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Determinants of Green MSME Performance: The Mediation Role of Green Product Innovation

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Abstract: This study aims to examine the influence of green transformational leadership, green entrepreneurial orientation, and green product innovation on the performance of green MSMEs, as well as the mediating role of green product innovation. The research is grounded in the growing importance of MSMEs in supporting sustainable development, particularly amid increasing demands for environmentally friendly products and business processes. The study focuses on woodcraft MSMEs in Gianyar Regency, Bali, employing a quantitative approach using Partial Least Squares-based Structural Equation Modeling (PLS-SEM). Respondents were selected through purposive sampling, with a final sample of 209 participants. The findings reveal that green transformational leadership has a significant and positive direct effect on both green product innovation and green MSME performance. Similarly, green entrepreneurial orientation has a significant impact on green innovation, but not directly on MSME performance. Moreover, green product innovation is proven to play a significant mediating role in linking both leadership and entrepreneurial orientation with sustainable MSME performance. The implications of this study highlight the need for practitioners, policymakers, and scholars to strengthen green product innovation through environmentally oriented leadership and support for green entrepreneurship, ultimately enhancing the sustainable performance of MSMEs.

Keywords: green MSME performance, green product innovation, green transformational leadership, green entrepreneurial orientation.

INTRODUCTION

Over the past few decades, global warming has emerged as a pressing issue, posing a serious threat to the sustainability of life on Earth. The continuous rise in average global temperatures is largely attributed to greenhouse gas emissions originating from various sectors, including industry and economic activities (IPCC, 2021). One sector that often escapes focused attention is Micro, Small, and Medium Enterprises (MMSMEs). Although MMSMEs operate on a smaller scale compared to large industries, their collective carbon footprint is substantial—

mainly due to fossil fuel consumption, inadequate waste management, and reliance on non-environmentally friendly raw materials (OECD, 2024). According to the Institute for Essential Services Reform (IESR), energy-related emissions from Indonesian MMSMEs were estimated to reach 216 million tons of CO_2 in 2023, an amount equivalent to nearly half of the national industrial sector's emissions recorded in 2022 (IESR, 2024). In response, several Indonesian government institutions, including Bank Indonesia (BI), have been actively pursuing initiatives to enhance MMSME productivity—both in terms of quantity and quality—while steering them toward more sustainable practices (Bank Indonesia, 2023).

Bank Indonesia has initiated efforts to empower MMSMEs by promoting the development of environmentally conscious, or "Green", MMSMEs. This strategic focus aligns with the increasing urgency to address climate-related economic damage in Indonesia, which has been reported to exceed IDR 100 trillion annually (Bank Indonesia, 2022). To respond to this challenge, MMSMEs are expected to take on a more active role as contributors to sustainable development, particularly by shifting toward eco-friendly business models. Green MMSMEs represent business actors who integrate sustainability principles to ensure long-term operational balance and resilience (Irianto, 2024). As of 2021, Indonesia had approximately 65.46 million MMSMEs—accounting for nearly 90% of all MMSMEs in ASEAN—making it the largest contributor in the region (The ASEAN Secretariat, 2022). In the absence of stronger green policy frameworks, the economic cost of climate change in Indonesia is projected to increase sharply, potentially reaching 40% of the country's GDP by 2048 due to the extensive scale of MMSME activity (Bank Indonesia, 2022).

The emergence of green MMSMEs is largely driven by growing concerns over the environmental damage resulting from conventional business operations (Sarango-Lalangui et al., 2018). Green-oriented MMSMEs are designed to align economic activities with ecological sustainability, promoting a synergistic relationship between human systems and natural ecosystems. This integration aims to ensure that current and future generations can meet their social, economic, and environmental needs in a balanced and sustainable manner (Creech et al., 2014). Evidence from The Economist Intelligence Unit (2021) highlights a rising consumer interest in sustainability, with online searches for eco-friendly products surging by 71% between 2016 and 2020—a trend commonly referred to as the "eco-awakening."

To realize the vision of Green MMSMEs, Bank Indonesia, in collaboration with the International Trade Analysis and Policy Studies (ITAPS) at IPB University, has developed a Green MMSME Business Development Model. This model categorizes MMSMEs into three implementation stages—eco-adopter, eco-entrepreneur, and eco-innovator—based on their level of environmental integration. The classification is assessed through four key dimensions: production, marketing, human resources, and finance. In 2024, Bank Indonesia identified the craft and agriculture sectors as the primary focus areas for initiating the green transformation agenda among MMSMEs (Bank Indonesia, 2023).

Environmentally friendly practices, in fact, resonate with Bali's local wisdom, particularly the cultural philosophy of *Tri Hita Karana* (THK). Within this philosophy, the *Palemahan* aspect emphasizes ecological harmony by promoting a balanced relationship between humans and their natural environment (Atmadja et al., 2022). Gianyar Regency ranks as the district with the highest number of MMSMEs in Bali Province as of 2023, totaling 75,666 registered units. This achievement is further strengthened by Gianyar's international recognition as a "World Craft City" in 2019 (Pemerintah Kabupaten Gianyar, 2019). While the number of business units has remained relatively stable, both production value and raw material usage have shown a consistent annual increase. This trend may indicate a growing reliance on raw materials, which—if left unmanaged—could contribute to deforestation and pose serious risks to environmental sustainability.

In response to evolving consumer trends and shifting market demands, MMSMEs are increasingly required to engage in continuous innovation—often through open innovation processes—which play a crucial role in enhancing overall business performance (Barrett et al., 2021). Many of these innovations involve transforming local natural resources, particularly forest-based materials, into culturally distinctive products that also support the region's tourism potential(Werastuti, 2022). However, despite this growing emphasis on innovation, the adoption of green MMSME practices still encounters various internal and external barriers. Internally, the challenges include low environmental awareness, limited technical knowledge and skills, financial constraints, and a shortage of qualified human resources necessary to support sustainable transformation (Lee, 2009). The responsibility for initiating and leading this transition often lies within the leadership of MMSMEs, particularly in fostering a mindset oriented toward sustainable business practices.

Leaders who adopt a green transformational leadership style are capable of inspiring and guiding employees to implement sustainable business strategies, comply with environmental regulations, and cultivate a deeper awareness of sustainability within organizational operations (Robertson & Barling, 2013). This leadership approach creates an environment that empowers employees to experiment and participate in the development of innovative products (Matzler et al., 2008). Moreover, transformational leaders play a critical role in nurturing and supporting employees' eco-innovative ideas, setting an example that fosters environmentally conscious creativity and drives sustainable innovation within the organization (Mansoor et al., 2021). A growing body of research affirms that green transformational leadership has a significant positive impact on innovation outcomes (Singh et al., 2020; Asad, 2021; Majali et al., 2022; Xie et al., 2018). In the context of MMSMEs, leadership is considered a pivotal determinant of business success, as the owner—who often doubles as the primary decision-maker—holds substantial influence over the formulation and implementation of business strategies that directly shape organizational performance (Madanchian et al., 2017).

Several scholars have highlighted the significant role of green transformational leadership in enhancing both business performance (Zhao & Huang, 2022) and environmental outcomes (Singh et al., 2020). However, contrasting findings have also been reported; for instance, Majali et al., (2022) found that green transformational leadership does not exert a significant influence on financial performance. In addition to the strategic importance of green transformational leadership in improving MMSME performance, green entrepreneurial orientation also plays a critical role in fostering eco-innovative products, which in turn positively affect business outcomes (Muangmee et al., 2021).

This orientation enables MMSMEs to identify internal capabilities, seize environmentally driven opportunities, and reconfigure operations in sustainable ways (Singh et al., 2020). Firms that manage their resources effectively are more likely to achieve competitive advantages over their rivals (Werastuti, 2014). Empirical evidence from Haddoud et al., (2023) and Jiang et al., (2018) further supports the view that green entrepreneurial orientation contributes positively to both environmental and financial performance. Similarly, Muangmee et al., (2021) assert that a strong green entrepreneurial orientation is associated with improvements in environmental performance.

Green Entrepreneurial Orientation (GEO) is often viewed as a driver for generating both economic and environmental value through the introduction of environmentally friendly products and services (Dean & McMullen, 2007). A number of scholars have argued that GEO significantly enhances innovation performance (Habib et al., 2020; Muangmee et al., 2021; Jiang et al., 2018; Ibarra-Cisneros & Hernandez-Perlines, 2019). However, this consensus is challenged by findings from Majali et al., (2022), who report that GEO does not significantly influence green product innovation within the MMSME sector. This inconsistency underscores the need to consider green product innovation as a mediating variable. Drawing upon the

Resource-Based View (RBV) theory Barney et al., (2001), green product innovation can be seen as a strategic internal capability that enhances the effects of leadership and entrepreneurial orientation on organizational performance. When MMSMEs are able to continuously and creatively develop eco-friendly products, the influence of both green transformational leadership and green entrepreneurial orientation on firm performance is likely to become more robust and sustainable over time.

In terms of mediation pathways, Muangmee et al., (2021) found that green product innovation plays a mediating role in the relationship between green entrepreneurial orientation and firm performance. However, contrasting evidence from Majali et al., (2022) indicates that the mediating effect of green product innovation is not statistically significant in linking either green entrepreneurial orientation or green transformational leadership to performance in the MMSME sector. Nevertheless, studies by Aastvedt et al., (2021) and Majali et al., (2022) have confirmed a significant direct relationship between green product innovation and financial performance. Research focused on green MMSMEs is particularly critical, as these enterprises constitute the majority of business actors in Indonesia and hold a strategic position in advancing sustainable economic development. Unlike large corporations, MMSMEs exhibit greater operational flexibility but also face considerable limitations in adopting green business practices. Preliminary observations reveal that most woodcraft-based MMSMEs in Gianyar Regency are still positioned at the "eco-entrepreneur" stage of green business transformation. Accordingly, this study narrows its scope to specifically examine green MMSMEs at the eco-entrepreneur stage. Although the implementation of green business practices among woodcraft MMSMEs in Gianyar has not yet reached the "eco-innovator" level, this very limitation highlights the urgent need for in-depth academic inquiry into the dynamics of green practices within the MMSME sector. The hypothesis that can be put forward is:

H1: GTL positively affects GPI
H2: GTL positively affects Performance of Green MSMEs
H3: GEO positively affects GPI
H4: GEO positively affects Performance of Green MSMEs
H5: GPI positively affects Performance of Green MSMEs
H6: GPI mediates the relationship between GTL and the Performance of Green MSMEs
H7: GPI mediates the relationship between GEO and the Performance of Green MSMEs

METHODS

This study aims to examine the influence of Green Transformational Leadership (GTL) and Green Entrepreneurial Orientation (GEO) on the performance of green MMSMEs, with Green Product Innovation (GPI) serving as a mediating variable. A quantitative research design was adopted using a variance-based Structural Equation Modeling (SEM) approach through Partial Least Squares (PLS) version 4.1.

The research was conducted among MSMEs in the woodcraft sector located in Gianyar Regency, Indonesia. This sector was chosen as the unit of analysis due to its high dependence on natural raw materials, necessitating sustainable business strategies. The data were collected through a structured questionnaire distributed to respondents in 2025. As of 2024, a total of 553 registered woodcraft MSMEs operate in Gianyar Regency, which serves as the research population. A purposive sampling method was employed to select respondents based on predetermined inclusion criteria. The sampling criteria for the analysis units are as follows:

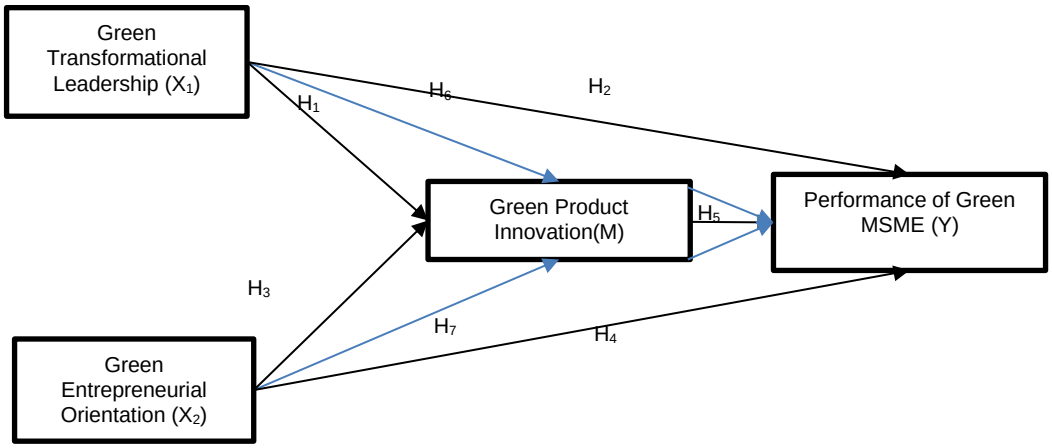
1. The business must qualify as a small or medium enterprise (MSME) involved in a production process;
2. The business must currently be at the Eco-Entrepreneur stage of green business development;
3. The MSME must have been in operation for at least two years;

4. The business must employ at least two workers;
5. The owner or manager must be actively involved in managerial decision-making;
6. The business must be willing to participate and complete the research questionnaire.

The minimum required sample size was determined using the guideline proposed by Hair et al. (2019), which recommends a minimum of 10 respondents per construct in the model. Given that the study includes four main variables, the minimum sample size is 40 respondents. However, the final sample size may be adjusted to reflect the number of eligible MSMEs accessible in the field.

Data collection was carried out using a structured questionnaire with both offline and online distribution methods. The survey items were measured using a five-point Likert scale. For most variables, the scale ranges from (1) Strongly Disagree to (5) Strongly Agree. For the dependent variable (green MSME performance), a frequency-based Likert scale was used, ranging from (1) Never to (5) Always.

The dependent variable was operationalized using mandatory indicator items provided by Bank Indonesia (2023), aligned with the eco-entrepreneur level measured using 12 items. Indicators for the mediating variable measured by 4 items adopted from Xie et al. (2019) and Singh et al. (2020). The Green Transformational Leadership construct was measured using 6 items adapted from Singh et al. (2020), while the Green Entrepreneurial Orientation construct was measured using 5 items developed by Jiang et al. (2018).



Source: author, 2025

Figure. 1 Research Framework

RESULTS AND DISCUSSION

The distribution of the questionnaire was carried out through both offline and online channels. While the target number of responses was set at 230 MSMEs.

Table 1. Descriptive Statistics Results

Construct	Item	*Mean*	Standard deviation
GTL	X11	4.081	0.602
	X12	4.081	0.585
	X13	4.077	0.582
	X14	4.038	0.602
	X15	4.010	0.579
	X16	4.014	0.591
GEO	X21	4.129	0.676
	X22	3.804	0.709
	X23	3.900	0.591

	X24	3.813	0.677
	X25	3.923	0.606
GPI	M1	3.962	0.497
	M2	4.038	0.534
	M3	4.014	0.503
	M4	4.005	0.531
Green MSME's Performance	Y11	3.990	0.570
	Y12	3.928	0.578
	Y13	4.005	0.599
	Y14	3.976	0.607
	Y15	4.024	0.582
	Y21	3.981	0.587
	Y22	3.990	0.570
	Y23	3.971	0.561
	Y31	4.010	0.527
	Y32	4.005	0.660
	Y41	3.976	0.614
	Y42	3.971	0.610

Source : research result

For descriptive statistical test results presented in Table 1 reveal that the mean values for all statement items and questions exceed their respective standard deviations. This indicates a low degree of data dispersion, suggesting that the respondents' answers are relatively consistent and concentrated around the average values. A low level of deviation reflects a uniform distribution of responses across the sample. The descriptive analysis results in Table 1 indicate that the majority of respondents selected "agree" "often" (4) on the Likert scale.

Tabel 2. Validity and Reliability of Outer Model

Construct	AVE	Outer Loading >0.70	HTMT	Fornell-Larcker met	Cronbach's Alpha	Composite Reliability	Conclusion
GTL	0.742	Accepted	Accepted	Accepted	0,931	0,932	Valid&Reliabel
GEO	0.605	Accepted	Accepted	Accepted	0,911	0,913	Valid&Reliabel
GPI	0.713	Accepted	Accepted	Accepted	0,866	0,867	Valid&Reliabel
PGMSME	0.710	Accepted	Accepted	Accepted	0,960	0,961	Valid&Reliabel

Source : research result

Table 2 shows that all items measuring Green Transformational Leadership (X1), Green Entrepreneurial Orientation (X2), Green Product Innovation (M), and Green MSME Performance (Y) have outer loading values greater than 0.70. This indicates that each item is valid in representing its respective construct. Moreover, the Average Variance Extracted (AVE) values for each latent variable exceed the 0.50 threshold—Green Transformational Leadership (X1) = 0.742, Green Entrepreneurial Orientation (X2) = 0.605, Green Product Innovation (M) = 0.713, and Green MSME Performance (Y) = 0.710—indicating that the model meets the requirements for convergent validity.

Table 2 further supports the construct validity of the model through discriminant validity testing. This confirms that all constructs fulfill the Heterotrait-Monotrait (HTMT) and the Fornell-Larcker criterion for discriminant validity. Table 5 also displays the results for internal consistency reliability. All constructs—*Green Transformational Leadership (X1)*, *Green Entrepreneurial Orientation (X2)*, *Green Product Innovation (M)*, and *Green MSME Performance (Y)*—show Cronbach's alpha values above the acceptable threshold of 0.60, specifically 0.931, 0.911, 0.866, and 0.960 respectively. These findings indicate that the measurement instruments demonstrate strong internal consistency. Furthermore, the composite

reliability values for all constructs also exceed 0.70: 0.932 for X1, 0.913 for X2, 0.867 for M, and 0.961 for Y. This confirms that each latent construct is reliably measured by its respective indicators.

For inner model test result, the coefficient of determination (R^2) for the *Green Product Innovation* variable is 0.323, indicating that 32.30% of the variance in green product innovation can be explained by *Green Transformational Leadership* and *Green Entrepreneurial Orientation*. The remaining 67.70% is attributable to other factors not included in the current research model. Meanwhile, the R^2 value of 0.620 for the *Green MSME Performance* variable suggests that 62% of the variance in performance can be accounted for by the combined influence of green transformational leadership, green entrepreneurial orientation, and green product innovation. The remaining 38% of the variation is explained by external variables beyond the proposed model. Based on common benchmarks, an R^2 value within this range is classified as moderate, indicating that the model demonstrates a reasonable explanatory power for the relationships among the constructs. The Q^2 (predictive relevance) value for the model is 0.743, which is significantly greater than zero, thereby confirming that the model possesses strong predictive relevance. The closer the Q^2 value is to 1, the better the model's predictive accuracy. A Q^2 of 0.743 (or 74.30%) suggests that the model can predict 74.30% of the observed variance, while the remaining 25.70% may be due to unexplained variables and measurement error. This result supports the model's robustness in terms of predictive capability, as suggested by Hair et al. (2019). Furthermore, the Standardized Root Mean Square Residual (SRMR) value for the model is 0.044, which is well below the recommended threshold of 0.08 (Hair et al., 2021). This indicates that the proposed model has a good fit with the empirical data and that the discrepancy between observed and predicted correlations is minimal. Lastly, the Goodness-of-Fit (GoF) index is calculated at 0.571, which falls into the high category. This implies that the model exhibits a strong fit, successfully capturing the complexity of both the measurement and structural models based on the empirical data used in the analysis.

Tabel 3
Path Coefficient & Indirect Effect

Hipotesis	Path	Original sample (O)	T statistics (|O/STDEV|)	P values	Conclusion
H1	GTL → GPI	0.550	9.539	0.000	Accepted
H2	GTL → PGMSME	0.202	3.371	0.001	Accepted
H3	GEO → GPI	0.130	2.089	0.037	Accepted
H4	GEO → PGMSME	0.028	0.607	0.544	Rejected
H5	GPI → PGMSME	0.655	13.620	0.000	Accepted
H6	GTL → GPI → PGMSME	0.360	7.852	0.000	Accepted
H7	GEO → GPI → PGMSME	0.085	2.003	0.045	Accepted

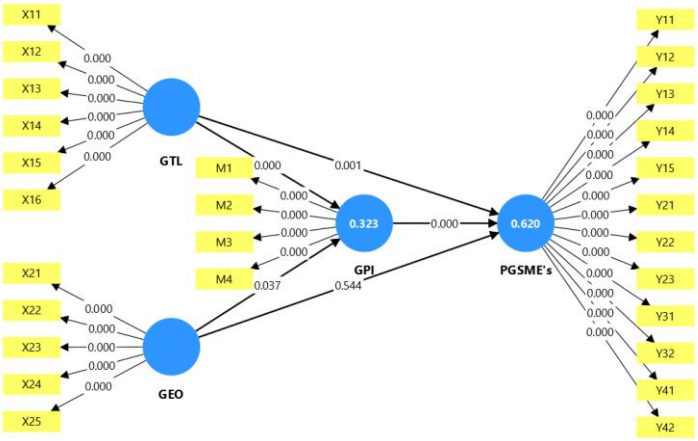
Source : research result

The direct and indirect effects between the variables were assessed through path coefficient testing, as presented in Table 3. The hypothesis testing results are summarized as follows:

1. The path coefficient between Green Transformational Leadership (X1) and Green Product Innovation (M) is 0.550, with a p-value of 0.000 (< 0.05), indicating that H1 is accepted. This finding confirms a statistically significant positive effect of green transformational leadership on green product innovation.
2. The relationship between Green Transformational Leadership (X1) and Green MSME Performance (Y) yields a path coefficient of 0.202 with a p-value of 0.001 (< 0.05), thus

H2 is accepted. This result suggests that green transformational leadership exerts a positive and significant impact on green MSME performance.

3. The direct effect of Green Entrepreneurial Orientation (X2) on Green Product Innovation (M) has a coefficient of 0.130 and a p-value of 0.037 (< 0.05), implying that H3 is accepted. These results demonstrate that green entrepreneurial orientation significantly and positively influences green product innovation.
4. The path coefficient between Green Entrepreneurial Orientation (X2) and Green MSME Performance (Y) is 0.028, with a p-value of 0.544 (> 0.05). As a result, H4 is rejected. This finding indicates that, although the direction of the effect is positive, green entrepreneurial orientation does not significantly affect green MSME performance in the studied context.
5. The coefficient for the relationship between Green Product Innovation (M) and Green MSME Performance (Y) is 0.655, with a p-value of 0.000 (< 0.05). Therefore, H5 is accepted, suggesting that green product innovation has a significant positive influence on the performance of green MSMEs.
6. The indirect effect of Green Transformational Leadership (X1) on Green MSME Performance (Y) via Green Product Innovation (M) yields a coefficient of 0.360, with a p-value of 0.000 (< 0.05). This indicates that H6 is accepted, confirming that green product innovation plays a significant mediating role in the relationship between green transformational leadership and green MSME performance.
7. The mediated relationship between Green Entrepreneurial Orientation (X2) and Green MSME Performance (Y) through Green Product Innovation (M) has a path coefficient of 0.085, with a p-value of 0.045 (< 0.05), which means H7 is accepted. This result highlights the significant mediating role of green product innovation in strengthening the influence of green entrepreneurial orientation on MSME performance.



Source : research result

Figure 2. Smart PLS Output

CONCLUSION

Based on the results of hypothesis testing using the PLS-SEM approach on 209 respondents of woodcraft MMSMEs in Gianyar Regency, six significant relationships and one insignificant relationship were found out of the seven hypotheses proposed. Overall, this study demonstrates that green transformational leadership, green entrepreneurial orientation, and green product innovation play important mediating roles in improving the performance of environmentally-based MMSMEs. The following conclusions are drawn:

1. Green transformational leadership has a direct, positive and significant effect on green product innovation, thus H1 is accepted. This means that the higher the adoption of an environmentally oriented transformational leadership style, the greater the drive of MMSMEs to create environmentally friendly product innovations. This finding

underscores the importance of leaders in transforming green visions into concrete innovative processes at the micro and small business level.
2. Green transformational leadership also has a positive and significant effect on the performance of green MMSMEs, thus H2 is accepted. This demonstrates that leadership that inspires, motivates, and exemplifies sustainable practices can improve MMSME business performance, both economically, socially, and environmentally.
3. Green entrepreneurial orientation has a positive and significant effect on green product innovation, therefore H3 is accepted. This finding indicates that the stronger the proactive, innovative, and risk-taking attitude based on sustainability principles, the higher the tendency of MMSMEs to develop environmentally friendly products.
4. Green entrepreneurial orientation has a positive but insignificant effect on the performance of green MMSMEs, therefore H4 is rejected. Although the direction of the relationship is positive, the magnitude of its contribution is not strong enough to directly explain variations in performance. This indicates that green entrepreneurial orientation tends to be long-term strategic and requires the intervention of other variables, such as innovation, to maximize its impact on performance.
5. Green product innovation has a positive and significant effect on the performance of green MMSMEs, therefore H5 is accepted. Green product innovation has proven to be a strong variable in explaining the performance of green MMSMEs. This underscores the importance of environmentally-based innovative practices in driving business growth that is not solely profit-oriented but also considers sustainability and product added value for consumers and the global market. 6) Green product innovation plays a significant role as a mediator in the relationship between green transformational leadership and green MMSME performance, with a positive and significant effect, thus H6 is accepted. This indicates that the influence of new leadership will be optimal on performance if it is transformed into concrete, marketable green products. This mediation role is crucial because it demonstrates that a leader's ability to direct environmentally friendly innovation is a strategic key to increasing MMSME competitiveness.
6. Similarly, the relationship between green entrepreneurial orientation and green MMSME performance through green product innovation produces a significant and positive relationship, thus H7 is accepted. Although green entrepreneurial orientation does not directly influence performance, through the practice of green product innovation, green entrepreneurial orientation can have a positive impact on overall MMSME performance. This strengthens the argument that innovation is a crucial intermediary in realizing the value of sustainable entrepreneurial orientation.

Therefore, it can be concluded that green product innovation is a key factor in strengthening the influence of both green transformational leadership and green entrepreneurial orientation on MMSME performance. These results emphasize the importance of encouraging green innovation as a concrete manifestation of leadership strategy and entrepreneurial orientation to achieve competitive business sustainability. These results also support the theoretical framework of RBV, AMO, and Triple Bottom Line, which places leadership, innovation capability, and environmental motivation as the main determinants of the sustainability of small and medium enterprises.

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