

Ecopreneurial Synergy: A Study of Sustainable Green Entrepreneurship Education

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Abstract: This study aims to analyze and model the structural relationship between entrepreneurship education, entrepreneurial self-efficacy, and green entrepreneurial intentions in shaping sustainable green entrepreneurship education. The research population was all residents of Vocational High Schools in Indonesia, while the sample used was 400 school residents, conducted by a random sampling method using a convenience sampling technique. The analysis method used is Structural Equation Modeling with Partial Least Squares (SEM-PLS) approach. The results show that there is a significant and positive influence between the variables of Entrepreneurial Education, Entrepreneurial Self-Efficacy, and Green Entrepreneurial Intention on Sustainable Green Entrepreneurship Education both direct influence and indirect influence. The increase of Entrepreneurial Education, Entrepreneurial Self-Efficacy, and Green Entrepreneurial Intention variables will affect the increase of Sustainable Green Entrepreneurship Education significantly and positively. This research has important implications for the development of an entrepreneurship education curriculum at the Vocational High School level, as it places Green Entrepreneurial Intention as a mediating variable. In addition, the role of green entrepreneurship education integration not only strengthens students' business competencies, but also forms sustainable character and environmental awareness. Therefore, it is recommended that policymakers and educational institutions design a well-rounded curriculum through psychological support and hands-on experience in green business.

Keywords: Entrepreneurial; Sustainable Green Entrepreneurship Education; SEM-PLS

1. Introduction

The role of education is crucial to the nation's economic growth. Education not only improves knowledge and attitudes, but also improves skills that can increase productivity in the workplace, so the level of education among Indonesian employees can have a positive and important impact on economic growth. Education is expected to encourage students to have the knowledge and skills to adapt quickly to the times (Chairia et al., 2024). Green skills are education that is oriented towards the combination of knowledge, abilities, values and attitudes that learners need to live, develop and sustainably support society. The experiences of developing countries in Asia face serious environmental challenges that put future growth, nutritional safety, and regional stability at stake. The environment has four main challenges: water management, air pollution, deforestation, land degradation, and climate change (Kwauk and Casey, 2022; Fuchs, 2024).

An economic shift has occurred to mitigate environmental concerns. This has the potential to create green jobs and green existing industrial sectors (Pavlova and Singh, 2022). In addressing environmental concerns and promoting sustainable development for energy security, green growth is crucial. This requires the development of new green skills in employment sectors, as well as the transformation of existing jobs to become more environmentally friendly. Green skills can be classified into three main categories, namely cognitive, interpersonal, and intrapersonal skills (Abd Hamid et al., 2019). Vocational education plays an important role in producing a competent workforce, capable of contributing to green jobs to promote sustainable development (Kamis et al., 2017). Without proper education and appropriate skills, it is impossible to realize sustainable development. One of UNESCO's strategic priorities is to ensure the facilitation of the transition to a green economy and society based on sustainability principles through vocational education. The integration of green skills for sustainable development in vocational education is one of the recommendations of the declaration of the Asia-Pacific Conference on Education and Training to advance TVET (technical and vocational education and training) in the Asia-Pacific region. Indonesia supports the green jobs campaign together with ASEAN, including in conducting vocational training with a focus on green skills, productivity, health, and safety. One of the strategic steps that can be taken is to integrate the concept of green entrepreneurship into the Vocational High School curriculum. Green entrepreneurship is an entrepreneurial concept that focuses on the efficient utilization of resources and the development of environmentally friendly products and services (UNESCO, 2016-2021).

Green entrepreneurship education in the Vocational High School curriculum can increase students' environmental awareness while equipping them with the skills to run a sustainable business. Entrepreneurship education not only conveys business theories, but also builds critical thinking, innovation, risk management, and resilience to failure. In the context of sustainability, this education must be able to integrate ecological values and social responsibility so that students not only become business actors, but also agents of environmental change (Mambali et al., 2024). Entrepreneurship in Vocational High Schools is increasingly becoming a concern as a solution to reducing unemployment and creating young entrepreneurs in Indonesia. The following is data on the phenomenon of entrepreneurship based on a tracer study of Vocational High School graduates:

Table 1. Distribution of National Vocational High School Graduate Activities

Category of Vocational School Graduates	National Percentage
Employed	43,69%
Entrepreneurship	21,34%
Continuing their studies	11,45%

Source: Directorate General of Vocational Education (2024)

Vocational education units need to create their own jobs by preparing young entrepreneurial candidates who are nurtured from school. In this way, schools overcome unemployment by preparing graduates who are not only ready to work, but are also entrepreneurs (Directorate General of Vocational Education, 2024). Research by Hertel and Millis (2023) shows that active learning approaches, such as green business simulations and real-world problem solving, can strengthen students' motivation and readiness to enter the green business world. This is reinforced by the findings of Gomez (2024), who stated that a green entrepreneurship education curriculum that adopts case studies, field learning, and project-based training, contributes significantly to increasing students' awareness, attitudes, and behaviors towards green entrepreneurship.

From a psychological perspective, Albert Bandura through his social-cognitive theory emphasized the importance of self-efficacy as a major factor influencing individual actions, including in the field of entrepreneurship (Yusof et al., 2018). A person with high self-efficacy has the confidence to pursue business opportunities, despite challenges and uncertainties. In the context of green entrepreneurship, self-efficacy needs to be extended to confidence in creating business solutions that are innovative and oriented towards solving environmental problems (Adi et al., 2023).

Green entrepreneurial intention, which reflects the internal drive to start an environmentally friendly business, is influenced by various factors such as attitudes towards the environment, social norms, perceptions of behavioral control, and experience and education received (Fatoki, 2024). According to the Theory of Planned Behavior developed by Ajzen (1991), intention is the strongest indicator of actual behavior. Therefore, forming green entrepreneurial intentions among students is an important step in producing a generation of young entrepreneurs who care about environmental sustainability (Mishra et al., 2024). Considering the important role of education in building green entrepreneurship awareness and competencies, it is necessary to make systematic efforts to integrate this approach into the Vocational High School curriculum as a basis for further research. Therefore, this study aims to analyze and model the structural relationship between entrepreneurship education, entrepreneurial self-efficacy, and green entrepreneurial intention in shaping sustainable green entrepreneurship education using Structural Equation Modeling with Partial Least Squares (SEM-PLS) approach. The novelty of this research is to develop a model that integrates Entrepreneurial Education, Entrepreneurial Self-Efficacy about green entrepreneurship, with the mediation of Green Entrepreneurial Intention in determining Sustainable Green Entrepreneurship Education.

2. Methodology

2.1 Research Location

This research is quantitative research. Quantitative research uses deductive reasoning in formulating research hypotheses. The research population is all Vocational High Schools in Indonesia. Vocational High Schools in this study refer to Vocational High Schools that have implemented environmental care education by the regulation of the Minister of Environment and the Minister of National Education No. 3 of 2010 of the State of Indonesia concerning Environmental Education, stating that one of the character education targets in the National Education System in Indonesia is the character of environmental care. The determination of the sample in this study was carried out by a random sampling method using a convenience sampling technique in the population that met the criteria set by the researcher. Any individual who is willing to provide the information needed and by the characteristics of the desired data source can be used as a respondent. In this study, the number of samples used was 400 school members consisting of students, teachers, employees, and principals. As for the sample criteria taken, concerning the definition of environmental education above, the research sample criteria were determined as follows:

1. Vocational High Schools in Indonesia that have implemented environmental awareness.
2. Schools that have implemented sustainable green entrepreneurship education.
3. Schools that have implemented sustainable green entrepreneurship subjects in their curriculum for at least 1 academic year.
4. Availability of school resources that support the implementation of a sustainable green entrepreneurship curriculum.
5. Schools that develop systems through changes and opportunities for sustainable green entrepreneurship.

This study uses four variables, consisting of two exogenous variables, one mediating variable, and one endogenous variable. The exogenous variables used are Entrepreneurial Education (X1) and Entrepreneurial Self-Efficacy (X2). The mediating variable used is Green Entrepreneurial Intention (Y1), while the endogenous variable is Sustainable Green Entrepreneurship Education (Y2). Operational definition of research variables:

The Entrepreneurial Education variable in this study is operationally defined as sustainable green entrepreneurship education is an activity aimed at instilling thoughts or mindsets regarding sustainable green entrepreneurship, fostering a person's intention, attitude and competence in developing their potential by realizing creative and innovative behavior. The indicators applied to measure Entrepreneurial Education (Kusumojanto et al. 2020): Understanding of the character of sustainable green entrepreneurship; Understanding of the steps to start sustainable green entrepreneurship; Understanding of the practical management of sustainable green entrepreneurship; Ability to build sustainable green entrepreneurial business networks; and Capacity to identify sustainable green entrepreneurial business opportunities.

Entrepreneurial Self-Efficacy is operationally defined as a strong belief in one's ability to successfully perform one's roles and tasks related to sustainable green entrepreneurship. According to Anggraeni and Nurcaya (2016), the indicators of self-efficacy variables are as follows: Strong belief in sustainable green entrepreneurship; Confidence can manage sustainable green entrepreneurship business; Confidence of success in sustainable green entrepreneurship; Confidence can survive in sustainable green entrepreneurship; and Confidence has creative thinking in sustainable green entrepreneurship.

Green Entrepreneurial Intention is defined as the awareness of students that makes students have a desire for something and students will continue to try with all their abilities to achieve their goals. The indicators applied to measure the Green Entrepreneurial Intention variable (Gao and Qin, 2022) are Having a strong intention towards sustainable green entrepreneurship after graduating from school; Having sustainable green entrepreneurial efforts as a business goal; The professional goal is sustainable green entrepreneurship; Strong determination to choose sustainable green entrepreneurship; Confident to start sustainable green entrepreneurship; and Dare to take risks to realize sustainable green entrepreneurship.

Sustainable Green Entrepreneurship Education is operationally defined as actions deliberately taken by the school when implementing the green entrepreneurship learning process with the aim of playing a role in reducing the negative impacts of educational activities in vocational schools. The indicator aspects include (Ministry of Environment, 2009): Sustainable green entrepreneurship education curriculum in schools; Stakeholders with sustainable green entrepreneurship education in schools; Resources available in schools to support sustainable green entrepreneurship education; and New learning models in schools related to sustainable green entrepreneurship education.

Data analysis used SEM-PLS with the research model shown in Figure 1 below.

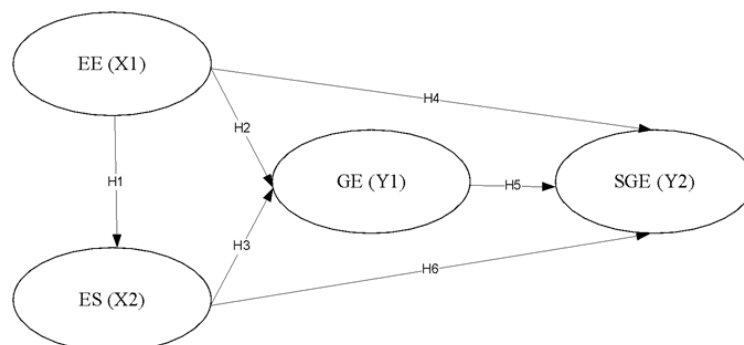


Figure 1. Research Model

Based on Figure 1, the hypothesis in this study is as follows:

- Hypothesis 1: Entrepreneurial Education (X1) has a significant influence on Entrepreneurial Self-Efficacy (X2).
- Hypothesis 2: Entrepreneurial Education (X1) has a significant influence on Green Entrepreneurial Intention (Y1).
- Hypothesis 3: Entrepreneurial Self-Efficacy (X2) has a significant influence on Green Entrepreneurial Intention (Y1).
- Hypothesis 4: Entrepreneurial Education (X1) has a significant influence on Sustainable Green Entrepreneurship Education (Y2).
- Hypothesis 5: Green Entrepreneurial Intention (Y1) has a significant influence on Sustainable Green Entrepreneurship Education (Y2).
- Hypothesis 6: Entrepreneurial Self-Efficacy (X2) has a significant influence on Sustainable Green Entrepreneurship Education (Y2).

3. Results

3.1 Characteristics of Respondents

The characteristics of respondents in this study totaled 400 school members. When viewed from the level of education, most respondents have a high school education as many as 270 people (67.5%), followed by graduates of Strata 1 as many as 98 people (24.5%), Strata 2 as many as 30 people (7.5%), and those from Diploma education are only 2 people (0.5%). Seen from the type of work, the majority of respondents are students as many as 265 people (66.25%), followed by teachers as many as 106 people (26.5%), employees as many as 16 people (4%), and principals as many as 13 people (3.25%). Meanwhile, based on gender, female respondents dominated with 228 people (57%), while men totaled 172 people (43%).

3.2 Measurement Model

The measurement model presents the variable measurement (as an unobservable variable) of each measuring indicator (as an observable variable). The outer loading coefficient shows how strongly the indicator reflects the latent variable, with a minimum recommended value of ≥ 0.7 . The indicator is declared significant as a variable measure if the P-value < 0.05 . The measurement model obtained from the SEM-PLS analysis is:

- The measurement model of the Entrepreneurial Education variable (X1) is as follows:

$$X_1 = 0.773X_{1.1} + 0.702X_{1.2} + 0.791X_{1.3} + 0.828X_{1.4} + 0.809X_{1.5} + 0.831X_{1.6} + 0.730X_{1.7} + 0.752X_{1.8} + 0.795X_{1.9} + 0.763X_{1.10}$$

- The measurement model for the Entrepreneurial Self-Efficacy (X2) variable is as follows:

$$X_2 = 0.801X_{2.1} + 0.824X_{2.2} + 0.834X_{2.3} + 0.815X_{2.4} + 0.822X_{2.5} + 0.824X_{2.6} + 0.801X_{2.7}$$

- The measurement model of the Green Entrepreneurial Intention (Y1) variable is as follows:

$$Y_1 = 0.792Y_{1.1} + 0.850Y_{1.2} + 0.782Y_{1.3} + 0.828Y_{1.4} + 0.846Y_{1.5} + 0.824Y_{1.6}$$

- The measurement model for the Entrepreneurial Self-Efficacy (X2) variable is as follows:

$$Y_2 = 0.734Y_{2.1} + 0.738Y_{2.2} + 0.821Y_{2.3} + 0.777Y_{2.4} + 0.826Y_{2.5} + 0.807Y_{2.6} + 0.819Y_{2.7} + 0.785Y_{2.8}$$

Based on the measurement model test results, it shows that all indicators have an outer loading value above 0.7 and a P-value of 0.000. This indicates that each indicator significantly reflects the latent variables of Entrepreneurial Education (X1), Entrepreneurial Self-Efficacy (X2), Green Entrepreneurial Intention (Y1), and Sustainable Green Entrepreneurship Education (Y2). This high and significant outer loading value also indicates that convergent validity has been achieved, meaning that the indicators can measure the same construct consistently. Thus, it can be concluded that all indicators on the constructs of Entrepreneurial Education (X1), Entrepreneurial Self-Efficacy (X2), Green Entrepreneurial Intention (Y1), and Sustainable Green Entrepreneurship Education (Y2) are worth maintaining in the model because they have met the criteria for validity and reliability of reflective models in SEM. Indicators with the highest loading value indicate that the indicator is the strongest/most dominant measure on the variable being measured. The indicator of understanding of applying green entrepreneurial practices in sustainable green business processes (X1.6) is an indicator measuring the Entrepreneurial Education variable (X1). Furthermore, the highest indicator loading obtained on the Entrepreneurial Self-Efficacy variable (X2) is designing and running a sustainable green entrepreneurship-based business by paying attention to environmentally friendly and sustainable aspects (X2.3). Then, the indicator of having entrepreneurial efforts that are friendly to the environment (Y1.2) is the strongest measure of the Green Entrepreneurial Intention (Y1) variable. And finally, in the Sustainable Green Entrepreneurship Education variable (Y2), the highest indicator loading value is obtained in the indicator of teachers and students in schools receiving training on environmentally friendly entrepreneurship (Y2.5), because it has the highest indicator loading coefficient.

3.3 Structural Model

The structural model presents the relationship between the research variables of the structural model coefficient, which states the magnitude of the relationship between one variable and another. There is a significant influence of one variable on another, if the p-value < 0.05 . In SEM, two effects are known, namely the direct effect and the indirect effect. The analysis results are presented in Figure 2 for the direct effect.

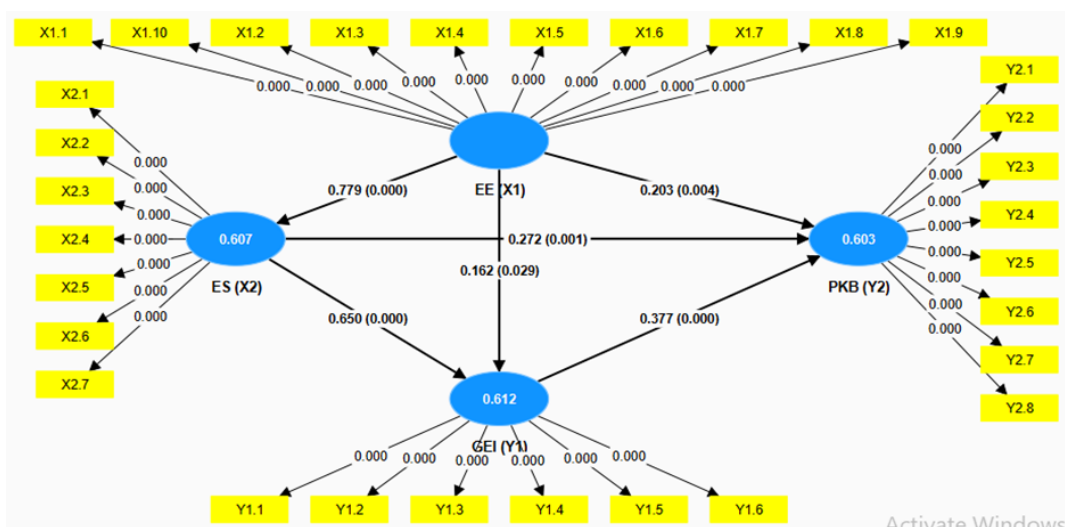


Figure 2. SEM-PLS Structural Model

SEM-PLS structural model formed:

$$X_2 = 0.779 X_1 + \zeta_1$$

$$Y_1 = 0.162 X_1 + 0.650 X_2 + \zeta_2$$

$$Y_2 = 0.203 X_1 + 0.272 X_2 + 0.377 Y_1 + \zeta_3$$

a. Direct Effect

The analysis shows that Entrepreneurial Education (X1) has a significant and positive direct effect on Entrepreneurial Self-Efficacy (X2) with a coefficient of 0.779 ($p = 0.000$), as well as on Green Entrepreneurial Intention (Y1) with a coefficient of 0.162 ($p = 0.029$), and on Sustainable Green Entrepreneurship Education (Y2) with a coefficient of 0.203 ($p = 0.004$). In addition, Entrepreneurial Self-Efficacy (X2) also has a significant and positive effect on Green Entrepreneurial Intention (Y1) (coefficient 0.650; $p = 0.000$) and on Sustainable Green Entrepreneurship Education (Y2) (coefficient 0.272; $p = 0.001$). In addition, Green Entrepreneurial Intention (Y1) is proven to have a positive and significant influence on Sustainable Green Entrepreneurship Education (Y2) with a coefficient of 0.377 ($p = 0.000$). These results indicate that an increase in Entrepreneurial Education (X1), Entrepreneurial Self-Efficacy (X2), Green Entrepreneurial Intention (Y1) will also increase Sustainable Green Entrepreneurship Education (Y2), and vice versa.

b. Indirect Effect

The indirect effect is the product of 2 (two) direct effects. The indirect effect is declared significant if both direct effects that make it up are significant. The following presents the results of the indirect effect:

Table 2. Indirect Effect Results

Exogenous Variables	Mediating Variable	Endogenous Variable	Coefficient	P-value	Conclusion
Entrepreneurial Education (X1)	Green Entrepreneurial Intention (Y1)	Sustainable Green Entrepreneurship Education (Y2)	0.061	0.005	Significant
Entrepreneurial Self-Efficacy (X2)			0.245	0.000	Significant

Table 2 presents information that Green Entrepreneurial Intention (Y1) acts as a significant mediating variable in the relationship between Entrepreneurial Education (X1) and Sustainable Green Entrepreneurship Education (Y2), with a path coefficient of 0.061 and a p value of 0.005. It also mediates the relationship between Entrepreneurial Self-Efficacy (X2) and Sustainable Green Entrepreneurship Education (Y2), where Green Entrepreneurial Intention mediates significantly with a path coefficient of 0.245 and a p value of 0.000. The positive path coefficients in both relationships indicate that increasing entrepreneurship education and entrepreneurial self-efficacy mediated by green entrepreneurial intention will increase the quality of sustainable green entrepreneurship education proportionally.

4. Discussion

Based on the hypotheses proposed, Hypothesis 1 states that Entrepreneurial Education (X1) has a significant effect on Entrepreneurial Self-Efficacy (X2). Entrepreneurial education provides students with a variety of knowledge, skills, and practical experience needed to start and manage a business. This is in accordance with the research of Fossen et al. (2021), which shows that entrepreneurship education increases student self-efficacy in the context of entrepreneurship. Self-efficacy in entrepreneurship reflects students' belief in their ability to identify business opportunities, take risks, and solve problems in an entrepreneurial context. Education that facilitates active learning and self-reflection also plays an important role in building students' confidence as future entrepreneurs.

Hypothesis 2 regarding the effect of Entrepreneurial Education (X1) on Green Entrepreneurial Intention (Y1) has also been studied by Makuya and Changalima (2024). This study confirms that entrepreneurship education plays an important role in increasing students' green entrepreneurial intention, especially when the education integrates sustainability and environmental values in its curriculum. Entrepreneurship education that integrates sustainability perspectives not only increases environmental awareness, but also fosters motivation to start green-oriented businesses.

Hypothesis 3, which is the effect of Entrepreneurial Self-Efficacy (X2) on Green Entrepreneurial Intention (Y1), gained support from the study of Amicarelli et al. (2021) which shows that students who are confident in their entrepreneurial abilities tend to be more courageous to explore new sectors, including the green sector which is often more complex and challenging. Self-efficacy serves as a catalyst that enables students to overcome the obstacles and uncertainties inherent in sustainability-based businesses. In addition, individuals with high self-efficacy are also more proactive in seeking innovative solutions that are environmentally friendly.

Hypothesis 4, which highlights the influence of Entrepreneurial Education (X1) on Sustainable Green Entrepreneurship Education (Y2), is supported by the research of Yu et al. (2024). The results showed that entrepreneurial education focusing on green aspects can increase students' intention to engage in green entrepreneurship, which in turn encourages the development of sustainable green entrepreneurship education. When students show high interest and enthusiasm for environmental issues in the business context, educational institutions are encouraged to adapt and develop curricula to better suit future needs. Sustainable green entrepreneurship education involves integration across disciplines (e.g. environmental science, technology and business), and requires updating teaching methods to be more collaborative, participatory and contextualized.

Hypothesis 5 states that Green Entrepreneurial Intention (Y1) has a significant effect on Sustainable Green Entrepreneurship Education (Y2). As students' intention to run a green business increases, the pressure on educational institutions to provide a curriculum that supports that intention also increases. Ediagbonya et al. (2024) explored the relationship between green entrepreneurial intention and sustainable green entrepreneurship education. The study found that strong green entrepreneurial intentions among university students encourage educational institutions to develop sustainable green entrepreneurship education programs.

Hypothesis 6, the effect of Entrepreneurial Self-Efficacy (X2) on Sustainable Green Entrepreneurship Education (Y2), is supported by the findings of Sanchez-Garcia et al. (2024) examined the role of green entrepreneurial self-efficacy in encouraging innovation and adaptation in sustainable entrepreneurship. The study results show that high green entrepreneurial self-efficacy contributes to the development of sustainable green entrepreneurship education through enhancing innovation and adaptation capabilities. Self-efficacy enables students to pioneer innovative projects and demonstrate that they are ready to implement the acquired knowledge in real life, which in turn reinforces the need for a supportive education system.

5. Conclusions

Based on the findings and discussion, our research has empirically proven that "Sustainable Green Entrepreneurship Education is significantly influenced by Entrepreneurial Education, Entrepreneurial Self-Efficacy, and Green Entrepreneurial Intention variables both directly and indirectly". The variables of Entrepreneurial Education, Entrepreneurial Self-Efficacy, and Green Entrepreneurial Intention influence the improvement of Sustainable Green Entrepreneurship Education positively.

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