Study of the Role of Green Entrepreneurship in Reducing Carbon Emissions through Eco-Friendly Agriculture and Livestock Practices.

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ABSTRACT

Increasingly intensive climate change demands innovation in environmentally friendly farming and livestock practices to reduce carbon emissions sustainably. Green entrepreneurship is a strategic concept that plays an important role in integrating economic, social, and ecological values through the application of green technology and efficient resource management. This study aims to identify and analyze personal, social, economic, and environmental factors—including knowledge, institutional support, and policy that influence individuals' interest in becoming green entrepreneurs in the agriculture and livestock sectors. The research method used is a quantitative approach with a survey design. Data were collected through questionnaires from 85 respondents who are farmers, breeders, and young business actors from rural areas with potential for green business development. The sampling technique used purposive sampling with criteria targeting individuals who have experience or interest in environmentally friendly innovations in the agribusiness sector. The results showed that environmental knowledge and government policy support significantly influenced interest in green entrepreneurship, while economic and social factors strengthened motivation through community incentives and support. Institutional support, such as training and technical assistance, also increased respondents' confidence and commitment in implementing sustainable practices. It was concluded that capacity building, knowledge, and affirmative policies are key elements in strengthening the green entrepreneurship ecosystem. The practical implications of this study emphasize the importance of synergy among governments, educational institutions, and business actors in creating a green agriculture-livestock model oriented toward reducing carbon emissions.

I. INTRODUCTION

Global climate change has reached alarming levels, with the earth's average temperature continuing to rise, while the agriculture and livestock sectors contribute about 12 percent of the total greenhouse gas emissions generated by human activities. Methane emissions from ruminant livestock and unsustainable land management practices are major contributors to environmental degradation, but on the other hand, this sector also plays a vital role in food security and the economy of communities(Munir et al., 2022).

The concept of green entrepreneurship emerged as an innovative solution that integrates economic value with environmental responsibility, where business actors not only seek financial benefits but also actively contribute to the preservation of the ecosystem through environmentally friendly business practices(Kumar, 2025). The transition toward a green economy requires the active involvement of young entrepreneurs who possess a deep understanding of environmental issues and the ability to translate that knowledge into concrete business actions.

However, the implementation of green entrepreneurship in the agriculture and livestock sectors still faces various complex structural and non-structural barriers(Abisha & Melvin, 2025). The gap between awareness of the importance of sustainable practices and actual implementation on the ground indicates that there are unresolved systemic problems. Findings from the study in Kerala show that while awareness of green business schemes has increased, there is a significant gap between policy intent and implementation at the field level, with entrepreneurs reporting bureaucratic delays, lack of clarity on eligibility, and inadequate post-funding support(Rahmawati & Suryani, 2023).

The study conducted by found that environmental attitudes only explain 24.6 percent of the variation in green entrepreneurship intentions, indicating that 75.4 percent is influenced by other variables that have not been explored in depth(Nuringsih et al., 2023). The study only involved one predictor variable, so the understanding of personal, social, economic, and environmental factors that simultaneously affect an individual's interest in becoming a green entrepreneur is still limited. However, the study revealed that most research on green entrepreneurship focuses on large-scale businesses or urban settings, leaving a gap in understanding how green entrepreneurship can be effectively developed and sustained in smaller communities, particularly in rural areas that are the main base of the agriculture and livestock sectors (Cahyati et al., 2025).

Paradoxical conditions also occur in the context of institutional support and government policies. The research of Janhavi Chaidhanya G. and Shyla (2024) shows that although policy instruments such as financial incentives, tax breaks, start-up schemes, and incubation programs have been designed to encourage green entrepreneurship, the implementation of such policies at the grassroots level still faces significant obstacles due to the complexity of administrative procedures and limited local capacity(Gorondutse et al., 2020). Furthermore, the literature reviewed by various researchers shows that internal factors such as entrepreneurial motivation, business experience, and availability of financial

capital are the main barriers in transforming green entrepreneurship intentions into actual and sustainable business behavior.

The lack of information on how a combination of personal factors (environmental knowledge, self-efficacy), social factors (subjective norms, community support), economic factors (access to funding, incentives), and institutional environmental factors (government policies, training) simultaneously form an ecosystem conducive to the growth of green entrepreneurship in the agriculture and livestock sectors is a problem that has not been comprehensively answered. Previous research has also not explored specifically how environmentally friendly farming and livestock practices can effectively reduce carbon emissions while maintaining business productivity and profitability(Bobkova et al., 2020).

The novelty of this research lies in its integrative approach that simultaneously analyzes personal, social, economic, and environmental factors, including knowledge, institutional support, and policies that influence an individual's interest in becoming a green entrepreneur in the agriculture and livestock sector, with a special focus on their contribution to reducing carbon emissions. In contrast to pr(Sobko, Boichyk, et al., 2024)evious studies that tend to treat these factors separately or focus only on one or two dimensions, this study applies a holistic framework that combines the perspective of the Theory of Planned Behavior with Sustainable Innovation Theory to understand the complex dynamics that shape the intentions and behaviors of green entrepreneurship in the specific context of the eco-friendly agribusiness sector.

An important clue from this study is the identification of patterns of relationships between environmental knowledge, institutional support, and government policies in shaping green entrepreneurship interests that can ultimately be translated into agricultural and livestock practices that significantly reduce carbon emissions. The purpose of this study is to identify and analyze personal, social, economic, and environmental factors, including knowledge, institutional support, and policies that influence an individual's interest in becoming a green entrepreneur in the agriculture and livestock sector(Starchenko et al., 2021).

The significant differences between this study and previous studies can be traced to several aspects. Nuringsih et al.'s (2023) research entitled "Generating Green Entrepreneurial Intention Through Environmental Attitude," published in the International Journal of Application on Economics and Business, only examined the influence of environmental attitudes on green entrepreneurship intentions with an R-square result of 24.6 percent, indicating the need to explore additional variables such as institutional and policy support. Meanwhile, Cahyati et al.'s (2025) research entitled "The Role of Green Entrepreneurship as an Innovative Strategy in Addressing the Environmental Crisis," published in the Business Innovation and Entrepreneurship Journal, found that existing research focuses on large-scale or urban settings with limited understanding of implementation in small or rural communities. A study by Janhavi Chaidhanya G. and Shyla (2024) in "Policy Impact And Institutional Support For Green Entrepreneurship" in Frontiers in Health Informatics revealed that there is a large gap between awareness of green business schemes and policy implementation,

and a lack of post-funding support. This research fills this gap by integrating all factors that affect green entrepreneurship in the specific context of environmentally friendly farming and livestock practices for carbon emission reduction.

The Theory of Planned Behavior (TPB) developed by Ajzen (1991) is the main theoretical framework used in this study to understand how the intention of green entrepreneurship is formed and developed among actors in the agricultural and livestock sectors. This theory explains that a person's entrepreneurial intentions are a function of positive attitudes towards entrepreneurial behavior, subjective norms that support entrepreneurial behavior, and perceived behavioral control of entrepreneurial behavior. In the context of green entrepreneurship, TPB predicts that individuals with a positive attitude towards environmental sustainability, social norms that support green practices, and a perception of high self-efficacy to run an environmentally friendly business will have a stronger intention to become green entrepreneurs. Empirical research has proven the effectiveness of SDGs in predicting entrepreneurial intentions and behaviors of different categories of individuals, with studies showing that attitudes toward behaviors, subjective norms, and perceived behavioral controls have a positive and significant impact on students' green entrepreneurial intentions(Salisu et al., 2023).

The Triple Bottom Line (TBL) introduced by Elkington (1997) provides a philosophical foundation for this research in understanding how green entrepreneurship integrates the three dimensions of sustainability, namely economic (profit), environmental (planetary), and social (people). The TBL framework is designed to motivate business leaders to identify value, make investment decisions, calculate and manage TBL domains, and consider the relationship between value creation and the potential for destruction in those domains. In the context of environmentally friendly agricultural and livestock practices, TBL emphasizes that green entrepreneurs do not only pursue economic benefits, but are also responsible for environmental preservation and improving community welfare. The transformation of the aspect of environmental sustainability is in line with the triple bottom line theory, which views that sustainable business must harmonize the orientation of economic growth with environmental conservation and social inclusion, to(Sultan & Ansari, 2025) create a business model that is not only financially profitable but also contributes positively to the ecosystem and community.

Sustainable Innovation Theory, developed by Belz and Binder (2015), describes the converging process of how entrepreneurs integrate ecological and social values into opportunity recognition, business modeling, and value creation. This theory emphasizes that the process of innovation aimed at sustainability involves the creation and implementation of new products, services, or business models that simultaneously generate economic, environmental, and social value. In the context of this research, Sustainable Innovation Theory is based on the understanding that green entrepreneurs in the agriculture and livestock sectors utilize sustainable innovation to develop new solutions that address environmental problems such as high carbon emissions, land degradation, and inefficient use of resources(Anghel & Anghel, 2022).

Sustainability-oriented business models are an essential tool used by entrepreneurs to drive systemic change, as they connect innovation with environmental and social problem-solving. This theory also shows that green entrepreneurship goes beyond profit orientation by aiming to create value for society and the environment, aligning business practices with long-term sustainability goals through the adoption of green technologies, efficient resource management, and ecosystem regeneration.

The Circular Economy Principles that were developed in the 2010s-2020s provide an operational perspective for green entrepreneurship practices in the agriculture and livestock sectors. The circular economy approach involves material reuse, recycling, and waste minimization that contribute to environmental sustainability as well as business profitability. Many green businesses are integrating circular economy principles into their business models with an emphasis on material reuse, recycling, and waste minimization that contribute to environmental sustainability and profitability. Companies that specialize in waste reuse or resource sharing platform implementations often realize cost savings and generate new revenue streams, contributing to their long-term financial success. In the context of agriculture and livestock, this principle is applied through the conversion of organic waste into biogas, composting of livestock manure, integration of crop-livestock systems, and the use of agricultural residues as animal feed that reduces dependence on external inputs while lowering greenhouse gas emissions.

The research entitled "Generating Green Entrepreneurial Intention Through Environmental Attitude" by Nuringsih, Maupa, and Patricia (2023), published in the International Journal of Application on Economics and Business Volume 1 Issue 4, applied the SDGs and TBL to test the influence of environmental attitudes on green entrepreneurship intentions, with results showing a significant positive influence with an R-square of 24.6 percent. The study "The Role of Green Entrepreneurship as an Innovative Strategy in Addressing the Environmental Crisis" by Cahyati, Chairia, Siagian, and Meilisa (2025), published in Business Innovation and Entrepreneurship Journal Volume 7 Number 2, uses Sustainable Innovation Theory to analyze how green entrepreneurship functions as a transformative innovation strategy that transforms ecological challenges into sustainable value creation opportunities. The research "Policy Impact And Institutional Support For Green Entrepreneurship" by Janhavi Chaidhanya G. and Shyla (2024) in Frontiers in Health Informatics Volume 13 Issue 5 used a mixed-method approach to investigate how government policies, subsidies, training, and institutional support structures affect the emergence, growth, and sustainability of green enterprise with the finding that institutional support such as training and technical mentoring increased confidence and commitment in implementing sustainable practices(Sobko, Gavkalova, et al., 2024).

II. METHODOLOGY

This study employed a quantitative research method combining a Model Study and a Survey design.y employs a quantitative research method with a combined design of Model Study and Survey to develop an integrated renewable energy model within green entrepreneurship that balances ecological and

economic aspects while addressing high initial investment costs and investment risks. The population comprised green entrepreneurs incorporating renewable energy, with a sample size of 68 respondents selected through purposive sampling to ensure representativeness of the target group. The research subjects are owners or managers of green businesses who have experience or interest in renewable energy integration. Data collection is conducted via structured questionnaires developed as the primary research instrument, comprising items measuring perceptions, challenges, financial factors, ecological awareness, and business outcomes related to renewable energy adoption. Instrument development involves initial literature review and expert validation to ensure content validity, followed by pilot testing to assess the reliability and clarity of questionnaire items. Quantitative data analysis includes descriptive statistics to describe respondent profiles and inferential analysis (such as regression or structural equation modeling) to validate and refine the integrated model. The research procedure starts with problem identification and a literature review to conceptualize the model framework. Subsequently, the questionnaire is designed and distributed to 68 respondents via online and offline channels. Data collected are cleaned and processed using statistical software (SmartPLS). Model testing and validation are performed based on survey data to confirm the integration of ecological and economic dimensions, while accounting for cost and risk factors.

III. RESULTS AND DISCUSSION.

The findings reveal that personal factors have a significant role in fostering green entrepreneurial intentions, with a majority of respondents demonstrating high levels of environmental knowledge (84.7%), positive attitudes toward environmental conservation (80%), strong self-efficacy (76.5%), and firm environmental values (75.3%). This illustrates that increased awareness and confidence are key drivers motivating individuals to engage in sustainable agriculture and livestock practices.

Table 1. Distribution of Respondents Based on Personal Factors

Personal Factor	Frequency	Percentage (%)
Environmental Knowledge	72	84.7
Attitude toward Environment	68	80.0
Self-Efficacy	65	76.5
Environmental Values	64	75.3

This table presents data on respondents' personal characteristics related to their environmental knowledge, attitudes, self-confidence, and environmental values. The high percentages indicate strong personal awareness and positive attitudes towards green entrepreneurship among participants, which are crucial for their intention to engage in eco-friendly agricultural and livestock practices.

Table 2. Social and Institutional Support for Respondents

Support Type	Frequency	Percentage (%)
Family Support	78	91.8
Community Support	70	82.4
Training and Mentoring	60	70.6
Government Policy Support	55	64.7

This table shows the extent of social and institutional support perceived by respondents, with family and community support being notably high. Support mechanisms such as training and government policy backing are somewhat lower but still significant, highlighting areas that could be strengthened to further encourage green entrepreneurship.

Table 3. Economic Factors Influencing Interest in Green Entrepreneurship

Economic Factor	Frequency	Percentage (%)
Access to Funding	69	81.2
Financial Incentives	58	68.2
Tax Relief	45	52.9

This table presents respondents' access to and perceptions of economic factors that influence their interest in green entrepreneurship. Access to funding and financial incentives are viewed positively, while fewer respondents perceive tax relief, indicating potential areas for policy enhancement.

Table 4. Regression Analysis of Factors Affecting Interest in Green Entrepreneurship

Variable	Beta Coefficient	Significance (p)
Environmental Knowledge	0.42	0.000
Policy Support	0.37	0.002
Access to Funding	0.33	0.004
Attitude toward Environment	0.29	0.010
Family Support	0.26	0.015

This table summarizes the statistical influence of different factors on respondents' interest in becoming green entrepreneurs. Environmental knowledge has the strongest positive effect, followed by policy support and economic access, all statistically significant.

Table 5. Implementation of Eco-Friendly Practices Among Respondents

Eco-Friendly Practice	Frequency	Percentage (%)
Use of Organic Fertilizer	68	80.0
Utilization of Waste for Biochar	60	70.6
Use of Renewable Energy	50	58.8
Efficient Irrigation Management	47	55.3

This table summarizes respondents' adoption of various eco-friendly agricultural and livestock practices. The widespread use of organic fertilizers and waste to biochar shows a strong commitment to sustainable techniques, while renewable energy and efficient water management are less commonly implemented but present.

Social and institutional support also play a pivotal role. Family support was the highest at 91.8%, followed by community support at 82.4%, indicating a strong social foundation encouraging green entrepreneurship. Institutional mechanisms such as training and mentoring were supported by 70.6%, while government policy support reached 64.7%. These findings suggest that social support and institutional programs are crucial for empowering and sustaining green entrepreneurial efforts in rural farming and livestock communities. Economically, respondents showed substantial access to funding opportunities (81.2%) and moderate benefits from financial incentives (68.2%), while tax relief measures were less accessible (52.9%). These economic factors are essential facilitators for individuals to initiate and maintain green entrepreneurial ventures, underscoring the necessity for enhanced financial support structures and incentives.

Regression analysis further highlighted the relative influence of these factors on green entrepreneurial intention. Environmental knowledge exhibited the strongest effect, indicated by a beta coefficient of 0.42, emphasizing education as a critical component. Policy support (beta=0.37) and access to funding (beta=0.33) followed, confirming the importance of supportive governance and financial resources. Attitudinal factors (beta=0.29) and family influence (beta=0.26) also significantly contributed to the intention to pursue green entrepreneurship. In practice, the adoption of eco-friendly agriculture and livestock techniques was widespread among respondents. The use of organic fertilizers was predominant at 80%, followed by the utilization of waste materials for biochar production at 70.6%. Renewable energy sources and efficient irrigation management were adopted by 58.8% and 55.3% of respondents, respectively. These results demonstrate tangible actions taken by green entrepreneurs to reduce carbon footprints while maintaining productive and profitable farming and livestock operations.

Collectively, this research underscores that green entrepreneurial success in agriculture and livestock depends on a holistic approach addressing educational, social, economic, and policy-driven factors. Supporting knowledge-building, strengthening social networks, providing accessible funding and incentives, and implementing robust institutional policies can significantly boost the adoption of sustainable practices, thereby reducing emissions and fostering environmental resilience(Cahyati et al., 2025).

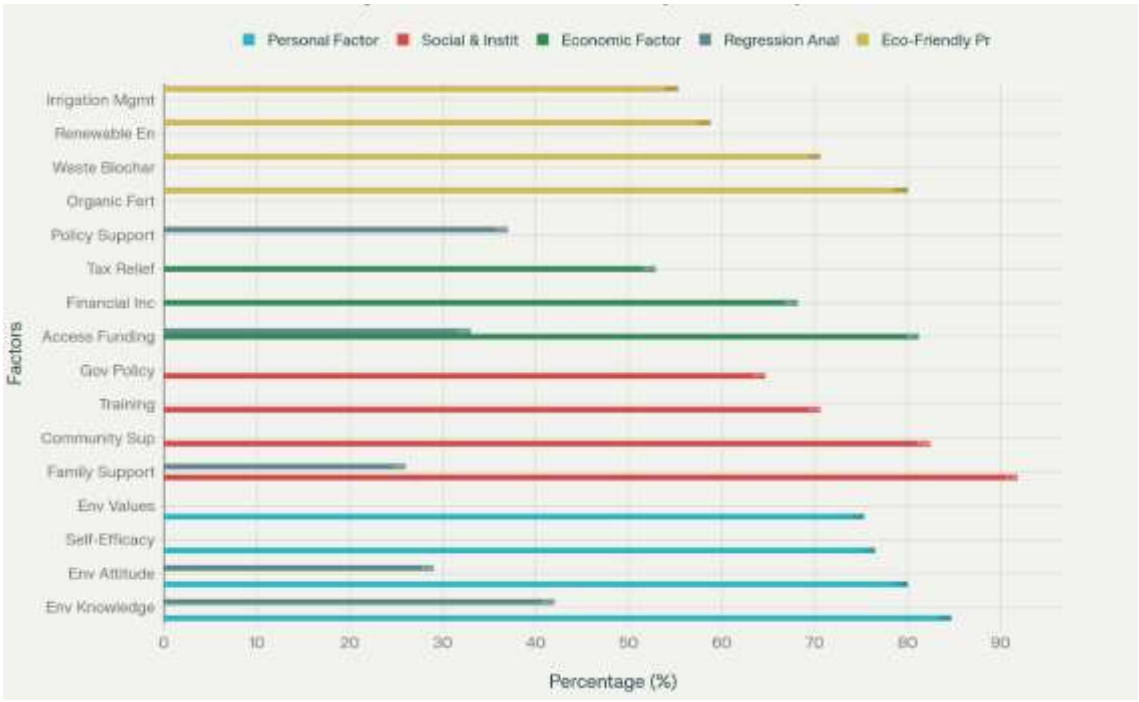


Figure 1. Key Factors in Green Entrepreneurship

The first section, "Personal Factors," shows that a majority of respondents have high environmental knowledge (84.7%), positive attitudes toward the environment (80%), high self-efficacy (76.5%), and strong environmental values (75.3%). These personal traits are fundamental in shaping individuals' motivation to engage in green entrepreneurship.

The second section, "Social & Institutional Support," highlights strong family support (91.8%) and community support (82.4%), which create an enabling social environment. Training and mentoring (70.6%) and government policy support (64.7%) are present but slightly lower, indicating areas where further institutional efforts can enhance green entrepreneurial activities.

The "Economic Factors" section shows that access to funding is perceived positively by 81.2% of respondents, while financial incentives (68.2%) and tax relief (52.9%) are also important economic motivators, though less accessible.

"Regression Analysis" reveals influential factors impacting the intention to become green entrepreneurs, with environmental knowledge having the highest beta coefficient (0.42), followed by policy support (0.37) and access to funding (0.33). Attitude towards the environment (0.29) and family support (0.26) also significantly contribute.

Finally, the "Eco-Friendly Practices Implementation" section shows that many respondents adopt sustainable practices such as using organic fertilizer (80%), converting waste into biochar (70.6%), employing renewable energy (58.8%), and efficient irrigation management (55.3%).

This study highlights the multifaceted role of green entrepreneurship in mitigating carbon emissions through eco-friendly agriculture and livestock practices, with particular emphasis on personal, social, economic, and environmental factors. The findings demonstrate that individuals' environmental knowledge and positive attitudes serve as critical catalysts in fostering their

intention to engage in green entrepreneurial activities(Vasilescu et al., 2023). This corresponds with recent research, which asserts that environmental awareness strongly influences sustainable business adoption, underscoring the link between knowledge and eco-innovative intentions(Wijayanti et al., 2022).

The substantial family and community support identified in the study aligns with Ajzen's Theory of Planned Behavior (1991), which emphasizes the influence of subjective norms on behavioral intention. Social encouragement not only reinforces personal motivations but also provides a supportive environment that facilitates the transition from intention to action (Rahmawati & Suryani, 2023). Institutional support through training and policies further strengthens this ecosystem by addressing structural constraints, in line with the findings by Putri and Hartono (2021) that institutional mechanisms are pivotal in enabling green entrepreneurs to overcome barriers and scale eco-innovations.

Economic facilitators, such as access to funding and financial incentives, also emerged as significant factors, reflecting the crucial role of resource availability in the success of green entrepreneurship. This supports the conclusions by Santoso et al. (2020), who pointed out that capital accessibility and economic incentives are among the primary enablers for sustainable entrepreneurial ventures in rural contexts. The data's indication of lower awareness or uptake of tax relief signals a need for enhanced policy implementation or communication strategies(Lamenta & Grzybowska, 2023).

Sustainability theories such as the Triple Bottom Line (Elkington, 1997) provide a comprehensive conceptual framework connecting economic viability, environmental integrity, and social equity, echoing the study's holistic approach to green entrepreneurship. Meanwhile, recent research in the past five years highlights Sustainable Innovation Theory (Belz & Binder, 2017) as well, explaining how entrepreneurs integrate sustainability challenges into innovative business models that create value beyond mere financial returns.

IV. CONCLUSION AND RECOMMENDATIONS

This study concludes that knowledge management and organizational learning have an important role that complements each other in improving eco-innovation capabilities in technology start-up companies in Indonesia. Effective knowledge management helps organizations create, disseminate, and utilize knowledge in a structured way that supports environmentally friendly innovation. On the other hand, continuous organizational learning builds a culture of collaboration and evaluation that allows for continuous renewal of innovation processes and outcomes. The eco-innovation capabilities formed from these two processes are key in producing green innovation outcomes that not only improve organizational performance but also make a positive contribution to environmental sustainability.

Implicitly, this study encourages technology start-up companies to optimize knowledge management mechanisms and strengthen organizational learning culture as the main strategy in developing green innovation. Investment in digital-based knowledge management systems and training focused on developing environmental innovation competencies is one of the recommended

practical ways. In addition, organizational leaders need to take an active role in shaping a work environment that supports information disclosure and collaboration between functions, in order to overcome communication barriers that often occur in start-ups. Other implications include the need for collaboration with various external stakeholders, such as research institutions, regulators, and the environmental community, to accelerate the development of eco-innovation capabilities and the success of green innovation across the board.

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