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Green Economy: Opportunities and Challenges for the Industrial Sector Amid Climate Change Issues

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ABSTRACT

This study aims to explore the understanding, challenges, and opportunities faced by the industrial sector in implementing the green economy concept amid climate change issues. Using a qualitative approach, this research investigates the experiences of large industries and MSMEs in transitioning toward a green economy, as well as its impact on production processes and competitiveness. The findings reveal a disparity in understanding between large enterprises and MSMEs, with larger companies generally being more prepared to adopt green technologies. In contrast, MSMEs tend to perceive this transition as a high-cost burden. The study also identifies key driving factors such as government regulations, market demands, and fiscal incentives that can accelerate green economy adoption. However, obstacles such as high investment costs, limited human resources, and policy uncertainty remain significant challenges. These findings highlight the importance of government support and cross-sector collaboration in accelerating a more inclusive transition toward a green economy.
Keywords: *Green economy, industrial sector, transition, MSMEs*

INTRODUCTION

Climate change and global warming have become the most pressing environmental challenges facing the world today. Human activities, particularly in the industrial sector, are major contributors to greenhouse gas emissions that exacerbate global climate conditions. The increasing frequency of natural disasters such as floods, extreme droughts, and heatwaves is clear evidence of the ongoing climate crisis. In response, the international community has established various global agreements such as the Paris Agreement and the Sustainable Development Goals (SDGs), which emphasize the importance of sustainable and environmentally friendly economic development.

The green economy concept has emerged as an alternative development pathway that integrates economic growth with environmental sustainability. A green economy emphasizes carbon emission reduction, resource efficiency, and social inclusivity. The momentum for this transition is growing not only from governments and international organizations but also from consumers and investors who are increasingly aware of the environmental impacts of business activities.

The industrial sector holds a strategic position in the transition toward a green economy. On one hand, industry is a key driver of economic growth and job creation. On the other, it is one of the largest carbon-emitting sectors through its use of fossil fuels, hazardous waste production, and exploitation of natural resources. Therefore, the industrial sector is required to transform towards more environmentally friendly production processes. However, this transformation is not without challenges. Industries

face pressure from multiple directions tightening environmental regulations, shifting consumer preferences toward sustainable products, and demands from global markets and business partners. At the same time, companies are challenged to innovate, improve efficiency, and maintain business competitiveness amid the pressures of transitioning to a green economy.

Despite these challenges, the transition to a green economy also presents significant opportunities for the industrial sector. By adopting clean and efficient technologies, companies can reduce long-term operating costs, improve energy efficiency, and minimize waste and pollution. Environmentally friendly product innovations also have the potential to open new market segments with eco-conscious consumers, both domestically and internationally. In addition, supportive government policies such as tax incentives, green financing, and public-private partnerships can serve as key drivers for industries to actively engage in sustainability initiatives. Corporate social responsibility (CSR) practices and investor demand for environmental, social, and governance (ESG) principles further reinforce external pressures that push industries toward serious adoption of green economy principles.

Although the green economy promises many opportunities, its implementation in the industrial sector faces several real obstacles. One of the biggest challenges is the high initial cost required to adopt environmentally friendly technologies, such as energy-efficient machinery, waste recycling systems, and renewable energy sources. For many industries, especially small and medium enterprises (SMEs), these investments are still considered burdensome and high-risk without guaranteed short-term returns. Beyond financial constraints, regulatory uncertainty and weak inter-agency coordination also act as barriers. Many companies express concerns about overlapping or inconsistent policies that hinder green transformation. Moreover, the availability of trained human resources in green technologies remains limited, thus impeding adaptation at the operational level. Without comprehensive support, the industrial sector will struggle to quickly shift toward sustainable production systems.

In Indonesia, the challenge of sustainable development is even more complex, as it must balance national economic growth with environmental protection. The industrial sector, as a major contributor to the country's Gross Domestic Product (GDP) and employment, plays a vital role in this dynamic. The Indonesian government has declared commitments to emission reduction and low-carbon development, but realization at the industrial level continues to face structural barriers.

Some large industries have begun adopting green economy principles, for example by using renewable energy or implementing environmentally certified production systems. However, such practices remain limited and mostly confined to companies with substantial capital access. SMEs which dominate Indonesia's industrial structure are often left behind in this transition. Therefore, a deep understanding of how industry players perceive the opportunities and challenges of the green economy is crucial for formulating a more inclusive and realistic transition strategy in Indonesia.

To date, most green economy research still focuses on quantitative approaches, such as measuring policy impacts or technological efficiency. Meanwhile, there are few studies that explore the subjective experiences and adaptive strategies of industry players directly. Yet, understanding business actors' internal perspectives can offer richer, contextual insights, particularly in identifying real-world constraints, potential, and needs.

Using a qualitative approach, this study aims to fill that gap by exploring the narratives, practices, and strategic considerations of industrial actors in facing the transition to a green economy. Such research will provide important contributions to

strengthening the knowledge base for more targeted policy formulation and industrial support. Based on the explanation above, this study aims to explore how the industrial sector responds to the opportunities and challenges that arise from the demands of transitioning to a green economy amid the escalating issue of climate change. By applying a qualitative approach, the study will examine the understanding, strategies, and adaptive dynamics employed by industry players in responding to regulatory, economic, and social pressures. Furthermore, the research aims to offer relevant recommendations for policymakers, industry players, and other stakeholders in designing interventions that can accelerate the implementation of a green economy more effectively and inclusively in Indonesia.

METHODS

This study uses a descriptive qualitative approach aimed at describing and understanding in depth how industrial actors respond to the opportunities and challenges of green economy implementation in the context of climate change. This approach was chosen because it allows the researcher to explore the meanings, perceptions, and direct experiences of informants involved in the transition process toward a green economy. Qualitative research also provides space to capture social dynamics and specific industrial contexts that cannot be fully explained through numbers or statistics alone.

The subjects of this research are industrial actors, particularly managers, business owners, or personnel involved in decision-making related to environmental and sustainability policies. The study focuses on several industrial sectors in Indonesia that have the potential or have already begun to undertake environmentally friendly initiatives, such as manufacturing, food and beverage, textile, or renewable energy industries. The research locations are determined purposively, selected based on criteria of involvement or initiatives in green economy practices.

Data were collected through in-depth interviews and field observations. Interviews were conducted in a semi-structured manner to provide flexibility in extracting information from the informants' experiences. In addition, the researcher will examine supporting documents such as corporate sustainability reports, CSR profiles, or internal policies related to green economy implementation. Secondary data from industry publications and government policies are also used as complementary sources.

Data analysis is carried out using thematic analysis techniques. The stages of analysis include interview transcription, data coding, identification of main themes, and interpretation of findings based on theory and field context. This process is conducted iteratively, continuously reviewing the data to ensure the accuracy and consistency of meaning. Data validity is maintained through source triangulation and member checking, by confirming the interpretation results with informants to ensure that the meanings captured by the researcher are aligned.

RESULTS AND DISCUSSION

Table 1: Comparison of Understanding Between Large Industry Players and SMEs on Green Economy

Aspect	Large Industry	SMEs
Perception of Green Economy	Seen as an opportunity for innovation and sustainability.	Seen as a cost burden, with limited benefits.
Readiness to Adopt Green Technologies	High readiness due to better resources and access to finance.	Low readiness due to financial constraints and lack of knowledge.

Barriers to Adoption	Initial high costs, but backed by long-term ROI.	Initial high costs and lack of infrastructure.
Perceived Government Support	Satisfied with regulations and incentives.	Lack of clarity and insufficient support.

Source : Author's Analysis 2024

The first table highlights the differing perceptions of green economy between large industries and SMEs. Large industries tend to view the green economy as an opportunity for innovation and sustainability, and are generally more prepared to adopt green technologies due to their access to resources and financing. In contrast, SMEs often perceive green economy initiatives as a costly burden with limited short-term benefits. These businesses face financial constraints and lack the infrastructure and knowledge required to adopt such technologies. While larger companies are generally satisfied with the government's regulations and incentives supporting green initiatives, SMEs struggle with unclear policies and insufficient support, which can hinder their ability to transition to greener practices.

Table 2: Main Barriers to Green Economy Implementation in the Industry

Barrier	Percentage of Industry Facing This Issue
High Initial Investment Costs	45%
Lack of Skilled Human Resources	30%
Uncertainty in Regulations	25%
Insufficient Infrastructure from Government	20%
Overlapping Government Policies	15%

Source : Author's Analysis

The second table outlines the primary barriers to the implementation of green economy initiatives in the industrial sector. The most significant barrier identified is the high initial investment required for green technologies, which affects 45% of the industries surveyed. This is followed by the challenge of acquiring skilled human resources, which is a constraint for 30% of industries. Uncertainty in regulations and insufficient government infrastructure support are also significant hurdles, with 25% and 20% of industries respectively citing these as challenges. Additionally, overlapping government policies add to the complexity of green economy adoption for 15% of respondents. These barriers collectively create a significant challenge for industries attempting to transition to more sustainable practices.

Table 3: Driving Factors for Adopting Green Economy

Driving Factor	Impact on Green Economy Adoption
Government Regulations and Policies	High – Government policies such as Paris Agreement drive adoption.
Consumer Demand for Sustainable Products	Medium – Consumer preference for eco-friendly products.
Fiscal Incentives and CSR Programs	High – Incentives significantly encourage green transitions.
Market Expansion Opportunities	Medium – Access to new markets through sustainability certification.

Source : Author's Analysis

The third table outlines the factors that drive the adoption of green economy practices in the industry. Government regulations and international agreements, such as the Paris Agreement, have a high impact on encouraging industries to embrace green initiatives. Consumer demand for environmentally friendly products also plays a role, though its impact is considered medium. Fiscal incentives and corporate social responsibility (CSR) programs are highly influential in pushing companies toward adopting green practices, as they provide the financial and strategic encouragement needed for the transition. Finally, market expansion opportunities through sustainability certification offer industries new market access, which also contributes to the adoption of green economy practices.

Table 4: Strategies for Adaptation and Innovation

Strategy	Implementation in Industry
Collaboration with Green Tech Startups	Used to obtain affordable and innovative solutions for sustainability.
Green Financing Options (e.g., Green Bonds)	Allows for easier investment in sustainable technologies.
Employee Training and Education on Sustainability	Internally developed programs to build skills for green practices.
Adoption of Renewable Energy Sources	Implementation of solar panels and energy-efficient machinery.

Source : Author's Analysis

The fourth table illustrates the strategies that industries are using to adapt and innovate in response to the green economy. Collaboration with green tech startups is a common strategy for industries to obtain affordable and innovative solutions that support sustainability. Green financing options, such as green bonds, are being utilized by industries to fund their transition to environmentally friendly technologies. Internally, companies are focusing on employee training and education to build necessary skills for implementing sustainable practices. Additionally, the adoption of renewable energy sources, such as solar panels and energy-efficient machinery, is a key strategy for industries to reduce their carbon footprint and become more sustainable.

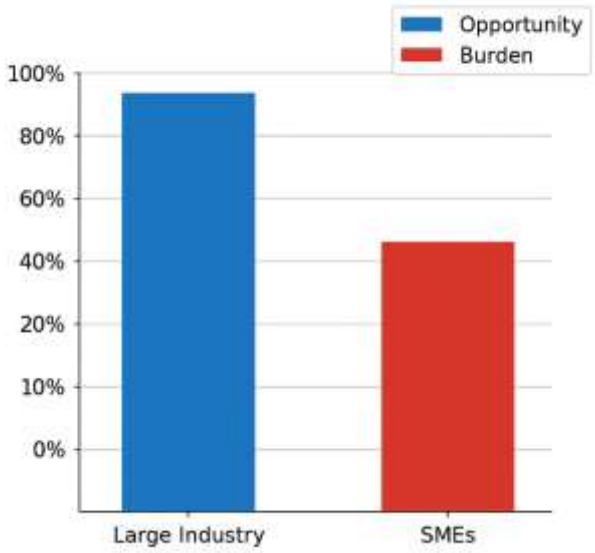

Fig. 1. Percentage of Large Industries and MSMEs Viewing the Green Economy as an Opportunity versus a Burden

The bar chart illustrates the comparison of perceptions between large industries and Micro, Small, and Medium Enterprises (MSMEs) regarding the green economy concept. It shows that the majority of large industry players view the green economy as a strategic opportunity for innovation and enhancing competitiveness, with approximately 70% holding this view. In contrast, most MSMEs perceive the green economy as a burden, mainly due to limited resources, high initial investment costs, and a lack of deep understanding of its long-term benefits. This disparity highlights a significant gap in understanding and readiness between industry scales in welcoming the transition toward more sustainable industrial practices.

Industry Players' Understanding of the Green Economy

The study shows that the level of understanding regarding the green economy varies significantly among industry players. Large companies, particularly those operating in international markets, tend to have a deeper grasp of the concept. They are more familiar with various environmental policies implemented in developed countries and have integrated sustainability principles into their business models. Meanwhile, MSMEs often still regard the green economy as a distant concept and more of an additional burden linked to high costs. Many see the transition as something that requires significant upfront investment, without recognizing the long-term benefits that can come from energy efficiency, waste reduction, and improved corporate image. This perception is influenced by limited resources, both financially and technically, in terms of knowledge of environmentally friendly practices. While there is growing awareness that environmental sustainability is becoming a global priority, the main challenge remains how to bridge the gap between perception and the reality of the green economy.

Forms of Adaptation and Initiatives Taken

Several large companies that have begun adopting the green economy are demonstrating significant adaptations in their production processes. One of the initial steps taken is the transition to renewable energy, such as installing solar panels at production facilities to reduce dependence on fossil energy. Some companies have also replaced production machines and equipment with more efficient and environmentally friendly alternatives, although the initial investment costs are quite high. Additionally, innovation in waste management has also become a primary focus. Many companies have begun implementing waste recycling systems, both for production and consumption waste, in order to reduce their carbon footprint. These efforts are often accompanied by the adoption of international environmental certification standards such as ISO 14001, which not only increases company credibility but also provides them access to global markets that increasingly prioritize sustainable products. On the other hand, sustainability reporting has become an important part of corporate communication strategies, functioning to demonstrate their environmental commitment and provide transparency to stakeholders regarding their operational impact on the environment.

Driving Factors for Green Economy Adoption

The main drivers encouraging industry players to adopt green economy principles include increasingly strict government regulations on carbon emissions and waste management. Governments, at both national and international levels, have introduced policies and regulations that push industries to transition toward more environmentally friendly production processes. Export markets are another major driving factor. Many export destination countries, especially in Europe and North America, require companies to meet specific sustainability standards regarding carbon emissions, energy use, or

waste management. Consumer pressure has also become increasingly significant. A growing environmentally conscious generation of consumers now prefers eco-friendly products, benefiting companies that implement green practices. Equally important, support from international institutions such as fiscal incentives, grants, or partnerships in Corporate Social Responsibility (CSR) programs offers opportunities for companies to develop environmentally friendly products at more affordable costs. All these factors play a crucial role in shaping the perception that the green economy is not just an obligation, but also an opportunity to grow in an increasingly competitive market.

Main Barriers Faced by the Industry

Despite the various opportunities arising from the transition to a green economy, many industry players face numerous challenges. One of the biggest barriers is the high upfront cost of implementing environmentally friendly technologies. Investments in more efficient machinery, renewable energy systems, or eco-friendly waste treatment often require significant budgets, which are difficult for capital-limited companies, particularly MSMEs, to afford. In addition, a shortage of human resources trained in sustainability poses a significant obstacle. Many companies struggle to find skilled workers with green technology competencies, which are increasingly essential for operating sustainably. Moreover, the lack of technical support from local governments such as green infrastructure or support for research and development makes green economy adoption even more challenging. Policy ambiguity or overlap between central and local governments, as well as among various agencies, also creates confusion among industry players regarding compliance with environmental regulations.

Strategies for Survival and Innovation

To address these challenges, many companies are developing survival and innovation strategies. One step taken is partnering with startups or environmental tech firms that can provide innovative and affordable solutions to sustainability challenges. These collaborations allow companies to access more efficient green technologies at lower costs than if they were to invest directly in developing new technologies. Green financing schemes such as issuing green bonds or accessing low-interest loans for environmentally friendly projects are also increasingly popular among companies undergoing transformation. Furthermore, companies are beginning to recognize the importance of internal education and employee training on sustainable practices. By enhancing the skills and awareness of their workforce, companies hope to optimize more environmentally friendly production processes while strengthening a culture of sustainability throughout the organization.

Industry Players' Expectations of the Government

Industry players have high expectations of the government. Many expect the government to provide more consistent, clear, and measurable regulations regarding green economy implementation. Transparent policies will offer legal certainty for companies to make long-term decisions. Additionally, many industry players seek further incentives, such as tax reductions or subsidies for adopting environmentally friendly technologies. In this regard, support in the form of access to technology and information is also crucial, especially for small and medium-sized enterprises. The government is also expected to facilitate collaboration between industries and research institutions or universities to develop innovative solutions that can be widely applied in the industrial sector. Without sufficient government support, the transition to a green economy will be hindered especially for smaller industries.

Implications for Future Industrial Transformation

Overall, industry players are developing an increasing awareness of the importance of the green economy, although implementation challenges remain substantial. They

recognize that transitioning to a green economy is not a choice but a necessity to survive in an increasingly sustainability-oriented global industrial landscape. The great potential to improve operational efficiency, reduce energy costs, and enhance corporate reputation has inspired some industry players to further innovate. However, to accelerate this transformation, support from the entire ecosystem including government, educational institutions, and the private sector is essential. Cross-sector collaboration will be critical in creating widely applicable solutions and lowering the transition costs for companies, particularly MSMEs. In the long run, the green economy will become a crucial pillar in building a more efficient, competitive, and sustainable industry.

Industry Players' Understanding and Perception of the Green Economy

Understanding of the green economy among industry players varies depending on company size and capacity. Large companies tend to have a more comprehensive understanding of sustainability concepts and easier access to resources needed to implement green economy principles. In contrast, many Micro, Small, and Medium Enterprises (MSMEs) remain burdened by a limited understanding of the long-term benefits of the green economy. Most MSMEs perceive the transition to a green economy as a financial burden and do not necessarily see it as a strategic opportunity for growth. This perception is often linked to the assumption that the initial cost of adopting environmentally friendly technologies is too high and not commensurate with the potential profits. This results in slower adoption of green technologies among smaller, less experienced businesses, which tend to focus on immediate costs rather than long-term benefits such as energy savings and enhanced market reputation.

Challenges in Implementing the Green Economy

Implementation of the green economy in the industrial sector faces various significant challenges. One of the main obstacles is the high upfront investment cost in green technology. Purchasing and installing energy-efficient equipment, using environmentally friendly raw materials, and implementing more effective waste management systems often require substantial investment. This is a major hurdle for many companies, especially MSMEs, that operate on limited budgets. Additionally, the difficulty in obtaining trained human resources (HR) in sustainability is another major issue. Limited education and training in this sector make it difficult for industries to build teams with the expertise needed to effectively implement environmentally friendly technologies and practices. Other challenges include regulatory uncertainty that hinders long-term planning and consistent policy development. Many industry players also struggle with overlapping policies between central and regional governments, leading to confusion about environmental standards and requirements that must be met.

Drivers of Green Economy Adoption

Several factors are accelerating the adoption of the green economy in the industrial sector. These include increasingly strict government regulations and pressure from international markets. International agreements, such as the Paris Agreement, strongly encourage countries to implement sustainable practices, pushing industry players to comply with global standards. Moreover, growing consumer awareness of sustainability issues has driven companies to innovate by offering environmentally friendly products. Demand for greener products such as those made from renewable and eco-friendly raw materials is on the rise in international markets.

Strategies for Survival and Innovation in the Green Economy

In facing the challenges of the green economy, many industry players have begun developing various strategies to survive and innovate. Collaborating with green technology companies and startups that develop environmentally friendly solutions has become one way to reduce the costs of implementing new technologies. Through such

partnerships, industries can gain access to more efficient and affordable technologies. In addition, green financing schemes such as green bonds and eco-friendly loans offered by financial institutions are becoming increasingly popular, providing a pathway for companies to secure funding for sustainability projects. These schemes not only help reduce financial burdens but also enhance a company's reputation in the eyes of consumers and investors who are increasingly concerned about sustainability. On the other hand, internal education and training focused on sustainability principles are crucial. Companies that implement training programs for employees on applying environmentally friendly practices in their production and operations will find it easier to adapt to change and be more prepared to meet market demands.

The Role of Government in Promoting Green Economy Adoption

The government's role is vital in encouraging the adoption of a green economy in the industrial sector. Consistent and transparent policies on sustainability can facilitate this transition by providing clear guidance for industries. The government must ensure that regulations do not overlap and instead support the adoption of green technologies by offering attractive incentives to industry players. Moreover, government support in providing access to information on green technologies and how to implement them is highly needed by industry players, especially SMEs. Technical assistance from the government, along with the development of green infrastructure such as recycling facilities and the use of renewable energy, can also accelerate the adoption process. Furthermore, the government should encourage collaboration between the industrial sector, research institutions, and universities to accelerate innovation in the field of sustainability.

Implications for Future Industrial Transformation

The transformation toward a green economy can have significant impacts on industrial competitiveness and long-term economic growth. In the future, industries that adopt sustainability principles and green technologies will be better positioned to survive in global competition, considering the increasing demand for environmentally friendly products. Additionally, cross-sector collaboration including between industry, educational institutions, and research organizations is crucial in creating greener and more inclusive supply chains. By approaching sustainability issues holistically and involving multiple stakeholders, industries can strengthen their market position and reduce negative environmental impacts. Moreover, SMEs also have significant opportunities to enter global markets that are increasingly focused on sustainability. However, this requires greater access to information, technology, and financial support to ensure a smooth transition.

Research Gaps and Future Research Directions

Although many studies have examined the implementation of the green economy in the industrial sector, significant research gaps remain, particularly regarding the firsthand experiences of industry players. Most existing studies tend to be quantitative and focus more on the impacts of policy or external factors influencing green economy adoption. More in-depth research using qualitative approaches that explore the real experiences of industry players regarding the challenges and opportunities they face in implementing the green economy is greatly needed. Additionally, there is still limited research discussing the crucial role of cross-sector collaboration in supporting industrial sustainability. Further research could provide more comprehensive insights into how government policies, partnerships with international institutions, and financial support can accelerate the industry's transition to a green economy.

CONCLUSIONS

Overall, the implementation of the green economy in the industrial sector reveals differences in understanding and perception among industry players, particularly between large companies and SMEs. While large companies are better prepared to adopt green technologies due to greater access to resources, many SMEs are still hindered by negative perceptions about high costs and financial challenges. Nevertheless, there are driving factors that increasingly accelerate the adoption of the green economy, such as government regulations, international market demands, and fiscal incentives that help reduce existing barriers. However, major challenges such as high investment costs, limited availability of skilled human resources, and regulatory uncertainty remain significant obstacles that must be addressed. On the other hand, cross-sector collaboration, government support, and the utilization of green technologies through environmentally friendly financing schemes are important strategies for companies in overcoming these challenges. Therefore, the government needs to provide clear, consistent, and supportive policies, as well as ensure the availability of green infrastructure for industry players. In the future, the transition toward a green economy will not only be essential for maintaining competitiveness but will also open new, more inclusive opportunities for all industrial sectors—especially for SMEs that need support in adapting to these changes.

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