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Analysis of gap between agribusiness and green economy: The role of environmental, social, and governance, environmentally friendly technologies, and sustainability solutions

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Abstract

This research aims to analyze the gap between agribusiness and the green economy, focusing on the integration of Environmental, Social, and Governance (ESG) principles, the adoption of environmentally friendly technologies, and the effectiveness of sustainability solutions. The study employs NVIVO software for data processing, using quantitative methods such as percentage coverage and Pearson correlation coefficient analysis to evaluate the relationships between these factors. The findings show a strong correlation between the application of ESG principles and the successful transition of agribusiness to a green economy, although the adoption of climate-smart technologies remains suboptimal. Additionally, the effectiveness of sustainability solutions is limited by insufficient policy support and infrastructure. In conclusion, to bridge this gap, it is crucial to increase ESG adoption, implement environmentally friendly technologies, and enhance policy and infrastructure support. The practical implications of this study emphasize the need for collaboration among government, business actors, and technology innovators to foster sustainable and economically efficient agribusiness practices.

Keywords: Agribusiness, Climate-smart agriculture, Environmental social and governance (ESG), Environmentally friendly technology, Green economy, Sustainability.

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1. Introduction

The gap between agribusiness and the green economy is evident when examining current business practices. Agribusiness, often prioritizing maximum production and economic efficiency, fails to adequately address environmental

sustainability. Conventional agribusiness practices contribute to soil degradation, excessive pesticide use, and significant carbon emissions, which contradict the principles of a green economy. In contrast, the green economy emphasizes resource efficiency, the adoption of environmentally friendly technologies, and the reduction of carbon footprints. This disparity highlights the urgent need for policies and technologies that support a more sustainable agribusiness model, one that balances environmental concerns with economic goals. The green economy promotes a circular economy model, where production waste is transformed into new resources. However, this concept is not optimally applied in many developing countries, where agricultural waste is often not reused or processed into valuable resources such as biogas or organic fertilizers. Instead, agricultural waste contributes to pollution and resource wastage, presenting significant opportunities for integrating green economy principles into agribusiness. The adoption of recycling technologies and efficient production systems could bridge this gap and encourage the transformation of agribusiness practices towards sustainability. Government policy plays a crucial role in narrowing this gap. Many countries have yet to fully integrate green economy principles into agribusiness regulations, leaving a lack of incentives for farmers to adopt sustainable practices. Supportive policies, such as fiscal incentives for farmers using environmentally friendly technologies and subsidies for renewable energy in agriculture, are crucial for advancing the transition. By closing this policy gap, agribusiness can contribute more significantly to achieving the Sustainable Development Goals (SDGs).

This study aims to explore the relationship between agribusiness practices and the green economy, focusing on the integration of Environmental, Social, and Governance (ESG) principles, the adoption of green technologies, and the effectiveness of sustainability solutions. The research seeks to address key questions, such as what factors influence the gap between agribusiness and the green economy, how ESG principles and green technologies impact the transition of agribusiness, and what challenges and opportunities exist in implementing sustainability solutions. While existing studies have examined sustainable agricultural practices, there is limited research on the integration of green economy principles into agribusiness, particularly in developing countries. This research aims to fill this gap by examining how the adoption of ESG principles and environmentally friendly technologies can promote sustainable agribusiness practices. To answer these questions, the study employs NVIVO software for data processing, using quantitative methods such as percentage coverage and Pearson correlation coefficient analysis. The findings are expected to provide insights for policy development and strategies to promote a more sustainable agribusiness sector.

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2. Literature Review

2.1. Traditional Economic Growth and Environmental Degradation

Traditional economic models have been primarily based on the use of various forms of capital, such as human, technological, and natural resources, to produce goods and services, thereby enhancing human welfare and living standards. According to Brears [1], these models have led to significant improvements in global living conditions, such as increased industrial productivity, infrastructure, and access to goods. However, these economic systems have also contributed to severe environmental degradation, resulting in climate change, biodiversity loss, and resource depletion [2]. The growing environmental challenges, coupled with rapid population growth, urbanization, poverty, and inequality, highlight the unsustainability of traditional economic growth models. In response, several multilateral organizations have advocated for a transition to a green economy that focuses on sustainable development, equitable resource distribution, and environmental conservation [1]. The green economy aims to promote human welfare and social equity while mitigating environmental damage.

2.2. Challenges and Solutions for Sustainable Economic Growth

The challenges of sustainable economic growth are complex and multifaceted. Menéndez [3] study on transaction systems in Oaxaca reveals how the dominance of elites over subordinate classes perpetuates systemic exploitation [4]. This exploitation is evident in the agricultural sector, where agribusiness elites use pesticides as a tool of control over farmers. Menéndez's research sheds light on the intersection of politics, economics, and social structure, emphasizing how elites' control of resources influences agricultural practices and exacerbates environmental degradation. From a broader perspective, addressing these challenges requires comprehensive policy changes that integrate social equity, environmental responsibility, and economic growth [3]. This can be achieved through the adoption of more sustainable agricultural practices and the reduction of harmful economic practices that contribute to climate change.

2.3. The Vital Role of Agribusiness in the Circular Economy for Sustainable Agriculture

Agribusiness plays a crucial role in transitioning to a sustainable agricultural system. Dankevych et al. [5] have demonstrated that agribusiness, when integrated into the circular economy, fosters the use of renewable resources, improves resource efficiency, and reduces carbon emissions. By emphasizing sustainable agricultural practices, agribusiness can contribute to reducing waste and promoting environmentally friendly techniques such as organic farming, precision agriculture, and renewable energy use in production systems. Such practices can minimize the environmental impact of agriculture, contributing to the broader goal of sustainable economic development [6].

2.4. Climate-Smart Agriculture in Global Agribusiness Strategies to Combat Climate Change

The role of climate-smart agriculture (CSA) in addressing climate change has gained prominence within global agribusiness strategies. Essaber [7] highlights CSA as a key strategy for mitigating the effects of climate change while maintaining high agricultural productivity. As outlined by the Paris Climate Agreement, CSA seeks to increase yields sustainably while safeguarding resources for future generations. By adopting CSA practices such as crop diversification,

water-efficient irrigation, and agroforestry, farmers can enhance resilience to climate change, improving food security and economic resilience. CSA also helps reduce the carbon footprint of agriculture, making it a crucial component of a green economy focused on sustainability and climate adaptation [7].

2.5. The Negative Impact of Climate Change on Agriculture

Schmitz et al. [8] emphasize the severe impact of climate change on agriculture, particularly regarding land use and greenhouse gas emissions. Agricultural practices, such as conventional tillage, contribute significantly to carbon emissions and soil degradation. Schmitz et al. [8] recommend the adoption of no-tillage or zero-tillage techniques as methods of sequestering carbon in the soil and reducing greenhouse gas emissions. This practice, which minimizes soil disturbance, enhances soil carbon storage and biodiversity, making it a critical element in the fight against climate change.

2.6. The Broad Scope of Agribusiness in the Agricultural Value Chain

The agricultural value chain encompasses a wide range of activities, from farm production to the final distribution of food products. Schmitz et al. [8] note that agribusiness includes large corporations involved in primary agriculture, as well as operations related to the manufacturing and distribution of agricultural supplies, storage, processing, and distribution of agricultural commodities. This broad scope allows agribusiness to drive innovation and efficiency in the agricultural sector, facilitating the adoption of sustainable practices and contributing to food security and economic resilience.

2.7. Labor and Policy in Agribusiness

The influence of labor on agribusiness and its associated policies is also significant. According to Schmitz et al. [8], changes in agricultural policies can affect labor market dynamics, alter income distribution, and create incentives for rent-seeking behavior. Understanding labor is crucial for designing policies that are more equitable and efficient, ensuring that the transition to a green economy is inclusive and that workers are adequately supported in the shift toward sustainable agricultural practices.

2.8. The Role of Green Economy and Hydrogen Technology in the Global Energy Transition

The global energy transition is another crucial component of the green economy. Gupta et al. [9] argue that green economy initiatives play a pivotal role in reducing environmental impacts and promoting sustainable resource use. Hydrogen technology, in particular, is a promising solution for reducing carbon emissions in the energy sector [10]. The development of hydrogen as a clean energy source requires significant investment in green infrastructure, supportive policies, and technological innovation, which are essential for achieving a low-carbon economy [9].

2.9. Digital Transformation and Challenges of the Digital Economy

The digital economy is another aspect of modern economic transformation that has both opportunities and challenges. Ismaillovac et al. [11] explain that the rapid expansion of digital technologies has reshaped industries, improving productivity and creating new markets. However, the shift from traditional to digital economies requires substantial investment in infrastructure, training, and regulatory frameworks to ensure that the benefits of digital transformation are widely distributed and do not exacerbate existing inequalities.

2.10. Agribusiness, Food Security, and Sustainable Economics

Agribusiness plays a significant role in ensuring food security, particularly in urban environments. O'Hara [12] argues that urban farming initiatives can help address food security issues in American cities by integrating agribusiness into local food systems. These initiatives provide a pathway toward a more just and sustainable economy by linking agricultural practices with social and environmental responsibilities, enhancing food availability and nutrition while reducing environmental impact.

The need for green economy development is becoming increasingly evident in the face of the challenges posed by traditional economic growth models. From the exploitation of natural resources to the negative impacts of climate change, the global economy must transition toward more sustainable practices. The integration of agribusiness into the circular economy, the adoption of climate-smart agriculture, and the promotion of green energy technologies are all crucial components of this transition. Through these efforts, it is possible to build a more sustainable and equitable global economy that meets the needs of both current and future generations.

3. Methodology

This research employs NVIVO software for data analysis to examine the factors influencing the gap between agribusiness and the green economy [13]. NVIVO is used to process qualitative data and conduct a detailed analysis based on the percentage coverage of various factors, followed by Pearson correlation coefficient analysis to measure relationships between key variables. The methodology allows for a more precise understanding of the influence of environmental, social, and governance (ESG) principles, environmentally friendly technologies, and sustainability solutions on agribusiness practices.

3.1. Differences from Past Studies

Unlike past studies that have primarily relied on qualitative methods, case studies, or simple descriptive analyses, this research integrates both qualitative and quantitative techniques using NVIVO. Previous research has often focused on

general agricultural sustainability or specific green economy initiatives without assessing the direct correlation between ESG adoption and agribusiness transitions. By applying the Pearson correlation coefficient, this study goes further by statistically measuring the strength and direction of relationships between variables, providing a more robust and detailed insight into how these factors interact and influence each other.

3.2. Identification of High-Coverage Factors

Factors with a high percentage of coverage in NVIVO data processing indicate recurring themes or categories that frequently appear in the analysis. These high-coverage factors are central to understanding the gap between agribusiness and the green economy. For instance, "The Role of Agribusiness in Integrating ESG Principles for Sustainable Development in Southeast Asia" and "The Contribution of Agribusiness to the Circular Economy in Sustainable Agriculture" may show high coverage, suggesting that ESG adoption and sustainability issues are frequently discussed in the literature or data analyzed.

3.3. Analysis of Moderate-Coverage Factors

Factors with moderate coverage percentages are not as dominant in influence or frequency but are still significant. For example, "Digital Transformation in Agricultural Value Chain" might show moderate coverage, indicating that digitalization is important, though its full impact and implementation face challenges. By analyzing these factors, the study highlights the emerging importance of digital technologies in bridging the gap between traditional agribusiness and the green economy.

3.4. Low-Coverage Factors

Low-coverage factors represent issues that, although important, are not widely discussed or implemented in real-world contexts. For instance, "Sustainable Hydrogen Economy Development through Biomass Utilization" may show low coverage. Despite the significant potential of biomass and hydrogen technologies to reduce carbon footprints in agribusiness, their adoption is still in its infancy and requires stronger policy support and financing. These findings emphasize the areas that need further exploration and development.

3.5. NVIVO Coverage Analysis

By analyzing the percentage coverage of these factors, the study identifies which issues are prioritized in policies or practical initiatives. High-coverage factors reveal areas where reforms and interventions are already in progress but need further strengthening. On the other hand, low-coverage factors represent areas of innovation with great potential that require further investment and policy support.

3.6. Pearson Correlation Analysis

An in-depth analysis using the Pearson Correlation Coefficient was performed via NVIVO. This analysis helps examine the linear relationship between variables identified in percentage coverage. Pearson correlation quantifies the strength and direction of relationships, where:

- A value of 1 indicates a perfect positive correlation (both variables increase together).
- A value of -1 indicates a perfect negative correlation (as one variable increases, the other decreases).
- A value of 0 indicates no correlation (the variables do not affect each other linearly).

In this study, Pearson correlation allows for a deeper understanding of how various factors influencing the gap between agribusiness and the green economy are interrelated.

3.6. Steps Taken in the Analysis

1. Identification of Positive Correlation Variables
   Efforts to address sustainability challenges are closely related to agribusiness strategies focused on climate adaptation. The Pearson correlation coefficient shows a strong positive correlation between variables, such as between "The Effectiveness of Solutions in Addressing the Challenges of Sustainable Economic Growth" and "The Implementation of Climate-Smart Agriculture in Agribusiness Strategies." The more effective the solutions for sustainable economic growth, the more likely agribusiness will adopt climate-smart agriculture.
2. Identification of Negative Correlation
   When the Pearson correlation shows a negative value close to -1, it indicates an inverse relationship between two variables. For example, the transformation of digital technologies may not be sufficient to address environmental issues unless it is supported by broader environmentally friendly practices, as evidenced by the negative correlation between "The Negative Impact of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices" and "Digital Transformation in Agricultural Value Chain." Digital technology alone cannot tackle the negative impacts of climate change.
3. Factors with Weak or No Correlation
   A Pearson value close to 0 indicates that the variables do not have a significant linear relationship. For instance, there may be a weak correlation between "Green Economy Development for Mitigating the Impact of Traditional Economic Practices" and "The Role of Labor in Agricultural Policies," suggesting that differences in policy focus prevent these two variables from directly influencing each other.

4. Discussion

Based on Figure 1, The analysis of the "Gap in Agribusiness and Green Economy" includes several important themes, showing the interconnectedness between agribusiness and the green economy, as well as areas where significant gaps exist.

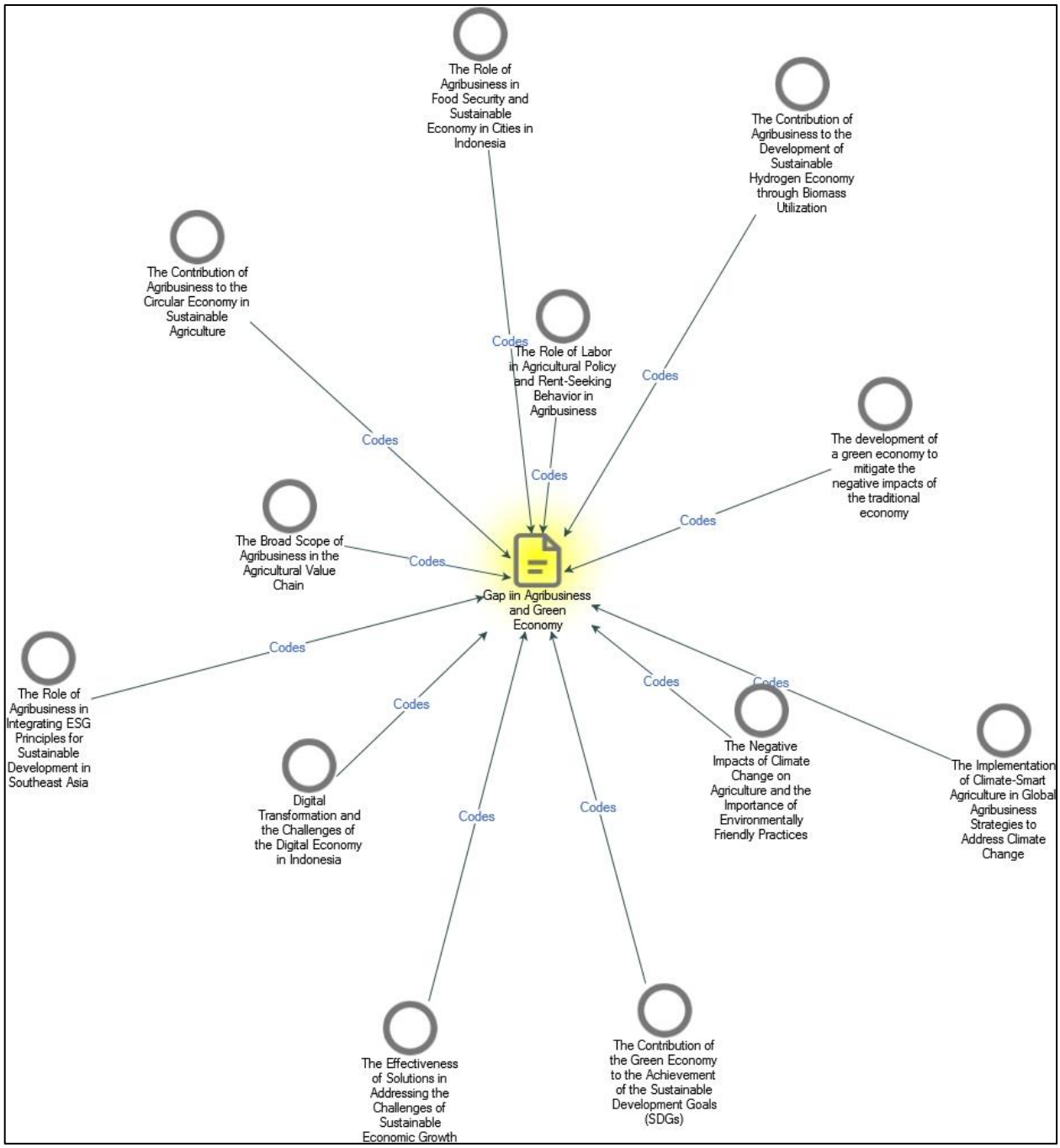

Figure 1.
Gap In Agribusiness and Green Economy.

Several key points can be analyzed from this figure:

1. The Role of Agribusiness in Sustainable Development
   Agribusiness plays a crucial role in supporting a sustainable economy, particularly concerning food security and economic growth in different regions. However, there is a gap in the implementation of sustainability principles such as ESG in Southeast Asia and urban sectors in Indonesia. This highlights the need for more proactive policies to ensure that agribusiness contributes to economic growth and environmental balance [14].
2. The Contribution of Agribusiness to the Circular Economy
   The contribution of agribusiness to the circular economy in sustainable agriculture is another important area in this gap analysis. The figure shows the existing gap in the application of effective solutions to address the challenges of sustainable economic growth and the potential to use biomass as a renewable resource. The development of technologies and policy initiatives to support circularity can help close this gap.
3. Digital Transformation and the Challenges of Green Economy

Digital transformation within the agribusiness sector is identified as a critical element in addressing gaps. Digitalization allows for increased efficiency, but challenges remain in the implementation across agricultural value chains. In contrast, the green economy focuses on mitigating the negative impacts of the traditional economy and the influence of climate change, showing room for closer collaboration between agribusiness and the green economy in facing climate change and achieving SDGs.

The analysis of Figure 1 suggests significant opportunities for balancing agribusiness with green economy principles through policy innovation, circular technologies, and enhanced cross-sector collaboration to tackle global sustainability challenges.

Table 1.
Coverage Percentage of Influencing Factors.

Influencing Factors	Percentage coverage
Effectiveness of Solutions in Addressing the Challenges of Sustainable Economic Growth	1.75%
Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Combat Climate Change	1.53%
Impact of Climate Change on Agriculture and Importance of Environmentally Friendly Practices	0.95%
Development of Green Economy for Mitigating the Negative Impact of Traditional Economy	1.93%
Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	0.81%
Role of Agribusiness in Integrating ESG Principles for Sustainable Development in Southeast Asia	1.04%
Scope of Agribusiness in Agricultural Value Chain	1.63%
Contribution of Agribusiness to the Development of a Sustainable Hydrogen Economy through Biomass Utilization	0.81%
Contribution of Agribusiness to the Circular Economy in Sustainable Agriculture	2.78%
Role of Agribusiness in Food Security and Sustainable Economics in Indonesian Cities	1.38%
Role of Labor in Agricultural Policy and Rent-Seeking Behavior in Agribusiness	1.67%
Digital Transformation and the Challenges of the Digital Economy in Indonesia	1.07%

Based on the processed results, the factors influencing gap between agribusiness and green economy can be analyzed as follows:

1. Effectiveness of Solutions in Addressing the Challenges of Sustainable Economic Growth (1.75%)
   This factor has the highest percentage coverage, showing that the challenges in achieving sustainable economic growth through agribusiness are a frequently discussed focus. Even though agribusiness has significant potential to drive local and national economies, the implementation of effective solutions to address environmental challenges is still lacking. This suggests a need for more innovative policies and technologies to facilitate economically efficient and sustainable growth.
2. Implementation of Climate-Smart Agriculture in Agribusiness Strategies (1.53%)
   The high coverage percentage for this factor reports that the adoption of climate-smart agricultural technology is a major concern in addressing the impacts of climate change on agribusiness. However, there remains a gap in the comprehensive implementation of the strategy, particularly in areas more vulnerable to climate change. This strategy is essential for improving food security and supporting long-term economic resilience, requiring support from various stakeholders, such as government policies.
3. Development of Green Economy for Mitigating the Negative Impact of Traditional Economy (1.93%)
   The factor has high coverage, reflecting significant attention to mitigating the negative impacts of environmentally unfriendly traditional economic practices. This shows the urgency of transitioning towards a green economy to reduce carbon footprints and mitigate environmental impacts stemming from conventional agribusiness. This gap reports an immediate need for supportive policies to facilitate changes in agribusiness to become more environmentally friendly.
4. Other Factors with Lower Coverage
   Several factors with lower percentage coverage, such as "Digital Transformation in Agricultural Value Chain" or "Contribution of Agribusiness to the Circular Economy," are relevant to the discussion. The contributions are relatively small, but the importance of integrating digital technologies and circularity is increasingly recognized. In this context, digital transformation can enhance supply chain efficiency, while a circular economy allows for more sustainable resource use.

The main gaps between agribusiness and the green economy revolve around the adoption of more effective and sustainable strategies. Improvements in climate-smart solutions, development of the green economy, and implementation of new technologies play important roles in closing these gaps. Meanwhile, supportive policies, technology adoption, and cross-sector collaboration ensure that agribusiness contributes to SDGs. Table 2 shows the Pearson correlation coefficient on gap between agribusiness and green economy.

Table 2.
Pearson Correlation Coefficient Gap Between Agribusiness and Green Economy.

Code A	Code B	Pearson correlation coefficient
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization.	1
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the circular economy in sustainable agriculture	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.236925
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the circular economy in sustainable agriculture	0.219769
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization	0.216364
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	0.216364
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	0.216317
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.207713
Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	0.201911
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	0.188968
Digital Transformation and Challenges of the Digital Economy in Indonesia	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.181172
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.177639
Digital Transformation and Challenges of the Digital Economy in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/contribution of agribusiness to the circular economy in sustainable agriculture	0.164823
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the circular economy in sustainable agriculture.	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen	0.142597

Code A	Code B	Pearson correlation coefficient
	economy through biomass utilization.	
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/contribution of agribusiness to the circular economy in sustainable agriculture.	0.142597
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the circular economy in sustainable agriculture.	Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	0.108553
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.108266
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.099202
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization.	0.098997
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	0.098997
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	0.098161
Digital Transformation and Challenges of the Digital Economy in Indonesia	Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	0.08691
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/contribution of agribusiness to the circular economy in sustainable agriculture.	0.082476
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.076141
Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.070578
Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.063239
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the circular economy in sustainable agriculture	0.054431

Code A	Code B	Pearson correlation coefficient
Digital Transformation and Challenges of the Digital Economy in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization.	0.049652
Digital Transformation and Challenges of the Digital Economy in Indonesia	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	0.049652
Digital Transformation and Challenges of the Digital Economy in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	0.046678
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	0.045848
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.045844
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization.	Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	0.04486
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	Effectiveness of Solutions in Addressing Sustainable Economic Growth Challenges	0.04486
Digital Transformation and Challenges of the Digital Economy in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	0.021739
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/contribution of agribusiness to the circular economy in sustainable agriculture	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.020766
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization.	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.018648
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	0.018648
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	0.013236

Code A	Code B	Pearson correlation coefficient
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change and Its Negative Impacts on Agriculture, Emphasizing the Importance of Environmentally Friendly Practices	0.012995
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	0.011004
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.009037
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	0.009037
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	0.00392
Digital Transformation and Challenges of the Digital Economy in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	-0.003082
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	-0.004321
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.007063
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.007063
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	Effectiveness of Solutions in Addressing Challenges of Sustainable Economic Growth	-0.014985
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.030886
Digital Transformation and Challenges of the Digital Economy in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains.	-0.032356
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/contribution of agribusiness to the circular economy in sustainable agriculture.	-0.033822

Code A	Code B	Pearson correlation coefficient
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	Effectiveness of Solutions in Addressing Challenges of Sustainable Economic Growth	-0.040442
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization	-0.066599
Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	-0.066599
Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	-0.069318
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of labor in agricultural policy and rent-seeking behavior in agribusiness	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.077026
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	Effectiveness of Solutions in Addressing Challenges of Sustainable Economic Growth	-0.082531
Effectiveness of Solutions in Addressing Challenges of Sustainable Economic Growth	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.089729
Digital Transformation and Challenges of the Digital Economy in Indonesia	Development of a Green Economy for Mitigating the Negative Impacts of Traditional Economics	-0.09375
Digital Transformation and Challenges of the Digital Economy in Indonesia	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change and Its Negative Impacts on Agriculture, as well as the Importance of Environmentally Friendly Practices.	-0.103942
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/Contribution of agribusiness to the development of a sustainable hydrogen economy through biomass utilization	-0.111499
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The role of agribusiness in food security and sustainable economy in cities in Indonesia	Development of Green Economy for Mitigating the Negative Impacts of Traditional Economics/Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)	-0.111499
Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.116415

Code A	Code B	Pearson correlation coefficient
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/contribution of agribusiness to the circular economy in sustainable agriculture.	Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies to Address Climate Change/Negative Impacts of Climate Change on Agriculture and the Importance of Environmentally Friendly Practices	-0.123063
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia/The broad scope of agribusiness in agricultural value chains	-0.124777
The role of agribusiness in integrating ESG principles for sustainable development in Southeast Asia	Development of a Green Economy for Mitigating the Negative Impacts of Traditional Economics	-0.126663

Analysis of the correlation between different factors affecting the gap between agribusiness and the green economy. The following points can be further analyzed.

1. High Correlation (1.0)
   Several pairs of factors, such as "Development of Green Economy for Mitigating the Negative Impact of Traditional Economy" and "Contribution of Green Economy to Achieving Sustainable Development Goals (SDGs)," show a perfect correlation with a value of 1.0. This indicates that the two factors have a very strong and positive linear relationship. The importance of ESG principles is reflected as central to the development of the green economy.
2. Moderate Correlation (0.21 - 0.23)
   The relationship between some factors, such as between "Role of Agribusiness in Integrating ESG Principles" and "Implementation of Climate-Smart Agriculture," shows a moderate correlation. This value suggests a strong relationship between the integration of ESG principles and the implementation of climate-smart technologies in agribusiness. Even though there is a relationship between social-environmental sustainability and the adoption of climate technologies, the factors are not related linearly.
3. Weak Correlation (below 0.2)
   Weak correlations among certain factors may indicate that the two variables do not have significant relationships. Therefore, the factors operate independently, and other variables mediate the relationships. This may present an area for further development to enhance synergies between agribusiness initiatives and the green economy.

Factors with high correlations show that sustainable agribusiness policies and practices significantly influence the success of the green economy. Based on factors with moderate correlations, efforts are needed to strengthen the synergy between the adoption of environmentally friendly technologies and other sustainability practices, even though relevant connections exist. Further research should be conducted to understand the relationship between gap analysis percentage coverage and the Pearson Correlation Coefficient, as summarized below.

4.1. Analysis Based on Percentage Coverage

The analysis of percentage coverage shows several factors that develop prominently in discussions about the gap between agribusiness and the green economy. Factors such as "Effectiveness of Solutions in Addressing the Challenges of Sustainable Economic Growth" (1.75%) and "Development of Green Economy for Mitigating the Negative Impact of Traditional Economy" (1.93%) show high coverage. The discourse surrounding the effectiveness of sustainability solutions and the necessity for transitioning from traditional to green economies is a central focus. The gap depends on the inability to integrate effective green solutions within agribusiness, which predominantly uses traditional practices.

Factors with moderate coverage, such as "Digital Transformation in Agricultural Value Chain," report that the adoption of digital technology is indeed relevant, but the challenges of implementation within the agribusiness ecosystem remain significant. The gap shows the need for improvements in infrastructure and digital capacity within the agribusiness sector. Factors with low coverage, such as "Sustainable Hydrogen Economy Development through Biomass Utilization," suggest that more innovative and sustainable technologies are in the early stages of development and adoption, showing great potential for long-term enhancement [15].

4.2. Analysis Based on Pearson Correlation Coefficient

The Pearson correlation analysis reports the relationships among various factors affecting the gap between agribusiness and the green economy. The results show a perfect positive correlation (1.0) between the "Development of Green Economy for Mitigating the Negative Impact of Traditional Economy" and "Role of Agribusiness in Integrating ESG Principles for Sustainable Development." Therefore, ESG principles play a critical role in supporting the transition toward a green economy. The implementation of ESG ensures that agribusiness is conducted for economic gains as well as the maintenance of ecological and social balances.

A moderate correlation of 0.21-0.23 between "The Role of Agribusiness in Integrating ESG Principles" and "Implementation of Climate-Smart Agriculture" suggests that other factors influence the implementation, even though the two concepts are interconnected. Despite the adoption of ESG principles, the implementation of environmentally friendly

technologies is not optimal, such as climate-smart agriculture. This gap shows the need for improved adoption of suitable technologies to address climate change challenges.

4.3. Analysis Based on gap Figure Between Agribusiness and Green Economy

The figure reporting various themes within the gap between agribusiness and the green economy shows the complex interrelationships among various issues. Some prominent themes include "Effectiveness of Solutions in Addressing the Challenges of Sustainable Economic Growth" and "Implementation of Climate-Smart Agriculture in Global Agribusiness Strategies." This indicates that global efforts to enhance food security through environmentally friendly technologies are a major focus in addressing the gap. However, significant challenges remain in ensuring adequate implementation at the local level, particularly in developing countries where resources to apply climate-smart technologies are limited. The figure also highlights the importance of policy roles in increasing the adoption of technologies and sustainability practices. This gap emphasizes the need for improvements in policy regulations, financial support, and education for stakeholders to adopt more sustainable practices.

Based on the three analyses, the gap is due to a lack of adoption of environmentally friendly technologies and inadequate integration of sustainability principles into agribusiness operations. Factors with high correlations and significant coverage report key areas requiring enhancement. Meanwhile, factors with weak correlations or low coverage represent areas still requiring further innovation. Solutions to bridge this gap necessitate strong collaboration among government entities, business actors, and technology innovators, with an emphasis on supportive sustainability policies and improved technological infrastructure.

5. Conclusion

In conclusion, the integration of Environmental, Social, and Governance (ESG) principles has played a crucial role in reducing the gap between agribusiness and the green economy. The strong relationship between the application of ESG principles and the development of the green economy emphasizes the importance of policies that promote social and environmental sustainability, as well as good corporate governance, to foster a sustainable agribusiness sector. Expanding the adoption of ESG throughout the agribusiness supply chain is essential to support a successful transition to a green economy. However, environmentally friendly technologies, such as climate-smart agriculture, have not been adopted to their full potential, despite their significant role in addressing climate change challenges. This gap highlights the need for more effective strategies to increase the adoption of these technologies. Additionally, the effectiveness of existing solutions to support sustainable economic growth remains a challenge, as sustainability initiatives identified in the study have often been insufficient in their implementation. In this regard, improving policies, infrastructure, and technological support is crucial to ensure that these solutions are genuinely effective in promoting a sustainable agribusiness economy. Innovations like the hydrogen economy and biomass utilization are still in the early stages, indicating that further innovations and investments are needed to comprehensively support the transition to a green economy. To narrow the gap between traditional agribusiness and the green economy, integrated and targeted strategies are required, with collaboration among governments, business actors, and technology innovators playing a key role in creating an economically efficient and environmentally sustainable agribusiness system. Future research could explore the further integration of sustainability principles with the adoption of innovative technologies and investigate the impact of policies and public-private partnerships on accelerating the transition to a green economy. Additionally, examining regional and sectoral variations in sustainability practices would provide a more nuanced understanding of the challenges and opportunities in different contexts.

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