SOCIO-ECONOMIC SUSTAINABILITY STRATEGY FROM THE PERSPECTIVE OF THE AGRICULTURAL BUSINESS IN DEVELOPING COUNTRIES

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Abstract

Agriculture is essential for economic development worldwide, particularly in developing countries, where around 2.5 billion people, or 80 percent of the population, depend on it for their livelihoods (Sarkar et al., 2021; Wijerathna-Yapa & Pathirana, 2022). In Thailand, agriculture is integral to both the economy and society, employing approximately 25 million people. However, agricultural workers often earn lower average incomes compared to those in other sectors (Digital Economy Promotion Agency [DEPA], 2020). By adopting environmental, social, and governance (ESG) principles, Thailand's rice industry can optimize resource use, reduce costs, and enhance competitiveness. This study aims to explore the application of ESG within Thailand's rice production supply chain, evaluate its impact on sector competitiveness, and identify best practices for integration. Utilizing qualitative methods, including content analysis and interviews with 30 participants, the findings reveal that ESG adoption presents substantial opportunities for improving sustainability and competitiveness. By fostering environmental stewardship, promoting social welfare, and strengthening governance, ESG can help farmers and businesses tackle challenges such as resource inefficiency and market volatility. Furthermore, the research highlights the importance of public-private partnerships and supportive policies in establishing a sustainable, ESG-driven rice production system, which could serve as a model for other developing nations aspiring to implement sustainable agricultural practices.

Keywords: Sustainable Development, Environmental and Social Governance, ESG, Innovative Practices, Rice Industry

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1. INTRODUCTION

In recent years, the world has faced significant challenges such as climate change, population growth, and increasing economic and social inequalities. These issues have underscored the importance of environmental, social, and governance (ESG) factors in shaping overall performance. Sustainable development has emerged as a guiding framework, focusing on meeting current

needs while ensuring future well-being (Intezar et al., 2024; Li et al., 2024). Within this context, environmental, social, and governance disclosures (ESGD) have become crucial for assessing corporate sustainability, providing insights into how businesses manage their environmental impact, social responsibilities, and governance standards (Terdpaopong et al., 2024). In developing countries like Thailand, rice is vital for socio-economic sustainability, serving as a staple food and a livelihood for many farmers. However, the rice industry faces interconnected challenges, including declining prices that render cultivation economically unsustainable, leading many farmers to lose their ancestral lands (Hani & Issoufaly, 2023; Napasintuwong, 2019; Sowcharoensuk, 2023). Integrating the ESG framework offers a promising approach to fostering sustainable development by harmonizing economic, environmental, and social factors. Embracing ESG principles can enhance efficiency, minimize costs, and improve farmer livelihoods while building community resilience (Alsayegh et al., 2020; Senadheera et al., 2021). The ESG framework aligns with global initiatives like the United Nations' Sustainable Development Goals (SDGs) and resonates with localized philosophies such as Thailand's sufficiency economy philosophy (SEP) (Luciani et al., 2018; Shayan et al., 2022; Kim & Yoon, 2023). Successful implementation of ESG in the rice industry requires collaboration among various stakeholders, including farmers, mills, and government entities. This holistic approach involves eco-friendly production methods, waste reduction, and market diversification. However, challenges persist, including limited access to knowledge, technology, and financial resources for farmers, as well as insufficient market demand for ESG-based products and policy support.

Despite the growing recognition of the ESG framework across various sectors, research on its application within Thailand's rice production supply chain remains scarce. Previous studies have generally focused on broader agricultural sustainability, without specifically addressing how ESG principles can improve the competitiveness of rice production. Furthermore, there is a noticeable lack of synthesized best practices for applying ESG in Thailand's agricultural sector, leaving stakeholders without clear guidance for implementation. The objectives of this study are threefold: 1) to explore how the ESG framework is currently being applied in Thailand's rice production supply chain, 2) to analyze the impact of ESG adoption on the competitiveness of the sector, and 3) to synthesize best practices for integrating ESG principles within the rice production industry. The central research questions guiding this investigation include:

RQ1: How is the ESG framework being applied in Thailand's rice supply chain?

RQ2: How does ESG adoption influence the competitiveness of Thai rice production?

The study employs the ESG framework as its conceptual foundation, focusing on the integration of environmental sustainability, social responsibility, and corporate governance into business practices. By examining how these principles can improve supply chain efficiency, reduce environmental impact, and strengthen governance, the research aims to demonstrate how ESG can foster competitive advantages for Thailand's rice industry in global markets.

This study holds relevance for both academic researchers and industry stakeholders by addressing the critical need for sustainable practices in Thailand's rice production sector. By applying the ESG framework, the research enhances understanding of how sustainability can drive economic competitiveness in agriculture, providing insights that can guide policymakers, producers, and supply chain managers in adopting ESG strategies. These strategies could strengthen Thailand's position in global rice markets while addressing key environmental and social challenges. Integrating ESG principles into Thailand's rice production offers significant opportunities for improving sustainability, social welfare, and governance practices. This research offers recommendations that may serve as a model for other developing nations aiming to adopt sustainable agricultural practices.

The rest of the paper structure is organized as follows. Section 2 provides a review of the relevant literature. Section 3 presents an analysis of the methodology. Section 4 details the results, showcasing the outcomes of the study. Section 5 discusses and interprets these results in relation to the study's objectives. Finally, Section 6 concludes by summarizing the key findings, acknowledging any limitations, and suggesting areas for future research.

2. LITERATURE REVIEW

The Thai food industry, composed of hundreds of thousands of entrepreneurs, exports products to over 200 countries worldwide. Being both directly and indirectly linked to global value chains, the industry is inevitably impacted by sustainability measures imposed by developed countries, which are key trading partners of Thailand. Understanding these new sustainability regulations under the ESG framework in major markets is critical. This equips entrepreneurs with the necessary information to adapt, presenting both challenges and opportunities. By doing so, Thai businesses will strengthen their competitiveness, while also offering valuable insights to the government and relevant agencies to develop policies that effectively support rapid adaptation. The core of this study focuses on ESG principles and the bio-circular-green (BCG) economy, which serves as an economic framework aligned with SDGs and the SEP of Thailand. The BCG model integrates bioeconomy, circular economy, and green economy, leveraging science, technology, and innovation to drive sustainable development in Thailand (Chutipat et al., 2023; Edyvean et al., 2023). The bioeconomy emphasizes sustainable growth by utilizing renewable biological resources and biotechnology businesses (Bröring et al., 2020; Simachaya, 2021).

2.1. ESG model

The growing threat of climate change and environmental degradation has intensified the focus on sustainability, with increasing social pressure for companies to adopt more responsible production practices (Ying & Xin-gang, 2021). In response, businesses are transforming their models to align with ESG objectives, striving to use resources more efficiently and minimize their environmental impact (Li et al., 2024). In the ESG paradigm, the focus is placed on optimizing resource utilization, enhancing manufacturing efficiency, and extending the lifespan

of goods, materials, and resources through effective recycling and waste reduction practices. This approach leverages scientific or semi-scientific principles to accomplish its objectives (Carus & Dammer, 2018; Corvellec et al., 2022; Kardung et al., 2021; Marsh et al., 2022; Stegmann et al., 2020). The green economy emerges as a pivotal strategy for mitigating adverse environmental impacts by promoting the prudent and responsible use of finite resources. Integral to its success is the establishment of key metrics to monitor resource consumption and waste emissions. Aligned with SDGs, the green economy facilitates the transition towards low-carbon, resource-efficient economies, thereby fostering holistic sustainability (Cho, 2023; Khoshnava et al., 2019; Phurksaphanrat & Panjavongroj, 2023).

Rice, a staple food and economic pillar for many developing nations, particularly in Asia, faces sustainability challenges. While it is the world's second-most cultivated cereal after corn, and offers diverse processing options, declining agricultural prices threaten farmers' livelihoods. This economic hardship, coupled with debt, can lead to land abandonment, disrupting traditional lifestyles and cultural heritage. Furthermore, traditional rice cultivation methods can contribute to environmental issues like water scarcity, soil erosion, and greenhouse gas emissions, jeopardizing long-term productivity. Unequal access to resources exacerbates these challenges. The lack of diverse income streams and limited social support, as seen in parts of Bangladesh and the Philippines, leave farmers vulnerable to market fluctuations. Sustainable solutions for the rice industry must address economic, social, and environmental factors. Initiatives like rice price insurance schemes and farmer assistance funds can bolster financial security for rice farmers (Cho, 2023).

In today's interconnected world, environmental concerns have become a critical societal priority, and ESG principles highlight the role of strong corporate governance in promoting sustainable practices (Gillan et al., 2021). The United Nations SDGs offer a framework for companies to operate ethically, considering not just profits but also the broader economic, social, and environmental impacts of their actions (Spitz et al., 2022). The environmental dimension of ESG focuses on reducing carbon emissions, conserving biodiversity, and managing energy and chemical use (Hill, 2020). In the agrifood sector, addressing environmental concerns across the supply chain is essential to mitigating impacts that threaten the long-term sustainability of production and the health of ecosystems, which are vital for future food security (Salathong, 2019). The social dimension of ESG emphasizes equal opportunity, human rights, labor rights, and community engagement, all of which contribute to positive societal outcomes (Sherwood & Pollard, 2018). Governance addresses corporate governance, risk management, anti-corruption measures, and transparency, incorporating corporate social responsibility initiatives (Charles et al., 2016; Ehlers et al., 2023; Tarmuji et al., 2016; Zieliński & Adamska, 2022). This holistic approach ensures that companies integrate sustainable and ethical principles across all aspects of their operations.

2.2. Successful worldwide of the ESG

The European Union (EU) is a global leader in developing and implementing ESG regulations, influencing worldwide practices. Key initiatives include the "Fit for 55" package, which features regulations such as the Taxonomy Regulation, Corporate Sustainability Reporting Directive, and the Carbon Border Adjustment Mechanism. The European Green Deal sets a goal of net-zero emissions by 2050, promoting renewable energy. Additionally, the proposed 2022 EU Directive on Corporate Sustainability Due Diligence mandates large companies to monitor human rights and environmental impacts across their supply chains, aiming to reduce business risks and prevent greenwashing. In parallel, the U.S., under the Biden administration, emphasizes ESG goals related to climate change, human capital, inequality, and corporate responsibility, aligning national security and foreign policy with sustainability efforts (Cash, 2021; Erickson & Brase, 2019; Câmara & Morais, 2022).

China has committed to achieving carbon neutrality and net-zero CO2 emissions by 2060 through various laws and regulations, including the Environmental Protection Tax Law. This law imposes environmental protection taxes on entities that directly discharge pollutants, such as air and water pollution, construction noise, and solid waste, aiming to reduce industrial emissions and promote sustainability. Additionally, the Green Food Certification Regulation, a voluntary standard, ensures the environmental safety and quality of food and beverages, contributing to China's broader sustainability goals (Bamisile et al., 2022).

Thailand has emerged as a leader in sustainable green management in Southeast Asia, with ESG standards that are on par with those of world-class companies. This focus on ESG has captured the attention of both consumers and investors. Thailand's increasing emphasis on ESG principles, such as environmental responsibility and improved corporate governance, has solidified its role as a sustainability leader in the region. The rise of Thai companies in ESG indices such as the Thailand Sustainability Investment (THSI), the Dow Jones Sustainability Indices (DJSI), and Morgan Stanley Capital International World Index (MSCI) reflects a growing commitment to sustainability, supported by new ESG guidelines implemented in 2022. Additionally, increased ESG reporting and policy support from the Stock Exchange of Thailand since 2021 underscores the government's strong backing. However, challenges remain in addressing social issues, particularly labor and human rights. Tackling these issues presents an opportunity for Thai businesses to strengthen ethical practices and global competitiveness, driving economic and social transformation.

The Thailand Development Research Institute (TDRI) recommends several strategies to promote sustainable agriculture, including land allocation, legal support for sustainable practices, and economic incentives for efficient water use. Farmers should receive training and financial support, such as revolving funds and green loans, during the transition period. Education on harmful practices is essential for sustainable production processes. Implementing taxes on hazardous chemicals and conducting research on alternative bio-based products are also critical. Furthermore,

the institute emphasizes the importance of product standards. Effective cold chain management, expanding marketing channels, and educating consumers through food literacy and labeling are vital. Effective ESG implementation requires collaboration between the public and private sectors to integrate ESG principles into national strategies, including linking management and collaboration databases (Jintrawet & Yasuyuki, 2024; Sutthinun & Leknoi, 2023) to reduce production costs for farmers (Ho et al., 2018) and amending relevant laws. Some Thai agricultural policies, such as income-based subsidies, may hinder sustainability, while others, like the Thai Rice NAMA program, support ESG goals by reducing emissions and promoting innovation. Shifting towards innovation and sustainable practices is essential for a resilient agricultural sector (Mu'adz & Muhyidin, 2024; Prangbang et al., 2020; TDRI, 2023). Thailand's focus on ESG provides a robust framework for driving sustainable economic growth.

3. RESEARCH METHODOLOGY

This study employed a qualitative research approach to investigate the implementation of the ESG concept in Thailand's rice production chain system. Qualitative methods were deemed appropriate for exploring stakeholder perspectives, experiences, and contextual factors influencing the adoption of ESG principles within the rice industry. The data collection process involved two main methods. The first method is documentary research: extensive analysis of printed documents, research papers, and articles related to the ESG and its application in various aspects of the rice production chain system, both in Thailand and internationally. The second one is field research: conducting in-depth interviews (unstructured or semi-structured) with key stakeholders involved in the Thai rice production chain system. This method is commonly used in qualitative research (Siripipatthanakul et al., 2022) to gather rich insights and identify best practices for integrating ESG into the rice supply chain.

This research employed semi-structured face-to-face interviews with panelists to gather more detailed data. This approach was chosen because the researcher was immersed in the actual environment, which often revealed unexpected insights not commonly found in academic literature. The two-way communication during the interviews provided valuable feedback and perspectives on the issues discussed. Additionally, the interviewer was able to adapt questions as necessary, clarify any uncertainties, and ensure a correct understanding of the interviewees' responses by re-probing and summarizing their answers. In this study, the same interviewer conducted all interviews, ensuring a consistent approach that facilitated critical analysis and comparison of results across interviews. The interview process followed six steps as recommended by Salin et al. (2019):

1) Topic definition: establishing the focus of the interviews and the investigation.

2) Design: planning the research design, with a strong emphasis on ensuring the desired outcomes were achievable in the context of this study.

3) Interviews: prepare interview documentation for comprehensive analysis.

4) Analysis: analyze the documents prepared in the previous step using suitable analytical techniques and methods aligned with the study's objectives and goals.

5) Validation: checking the validity, reliability, and generalizability of all interview results.

6) Reporting: writing or communicating the results of the interviews conducted in this study, along with the technical processes involved in data analysis.

The study employed purposive sampling to select areas and participants directly involved in the rice production chain system in Thailand. The selected study areas were Bangkok, Pathum Thani, Nonthaburi, and Nakhon Pathom provinces, which collectively account for a significant portion of the country's rice production and processing. As presented in Table 1, a total of 30 key informants were identified and interviewed, representing seven distinct stakeholder groups within the Thai rice supply chain.

Table 1. Numbers of informants

Informant	*Quantity*
Rice farmers	15
Rice mills	3
Rice bag manufacturers	2
Traditional rice retail shops	3
Rice exporters	2
Rice warehousing business operators	3
Thai Rice Exporters Association	2
Total	30

The selection of key informants followed the theoretical sampling approach proposed by Curtis et al. (2000), which is aligned with the qualitative research paradigm. This approach allows for the sample size to be adjusted as needed until theoretical saturation is achieved, ensuring comprehensive and information-rich data collection. To ensure accuracy and reliability, the researchers employed several data verification techniques: 1) cross-checking data against existing databases and observed phenomena; 2) triangulation of interview data to validate findings from multiple sources; 3) integrating mathematical logic and interdisciplinary concepts for data analysis.

Content analysis is a qualitative research method for objectively describing and quantifying phenomena by systematically examining verbal and written data (Thetlek et al., 2024). In this study, content analysis was employed to systematically analyze the qualitative data collected from interviews and documentary research. This method allows for the identification, categorization, and interpretation of themes and patterns within the data. This rigorous content analysis approach allowed for a systematic examination of the complex factors influencing ESG adoption in Thailand's rice production chain, providing a foundation for the development of evidence-based recommendations and insights.

Alternative approaches that can be employed in research to provide a comprehensive overview of research methods include the use of focus groups and quantitative methods. Focus groups allow for the gathering of opinions from a collective of stakeholders, facilitating an exchange of ideas that can lead to deeper insights than individual interviews might provide. On the other hand, quantitative methods, such as using questionnaires, enable researchers to collect structured feedback from stakeholders, helping to identify and analyze issues and obstacles in establishing competitive advantages.

4. RESULTS

The study examines how Thailand, a powerhouse in rice production, can cultivate a more sustainable and economically just rice industry. The key is integrating ESG principles across the entire production chain. We'll delve into how ESG can address environmental concerns, ensure fair labor practices, and promote good governance within Thailand's rice sector.

4.1. Implementing ESG principles in Thailand's rice production

For generations, farmers have grappled with declining agricultural prices, making rice production a financially risky proposition. This burden often leads to debt and the loss of family land, eroding their cultural heritage. Effective policy is crucial for addressing these issues and fostering national development. Successful policy implementation requires a nuanced understanding of regional needs and a focus on farmers' true challenges. Flexible guidelines tailored to local contexts are essential, as is a balance between top-down and bottom-up approaches. Additionally, minimizing political influence and bureaucracy while empowering farmers through entrepreneurial initiatives is key to long-term sustainability. In essence, successful policy in Thailand hinges on recognizing regional variations and prioritizing farmers' needs. Adaptable, localized guidelines and a balanced power dynamic are fundamental for achieving a sustainable agricultural future.

The ESG framework provides a vital solution for fostering a sustainable Thai economy amid global environmental challenges and resource scarcity due to population growth. It emphasizes resource circulation to optimize usage and minimize waste, contrasting with unsustainable resource-dependent practices that harm the environment. By adopting ESG principles, Thailand can reap economic benefits while protecting the environment and society. The Thai government has recently aligned national development goals with the ESG paradigm, focusing on integrating bioeconomy, circular economy, and green economy concepts. Leveraging science, technology, and innovation aims to boost the sustainable competitiveness of key sectors such as agriculture, food, energy, healthcare, and tourism. By promoting resource efficiency, reducing energy consumption, and implementing effective waste management, these industries could significantly drive gross domestic product (GDP) growth within the next five years. The ESG framework aligns with Thailand's SDGs, emphasizing sustainable production, climate change mitigation, biodiversity conservation, and international collaboration. It also complements Thailand's SEP, promoting responsible resource use. Successful implementation of ESG requires collaboration among stakeholders, including government agencies, private companies, communities, universities, and international organizations. This collective effort focuses on minimizing waste throughout the rice product lifecycle, aiming for a zero-waste approach through initiatives that utilize waste management technologies and foster green innovation. Scientific tools are employed to ensure environmentally friendly production practices.

Thailand's rice supply chain is a complex network involving various stakeholders, including farmers, traders, millers, and consumers, and can be divided into three main sections: upstream (input providers), midstream (processing), and downstream (export). Farmers play a vital role in the upstream sector, utilizing resources such as fertilizers and machinery, with support from the Bank for Agriculture and Agricultural Cooperatives (BAAC). The midstream sector connects farmers with rice traders and millers, focusing on improving efficiency through technology and management systems. The downstream sector handles the marketing of rice, both domestically and internationally. The rice value chain impacts multiple industries, including food and health (rice-based products), processing (milling for export), and research and development (enhancing rice varieties). Rice is also used in sectors like alcoholic beverages, animal feed, bioplastics, and bioenergy, showcasing its versatility and significant influence. However, challenges remain in the Thai rice industry, particularly regarding export competitiveness. Despite its reputation for quality, Thai rice faces competition from countries with lower production costs, influenced by factors such as lower yields and fluctuating export prices. To address these challenges, strategies must focus on improving water management, increasing yields, and reducing production costs. Encouraging the consolidation of small farms to achieve economies of scale and leveraging Agritech for efficient cultivation are essential. Establishing shorter food production supply chains can also mitigate risks and diversify sources. As a leading rice exporter, Thailand should prioritize enhancing food quality and producing health-beneficial products to promote sustainable growth, bolster resilience, and strengthen its global competitiveness in the rice market.

4.2. ESG economic development guidelines for use in the Thai rice production chain system in Thailand

ESG principles in the Thai rice production chain present substantial benefits and are deemed highly feasible, potentially transforming the industry by enhancing sustainability and profitability. The adoption of ESG can significantly reduce production costs for farmers through organic alternatives to chemical inputs, and precision agriculture technologies to minimize losses and streamline operations. It also allows for the transformation of raw rice into higher-value products like organic rice, brown rice, and rice bran oil, thereby increasing market prices and profitability. Furthermore, ESG practices enable farmers to diversify income sources through additional agricultural products such as vegetables and fruits, enhancing their financial stability. These practices also contribute positively to environmental conservation by mitigating pollution and promoting a balanced ecosystem. Despite these advantages, several challenges hinder widespread adoption, including gaps in necessary knowledge and technology among farmers, financial constraints limiting the ability to invest in new ESG initiatives, and insufficient market demand for ESG-derived

products. Addressing these challenges requires concerted efforts to improve education and provide technological support to farmers, increase financial assistance, and expand market opportunities for sustainable products. Collaboration between the public and private sectors is essential to promote the effective integration of ESG principles, aiming to optimize both ecological and economic outcomes in the Thai rice sector.

4.3. Addressing agricultural challenges in Thailand through ESG principles

The expansion of economic crops like rice into forest areas in Thailand is often driven by volatile agricultural prices. Despite increasing yields per rai, small-scale farmers face challenges due to limited access to knowledge, technology, and innovation. High production costs from chemical fertilizers and pesticides, along with weather variability and natural disasters, further impact both product quality and farmers' livelihoods. To enhance the agricultural sector in alignment with the ESG economic approach, it is essential to examine government policies that support agriculture, particularly those focused on increasing income rather than simply reducing costs. A review of the study of the impact and budget from implementing policies or measures to provide assistance to the agricultural sector found that interventions in agricultural product prices and supporting agricultural product prices to help farmers have a better living and increase income have an impact on the economy and sustainable agriculture. This has prevented the Thai agricultural sector from truly developing, affecting the strength of the agricultural sector in the long term and the ability to compete with the economic crops of trading partners. It also creates economic losses and is a financial burden for the country. In addition, the unconditional subsidy policy undermines farmers' motivation to cope with and enhance their potential or increase the efficiency of economic crop production. In addition, the results of the economic loss assessment of rice during 2009–2020 indicate that the implementation of the income insurance project caused a loss of income from the government having to pay farmers and income from the government having to purchase excess rice totaling 159,913 million baht, and caused economic costs from producing rice in excess of the market equilibrium amount, resulting in a total opportunity cost of 118,725 million baht. At the same time, the rice pledging project caused a total loss of income of 886,468 million baht and economic costs from producing rice in excess of the market equilibrium amount, resulting in a total opportunity cost of 800,539 million baht. However, even though most of the government's money is spent on income-generating projects rather than increasing production efficiency, the government has continuously implemented assistance measures under the roles and responsibilities of relevant agencies and used the regular budgets of relevant agencies to carry out operations to increase efficiency and reduce production costs for major economic crops through various mechanisms, especially the financial mechanism for providing loans/capital. Developing farmers' capabilities, promoting processing, and developing marketing to help farmers have a better living standard and increase their income by promoting sustainable farming, creating a plant database system, using geographic information systems in plant cultivation, managing planting areas, developing agricultural machinery, developing databases and developing production and marketing networks, as well as developing processing and creating added value and promoting investment. The primary strategy for agricultural development within the ESG economy focuses on creating new knowledge, technologies, and innovations to increase farmers' incomes and enhance competitiveness in sustainable agriculture. This approach aims to boost crop yields while reducing forest encroachment and addressing climate change impacts. To meet international standards, Thailand's government promotes agricultural efficiency aligned with the ESG economic model, encouraging the adoption of modern practices like Smart Farming. Key initiatives include optimizing productivity to lower production costs through plant breeding, developing water management systems, securing funding, and supporting modern technologies. Additionally, efforts are made to provide education for farmers, transforming them into smart farmers and improving the quality of agricultural products to comply with global standards.

4.4. Plans for strengthening the ESG in Thailand

Findings from interviews involving 30 participants, organized into seven groups, shed light on the integration of ESG principles in Thailand's rice production and its implications for the competitiveness of the sector. These findings can be distilled into three main points: the application of ESG in rice production, the resultant effects on the competitiveness of Thai rice, and the identification of best practices arising from ESG implementation in the country's rice production landscape.

According to key informants' perspectives, a summary of suggested plans for strengthening the ESG in Thailand, categorized by groups of interviewees, is shown in Table 2.

Table 2. Suggested plans for strengthening the ESG in Thailand

Key informants	*Plans*
Rice farmers	1. Integrating ESG principles into Thailand's rice production chain, with a focus on resource efficiency and waste minimization. 2. Addressing regional variations in environmental suitability and resource optimization challenges. 3. Assessing the impact of ESG adoption on Thailand's rice production competitiveness, considering factors such as weather constraints, production costs, and market dynamics. 4. Leveraging best practices, like those from the World Rice Conservation Project, to enhance value addition, environmental sustainability, and farmer incomes. 5. Emphasizing organic agriculture networks to create diversified income streams for farmers.
Rice mills	1. Integrating ESG throughout Thailand's rice production supply chain, encompassing all stages from cultivation to distribution. 2. Adapting to a new, environmentally conscious economic model to enhance rice quality and competitiveness. 3. Leveraging successful projects like the World Rice Conservation Project to elevate value addition and promote long-term sustainability in rice production.
Rice bag manufacturers	1. Integrating ESG principles into Thailand's rice production chain to achieve improved environmental sustainability. 2. Enhancing rice quality and competitiveness through environmentally conscious practices. 3. Leveraging successful initiatives like the World Rice Conservation Project to boost value addition and promote long-term sustainability.
Traditional rice retailers	1. The application of ESG in Thailand's rice production chain involves adapting to a new economy that prioritizes environmental preservation. 2. Implementing ESG has outcomes that impact the competitiveness of Thai rice production. With an environmentally conscious production chain, there's an expectation that health-conscious consumers will enhance competitiveness both quantitatively and qualitatively in the future. 3. Best practices resulting from implementing the ESG in Thai rice production include initiatives like the Organic Rice Agriculture Network Project.
Rice exporters	1. Embracing an environmentally conscious economic model to elevate rice quality and competitiveness. 2. Prioritizing environmental sustainability as a key driver for enhancing rice quality and competitiveness. 3. Leveraging insights from successful projects like the World Rice Conservation Project to boost value addition and ensure long-term sustainability.
Rice business operators	1. Embracing the new environmentally focused economy by integrating ESG principles throughout Thailand's rice production chain. 2. Assessing the impact of ESG adoption on Thailand's rice production competitiveness.
Thai Rice Exporters Association	Integrate ESG principles throughout Thailand's rice production chain, benefiting all stakeholders from cultivation to consumption.

Table 2 summarizes plans for enhancing ESG practices in Thailand's rice production supply chain, reflecting insights from various key informants. All stakeholder groups emphasized the necessity of integrating ESG principles throughout the entire supply chain, from cultivation to consumption. A notable focus on environmental sustainability emerged, with recommendations for improving rice quality, minimizing waste, and adopting eco-friendly practices. Informants underscored the potential for ESG implementation to increase value addition and bolster the competitiveness of Thai rice in both domestic and international markets. The World Rice Conservation Project was often cited as a key reference for best practices. Additionally, rice farmers highlighted the importance of addressing regional environmental variations to ensure effective ESG adoption. There was a collective recognition of the need to transition to a new economic model that prioritizes environmental preservation, and establishing organic agriculture networks was suggested as a way to diversify income for rice farmers while aligning economic goals with sustainable practices.

5. DISCUSSION

The long-term economic and social sustainability of the rice industry is a complex and delicate issue that requires a comprehensive approach, addressing both the challenges faced by farmers and the environmental impacts of production. Central to this problem is the precarious situation of rice farmers in developing countries, who often contend with low yields due to inefficient practices, minimal profits that perpetuate poverty, and exposure to price volatility in global rice markets (World Bank, 2023). Efforts to boost rice yields frequently come at a high environmental cost. Intensive farming, dependent on chemical fertilizers and pesticides, leads to water depletion, soil degradation, and increased greenhouse gas emissions. These environmental consequences not only jeopardize the long-term viability of rice production but also harm fragile ecosystems, posing risks to the food security of future generations (Salathong, 2019).

Establishing an organic farming network as a strategy to distribute income to rice farmers requires strong public-private partnerships. These partnerships are essential for promoting the integration of ESG principles, aiming to improve both ecological and economic outcomes in Thailand's rice sector. This aligns with the research of Sutthinun and Leknoi (2023), who emphasized the need for a centralized management database system in Thailand to link sustainability issues across sectors and harmonize international and national standards. Currently, data collection is fragmented across different agencies and the private sector, resulting in inconsistent buyer requirements and complex data-sharing processes. Jintrawet and Yasuyuki (2024) further support this, noting that the lack of an integrated framework to connect experts with real-world farming situations and collaborate with farmers to identify underlying factors contributes to chronic, cyclical challenges in agricultural production systems. The adoption of ESG principles can notably lower production costs for farmers by encouraging the use of organic alternatives to chemical inputs. These practices not only reduce expenses but also contribute to environmental conservation by minimizing pollution and fostering a balanced ecosystem. This aligns with the findings of Ho et al. (2018), which demonstrated that ESG implementation helps farmers achieve lower production costs, higher income, and reduced risks to their livelihoods. Moreover, certified

production methods have been shown to deliver significant positive environmental outcomes. To enhance Thailand's agricultural potential in line with ESG economic principles, it is crucial to examine the government policies and measures that support the sector. Specifically, the focus should be on the impact of these policies, which prioritize increasing income rather than reducing costs. This approach aligns with the recommendations of NFI (2022), which emphasizes the need to accelerate the integration of regulations and standards related to sustainable development across various dimensions. Establishing clear guidelines and development indicators aligned with sustainability goals will enable entrepreneurs to use these standards to elevate their businesses and achieve long-term objectives.

Achieving socio-economic sustainability in the rice industry of developing countries requires a collaborative effort among governments, the private sector, and farmer cooperatives. This dialogue can create a framework that addresses farmers' challenges while protecting the environment. Prioritizing farmer well-being through social safety nets, such as crop insurance and minimum wage guarantees, is essential for providing financial security during periods of low prices or crop failures. Investing in research and development is crucial for long-term sustainability, particularly in developing climate-resilient rice varieties that can adapt to harsh conditions. Advancements in post-harvest technologies are also vital for reducing food waste and improving food security. Although challenges remain, the potential rewards of a sustainable rice industry are significant. By embracing innovative practices, promoting collaboration, and prioritizing environmental well-being, stakeholders can ensure a future where rice continues to nourish both people and the socio-economic structures of developing nations. Balancing economic prosperity with environmental sustainability can pave the way for a thriving rice industry that benefits farmers and consumers for generations to come.

6. CONCLUSION

The research on ESG introduces innovative strategies for managing resources within the economy, focusing on resource utilization and waste minimization in production and consumption. Departing from the linear economy model, which prioritizes resource use and disposal, the ESG emphasizes resource efficiency and waste reuse, aiming to conserve and enhance natural resource efficiency. The ESG drives long-term sustainable development across economic, social, and environmental spheres, underlining the significance of resource efficiency and waste reduction for businesses' sustainable growth, quality of life, and the planet's future. One of the key advantages of integrating ESG principles into Thailand's rice industry is the potential for cost reduction for rice farmers. By adopting organic inputs and precision agriculture, farmers can optimize input usage and minimize post-harvest losses, enhancing their cost competitiveness. Additionally, the ESG facilitates value addition by enabling farmers to transform rice into higher-value products like organic rice, rice flour, and rice bran oil, enhancing income diversification. Mitigating the pollution impacts of conventional agriculture is crucial for environmental conservation and restoring ecological balance. The ESG's focus on recycling/reusing waste, optimizing resource flows, and minimizing negative externalities is central to its sustainability approach. However, addressing barriers such as knowledge gaps, financial constraints, and limited market demand for some BCG-based rice products is essential for effective implementation. Concerted efforts from stakeholders and government support through enabling policies, capacity building, financial assistance, and market access expansion are vital for the wider adoption of ESG principles. Learning from global examples like China can provide valuable lessons for Thailand in implementing circular bioeconomy models. Effective strategies include fostering circular material flows, maximizing resource productivity, and proactive eco-design of products/processes to mitigate environmental impacts. Overall, integrating ESG presents a transformative opportunity for enhancing the sustainability, competitiveness, and resilience of Thailand's rice supply chain, requiring committed multi-stakeholder efforts supported by an enabling policy environment. To enhance the efficacy and comparability of ESG systems, it is imperative to develop uniform guidelines that facilitate data comparison across diverse contexts. Employing quantitative research methods will allow for the systematic analysis of varied data sets, enriching the breadth and depth of information collected. Furthermore, conducting comprehensive interviews will enable the acquisition of multifaceted insights, which are crucial for refining the ESG framework and formulating strategies, plans, and objectives that align with sustainable business practices.

A significant limitation identified in this study is its predominant reliance on qualitative data, which may limit the scope of conclusions that can be drawn. To address this, future research should embrace a mixed-methods approach that combines quantitative techniques to corroborate and expand upon qualitative insights. Comparative and longitudinal studies could be particularly beneficial, offering valuable insights into the effectiveness of ESG practices across different agricultural sectors and over time. Such research would not only refine existing models but also strengthen the evidence base, supporting informed decision-making by policymakers and industry stakeholders.

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