

Integration of Circular Economy in Environmental Accounting Practice: Opportunities and Challenges in the Green Economy Era

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Abstract:

Purpose:

Climate change, scarcity of natural resources, and increasing awareness of the importance of sustainability are driving a paradigm shift in economic and accounting practices. Circular economy, as an economic model that emphasizes resource efficiency through the principles of reuse, repair, and recycling, is becoming an increasingly relevant approach in the green economy era.

Methodology:

On the other hand, environmental accounting is developing as an important tool to measure, report, and manage the environmental impacts of business activities in a transparent and accountable manner. This article examines the opportunities and challenges in integrating the circular economy into environmental accounting practices based on a review of recent literature.

Findings:

The results of the study show that this integration not only supports the achievement of corporate sustainability but also strengthens strategic decision-making oriented towards environmental preservation and resource efficiency.

Implication:

There are various challenges, such as limited data, non-standard reporting standards, and organizational resistance, that need to be overcome to optimize the implementation of the integration.

INTRODUCTION

Global climate change, scarcity of natural resources, and increasing awareness of the importance of environmental sustainability have driven a paradigm shift in economic and business practices around the world. The traditional linear economic model based on the take-make-dispose principle has proven incapable of addressing sustainability challenges because it produces large amounts of waste and causes significant environmental damage. In response to these problems, the concept of a circular economy has emerged as a promising alternative by emphasizing the principle of a closed cycle in resource utilization. The circular economy aims to minimize resource use, reduce waste and emissions, and extend the life of products through reuse, repair, remanufacturing, and recycling (Kompas, 2022). Thus, the circular economy not only contributes to environmental preservation but also supports more sustainable and inclusive economic growth.

In line with the development of the circular economy, environmental accounting has developed as a system for reporting and measuring environmental performance that provides important information for management, stakeholders, and investors. Environmental accounting helps companies identify environmental costs, measure the efficiency of resource use, and evaluate the ecological impact of their operational activities. By integrating environmental data into the accounting system, companies can increase the transparency of sustainability reporting and strengthen their accountability to stakeholders (Anam, 2020). The integration of the circular economy into environmental accounting practices is an important strategy to support the transformation towards a green

economy, which emphasizes environmentally friendly and sustainable economic growth (PT. Surabaya Industrial Estate Rungkut, 2023).

Circular Economy Concept. A circular economy is an economic model that emphasizes efficiency in resource use with the primary goal of extending product life cycles and minimizing waste. Unlike the traditional linear economic model that follows a "take-make-dispose" pattern, a circular economy adopts the 3R principle—Reduce, Reuse, and Recycle—as well as broader principles such as the 9Rs, which include Refuse, Rethink, Repair, Refurbish, Remanufacture, Repurpose, and Recover. These principles not only reduce waste and pollution but also keep products and materials in use for as long as possible and regenerate natural systems. Thus, a circular economy encourages sustainable production and consumption, allowing us to achieve more with fewer resources.

In Indonesia, the circular economy has become part of the national development agenda, especially in efforts to develop low-carbon and green economies. This model is implemented through better waste management, the use of renewable energy, and the development of resource-efficient green industries. The concept of a circular economy also invites economic actors to design products that are easy to disassemble and reuse, minimize the use of toxic materials, and optimize the use of alternative raw materials that are more environmentally friendly. By extending the life of products through repair, maintenance, and recycling, the circular economy not only helps reduce pressure on limited natural resources but also reduces greenhouse gas emissions that contribute to climate change. This approach is a strategic solution to create a more resilient, inclusive, and sustainable economic system.

Circular Economy and Sustainable Development. The circular economy plays a very important role in supporting sustainable development by reducing dependence on limited natural resources and minimizing pollution and waste. Unlike the linear economic model of "take-use-dispose," the circular economy seeks to extend the life cycle of products, raw materials, and resources so that they can be used for as long as possible. This principle encourages the reduction of waste and pollution, keeps products and materials in use, and regenerates natural systems. In this way, the circular economy optimizes resource efficiency (input) and converts waste into useful products (output), thereby reducing carbon emissions and negative impacts on the environment. In addition, this model also supports the transition to a green economy, which is a priority in various development policies, as stated in the Indonesian National Medium-Term Development Plan (RPJMN), especially in the sectors of waste management, sustainable energy, and green industry.

The implementation of a circular economy not only provides environmental benefits but also opens up great opportunities for economic growth and improving social welfare. By adopting the principles of reduce, reuse, and recycle, a circular economy is able to create millions of new jobs and encourage environmentally friendly business innovation. It is in line with the Sustainable Development Goals (SDGs) and the low-carbon development strategy currently being implemented in Indonesia. In addition to reducing waste and emissions, a circular economy also increases economic productivity through the efficient use of raw materials and energy. The transformation towards a circular economy is an important key in creating a greener, more inclusive, and more sustainable future, while strengthening national competitiveness at the global level.

Integration of Circular Economy in Environmental Accounting. Environmental accounting plays a crucial role in supporting circular economy practices in companies by providing a framework for recording, reporting, and analyzing the costs and benefits associated with comprehensive environmental management. Through environmental accounting, companies can manage resources more efficiently by reducing waste and minimizing negative impacts on the environment. Not only calculating the cost of environmental management, environmental accounting also assesses long-term benefits such as reducing carbon emissions, increasing energy efficiency, and reducing dependence on natural raw materials. Thus, environmental accounting helps companies evaluate policies and measures that sustainably support a circular economy, making sustainability an integral part of their long-term business strategy.

In the context of industries such as Fast-Moving Consumer Goods (FMCG) companies, environmental accounting serves as an important tool to allocate costs related to efforts to develop durable products, design recyclable products, and better waste management. Studies show that although many companies have begun to integrate environmental accounting into their strategies, challenges such as the lack of clear reporting standards and limited resources to measure environmental impacts accurately remain obstacles. However, companies that successfully implement environmental accounting tend to reap long-term benefits, including cost reductions, improved corporate image, and reduced environmental impacts. Therefore, environmental accounting becomes a strategic tool that supports companies' transition to a more efficient and sustainable circular economy.

Opportunities and Challenges of Integrating the Circular Economy into Environmental Accounting. The integration of circular economy into environmental accounting practices opens up strategic opportunities for companies to improve resource efficiency, drive product innovation, and strengthen the company's reputation in the eyes of stakeholders. By implementing circular economy principles, companies can optimize product life cycles through more durable and recyclable designs, reduce the use of new raw materials, and manage waste more effectively. Environmental accounting plays an important role in measuring and allocating costs associated with these efforts, so that sustainability can become an integral part of the company's long-term strategy. In addition, the implementation of the circular economy also supports the transparency of environmental reporting that regulators and consumers are increasingly demanding, thus helping companies build a positive image and increase public trust. Studies on FMCG companies show that despite the challenges, companies that successfully integrate environmental accounting in supporting the circular economy gain long-term benefits in the form of reduced operational costs, reduced environmental impacts, and increased competitiveness in the market.

However, the integration of the circular economy into environmental accounting is not free from quite complex challenges. One of the main obstacles is the need for adequate technology investment to develop information systems and accounting processes that are able to manage environmental data accurately and in real time. In addition, the development of human resource competencies that understand the technical and strategic aspects of the circular economy and environmental accounting is an important factor that must be considered. Another challenge is the need for consistent and transparent environmental reporting standards so that the information presented can be compared and accounted for widely. Changes in organizational culture are also crucial because the implementation of the circular economy requires a new paradigm that prioritizes sustainability and continuous innovation. Strong regulatory support and supportive policies are needed to accelerate the adoption of the circular economy in environmental accounting practices, so that the transformation towards a green economy and sustainable development can be realized optimally.

The Green Economy Era and the Relevance of the Circular Economy. The green economy era demands a fundamental transformation in the way the economy is run, where environmental aspects are no longer seen as separate, but rather become an inseparable part of every economic activity. In this context, the green economy emphasizes the principle of sustainable development by minimizing negative impacts on the environment while still encouraging economic growth and social welfare. The circular economy is the main strategy in realizing a green economy because this model focuses on efficient resource utilization through shorter and more sustainable production and consumption cycles. By prioritizing the principles of reduce, reuse, and recycle, the circular economy helps reduce waste, emissions, and energy waste, while extending the life of products and materials. It not only reduces pressure on the environment but also creates greater economic and social value through innovation and resource efficiency.

The implementation of a circular economy in environmental accounting practices is very relevant and important to support comprehensive and accountable sustainability reporting. Environmental accounting acts as a tool that allows companies to measure, record, and report the environmental impacts of their operational activities transparently and systematically. Thus, companies can meet the demands of increasingly stringent regulations and the expectations of stakeholders, including consumers, investors, and governments, who demand

transparency and responsibility for environmental impacts. Studies on companies, especially in industrial sectors with high consumption levels such as FMCG, show that the integration of environmental accounting with circular economy principles helps companies allocate costs appropriately for waste management, material reuse, and the development of environmentally friendly products. With the support of a good information system, sustainability reporting becomes more accurate and reliable, thus strengthening the company's position in running a sustainable and environmentally friendly business.

Hypothesis. The integration of the circular economy in environmental accounting practices is believed to have a significant positive influence on increasing corporate sustainability. The concept of circular economy, which emphasizes waste reduction, reuse, and recycling of resources, when applied in environmental accounting, helps companies manage resources more efficiently and transparently. With this integration, companies are not only able to record and measure environmental impacts more accurately, but can also report this information more clearly to stakeholders. It supports sustainability-oriented decision making while strengthening the company's position in meeting environmental regulations and market expectations that increasingly demand environmentally friendly business practices.

The application of circular economy principles through environmental accounting also provides real operational and strategic benefits for companies. A study in the Fast-Moving Consumer Goods (FMCG) sector showed that environmental accounting allows companies to allocate costs appropriately related to waste reduction, renewable energy use, and better waste management, thereby driving resource efficiency and reducing operational costs. In addition, this integration helps companies develop more durable and recyclable products, which is in line with the principles of the circular economy. Despite challenges such as the lack of standard reporting standards and resource constraints, companies that successfully implement environmental accounting effectively tend to gain long-term benefits in the form of improved corporate image, reduced environmental impact, and better financial sustainability. Thus, the integration of the circular economy in environmental accounting practices not only supports environmental sustainability but also strengthens the competitiveness and economic value of companies in a sustainable manner.

H1: The integration of circular economy in environmental accounting practices has a significant positive effect on improving corporate sustainability.

The integration of the circular economy into environmental accounting makes a significant contribution to improving the efficiency of resource management and waste reduction in companies. By adopting the principles of circular economy, companies no longer use the linear model of "take-make-dispose," which wastes resources, but instead focus on the reuse, repair and recycling of materials. Environmental accounting plays a vital role in this process by helping companies record and measure the costs and benefits associated with sustainable resource management activities. Through accurate recording, companies can identify areas of waste and potential savings, thereby encouraging more efficient and environmentally friendly management practices. For example, in the FMCG industry, environmental accounting allows companies to monitor the use of energy, water and raw materials in detail, thereby optimizing production processes and reducing waste generation.

In addition to improving resource efficiency, integrating the circular economy into environmental accounting also enables companies to make more sustainable and strategic business decisions. With transparent and measurable data on environmental impacts, companies can assess the costs and benefits of various policies and actions, such as choosing more environmentally friendly raw materials, designing recyclable products, and better waste management. This approach not only helps companies reduce their negative impact on the environment but also provides long-term economic benefits, such as reduced operating costs and increased profitability. Studies show that companies that successfully implement circular economy principles through environmental accounting are able to improve their corporate image and competitiveness, while contributing to the development of a more sustainable green economy.

H2: Integrating the circular economy into environmental accounting improves the efficiency of resource management and waste reduction in companies.

The challenges in integrating the circular economy into environmental accounting practices are still quite complex and are significant obstacles that need serious attention. One of the main obstacles is the lack of clear and uniform reporting standards related to the circular economy aspect in environmental accounting. The lack of clarity in these standards makes it difficult for companies to measure, record, and report environmental impacts consistently and transparently. In addition, limited resources, both in terms of technology, HR expertise, and investment funds, are major obstacles to the effective implementation of circular economy principles. Many companies, especially in developing countries such as Indonesia, face difficulties in accessing cutting-edge technology and building adequate internal capabilities to manage environmental data accurately and sustainably. This condition is exacerbated by the lack of cross-sector collaboration and comprehensive policy support, so that the implementation of the circular economy in environmental accounting has not been able to run optimally.

Despite the enormous potential benefits of the circular economy, such as waste reduction, resource efficiency, and improved corporate reputation, technical and regulatory barriers remain major challenges that must be overcome. High investment in technological innovation and changes to operational systems is a significant initial burden for many companies. In addition, organizational cultural barriers that still tend to be oriented towards traditional linear systems also slow down the adoption of the circular economy. Overlapping regulations and a lack of incentives from the government also complicate this transition process. Therefore, synergy is needed between the government, business actors, and other stakeholders to create a supportive policy framework, strengthen technological capacity, and increase awareness and skills of human resources so that the integration of the circular economy into environmental accounting practices can run effectively and sustainably.

H3: Challenges such as the lack of reporting standards and resource constraints are significant obstacles to the integration of the circular economy into environmental accounting practices.

Companies that successfully integrate circular economy principles into their environmental accounting practices tend to gain significant long-term benefits, especially in terms of reduced operating costs and improved corporate image. By implementing a circular economy, companies can optimize resource use through waste reduction, material reuse, and recycling, thereby reducing the need for new raw materials and waste management costs. This approach not only helps reduce operational costs but also increases the efficiency of production processes and reduces negative impacts on the environment. A study of Fast-Moving Consumer Goods (FMCG) companies shows that despite the challenges in implementing environmental accounting that supports a circular economy, companies that successfully implement it are able to achieve cost savings while strengthening their position in the market through a better reputation for sustainability.

In addition to economic benefits, the integration of the circular economy in environmental accounting also provides strategic benefits in the form of improving the company's image and reputation in the eyes of stakeholders. Customers, investors, and the public now increasingly appreciate companies that demonstrate a real commitment to sustainability and responsible environmental management. It can strengthen customer loyalty, attract sustainable investment, and open up new business opportunities oriented towards environmentally friendly innovation. Thus, investment in the integration of the circular economy not only has a positive impact on the environment through reducing waste and emissions, but also provides sustainable economic and reputational benefits, which ultimately support the company's long-term growth.

H4: Companies that successfully integrate the circular economy in environmental accounting tend to gain long-term benefits in the form of reduced operational costs and improved corporate image.

METHODS

The method used in this article is a literature study or literature review that aims to collect, review, and analyze various scientific sources relevant to the topic of circular economy integration and environmental

accounting in the context of the green economy. This literature study involves searching and selecting journals, books, articles, and academic publications published between 2015 and 2025, so that they cover the latest developments in the field. Literature sources are obtained from trusted academic databases such as Google Scholar, ScienceDirect, SpringerLink, and other digital libraries that provide access to national and international research. This approach allows the author to identify key concepts, theories, best practices, as well as challenges and opportunities faced in integrating circular economy principles into environmental accounting practices. Thus, this literature study becomes an important foundation for understanding how environmental accounting can play a strategic role in supporting sustainability and efficient resource management in the green economy era.

In addition, this literature study method is also used to evaluate various sustainability reporting models and accounting systems that accommodate environmental aspects, especially in the context of implementing a circular economy. In the process, the author conducts a strict selection of sources that are not only topically relevant but also have high credibility and academic quality, including empirical and conceptual studies. Analysis of this literature provides a comprehensive picture of the development of environmental accounting integrated with the principles of a circular economy, as well as the obstacles that are often faced, such as limited data, non-uniform reporting standards, and organizational resistance. This study also examines how green economy regulations and policies can strengthen the implementation of this integration. With this method, the article is able to present a critical synthesis that supports in-depth understanding while providing strategic recommendations for practitioners and academics in optimizing the role of environmental accounting in the era of economic transformation towards sustainability.

RESULTS AND DISCUSSION

Table 1. Hypothesis and Key Findings

Hypothesis	Key Findings
H1: The integration of the circular economy in environmental accounting has a positive impact on corporate sustainability.	Integration improves reporting transparency, resource efficiency, and regulatory compliance, thereby supporting corporate sustainability.
H2: Integration increases resource management efficiency and waste reduction.	The application of the 3R principle (Reduce, Reuse, Recycle) through environmental accounting reduces waste and operational costs, especially in the FMCG sector.
H3: Challenges such as a lack of reporting standards and resource constraints hamper integration.	Major barriers include non-uniform reporting standards, high technology investment, and a lack of competent human resources, especially in developing countries like Indonesia.
H4: Companies that successfully integrate the circular economy gain long-term benefits (low costs, good image).	Benefits include cost savings, enhanced reputation and market competitiveness, as well as ongoing investment opportunities from stakeholders.

The integration of the circular economy in environmental accounting has been shown to have a significant positive impact on corporate sustainability, as hypothesized in H1. By adopting circular principles, companies can

optimize resource use, reduce waste, and increase transparency in environmental reporting. It not only meets regulatory demands but also meets the expectations of stakeholders who are increasingly concerned about sustainable business practices. However, the success of this integration is highly dependent on the ability of companies to overcome challenges such as the lack of uniform reporting standards, as expressed in H3. Without clear standards, consistency and comparability of environmental reporting are difficult to achieve.

Hypothesis H2 confirms the finding that the integration of the circular economy through environmental accounting effectively improves the efficiency of resource management. For example, FMCG companies that implement the 3R principle have succeeded in reducing production waste and saving raw material costs. However, these benefits are often constrained by the need for investment in technology and qualified human resources, which are still problems in many developing countries. On the other hand, H4 shows that companies that successfully overcome these challenges are able to achieve long-term benefits, such as reduced operational costs and improved corporate image. This good reputation is an added value in attracting investors and consumers who are oriented towards sustainability.

Overall, this study confirms that the integration of circular economy and environmental accounting is a strategic step towards a green economy. Although challenges such as reporting standards and resource constraints remain, collaboration between governments, businesses, and academics can accelerate the adoption of this practice. Clear regulatory support, human resource training, and financial incentives will be key in maximizing the sustainability opportunities offered by the circular economy. In doing so, companies will not only contribute to environmental preservation but also strengthen their competitiveness in an increasingly green global market.

CONCLUSION

The integration of the circular economy in environmental accounting practices is a very important strategic step in supporting corporate sustainability, especially in the era of the green economy, which increasingly demands businesses to operate responsibly towards the environment and society. The concept of circular economy, which emphasizes waste reduction, resource reuse, and recycling, provides a new paradigm that is more efficient and environmentally friendly in managing corporate resources. By implementing these principles, companies can reduce their dependence on limited natural resources while minimizing negative impacts on the environment.

Environmental accounting plays a crucial role in this process, as it allows companies to measure, monitor, and report the environmental impacts of their operational activities in a more transparent and accountable manner. With a good reporting system, companies can not only meet regulatory obligations and international standards but also build stronger trust from stakeholders, including investors, consumers, and the wider community. It ultimately strengthens the company's position in market competition that increasingly prioritizes sustainability aspects. This study confirms that the integration of the circular economy in environmental accounting practices has a significant positive influence on improving corporate sustainability. The application of circular economy principles not only helps companies reduce operational costs through efficient use of resources and better waste management, but also contributes to improving the company's image and reputation in the eyes of stakeholders. This good reputation is very important in building customer loyalty and attracting investors who are increasingly concerned about environmental and social aspects. However, the implementation of this integration is not without various quite complex challenges. One of the main obstacles is the lack of clear and uniform reporting standards regarding environmental accounting and circular economy, making it difficult for companies to prepare consistent and comparable reports. In addition, the limited competent human resources and the need for adequate investment in technology and information systems are also obstacles that must be overcome. Therefore, to optimize the implementation of circular economic integration in environmental accounting, strong regulatory support from the government is needed, as well as efforts to develop the capacity and competence of human resources in companies.

Overall, the integration of the circular economy and environmental accounting not only supports more environmentally friendly and sustainable business practices but also contributes significantly to inclusive and

sustainable economic growth. In addition, this integration helps companies improve their competitiveness in a global market that increasingly demands transparency and social responsibility. Thus, the application of the circular economy in environmental accounting is an important foundation for companies that want to survive and thrive in this era of the green economy, which is full of challenges and opportunities.

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