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GREEN ECONOMY AT THE VILLAGE LEVEL: A LITERATURE REVIEW ON ENVIRONMENT BASED AGRICULTURAL STRATEGIES IN NORTH SUMATRA

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ABSTRACT: This study aims to provide an in-depth analysis of the implementation of the green economy at the village level, focusing on environmentally based agricultural development strategies in North Sumatra. Employing a literature review of sources published between 2020 and 2025, the research finds that green economy adoption represents a socio economic transformation, moving beyond mere productivity to sustainable, community-oriented systems. The application of green technologies such as organic fertilizers and agroforestry significantly contributes to ecological preservation and rural welfare. Furthermore, institutional support and cross-sectoral collaboration involving local governments and farmer groups are crucial for success. Challenges remain, however, including limited access to green financing, low environmental literacy, and inadequate policy integration. Strengthening community capacity and expanding inclusive green financing are essential to realize an equitable and sustainable green economy model in North Sumatra.

Keywords: Green Economy, Sustainable Rural Development

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INTRODUCTION

Sustainable economic development is a global agenda that is inseparable from efforts to maintain a balance between economic growth, environmental sustainability, and social welfare. One approach that has developed rapidly in the last two decades is the green economy, a development paradigm that prioritizes resource efficiency and carbon emission reduction without sacrificing economic growth (UNEP, 2011). In the context of Indonesia, the implementation of a green economy is becoming increasingly relevant as pressure on the environment increases due to intensive agricultural activities and uncontrolled exploitation of natural resources (Pradani & Kamalia, 2022).

As an agricultural country, the agricultural sector plays an important role in the Indonesian economy, especially in rural areas. Data from the Central Statistics Agency (BPS, 2023) shows that more than 30% of Indonesia's population works in the agricultural sector, and most of them are in rural areas. However, the conventional agricultural system that is still widely practiced tends to cause various environmental problems such as soil degradation, water pollution due to chemical fertilizers, and greenhouse gas emissions from land burning practices. Therefore, the transformation towards an environmentally-based agricultural system is a must to achieve a balance between productivity and ecological sustainability (Setyawati et al., 2023). The implementation of a green economy at the village level plays a strategic role in strengthening community economic resilience while preserving the environment. Villages are important entities because this is where agricultural practices and natural resource management take place directly. Indonesian government has also promoted the "Energy Independent Village" and "Green Village" programs, which are concrete examples of the integration of the green economy into village development (Ministry of Villages, Development of Disadvantaged Regions and Transmigration, 2022).

These programs encourage village communities to apply the principles of energy efficiency, use organic fertilizers, and manage agricultural waste to create a sustainable economic cycle.

One region with great potential for green economic development is North Sumatra Province, which is known for its abundant agricultural resources and diverse ecosystems. Regions such as Deli Serdang, Simalungun, and Toba have begun to adopt environmentally friendly agricultural practices by utilizing simple technology and local wisdom (Ardianti et al., 2023). For example, farmers in Balige District, Toba Regency, have developed an agricultural waste-based organic fertilizer system that has been proven to increase soil fertility without relying on chemical fertilizers (Nurfasira et al., 2024). In addition, the application of the agroforestry concept in several villages in Simalungun has become a tangible form of green economy integration in agricultural land management oriented towards environmental conservation. However, despite various initiatives, the implementation of green economy at the village level still faces a number of challenges. Factors such as limited environmental literacy among the community, low access to green technology, and lack of financial support are the main obstacles (Pradani & Kamalia, 2022). On the other hand, village government policies have not fully integrated green economy principles into village medium-term development planning (RPJMDes). This has resulted in a lack of continuity between central government policies and their implementation at the grassroots level (Setyawati et al., 2023).

In addition to technical and institutional factors, local wisdom also plays an important role in supporting the success of the green economy in villages.

In North Sumatra, for example, the Batak people have a tradition of "marsiadapari" (mutual cooperation in agricultural activities) which can be used as social capital in developing a community-based sustainable agricultural system. Such social values are in line with the principles of the

green economy, which emphasize collaboration, participation, and balance between humans and nature (Ramana, 2024). In view of this phenomenon, a deeper understanding is needed of how environmentally-based agricultural development strategies are implemented at the village level, particularly in North Sumatra.

Previous studies have been partial and have not provided a comprehensive picture of the patterns, challenges, and opportunities for implementing a green economy in this region. Therefore, this study attempts to compile a literature review that identifies strategies for environmentally based agricultural development in villages, with a primary focus on the context of North Sumatra. This study is expected to provide a conceptual contribution to strengthening sustainable village development models and serve as a basis for the formulation of green economy policies at the local level.

LITERATURE REVIEW

Basic Concepts of Green Economy

The green economy is a development paradigm that emphasizes a balance between economic growth, environmental sustainability, and social welfare. This concept emerged as a response to conventional economic models that often ignore ecological sustainability and cause the degradation of natural resources. According to the United Nations Environment Programme (UNEP, 2021), a green economy is defined as an economy that generates human well-being and social justice, while significantly reducing environmental risks and ecological scarcity. In other words, a green economy is not just about economic efficiency, but also about transforming production and consumption structures to be more environmentally friendly (Amir et al., 2025).

In the context of development theory, the green economy is often associated with the triple bottom line approach, namely sustainability from the economic (profit), social (people), and environmental (planet) perspectives (Sudomo, 2023). This approach rejects the dichotomy between development and nature conservation, emphasizing that both aspects can be

mutually supportive if managed systematically. The transformation towards a green economy is also related to the concept of decoupling, which is the separation between economic growth and the exploitation of natural resources. Within this framework, economic productivity is expected to increase without increasing energy consumption and carbon emissions (Djana, 2024).

Furthermore, the green economy encompasses institutional and public policy dimensions. The application of this concept cannot be separated from the role of the government in creating supportive regulations, such as incentives for green investment, carbon taxes, and clean energy transition policies. International institutions such as the OECD and UNEP also emphasize the importance of integrating national economic planning with environmental policy through instruments such as green budgeting and sustainable finance (OECD, 2022).

The Theory of Sustainable Development and Its Relationship with the Green Economy

The green economy is closely related to the concept of sustainable development. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland Report, 1987). In the modern context, sustainable development has evolved into a multidimensional framework that encompasses economic, social, and environmental sustainability (Ulya, 2023).

The theory of sustainable development provides a normative basis for the green economy, namely how development can be directed to remain productive while maintaining ecological functions.

This approach rejects excessive exploitation and emphasizes the principle of a circular economy, where waste from one production process becomes input for another process, thereby minimizing waste and emissions (Lumbanraja, 2023).

In addition, the sustainable development goals (SDGs) adopted by the United Nations serve as a global guide for countries in integrating social, economic, and environmental aspects into national policies (UNDP, 2021). The green economy is considered an operational tool for achieving sustainable development goals. For example, SDG 8 on Decent Work and Economic Growth and SDG 13 on Climate Action provide the basis for developing countries to introduce the concept of green growth (Lumbanraja, 2023). Thus, the green economy is not a stand-alone concept, but an implementative mechanism of sustainable development principles applied in various sectors, particularly agriculture, energy, and industry.

Environmentally Based Agriculture in the Perspective of the Green Economy

Agriculture is a key sector in the implementation of a green economy, mainly because this sector is highly dependent on natural resources such as land, water, and biodiversity. Environmentally based agriculture refers to a production system that minimizes negative impacts on ecosystems through the use of natural inputs, crop rotation, water conservation, and protection of soil fertility (Ulya, 2023).

In green economy theory, sustainable agriculture is seen as a manifestation of eco efficiency, which is the effort to produce maximum economic output with minimal use of resources and energy (Sudomo, 2023). In addition, the agroecology approach places the balance between productivity and ecological stability as the main indicator of the success of an agricultural system. Agroecology views the agricultural system not only as a production process, but also as a social ecosystem involving interactions between humans, soil, and the environment (Djana, 2024).

The development of green agricultural economic theory is also related to the concept of resilient agriculture, which is an agricultural system that is able to adapt to climate change, land degradation, and global economic crises. This model emphasizes the importance of diversifying farmers' sources of income, using environmentally friendly technologies, and strengthening local

institutional capacity in resource management (Talenta USU, 2023).

METHODOLOGY

This study uses a qualitative approach with a literature review method. This method was chosen because it is in line with the research objectives, which are to analyze and synthesize various research results, policy documents, and scientific literature discussing the implementation of the green economy at the village level, particularly in the context of environmentally-based agricultural development in North Sumatra. This approach allows researchers to obtain a more in understanding of the phenomena, strategies, and challenges of implementing the green economy concept without having to conduct direct observations in the field (Sugiyono, 2021). The data used in this study is secondary data, obtained from various sources such as scientific journals, government reports, policy documents, academic publications, and official data from institutions such as the Central Statistics Agency (BPS) and the Ministry of Villages, Disadvantaged Regions, and Transmigration (Kemendesa PDDT, 2022). The sources were selected purposively by considering the relevance, credibility, and recency of the literature (2020–2024). The main sources include studies focusing on the concepts of green economy, sustainable village development, and environmentally friendly agriculture in North Sumatra. Data analysis was conducted using content analysis, a technique for examining and interpreting the content of relevant documents and publications. The analysis was descriptive, meaning that the researchers not only explained the findings of the literature but also compared, connected, and interpreted each piece of information to produce a comprehensive conceptual synthesis. The stages of analysis included data reduction to select important information, presentation of data in the form of thematic narratives, and drawing conclusions to build a comprehensive picture of the implementation of the green economy at the village level. Through this approach, the study is expected to provide a deeper understanding of environmentally-based agricultural development strategies in villages in North Sumatra, while also offering a conceptual framework that

can be used as a reference in the development of green economy policies at the local and national levels.

RESEARCH RESULT

The implementation of green economy at the village level in North Sumatra shows that environmentally-based agricultural development is not only related to technical aspects of production, but also includes social, institutional, and economic dimensions of the community. A number of recent studies highlight that environmentally friendly agricultural practices are increasingly being adopted by farmers in several areas such as Deli Serdang, Simalungun, Humbang Hasundutan, and Serdang Bedagai (Nainggolan, 2022). These efforts are carried out through the implementation of organic farming systems, the production of manure, and crop diversification in line with local agroecological conditions (Erlita, 2024). This strategy has proven to be able to increase productivity while maintaining the sustainability of natural resources without sacrificing farmers' incomes.

In a technical context, the practice of making organic fertilizer and the application of agroforestry systems are two main strategies often found in villages in North Sumatra. Research in Sipolha Horison Village, Simalungun Regency, shows that agroforestry contributes to maintaining ecosystem balance and increasing community income through non-timber forest products and intercropping (Purwoko, 2021). In addition to increasing land productivity, this system also strengthens the ecological function of the area by reducing erosion and increasing soil fertility (Desmiwati et al., 2025). On the other hand, a program to assist in the production of liquid organic fertilizer in Kedai Damar Village, Serdang Bedagai Regency, has been proven to reduce agricultural input costs and improve soil structure through increased organic matter (Erlita, 2024). These findings show that simple innovations based on local resources can effectively support the principles of a green economy at the village level.

Beyond technical aspects, institutional dimensions and community empowerment are crucial factors in the successful implementation of a green

economy. For example, assistance provided to farmers in Sumbul Village, STM Hilir Subdistrict, Deli Serdang District, has successfully increased community understanding of sustainable smallholder oil palm plantation management (Nainggolan, 2022). The training not only introduced environmentally friendly agricultural techniques, but also strengthened farmer group institutions and raised awareness of the importance of land conservation. In this context, support from higher education institutions and local governments plays an important role in ensuring the sustainability of initiatives through the provision of more inclusive access to information, technology, and financing (Lubis, 2023). Similar progress has also been seen in the development of green economy-based tourism villages. A study in Denai Lama Village, Deli Serdang Regency, shows that applying green economy principles to the tourism sector can improve the welfare of local communities without damaging the environment (Lubis, 2023). Through a community-based tourism approach, the community is directly involved in environmental management, village landscape planning, and the promotion of environmentally friendly local products. This model is considered capable of creating a double effect: increasing income and strengthening the ecological awareness of the village community.

However, several obstacles have also arisen in the implementation of the green economy at the village level. The main obstacles include limited capital and access to green technology, low environmental literacy, and suboptimal coordination between local government policies and village programs (Teungoh et al., 2022). For example, in the food estate project in Humbang Hasundutan Regency, it was found that the conversion of idle land into productive land did not fully take into account the characteristics of the soil and the social needs of the local community, thus requiring more in-depth local adaptation (Teungoh et al., 2022). This shows that the success of the green economy in villages is not only determined by top-down policies, but also by the extent to which the program is adapted to the local context.

Local wisdom is also an element that cannot be ignored. Social values such as mutual cooperation and traditional practices in natural resource management have been proven to contribute to the successful implementation of the green economy (Purwoko, 2021). In several communities in Tigaras, Simalungun Regency, for example, a communal land management system (*tanah ulayat*) is used for agroforestry practices that balance economic needs and environmental conservation (Desmiwati et al., 2025). This shows that green economy strategies at the village level should not only replicate global models but also integrate local knowledge that has proven to be adaptive to the environment.

In general, green economy implementation strategies in North Sumatra villages can be categorized into three main approaches. First, strengthening the capacity of farmers and communities through training, extension, and technical assistance related to organic farming, soil conservation, and waste management. Second, developing local economic institutions through the formation of green farmer groups, sustainable agricultural cooperatives, and the integration of green economy principles into the Village Medium-Term Development Plan (RPJMDes). Third, strengthening access to green microfinance, for example through village revolving funds or green small business loans (KUR) that can support initial investments for small businesses that want to switch to sustainable practices (Lubis, 2023; Nainggolan, 2022).

If these three approaches are implemented synergistically, villages in North Sumatra have great potential to become models for the implementation of a resilient and inclusive community based green economy. Future research should focus on measuring the long-term economic impact of green practices on household welfare, as well as evaluating the effectiveness of integrating local wisdom values into sustainable development policies at the village level (Desmiwati et al., 2025).

DISCUSSION

This discussion section serves to analyze key findings regarding the implementation of environmentally-based agricultural strategies in villages in North Sumatra, linking them to the conceptual framework of the green economy, sustainable development, and relevant literature. The application of green agricultural practices, such as the use of organic fertilizers and agroforestry systems, clearly demonstrates the principles of the Green Economy and the Triple Bottom Line concept (People, Planet, Profit). Ecologically, practices such as agroforestry in Sipolha Horison, Simalungun, contribute to environmental conservation by reducing erosion and increasing soil fertility, while also increasing community income through non-timber forest products. Economically, the use of local organic fertilizers has been proven to reduce agricultural input costs and increase productivity, demonstrating that decoupling economic growth from resource exploitation is possible at the village level.

The success of the green economy at the village level is also strongly driven by social and institutional dimensions. Local social capital, such as the value of mutual cooperation ("marsiadapari" in Batak society) and collective land management practices (customary land) in Tigaras, serves as an important foundation for strengthening social cohesion and fostering a sense of community ownership of the environment. These values are in line with the People component of sustainable development, which emphasizes participation and collaboration. In addition, institutional support from external parties, including local governments and higher education institutions, plays a vital role in ensuring the sustainability of initiatives by providing access to information, technology, and assistance that successfully improves community understanding of sustainable land management.

However, this study also highlights structural challenges that hinder the expansion of green economy practices. The main obstacles include limited capital and access to green financing, low environmental literacy, and suboptimal policy coordination between local governments and village

programs. The case of the food estate in Humbang Hasundutan confirms that top-down programs need to be deeply adapted to the local context in order to be adaptive to the characteristics of the land and the social needs of the community. Therefore, this discussion concludes that the sustainability of the green economy in North Sumatra is highly dependent on policy synergies that encompass three strategic pillars: strengthening community capacity through environmental training, increasing institutional support that integrates green principles into the Village Medium-Term Development Plan (RPJMDes), and expanding access to green microfinance to support farmers' initial investments in sustainable practices. Through integrated efforts, villages in North Sumatra have the potential to become a national model in the implementation of resilient and ecologically equitable agricultural development.

CONCLUSION AND RECOMMENDATIONS

The implementation of a green economy at the village level in North Sumatra is one of the strategic approaches to realizing sustainable, adaptive, and ecologically equitable agricultural development. This study confirms that the concept of a green economy is not only related to the transformation of production patterns towards environmentally friendly practices, but also touches on the social, institutional, and cultural aspects of village communities. Through the application of green economy principles, the village agricultural sector in North Sumatra has experienced positive changes in terms of resource efficiency, increased productivity, and strengthened economic resilience of farming households. Local innovations such as the production of organic fertilizers, the application of *agroforestry* systems, and the management of agricultural waste are concrete examples of the integration of sustainability values.

The successful implementation of the green economy in various villages in North Sumatra cannot be separated from the important role of supporting institutions and multi-stakeholder collaboration. Local governments, higher education institutions, farmer groups, and community organizations have contributed greatly to expanding the understanding and

practice of sustainable development at the village level. Assistance and extension programs carried out by various parties have increased the community's capacity to manage land wisely, introduced green agricultural innovations, and raised awareness of the importance of maintaining ecosystem balance. This collaboration is an important foundation in building an agricultural system that is not only productive but also in harmony with the carrying capacity of the environment.

From a social perspective, the green economy also strengthens the social structure and values of mutual cooperation in rural communities. Active community involvement in green agriculture fosters a sense of ownership of the environment, strengthens social cohesion, and encourages participation in village development decision-making. Through the principle of community based development, communities are no longer just beneficiaries, but also key actors in managing their natural resources independently and sustainably. This approach also shows that environmentally oriented development does not have to sacrifice economic welfare, but can go hand in hand with improving the living standards of rural communities. However, the implementation of a green economy in North Sumatra still faces various challenges. Limited green capital, low environmental literacy, and a lack of policy integration between sectors remain major obstacles to expanding sustainable agricultural practices at the village level. In addition, most rural communities still need appropriate technology support and broader market access so that green agricultural products have competitive economic value. Therefore, efforts to strengthen public policies that support green financing and local economic empowerment need to be continuously strengthened so that the green economy can truly become a main pillar of rural development.

From the results of this study, it can be concluded that the success of implementing a green economy at the village level will depend on three main pillars, namely: strengthening community capacity through environmental education and training; increasing institutional support and regional policies

that favor sustainable development; and optimizing the use of local resources based on community wisdom. These three aspects complement each other and form the basis for the realization of independent and competitive green villages. With continuous support, villages in North Sumatra have great potential to become national examples in the implementation of environmentally-based agricultural development that not only strengthens the local economy but also maintains harmony between humans and nature. Overall, the green economy at the village level is not merely an ideal concept, but a real necessity in facing global challenges such as climate change, environmental degradation, and economic inequality. Through the implementation of strategies based on local potential, traditional wisdom, and cross-sector collaboration, North Sumatra can become a model for sustainable and inclusive green economy implementation. This approach is expected to create a resilient agricultural system, an empowered community, and an environment that remains sustainable for future generations.

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