

The Optimization of SMEs Performance Through Green Entrepreneurship, Green Innovation, And Green Finance with Age as Moderating Variable

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Abstract. This study aims to explore how green entrepreneurship, green innovation, and green finance can contribute to improving the performance of MSMEs in Medan City. The present research used structural equation modelling (SEM) to analyze the sample of 106 MSMEs for testing the hypothesized relationships between the variables. The findings of this study show that green entrepreneurship plays a significant role in the growth of green innovation in the case of MSMEs. The use of green finance and green innovation within the company is expected to lead to a high level of improvement in MSME performance. Nevertheless, the application of green entrepreneurship has been discovered to influence the success of companies through the employment of green innovation. The outcome of the research suggests that companies with consistent drive towards innovation and use of green entrepreneurship activities are likely to contribute to the enhancement of MSME performance.

Keywords: Green Entrepreneurship, Green Innovation, Green Finance, Age, SMEs Performance

1. Introduction

The rapid growth of Micro, Small and Medium-sized Enterprises (MSMEs) has been shown to engender significant advantages in terms of societal and national welfare, as it engenders an environment of heightened competitiveness for employment opportunities, thereby facilitating the establishment of business ventures by individuals. Furthermore, tax revenue generated by MSMEs contributes a substantial 60.5% to the national GDP, with a total of 61.95 million MSMEs in the micro sector, 193,900 in the small business sector, and 44,700 in the medium-sized business sector, where employment absorption reaches 97% [1]. The significance of this role is such that it presents opportunities for the government to develop facilities and regulations with a view to enhancing the sustainability of businesses. Medan, a prominent city in Indonesia, exemplifies this trend. In 2021, the city recorded a total of 13,744 SMEs, a figure that declined to 10,799 in 2022, as reported by the BPS, [2, 3]. However, a notable resurgence was observed, with the number of SMEs reaching 38,343 in June 2023, as reported by the [4]. Consequently,

it is imperative to consider the growth and sustainability of SMEs, particularly in the city of Medan, in supporting the economic development of the community.

A significant factor worthy of consideration is the sustainability of MSMEs, defined as businesses' capacity to withstand economic conditions and competitive pressures. In the context of economic conditions characterised by rising prices, MSMEs find themselves compelled to adjust their prices. Concurrently, the dynamics of business competition and the emergence of new enterprises engender challenges that impede the formulation of effective strategies for sustaining their operations. It is evident that a number of SMEs in Medan City are prone to short-term survival, primarily due to their inability to effectively compete and innovate, which significantly impacts their business sustainability. This assertion is corroborated by the findings of Almeida & Wasim, [5], which determined that the survival of companies is contingent upon their capacity to develop, demonstrate creativity, and function in a systematic manner. A business's capacity to endure is demonstrably correlated with its prospective success [6]. Consequently, there is a necessity to conduct research on the challenges faced by SMEs in order to facilitate their competitiveness and ensure business sustainability.

In the context of business sustainability, it is imperative for MSMEs to take environmental factors into consideration when formulating strategies to enhance their performance without causing harm to the surrounding environment [7]. In essence, entrepreneurs will endeavor to sustain their enterprises by innovating, which may result in adverse environmental impacts, including waste and pollution. This phenomenon has the potential to engender a negative perception among the public and consumers [8]. Consequently, the implementation of suitable strategies will prove advantageous for both environmental sustainability and business viability. A body of research has emerged on the subject of environmental protection and its relationship to innovation in the corporate sector. According to Qazi et al., [9] and Sulaiman et al., [10], local government regulations and policies, as well as the actions of stakeholders and consumers, have created a significant pressure to protect the environment. This pressure, in turn, has led to the development of innovations aimed at enabling companies to compete with their peers [11], [12], [13]. Moreover, the deleterious effects of contemporary environmental degradation, including floods, landslides, and extreme weather events, have heightened public consciousness regarding environmental conservation and the significance of opting for ecologically sustainable products [14]. This phenomenon presents an opportunity for MSMEs to develop processes and products that can positively impact public perception of business sustainability and environmental preservation [15], [16], [17].

The enhancement of performance among MSMEs has emerged as a pivotal factor in ensuring business sustainability. This enhancement, therefore, signifies an augmentation or preservation of earnings in each given interval. It functions as a guarantee for the enterprise's sustained operation through investment and the formulation of suitable strategies. Moreover, optimal performance establishes a robust foundation for business sustainability, thereby mitigating the risk of bankruptcy [18]. Furthermore, the company has identified the maximization of profits as a primary objective. To that end, it has developed a range of strategies intended to increase its net income. However, the implementation of inappropriate strategies can result in environmental degradation, including excessive consumption of resources and the release of pollutants into the environment, thereby endangering the surrounding ecosystem. A heightened sense of environmental awareness has the potential to influence a company's revenue, thereby impacting its financial viability and, consequently, the viability of its business model.

Another factor that influences company performance and MSME sustainability is green entrepreneurship. This concept elucidates the manner in which the implementation of green entrepreneurship in the conception of environmentally sustainable innovations that are competitive and capable of capitalizing on opportunities can engender business sustainability and enhance performance [19]. The notion of environmental impact assessment was initially introduced in the 1960s, during conferences of developed countries that addressed the consequences of industrialization on the environment. This led to the establishment of the concept with the objective of mitigating its adverse effects on environmental degradation [11]. The implementation of environmental impact assessment has the potential to influence business performance and sustainability [20], [21], [22], [23], [24], [25]. Consequently, this approach emerges as a viable and sustainable solution for SMEs in generating innovations that prioritize environmental sustainability and yield advantages over competing businesses. Research on the application of green entrepreneurship to improve SME performance remains inconclusive and inconsistent [26], [27], [28], necessitating further studies on the implementation of this concept to enhance theoretical frameworks and provide additional references.

The implementation of green innovation has emerged as a significant factor in enhancing business performance and sustainability. In this approach, MSMEs evaluate processes and products based on environmentally-friendly innovations, which ultimately reduce their negative impact on the environment and increase company revenue [29], [30]. However, for small and medium-sized enterprises, this concept poses a significant burden and is difficult to implement [26], [28], [31]. This is attributable to the substantial capital and strategic requirements, which engender considerable challenges for them in terms of competitiveness. If implemented effectively, this concept has the potential to exert a positive influence on company economics and performance enhancement [32], [33]. Research conducted by Khan et al., [34] and Kusi et al., [35] indicates that SMEs that successfully implement this concept will demonstrate superior performance in comparison to their competitors.

Green finance constitutes a pivotal element in the assessment of business performance enhancement and sustainability. This concept underscores the responsibility of companies to either mitigate or prevent environmental damage. The strategic implementation of CSR by companies has facilitated the formulation of suitable policies that incorporate the principles of green finance. The implementation of such policies is achieved through the mechanisms of good corporate governance, the utilization of suitable technological solutions, and the integration of environmental-oriented innovation [36], [37]. while concurrently regulating and averting environmental degradation. However, other studies have demonstrated that there is no significant influence between the implementation of CSR and improvements in company performance [38]. Consequently, there is a necessity to re-evaluate the relationship between the implementation of green finance and company performance as well as business sustainability.

Conversely, corporate culture, defined as the set of rules and procedures that govern a company's operations, exerts a significant influence on the sustainability and performance of the organization. Companies are known to establish a set of rules and policies that are designed to achieve both short-term and long-term goals. A suboptimal corporate culture can impede the realization of a company's vision and mission. It is evident that corporate entities that prioritize the pursuit of profits, often at the expense of environmental considerations, are likely to encounter adverse consequences and a tarnished reputation in the eyes of both society and the natural environment. The contemporary trend of prioritizing environmental sustainability among companies is prompting an evaluation of the implementation of an environmentally focused corporate culture, particularly among SMEs where entrepreneurs are primarily focused

on revenue generation. The majority of SMEs are under direct management by their proprietors, leading to an unwavering commitment to attaining objectives. A substantial body of research suggests a positive. However, the implementation of an environmentally-based organizational culture remains deficient due to its prioritization of profits and a dearth of understanding, which consequently impacts sales and business sustainability. Consequently, it is imperative to prioritize the cultivation of an environmentally-oriented organizational culture to enhance the performance and sustainability of MSMEs.

Finally, the age of the company must be considered when evaluating business sustainability. This factor analyzes the duration of the business's operation, with a longer duration signifying the company's capacity to withstand technical and material challenges. Researchers largely regard this factor as a moderating factor, as it is not yet considered a major factor in determining a company's success. This phenomenon is exemplified by the increasing number of new companies that are able to withstand the challenges of the business world and emerge with a competitive advantage over their more established counterparts. Concurrently, a limited number of well-established companies have demonstrated resilience in the face of competition from new market entrants. Consequently, the experience of employees is a critical factor in enhancing performance and ensuring business sustainability. It is evident that certain companies, characterized by their extensive histories and robust brand identities, possess the capacity to effectively compete with new market entrants while concurrently implementing environmentally-oriented technologies. In light of the aforementioned discourse, the researcher is interested in testing which factors impact business sustainability through performance improvement, green entrepreneurship, green innovation, green finance, and organizational culture, with company age serving as a moderating variable.

2. Research Method

The present study has been designed to examine the effect of green entrepreneurship, green innovation, green finance and organisational culture on UMKM performance, with a view to assessing the impact on the sustainability of UMKM. The study will also examine the role of general UMKM as a moderating variable. The present study employs a quantitative approach, which is predicated on deductive-inductive reasoning. This approach is predicated on the theoretical framework, the ideas of experts, and research understanding based on experience, which is then developed into problems that are proposed to obtain justification or rejection in the form of empirical data documents. The location of this research is Micro, Small and Medium Enterprises in Medan City. The population of interest in this study was comprised of micro, small and medium enterprises in Medan City. The sampling technique employed was that of simple random sampling. The measurements of this research variable are as follows:

- a. Green entrepreneurship is the practice of implementing a business with regard to environmental sustainability.
- b. Green Innovation shows creating new products or processes that do not damage the environment by paying attention to the use of materials, energy, and waste treatment.
- c. Green Finance is a concept where companies charge efforts to preserve the environment into production and service costs.
- d. Organization culture is a system of values, beliefs, norms, and habits adopted and applied by members of an organisation that shapes the way they behave, communicate, and work together.

- e. MSME performance is the level of success of MSMEs in achieving their business objectives, which is measured through various indicators both financially and non-financially.
- f. MSME sustainability is the company's ability to operate consistently with regard to the environment, social initiatives and economic value.

The data presented in this study are primarily derived from questionnaires disseminated to owners or leaders of MSMEs in Medan City. Prior to the testing of the hypothesis, it is first necessary to carry out a classic assumption test. The analytical technique employed for the interpretation and analysis of data utilises a Structural Equation Model (SEM). The objective of this model is to ascertain the relationship between exogenous and endogenous variables. It permits influences that are in accordance with the temporary theory and facilitates simultaneous evaluation of variables, including latent variables. Additionally, SEM provides a statistical model fit.

3. Results

The present study has been designed to examine the effect of green entrepreneurship, green innovation, green finance and organisational culture on improving the performance of MSMEs in Medan City. In this study, company age is proposed as a moderating variable, with the aim of investigating its impact on sustainability in the face of competitors. The research was conducted in 2025 in MSMEs in Medan City with 106 respondents. Prior to the empirical investigation of the hypothesis, the researchers conducted a preliminary evaluation of the data quality. The present study will utilise structural equation model (SEM) analysis for the purpose of hypothesis testing. The ensuing hypothesis testing results are presented herewith.

Table 1. Hypothesis Testing

	Original Sample (O)	T Statistics (O/STDEV)	P Values
Age -> SMES Sustainability	-0.044	1.276	0.205
Age -> SMEs Performance	-0.158	1.623	0.108
Organization culture -> SMES Sustainability	0.000	0.002	0.998
Organization culture -> SMEs Performance	0.000	0.003	0.998
Green Entrepreneurship -> SMES Sustainability	0.040	1.126	0.263
Green Entrepreneurship -> SMEs Performance	0.141	1.096	0.275
Green Finance -> SMES Sustainability	0.118	2.265	0.026
Green Finance -> SMEs Performance	0.422	3.398	0.001
Green Innovation -> SMES Sustainability	0.094	1.585	0.116
Green Innovation -> SMEs Performance	0.334	2.435	0.017

SMEs Performance -> SMES Sustainability	0.281	3.291	0.001
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Source: Data processed for 2025

The preceding table indicates that green innovation and green finance exert a significant influence on the financial performance of MSMEs. The performance of MSME is also ultimately consequential for business sustainability. Conversely, the variables of green entrepreneurship and organisational culture have been found to exert a negligible influence on business performance and sustainability. The following table presents an overview of the indirect testing of green entrepreneurship, green innovation, green finance and organisational culture variables on business sustainability through MSME performance. The following section presents the results of the hypothesis testing.

Table 2. Indirect Effect

	Original Sample (O)	Sample Mean (M)	T Statistics (O/STDEV)	P Values
Age -> SMEs Performance -> SMES Sustainability	-0.044	-0.047	1.276	0.205
Organization culture -> SMEs Performance -> SMES Sustainability	0.000	0.006	0.002	0.998
Green Entrepreneurship -> SMEs Performance -> SMES Sustainability	0.040	0.044	1.126	0.263
Green Finance -> SMEs Performance -> SMES Sustainability	0.118	0.117	2.265	0.026
Green Innovation -> SMEs Performance -> SMES Sustainability	0.094	0.099	1.585	0.116
Moderating Effect 1 -> SMEs Performance -> SMES Sustainability	0.006	0.002	0.168	0.867
Moderating Effect 2 -> SMEs Performance -> SMES Sustainability	-0.034	-0.039	1.015	0.312
Moderating Effect 3 -> SMEs Performance -> SMES Sustainability	-0.001	-0.002	0.051	0.960

Source: Data processed for 2025

The table above demonstrates that solely green finance variables exert a positive influence on business sustainability through MSME performance. Conversely, the variables of green entrepreneurship, green innovation and organisational culture exert no direct influence on MSME performance in terms of business sustainability.

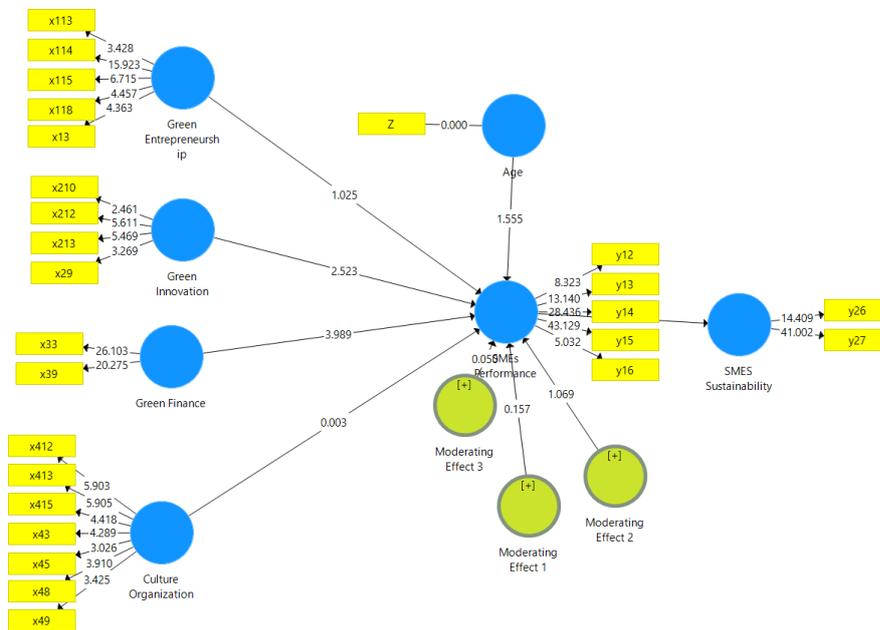


Figure 1. Path Analysis

4. Discussions

As illustrated by Figure 2 — illustrating the impact of green entrepreneurship on the performance and sustainability of MSMEs — the figure obtained for the level of significance was 0.276 for MSMEs, indicating an absence of statistically relevant effect. Conversely, the investigation of business sustainability through MSME performance yielded a substantial value of 0.263, thereby concluding that green entrepreneurship exerts no considerable influence on MSME performance, either directly or indirectly, on MSME sustainability. In consideration of the aforementioned results, it is evident that business practices that accord a high priority to environmental considerations continue to be regarded as a burden by companies. Consequently, the performance of MSMEs in implementing environmental practices remains suboptimal. In an effort to engender public confidence in environmentally-based entrepreneurial practices, it is considered that the current system is not providing consumers with a satisfactory level of information. A review of the results indicates that consumers have not been reassured by the actions of MSMEs that prioritise environmental responsibility. It is evident that the implementation of this concept does not result in an enhancement of the performance of MSMEs. Moreover, the absence of an increase in performance suggests that the company is impeded in enhancing business sustainability. The findings of this study stand in contrast to those of a previous study [39], which found that public concern for the environment encouraged MSMEs to implement environmentally-based business practices with the aim of attracting consumer attention to purchase their products. This finding is consistent with the findings of research conducted by [40], [41], [42], [43]. In terms of its relationship with business sustainability, it also contradicts the findings of [19], [44], [45], which state that entrepreneurship has no significant effect on business sustainability.

The green innovation variable indicates the company's capacity to generate environmentally oriented innovations through processes, production, and organisation. The

analysis reveals a substantial impact of green innovation on MSME performance, with a value of 0.017. Furthermore, MSME sustainability through MSME performance demonstrates a significant value of 0.116. Consequently, it can be concluded that green innovation exerts a substantial influence on MSME performance, though it is unable to significantly impact MSME sustainability through enhanced performance. It is widely acknowledged that companies which demonstrate the capacity to compete and create innovations based on technology will invariably possess a competitive advantage over other companies in their field. Consequently, it is expected that these companies will continue to improve their performance. The findings of this study are consistent with those of previous research [46], [47], [48], which demonstrates a substantial impact of incorporating green innovation in technological applications on enhancing the performance of MSME. Moreover, the findings of this study demonstrate that green innovation practices do not exert an effect on business sustainability. This outcome is incongruent with the results of previous research [49], [50], which indicated that the implementation of green innovation strategies would have a positive impact on business sustainability.

The subsequent variable under consideration is that of green finance. The findings of this study demonstrate that green finance exerts a substantial influence on corporate performance, with a statistical significance value of 0.001. The findings of this study demonstrate that green finance exerts a substantial influence on the performance of MSME entities. Moreover, the impact of green finance on business sustainability is demonstrated by a significant value of 0.026, indicating that green finance exerts a substantial influence on business sustainability through the enhancement of MSME performance. The findings of this study are consistent with those of [51], which demonstrates that the implementation of green finance has a favourable effect on the enhancement of MSME performance. Moreover, the utilisation of green finance has been demonstrated to exert an influence on the sustainability of MSMEs, as evidenced by research findings [52], [53], [54]. Companies that adopt green finance are responsible for the processes and products they produce, and this does not impose a significant burden on the company. Consequently, this has a positive impact on business performance and sustainability.

The subsequent variable that impacts the performance and sustainability of MSMEs is organisational culture. This variable is indicative of the company's operational activities, as governed by its established rules and procedures. The findings of the test yielded a significant value of 0.998 for both variables, namely MSME performance and business sustainability. In consideration of the findings, it was determined that there was no substantial impact on business performance and sustainability. The findings of this study stand in contrast to those reported in the study by [55], which posits that the presence of environmentally oriented leadership is associated with the formulation of policies that exert an influence on the performance of MSME. Conversely, research undertaken by Suriyankietkaew et al., [56] posits that sustainable MSMEs must develop and integrate value-based practices and competencies.

The final variable pertains to the performance of MSMEs, which is indicative of the company's capacity to generate revenue from its operational activities. It is evident from the results of the hypothesis testing that a significant value of 0.001 has been obtained. The findings of this study suggest that MSME performance exerts a substantial influence on business sustainability. The findings of this study demonstrate its alignment with the extant research conducted by [57], [58], [59], which substantiates the significant impact of MSME performance on MSME sustainability.

5. Conclusion

The findings of the research indicate that the implementation of green finance and green innovation exerts a substantial influence on the performance of MSMEs. Moreover, green finance exerts a substantial influence on the sustainability of MSMEs through MSME performance. MSME performance has also been demonstrated to enhance its own performance. Conversely, the impact of green entrepreneurship and organisational culture on the performance and sustainability of MSMEs remains negligible. The findings of this research suggest that the implementation of green innovation and green finance is a significant factor in enhancing the performance of MSMEs. Moreover, the utilisation of green finance fosters corporate growth and development over an extended timeframe.

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