Jiira (right)
Source: Qualy, 2024a, 2024b

Pipatchara brand

Pipatchara aims to be a fashion brand, therefore it aims to contribute to the community society and environment under the concept of sustainability. The design work "Infinitude" primarily uses orphan plastic waste such as plastic bottle caps yogurt drink bottles and plastic cutlery which constitute waste with no intrinsic market value. These materials are repurposed through the production process to create eye-catching pieces that are woven into clothing, bags, and accessories. The colours and patterns depend on the types of plastic mixed, resulting in unique characteristics for each piece. This embodies the meanings of Rebirth Recycle and Redone representing the concept of Infinitude (Room, 2022).

Figure 6 Material and product from Pipatchara
Source: Room, 2022

Sarr.rai brand

The alternative jewellery brand aims to create fun for consumers drive environmental initiatives and develop Thai craftsmanship. Its three key design principles are: 1) Organic form design to maintain the essence of craftsmanship 2) Using environmentally friendly materials such as silver metal and endlessly recyclable glass beads freshwater pearls from eco-friendly farms and upcycled glass bottles to showcase the beauty of materials that were once considered worthless waste and 3) Creating jewellery suitable for all genders and ages to convey environmental awareness (Chatchanok Chaiwong, 2024).

Figure 7 jewellery from Sarr.rai
Source: Chatchanok Chaiwong, 2024

Benjaglai brand

From the ancient Benjarong ceramics of Samut Songkhram province, Pinsuwan Benjarong has transformed them back into life through fashion accessories. By taking imperfect, substandard, flawed, or broken Benjarong pieces and creatively polishing them alongside silver, they become unique accessories, each piece distinct from the others. This presents an interesting new image, communicating Thai identity in a different and modern way (Sukontala Yaempiew, 2020).

Figure 8 Jewellery from Benjaglai
Source: Sukontala Yaempiew, 2020

From the examples of jewellery manufacturers above, it can be seen that the principles of circular economy are being raised through the thinking process and planning. Production and disposal using innovative and environmentally conscious technologies throughout the product lifecycle results in waste or garbage being transformed into resources for producing jewellery and accessories that express their own beauty. These things not only have added value but are also environmentally friendly and create awareness in conserving resources in another way.

Conclusion and Suggestions

Environmentally friendly jewellery aims to eliminate waste by utilizing resources within the system's cycle according to the circular economy approach. This includes using products throughout their entire life cycle transforming them for reusing and designing to minimize waste or by-products from the system. This practice should be accelerated, which requires support from the government to drive the 9R strategy. It is an important strategy to drive the circular economy, promote environmental conservation policies, and spread knowledge to communities. In addition, in the private sector, manufacturers, entrepreneurs and designers should apply the 9R strategy, considering designing and planning from the beginning of the product cycle, creating value-added products from circular materials. Meanwhile, they also raise awareness of the consequences, persuading consumers to pay more attention, give importance and choose to consume more environmentally friendly products. This is to jointly create a balance between humans and nature, which would finally lead to moving towards sustainable development.

References

Buchholz, K. (March 28, 2022). A world of waste. *Statista*. Retrieved August 19, 2024, from https://www.statista.com/chart/18732/waste-generated-country/

Chatchanok Chaiwong. (February 1, 2024). Stay chic & sustainable. *Capital.* Retrieved September 12, 2024, from https://capitalread.co/sarrrai/

Cooperation, A.P.E. (2023). Understanding the Bio-Circular Green (BCG) Economy Model. www.apec.org/publications/2022/08/understanding-the-bio-circular-green-(bcg)-economy-model

Gem and jewellery information center. (October 27, 2021). *The circular economy towards sustainability in the gemstone and jewellery industry jewellery*. Retrieved September 11, 2024, from https://infocenter.git.or.th/th/article/article-20211027

Gem and jewellery information center (December 29, 2020). *Eco-friendly jewellery…A new environmentally conscious choice.* Retrieved September 3, 2024, from https://infocenter.git.or.th/th/article/article-20201229

LMN Architects. (August 12, 2022). *09 – Circular economy + products.* Retrieved September 8, 2024, From https://lmnarchitects.com/lmn-research/09-circular-economy-products

Malooly, L. and Daphne, T. (November 9, 2023). R-strategies for a circular economy. *Circularise.* Retrieved September 9, 2024, from https://www.circularise.com/blogs/r-strategies-for-a-circular-economy

National science and technology development agency (NSTDA). (August 26, 2019). *BCG in Action*. Retrieved September 3, 2024, from https://www.bcg.in.th/data-center/ebook-series/bcg-in-action/

Pollution control department, ministry of natural resources and environment. (2024). *Thailand state of pollution report 2023*. Bangkok: AP Connex Co., Ltd.

Pranda Group. (January 17, 2023). *Pranda Group drive towards goals to sustainable jewellery manufacturer.* Retrieved August 19, 2024 from https://www.pranda.com/corporate-news/pranda-group-drive-towards-goals-to-sustainable-jewellery-manufacturer/

Puey Ungphakorn Institute for Economic Research. (December 15, 2020). *Jewellery and gemstone industry*. Retrieved September 3, 2024 from https://www.pier.or.th/forums/2020/18/jewellery/

Qualy. (January 30, 2024a). *Beauty...without boundaries from the fusion of craft and industry*. Retrieved September 12, 2024 from https://www.facebook.com/share/p/JnoT6BGcui9rn76C/

Qualy. (March 11, 2024b). *Contemporary sustainable jewellery at Qualy in collaboration with Jiira jewellery*. Retrieved September 12, 2024 from https://www.facebook.com/share/p/EcRd8VwYeEWJzS41/

Qualy design. (22 July 2022). *Sustainability policy*. Retrieved September 12, 2024 from https://qualydesign.com/thailand/sustainable/

Room. (November 16, 2022). Infinitude with an endless cycle. *Bannlaesuan*. Retrieved September 11, 2024 from https://www.baanlaesuan.com/270294/design/design-update/product/infinitude-pipatchara

Royi sal. (March 25, 2024). *Crafting a brighter future: innovations in recycled materials and eco-friendly manufacturing for jewellery*. Retrieved August 19, 2024, from https://royisal.com/innovations-recycled-materials-eco-friendly-manufacturing-jewellery/

Sukontala Yaempiew. (August 6, 2020). Benjaglai. *The cloud*. Retrieved September 24, 2024, from https://readthecloud.co/benjaglai-by-pinsuwan-benjarong/

Thailand institute of scientific and technological research (TISTR). (2019). *Circular economy...that everyone should know*. Pathum Thani: Thailand institute of scientific and technological research