

CHAPTER 1

INTRODUCTION

1.1. Circular Economy Potential in Indonesia

The transition from a linear economy to a circular economy has become an essential strategy in addressing global environmental challenges. In a circular economy, waste and by-products are repurposed as valuable resources, reducing dependency on finite materials and minimizing environmental degradation (Kirchherr et al., 2021). Implementing circular economic principles in sustainable business practices offers significant opportunities for innovation, economic growth, and environmental conservation. Circular economy models incorporate renewable energy, waste valorization, and resource efficiency are key to reducing fossil fuel dependency. By promoting renewable energy sources and repurposing organic waste into value-added products, businesses can contribute to climate resilience, reduce environmental pollution, and support Indonesia's energy transition goals (Rahmawati et al., 2023).

Table 1. Environmental Factors from Coconut Shell Charcoal and Wood Charcoal

Factors	Coconut Shell Charcoal	Wood Charcoal
Raw Material Source	Coconut shell waste (by-product, not cutting down trees)	Wood from cutting down trees
Energy Efficiency	Higher heat and more stable combustion	Heat varies depending on wood type
Environmental Impact	Reduces organic waste and deforestation	Potentially increases deforestation
Circular Economy	Supports a circular economy model by utilizing waste	Less supportive because it is based on tree felling

Source: Susanto, 2022.

Coconut shell charcoal, derived from coconut shell waste, offers several environmental advantages over wood charcoal (Table 1). In terms of energy efficiency, coconut shell charcoal provides higher and more stable heat, making it more energy-efficient, while also supporting environmental sustainability by reducing organic waste and deforestation. Additionally, coconut shell charcoal aligns with a circular economy model by utilizing by-products, unlike wood charcoal, which relies on tree harvesting and may contribute to deforestation. The application of circular economy in the coconut shell charcoal industry supports the target of reducing waste and carbon emissions, in line with global environmental policies. Therefore, this study aims to evaluate the potential of the coconut shell charcoal business in a circular economy perspective.

1.2 Coconut Shell Charcoal and Efforts Towards Sustainability

The selection of materials is essential to reducing environmental effect as the globe places more emphasis on sustainable practices. An environmentally beneficial substitute for conventional wood charcoal, coconut shell charcoal provides a renewable energy source that supports international sustainability initiatives. Coconut shell charcoal prevents deforestation and encourages waste management and energy efficiency by using agricultural waste and promoting a circular economy. This invention demonstrates how creative methods can be used to solve environmental problems and promote a more environmentally friendly future. One approach that can be taken is to utilize organic waste, such as coconut shells, as an alternative fuel to reduce carbon emissions and dependence on fossil fuels (Hasan & Harahap, 2022). Table 2 below summarizes the advantages and disadvantages of coconut shell charcoal.

Table 2. Advantages and Disadvantages of Coconut Shell Charcoal

Aspect	Advantages	Disadvantages
Environmental	Reduces waste by repurposing coconut shells	Potential air pollution if not processed properly
Economic	Creates new business opportunities and increases farmers' income	High initial investment for production equipment
Energy Efficiency	High calorie value and cleaner burning than wood charcoal	Requires standardized production to ensure consistent quality
Circular Economy	Supports circular economy by reducing dependency on fossil fuels	Limited public awareness and market penetration
Social Impact	Provides employment opportunities in rural areas	Lack of technical knowledge in some communities

Source: *Pratama & Nugroho (2021)*

The use of coconut shell waste to produce charcoal as fuel supports environmental sustainability by reducing organic waste. This agricultural waste that was previously not utilized can be processed into a source of energy with high economic value, reducing pollution and diverting waste from open burning which is commonly done in coconut-producing areas (Ojha et al., 2022), but only limited to cooking purposes.

Indonesia, with its vast biodiversity and abundant agricultural waste, offers significant potential for sustainable energy development. By adopting renewable energy systems on a small scale, such as converting agricultural by-products like coconut shells into biochar, businesses can reduce waste, generate alternative energy sources, and create new revenue streams (Atienza AH, et al., 2020). The transition

from fossil fuels to sustainable energy sources is crucial in addressing global environmental and economic challenges. In this context, sustainable business practices play a pivotal role in reducing the reliance on finite resources, mitigating environmental degradation, and fostering economic growth. Businesses that integrate renewable energy and circular economy principles can not only reduce carbon footprints but also create innovative opportunities for small and medium enterprises (SMEs) to thrive (Murray et al., 2021).

Table 3 lists Indonesia's many energy options along with their potential for integrating the circular economy and promoting sustainable development. Due to Indonesia's equator location, solar energy has a lot of promise. Initiatives for solar farms are making headway, and there are chances to recycle panels to reduce waste. Although wind energy is still in its infancy, it has the potential to grow in the future and reduce waste by reusing old turbines. It is especially feasible in coastal and eastern locations. Utilizing Indonesia's numerous rivers, hydropower is now in use but has unrealized potential and chances to recycle parts for sustainability.

Table 3. Different Types of Energy Alternatives in Indonesia

Types of Energy	Potential in Indonesia	Current Development and Circular Economy Opportunities
Solar Energy	High potential due to Indonesia's location on the equator, especially in remote areas.	Developing solar farm initiatives (Ramdani et al., 2022) with opportunities to integrate end-of-life solar panel recycling into a circular economy framework.
Wind Energy	Great potential in coastal areas, especially in eastern Indonesia.	Still in the early stages of development with promising advancements (Susanto & Permana, 2021).
Hydropower	Significant potential from Indonesia's many rivers, both for small and large-scale power plants.	Existing installations contribute to clean energy; opportunities to improve efficiency and recycle hydropower components for circular use.

Biomass and Bioenergy	Potential for communities, especially from agricultural waste like coconut shells.	Utilization of biomass supports circular economy principles by transforming agricultural waste into energy and reducing waste streams (P. Sudarno & I. G. Wibowo, 2019).
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Source : International Energy Agency, 2022.

By converting garbage into useful energy, biomass and bioenergy - especially from agricultural waste like coconut shells - exemplify the concepts of the circular economy and simultaneously address environmental issues. Biomass, such as coconut shell charcoal, stands out as a community-accessible option, offering immediate economic and environmental benefits, particularly in rural areas with agricultural waste abundance (Ramdani et al., 2022). Unlike solar and wind energy, which require significant infrastructure investments, biomass energy leverages readily available agricultural waste, such as coconut shells, to create value-added products. This approach aligns with Indonesia's goals to increase renewable energy adoption and reduce environmental degradation (Mulyadi et al., 2023).

1.3 Coconut Shell Charcoal for a Sustainable Circular Economy

Coconut shell charcoal, a form of biochar created through pyrolysis—thermal decomposition of organic material at high temperatures in limited oxygen—embodies the principles of the circular economy. By repurposing coconut shells, a common agricultural waste product, into a carbon-neutral, renewable resource, it adds value to a previously underutilized byproduct. Beyond its role as a fuel source, coconut shell charcoal finds applications in industries like water purification, odor control, and pharmaceuticals, demonstrating its versatility and contribution to a waste-to-value cycle (Santoso & Widjaja, 2020).

In various sectors, coconut shell charcoal replaces conventional fossil fuels, particularly in areas with limited access to gas or electricity. For rural households, it serves as a cost-effective and accessible energy source for cooking and heating. In agriculture, its use as a soil enhancer not only enriches soil quality and retains moisture but also aids in carbon sequestration, aligning with sustainable farming practices and supporting local agricultural economies (BioEnergy Consult, 2023).

Governments can further integrate coconut shell charcoal into their strategies to reduce carbon footprints, promoting its use in small-scale industries and advancing circular energy systems (Mazaya et al., 2022).

As one of the world's largest coconut producers, Indonesia has significant potential to strengthen its circular economy through coconut shell charcoal. With an annual coconut production of approximately 2.90 million tons in 2023, the country generates an abundant supply of coconut shell waste for processing into charcoal (Pusat Data dan Sistem Informasi Pertanian, 2023). This renewable resource not only reduces reliance on fossil fuels but also mitigates deforestation caused by wood-based charcoal production. Furthermore, it enhances economic value in the coconut industry by creating opportunities in renewable energy markets and supporting local economies (Hasan & Harahap, 2022).

For wider adoption, coconut shell charcoal production and use must be supported by sustainable energy policies, advancements in production technologies, and market development. Encouraging local communities in coconut-producing regions to adopt its use, paired with the right incentives and infrastructure, can strengthen the circular economy (Ramdani et al., 2022). Whether produced in small-scale kilns or advanced industrial facilities, the process of converting coconut shells into charcoal ensures the transformation of waste into a valuable resource, exemplifying the principles of sustainability and circularity (Ojha et al., 2022).

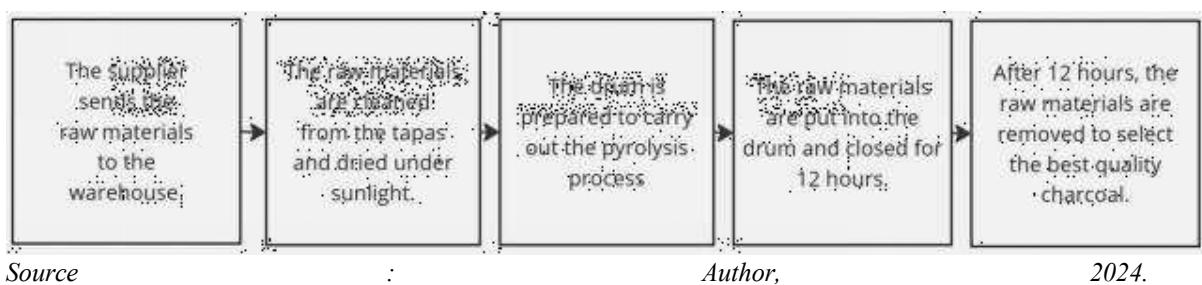


Figure 1. The Process of Making Coconut Shell Charcoal

The use of coconut shell charcoal exemplifies the benefits of a circular economy by transforming agricultural waste into a valuable energy source, contributing to environmental sustainability and local economic growth. Coconut shells, an abundant byproduct in tropical regions, offer significant potential as raw material for charcoal production. Recent research by Santoso (2024) highlights that processing organic

waste like coconut shells into charcoal can reduce reliance on fossil fuels by up to 40% while simultaneously boosting the income of communities in coconut-producing areas.

Additionally, a 2024 report by the Ministry of Environment reveals that coconut shell charcoal contributes to a 25% reduction in carbon emissions compared to traditional fossil fuels. This underscores its dual role in supporting the local economy and advancing global climate change mitigation. By repurposing waste and creating renewable energy alternatives, coconut shell charcoal aligns with the principles of a circular economy, fostering sustainability and resilience in both environmental and economic systems.

1.4 Research Gap

Although existing research on coconut shell charcoal highlights its promising benefits, most studies have primarily focused on the technological aspects, with limited exploration of its business potential. There is a need for more research into the economic viability of coconut shell charcoal at the local level, including conducting a cost-benefit analysis that takes into account production costs, market fluctuations, and international trade barriers (Handoko, 2024). Given its abundant raw material source and the growing demand for sustainable energy, coconut shell charcoal presents a promising opportunity for a profitable business, particularly in rural areas. However, few studies have compared coconut shell charcoal with other energy sources, especially in terms of energy efficiency, emission reduction, and long-term environmental sustainability (Renewable Energy Research Institute, 2024). This gap limits understanding of how coconut shell charcoal can be competitive within the broader renewable energy market (Das et al., 2020).

Furthermore, the socio-economic benefits of coconut shell charcoal for local communities involved in its production, including potential income generation and job creation, have not been widely explored. Research on how charcoal production can improve living standards and contribute to rural development is limited (Paniagua et al., 2022). Therefore, there is a need for further research into the socio-economic impacts of coconut shell charcoal on local communities and its potential to become a profitable business that drives economic growth (Fernandes et al., 2021). This study aims to address these gaps by assessing the economic value and business

potential of coconut shell charcoal in local communities.

1.5 Research Problem

The research problems are stated as follows:

8. Despite the availability of raw materials, the economic feasibility of coconut shell charcoal production as business opportunity has not been adequately explored
9. Limited involvement of local communities in coconut shell charcoal production, resulting in missed opportunities for creating jobs and fostering economic empowerment.
10. The circular economy benefits of utilizing coconut shell charcoal, such as reducing waste and promoting eco-friendly practices, remain underutilized.

1.6 Research Question

This study aims to answer the following question:

"How can coconut shell charcoal be developed into a profitable business within the circular economy framework, and what are its socio-economic impacts on local communities involved in its production?"

1.7. Research Objectives

The objectives of this study are:

1. To assess the economic viability of coconut shell charcoal as a profitable business within the circular economy framework.
2. To evaluate the socio-economic impacts of coconut shell charcoal production on local communities, including income generation, job creation, and rural development.
3. To explore how coconut shell charcoal can contribute to environmental sustainability and reduce waste through circular economy practices.

1.8. Benefits of Research

The main benefit of this study is to provide a comprehensive framework for developing a sustainable and socially responsible coconut shell charcoal business. For academic purposes, the study will add literature and references in the field of environmental management and renewable energy. For practical purposes, the study

will benefit the community to utilize coconut shell waste as an economical and environmentally friendly energy source.