

## **Toward Sustainable Development: Business Experiences in Green Innovation and Circular Economy**

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### **Abstract:**

In response to growing environmental concerns, businesses and governments are increasingly rethinking their strategies for sustainable development. Green innovation (GI) has emerged as a key solution that enhancing both environmental sustainability and business competitiveness. It involves the development and adoption of eco-friendly processes, technologies, and products. Furthermore, GI serves as a driving force in the transition toward a circular economy (CE), which emphasizes reducing, reusing, and recycling resources. This paper also explores the barriers that hinder the broader adoption of GI within the CE framework, and through industry case studies how the transition to this model improves resource efficiency, minimizes waste, and contributes to long-term environmental resilience.

**Keywords:** Green Innovation, Circular Economy, Sustainability, Sustainable Development

**Jel Classification Codes :** O13, O31, Q56

### **Introduction:**

The global push for environmental sustainability has brought the circular economy to the forefront of sustainable development strategies. This innovative approach to production and consumption aims to minimize waste, maximize resource efficiency, and reduce pollution. By promoting recycling, sustainable practices, and zero waste initiatives, the circular economy model, which emphasizes the continual use of resources and the minimization of waste, presents a compelling alternative to the traditional linear economy that is characterized by a 'take-make-dispose' approach (Siedschlag et al., 2022). It has an influence on various sectors, from manufacturing to services, reshaping how businesses operate and consumers behave.

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Green innovation refers to the development and implementation of new ideas, technologies, processes, or practices that aim to find innovative solutions to address environmental challenges, minimize negative environmental impacts and create a more sustainable future. Eco-innovation and environmental innovation are two concepts that have been used interchangeably with green innovation (Ahmad et al., 2023). While, according to (Porter & Linde, 1995) "Properly designed environmental standards can trigger innovations that lower the total cost of a product or improve its value". These innovations allow a company to use various inputs more productively which offset the costs of improving the environmental impact. All of this prompts us to consider the following question: **"How green innovation fosters the shift from a linear economy to a regenerative system, with the aim of enhancing progress toward the Sustainable Development Goals (SDGs)."**

This primary question is further examined through these sub-questions:

- What are the conceptual foundations of Green Innovation (GI) and the Circular Economy (CE), and how are they interrelated?
- What are the key barriers and challenges impeding the adoption of Green Innovation (GI)?
- How do Green Innovation (GI) and the Circular Economy (CE) influence the achievement of sustainable development?

#### **Objectives of the study:**

This study aims to explore how businesses contribute to sustainable development through the adoption of green innovation and circular economy practices. It seeks to examine how circular principles are integrated into business models, and analyse the drivers, benefits, and challenges associated with these approaches. The study also aims to assess the environmental, economic, and social impacts of such practices and highlight successful experiences, providing insights and recommendations to support the transition toward more sustainable business models.

#### **Importance of the study:**

This study lies in its contribution to understanding how businesses can play a vital role in achieving sustainable development through innovative and circular approaches. As global environmental challenges intensify, there is a growing need for practical strategies that reduce resource consumption, minimize waste, and promote environmental responsibility. By examining real business experiences in green innovation and the circular economy, this study provides valuable insights for policymakers, managers, and researchers seeking to foster more resilient, efficient, and sustainable economic systems. It also helps bridge the gap between theory and practice, offering evidence-based guidance for supporting sustainable business transformation.

### **1-Green Innovation:**

#### **1.1. Definition**

The concept of innovation is a broad concept that includes all what is new and different, in all fields, it is related to a new solution for an existing problem through innovative thinking (Bellakhdarda, 2022). Thus, green innovations are brand-new or altered structures, processes, practices, and products that try to minimize or completely eradicate the negative consequences of economic

activity on the environment (Siedschlag et al., 2022). In other words, GI is an innovation that is used across the whole commercial product life cycle, which includes the creation, manufacturing, distribution, and final use of goods that primarily support environmental sustainability (Guinot et al., 2022).

Furthermore, the Environmental Technology Action Plan (ETAP) defined it as “the production, assimilation or exploitation of a product, production process, service or management or business method that is novel to the organization (developing or adopting it) and which results, throughout its life cycle, in a reduction of environmental risk, pollution and other negative impacts of resource use (including energy use)(OECD, 2010). While, (Javier Martínez-Falcó, et al., 2024) emphasize that green innovation refers to businesses' efforts to create environmentally friendly products and processes, aligning economic goals with ecological and social needs by adopting green technologies that can significantly reduce their environmental impact while enhancing operational efficiency and competitiveness, thus enhancing sustainability and stakeholder satisfaction.

### **1.2. Green innovation types and dimensions**

(Porter & Linde, 1995) mentioned that there are two main types of innovation in response to environmental regulations. The first is new methods and technology that reduce the overall cost of cleaning up pollution after it happens. These methods frequently include taking the materials found in pollution and turning them into something worthwhile. The second, and far more significant, kind of innovation increases resource productivity initially, thereby addressing the fundamental causes of pollution, which is improved when less expensive materials are used instead of those that aren't or when the ones that are used better. When, (Liu et al., 2024) pointed out that green innovation includes non-green technological breakthroughs like new management styles or business models that enhance environmental sustainability, as well as green technical innovations like new or more effective goods and processes.

Over and above, GI generally consists of several dimensions that can be broken down into three main categories depending on reviewed literature:

- **Green Product Innovation:** This dimension focuses on creating or improving products and services that have a lower environmental footprint over their lifecycle. It is an environmentally friendly product that stresses the inclusion of ideas related to environmental protection in the design of products, the selection of raw materials, and other areas (Chan et al., 2016). In other hand, (Bellakhdarda, 2022; Nan et al., 2022) underline that green product innovation essentially focuses on minimizing the use of harmful materials, reducing energy or resource consumption and creating a complete recycling system in order to improve products and transforming them into safe ones.
- **Green Process Innovation:** It refers to the modifications made to the production, delivery, or distribution of goods in order to reduce their environmental effect. For (Hellström, 2007) green process were more closely associated with "hardware," which refers to replacing a whole piece of equipment or a component, than with "software," which refers to

maintaining the equipment in place but reorganizing the way the manufacturing process is executed. Besides, (Ali Jassim & Challob, 2022; Bellakhdarda, 2022) mentioned that the term "green process" is associated with technical advancement and refers to changing production methods and systems to provide environmentally friendly products. It highlights how industrial processes may be adjusted to have less negative environmental consequences by utilizing creative solutions that minimize the effects of production and related activities.

- **Organizational Innovation:** Based on (OECD, 2010), the term refers to changes in the structure, policies, and culture of a company to integrate sustainability principles. It involves new ways of managing methods (EMSs and corporate environmental strategies). Moreover, it can also happen through modifications made to the organization's workplace environment, such the creation of staff training programs intended to raise environmental performance and awareness. It also includes adjustments to the way businesses structure their relationships with each other and with governmental organizations, as well as involvement in public-private partnerships for environmental initiatives and research.

### 1.3. The benefits of GI implementation

According to (Karimi Takalo et al., 2021), green innovation has been acknowledged as a business reaction to environmental restrictions as well as one of the critical aspects determining environmental and economic performance in organizations and communities. Besides, it had many benefits. First, depending on (Chavira et al., 2023) green innovation is employed to improve sustainability management efficiency to meet the need for protecting the environment. In addition, it could be used to boost resource productivity in order to offset the environmental expenses. Next, GI brings sustainable and positive advantage to organizations which will, in turn, help them Increase market share, higher sales and the possibility of developing of new markets (Aragón-Correa & Sharma, 2003; Cheng et al., 2014).

Furthermore, for (Chavira et al., 2023) it boosts corporate image through Carbon footprint reduction by the using of greener energy sources, and upgrade products over better packaging methods and Green designs. Even while there are several advantages, they won't always be apparent when GI is implemented in a company; rather, they will only become apparent over time and only if those businesses meet the necessary requirements (Kneipp et al., 2021).

## 2. Circular Economy

### 2.1. Definition

Circular economy is a model that demonstrates that sustainable development is feasible and that economic progress may be accomplished without depleting natural resources or harming the environment (Prieto-Sandoval et al., 2018). It is defined by (Kirchherr et al., 2017) as "an economic system that replaces the 'end-of-life' concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial

parks) and macro level (city, region, nation and beyond), with the aim to accomplish sustainable development, thus simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations". In addition, CE is a regenerative system that slows, closes, and narrows material and energy loops to reduce resource input, waste, emissions, and energy leakage. Long-lasting design, maintaining, repair, reuse, remanufacturing, refurbishment, and recycling may all help achieve this (Geissdoerfer et al., 2017).

In a concise manner, (Stahel, 2016) determines it as a system that "would turn goods that are at the end of their service life into resources for others, closing loops in industrial ecosystems and minimizing waste. It would change economic logic because it replaces production with sufficiency: reuse what you can, recycle what cannot be reused, repair what is broken, remanufacture what cannot be repaired."

## **2.2. Circular Economy principles**

They are basically all gathered in three main principles: reduce, reuse, and recycle. (Wang et al., 2014) state that low consumption, low emissions, and high efficiency are the fundamental characteristics of a circular economy, which is founded on the "reduce, reuse, recycle" principle. Moreover, (Ghisellini & Ulgiati, 2020) mentioned that throughout a product's whole life cycle, reduce seeks to have the least possible negative impact on the environment in terms of waste and resource consumption. While, after a product has reached the end of its initial economic life, reuse attempts to return it to its original state or to its original components. And finally, the goal of recycling is to make the raw materials used in production reusable when the product's life is over.

According to Ellen MacArthur Foundation (*Circular Economy Principles*, n.d.), each of these principles has a positive change that's present in eliminate waste and pollution by creating infrastructure, goods, and materials that, after used, can possibly be reintroduced back into the economy. In addition, waste can be avoided entirely if we design everything for a circular system from the start. Next, circulate products and materials by maintaining, reusing, and refurbishing them. Moreover, regenerate nature by restore nature by concentrating on enhancing natural habitats and increasing biodiversity.

## **3. The Interplay Between Green Innovation and Circular Economy**

By increasing resource efficiency and encouraging sustainable practices across several industries, the incorporation of green innovation plays a crucial role in facilitating the shift towards a CE. The adoption of eco-innovative solutions not only minimize environmental problems but also provide economic value. Based on (Brogi & Menichini, 2024; Hamam, et al., 2022; Siedschlag et al., 2022; Van Hieu et al., 2023) papers, eco-innovation serves as a catalyst for the CE, enabling firms to adopt sustainable business models and leverage disruptive technologies. It encompasses various forms, including product, process, organizational, and marketing innovations, which collectively contribute to resource efficiency and waste reduction. moreover, environmental regulations, in-house research and development (R&D), and public funding are critical enablers for firms to introduce

green innovations. Furthermore, collaboration among firms and knowledge sharing enhances the capacity for innovation, leading to a more robust transition to CE practices.

#### 4. Challenges and Barriers

The transition to a circular economy and the adoption of green innovation present numerous challenges for businesses and industries. These obstacles range from financial constraints to technological limitations and organizational resistance. Based on (Amardas Tuboalabo, et al., 2024; Elīna Dāce, et al., 2024; Ghisellini & Ulgiati, 2020; Gupta, 2024; Yüce & Altındağ, n.d.), these barriers are divided into:

##### a) Legislative:

- Inadequate and unfinished legal structure that promotes material recycling and reuse, as well as the use of secondary raw resources in place of raw materials;
- Incompatibility of environmental policies applied at the local, province, and regional levels;
- Businesses may be pushed from implementing CE practices by unclear regulations and incentives. The shift to more sustainable practices may be slowed down and investment discouraged by this uncertainty.

##### b) Market and financial:

- Competitiveness between secondary raw materials made by recycling waste materials and virgin raw materials' cheap prices;
- Resource Limitations: Lack of funds and technical resources is a significant obstacle, especially in industries requiring large initial investment like recycling and building;
- Inability to obtain credit to fund research on eco-innovation;
- High projected expenses: Implementing the circular economy successfully will lead to long-term growth and resilience to price and resource problems. Costs and the associated risk, however, prevent companies from implementing this system in the near future.

##### c) Cultural:

- Uncontrollable purchasing patterns and a lack of environmental consciousness on the part of the customer;
- Resistance to changing long-standing practices is frequently caused by stakeholder inertia and a lack of consumer involvement;
- Inattention of waste prevention techniques on the production and consumption sides (design, sustainable production and consumption...).

##### d) Technological:

- the absence of sufficient technologies for reusable, recycled, and recovered materials;
- The high-power consumption required to operate digital technologies.

#### 5. The impact of GI and CE on Sustainable development

The integration of green innovation and circular economy principles has profound implications to the accomplishment of Sustainable Development. According to the Green Policy Platform (*Circular Economy | Green Policy Platform*, n.d.) the impact of GI and CE is mainly represented by Sustainable Development Goals

(SDG) 8, 9 and 12. Where, SDG 8 encourages a steady, equitable, and sustainable growth by increasing the world's resource efficiency in production and consumption. SDG 9 encourages Industry use of resource-efficient and ecologically sound technology which focuses on sustainable infrastructure and industrialization. And last but not least, SDG 12 that is about sustainable production and consumption, with a focus on waste reduction and resource efficiency.

In other words, the papers of (El Samad, 2024; Narang, et al., 2024) highlighted that green innovation and circular economy significantly enhance both economic growth and the mitigation of ecological degradation by fostering environmentally friendly innovations and practices. This multifaceted approach also aligns with broader societal goals. The key contributions could recapitulate in the following elements:

**a) Economic growth:**

- GI and CE implementation enhance resource efficiency, leading to cost savings, enhance competitiveness and attracting new growth opportunities;
- They support the development of eco-friendly technologies that reduce greenhouse gas emissions and resource depletion;
- The transition to a circular economy encourages investments in environmentally friendly methods, which results in the creation of jobs and skills improvement.

**b) Social and Environmental Impact:**

- the responsible use of natural resources contributes in improving environmental quality and public health by minimizing the negative impacts of industrial activities;
- By promoting cultural changes toward sustainable behaviours, they improve community resilience and overall quality of life;
- They contribute to environmental conservation and climate change mitigation by optimizing resource utilization and reducing reliance on finite resources.

**6. Successful Case Studies of Circular Economy Implementation**

This section is dedicated to explore the experiences of companies engaged in green innovation within the framework of circular economy principles. The focus is on identifying best practices and outcomes associated with their sustainability initiatives.

**6.1. Ananas Anam**

Ananas Anam established in 2013 as a start-up by Dr. Carmen Hijosa. It operates in United Kingdom, Spain and Philippines. The company has created Piñatex, a naturally occurring plant-based substance that is adaptable and comes from a sustainable source. Piñatex is a cost-effective textile and leather substitute since it can be mass-produced and conforms to a strong social and ecological goal. It is patent-protected and has applications in the automobile, upholstery, accessories, footwear, and fashion sectors. Ananas Anam has included the circular economy idea since its inception, by providing a waste product with an economic value. Pineapple plantations in the Philippines

generate 13 million tons of leaves waste annually, whereas those in other countries produce around 54 million tons. Two percent of the trash is made up of the fibres from pineapple leaves, which are utilized to make Piñatex. Under some circumstances, the waste material can be converted into compost and utilized as fertilizer (Kowszyk & Maher, 2018)

**A. Company's objectives:** (Ananas Anam: The Pioneers of Innovative Natural Textiles from Waste Pineapple Leaves, 2017)

- The production line has been designed to use less energy and raw materials while producing less trash;
- Every individual involved in the development of Piñatex receives fair remuneration, with all production needs based on the principles of a fair-trade economy (from the pineapple farmers to Ananas Anam manufacturing partners);
- Increasing the finished product's biodegradability and the waste's value is a crucial component of ongoing research and development.

**B. Contribution to company performance** (Kowszyk & Rajiv, 2018)

In the two years that Ananas Anam has been in business, the fashion, accessory, bag, footwear, upholstery, and automotive sectors have placed over 900 paid production and sample orders. Since its founding, the firm has raised around 2.2 million Euro from financial institutions and individual investors. Piñatex's 2018 and 2019 sales are anticipated to be €625,000 and €2,900,000, respectively.

**C. Social and environmental benefits** (Ananas Anam-Responsibility, 2017)

Fair Trade principles underpin the creation of Piñatex, which benefits rural, agricultural communities. The development of employment prospects for agricultural communities is one of the most significant social advantages; this in turn reflects and reinforces the local communities and social networks.

Environmentally, Piñatex primarily uses natural resources, such as waste-derived natural fibre. This indicates that they are minimizing the enormous amount of trash produced by pineapple farming, which lowers the impact that its production has on the environment.

**6.2. Serendipalm** (Ellen MacArthur foundation, 2022; Serendipalm : About Us, n.d.)

Beginning in 2007 in the Ghanaian town of Asuom, the Serendipalm project is a sister company of Dr. Bronner's, the leading brand of natural soaps in the United States. It found in order to restored degraded existing palm fields using regenerative farming techniques and worked with smallholder oil palm plots to support the growth of organic palm fruit trees, preventing the need to clear more forest. This method helps preserve local animal habitats, which are frequently lost to get high yields, and safeguards natural carbon stores.

Since Serendipalm only uses the exterior palm fruit, the palm kernels are gathered and sold to a fair-trade soap manufacturing firm in a nearby town in Togo. By-products from crops are turned into fertilizer and recycled back to the fields, replenishing the soil with nutrients. Serendipalm's network, which includes hundreds of farmers and a local mill, forms a fully transparent supply chain that is managed and overseen by the company. This demonstrates how big businesses can establish equitable and regenerative supply chains, providing consumers with the assurance that the surroundings and people that produced their commonplace goods are benefiting from them.

**A. Company's objectives:**

- Continuing the proper use of natural inputs that allows farmers to maintain their organic farming certification, which guarantees a 10% premium over the local market price for palm fruits;
- The goal of Serendipalm and Dr. Bronner's is to significantly contribute to the fight against climate change and improve the quality of life for local populations in Ghana by establishing regenerative agricultural methods;
- Working on transforming farms into more varied agroforestry systems in order to increase agricultural yields and provide more ecological advantages for biodiversity and soil. The adoption of agroforestry improves hydrology, provides shade, and boosts food security while enhancing climate change resistance.

**B. Contribution to company performance**

As commercial enterprise, Serendipalm operations also significantly benefit the environment, its workers, and the nearby rural communities. Implementing fair trade initiatives in the host communities is one aspect of their vision. Every invoice they send to palm oil clients includes a fair-trade surcharge to help pay for these initiatives. It presently generates an annual contribution of \$85,000 to a Fair-Trade Fund, which is overseen by a committee comprising farmers, employees, and Serendipalm management. This amount is equivalent to around 10% of the pro rata costs of the palm fruit and wages.

In 2020, Serendipalm became the worldwide first Regenerative Organic Certified (ROC) palm oil project.

**C. Social and environmental benefits**

- The idea of dynamic agroforestry, which combines the production of palm and cocoa with the cultivation of secondary crops like bananas, papayas, cassava, turmeric, and ginger, is being used to plant a lot of additional fields with the help of a German development agency. In order to boost food security and generate income sooner, many of these supplementary crops can be harvested within the first year, well before the cocoa and palm fruits are ready;
- Serendipalm is a prime example of the circular economy's fundamental principle, which is to restore natural systems that create more biomass and absorb more CO<sub>2</sub> from the atmosphere per hectare annually, so contributing in the fight against climate change;

- The firm offers free healthcare and wages that are 25% greater than the area average. In addition to paid time off and sick leave, employees receive yearly bonuses, healthcare, and ongoing education;
- The company has funded and implemented some smaller projects such as painting schools, or repairing streetlamps, to encourage the spirit and practice of cooperation which seen as an important element of humanitarian rural development in Ghana and elsewhere.

**Recommendation:**

- Strengthening policies and regulations by implementing stricter environmental regulations and ensure better enforcement;
- Increasing financial aid for Green Innovation through encourage banks and financial institutions to provide green loans and low-interest financing for sustainable projects and establish public-private partnerships to support investment in renewable energy, eco-friendly infrastructure, and sustainable agriculture;
- Encouraging Circular Economy Practices via the creation of recycling and waste management programs at both the governmental and corporate levels;
- Incentivize companies to integrate eco-design and resource efficiency in their production models. As well, working on help businesses in adopting industrial symbiosis, where waste from one company becomes raw material for another;
- Increase funding for R&D in green technologies through university-industry collaborations;
- Build up entrepreneurial education focused on green business models. Besides, supporting the development of green tech start-ups through incubators and accelerators;
- Launch national awareness campaigns to educate consumers about sustainable products.

**Conclusion:**

The imperative for companies to adopt green innovation within a circular economy framework has never been more pressing. As environmental challenges escalate, organizations are increasingly recognizing that traditional linear models of production and consumption are unsustainable. This paper has explored the multifaceted dimensions of green innovation and circular economy, emphasizing their critical roles in fostering sustainable development and their goals. The findings indicate that the integration of green innovation not only enhances a company's ecological footprint but also drives economic growth and competitive advantage. furthermore, by rethinking product life cycles, companies can minimize waste, optimize resource use, and promote sustainable practices.

In conclusion, to move forward, it's crucial to address the challenges that hinder the widespread adoption of green innovation and circular economy practices through overcoming financial barriers, technological limitations, and organizational resistance requires concerted efforts from businesses, policymakers, and

consumers. By promoting green innovation, implementing supportive regulations, and raising awareness about sustainable consumption, we can accelerate the transition to a more circular and sustainable economy. This shift not only benefits the environment but also presents significant opportunities for economic growth and social well-being in the long run.

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