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Enhancing Business Sustainability of Food and Beverage SMEs through Green Manufacturing Implementation

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Abstract

Environmental degradation has emerged as a critical global issue, particularly due to the escalating accumulation of single-use plastic waste generated across various industrial and commercial sectors. Within this context, Small and Medium-sized Enterprises (SMEs), especially those operating in the food and beverage industry, contribute substantially to environmental pollution through the extensive utilization of disposable plastic packaging. Despite growing environmental concerns and increasing public awareness regarding sustainable production practices, the adoption of environmentally responsible manufacturing systems among SMEs remains relatively limited. Therefore, this study aims to examine the implementation of green manufacturing practices and analyse their influence on business sustainability among food and beverage SMEs in Bangkalan Regency, Indonesia. This research adopts a quantitative research design and employs the Structural Equation Modelling–Partial Least Squares (SEM-PLS) approach to evaluate the relationships among strategic orientation, green awareness, green knowledge, green manufacturing, and business sustainability. Primary data were collected through structured questionnaires distributed to 44 SMEs operating within the food and beverage sector. The empirical findings indicate that strategic orientation and green awareness are positively associated with both green manufacturing practices and business sustainability. Conversely, initial estimations show an inverse association between green knowledge, green manufacturing, and business sustainability, which reflects resource constraints faced by SMEs rather than a direct negative impact. This study provides practical implications for policymakers, local governments, and SMEs in designing more effective sustainability-oriented policies, environmental training programs, and green innovation strategies aimed at strengthening environmentally responsible business practices in the food and beverage sector.

Keywords: Business Sustainability, Food & Beverage (F&B), Madura Island, SDGs



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1. INTRODUCTION

Environmental damage is now an increasingly urgent global problem to address. One of the problems that is important to address is the increase in waste, especially single-use plastics (Rabiu & Erben, 2024). One of the sectors that is the main contributor to waste production is the business sector (Guzman et al., 2023). Thus, the understanding of the importance of maintaining the environment needs to be improved in all sectors, especially in the business world (Kusumawardani

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et al., 2024) This is important so that business activities do not always have to be directed to profit alone, but also play an active role in supporting the achievement of sustainable development goals.

Sustainable Development Goals (SDGs) is one of the keys to achieving the SDGs is the empowerment of SMEs (Sonntag et al., 2022) This is because SMEs are the main drivers of economic growth, social inclusion, and environmental sustainability, and directly contribute to job creation, and poverty alleviation (Judijanto et al., 2025) The 12th goal in the Sustainable Development Goals is in line with this research which ensures responsible consumption and production patterns. One of its main focuses is to reduce plastic waste through prevention, reduction, recycling, and reuse. This activity is also expected to encourage changes in people's behavior to choose products that can be reused as an alternative to daily products (Filho et al., 2022)

Data from the Coordinating Ministry for Economic Affairs of the Republic of Indonesia shows that SMEs contribute up to around 60% to the Gross Domestic Product (GDP) and receive more than 97% of the national formal workforce (Limanseto, 2025) Micro, Small, and Medium Enterprises (SMEs) are business sectors that play an important role in creating jobs, increasing income, and encouraging economic growth (Malau et al., 2025) SMEs in Bangkalan were also found to contribute significantly to job creation and increase community income (Kurniyanto et al., 2025; Munawara et al., 2025). However, there are still many SMEs, especially in the food and beverage sector, who use single-use packaging so that it has the potential to increase the amount of plastic waste (Afriani et al., 2025; Santosa, 2024).

The food and beverage sector is one of the main contributors to generating waste (Sampepajung et al., 2023) Organic waste and inorganic waste are two types of waste generated from the sector's activities. Organic waste is generally sourced from leftover raw materials, unsold food, and processing process residues. Meanwhile, inorganic waste mostly comes from the use of plastic packaging, bottles, disposable cups, and straws (Chazanah & Nandiyanto, 2022) In addition to having a bad impact on the environment, these conditions also have the potential to reduce the competitiveness of business actors if they are not accompanied by the implementation of business practices that are oriented towards environmental sustainability.

One of the environmentally friendly business practices that can be applied is green innovation. Green innovation is an effort to develop products, processes, services, and business models that are able to reduce environmental impacts while increasing the efficiency of resource utilization (Alshammari & Alshammari, 2023) This innovation then becomes the foundation for the implementation of green manufacturing, which is a production process that utilizes environmentally friendly principles through energy efficiency, waste reduction, safe use of raw materials, and product design that is easy to recycle (Lubaba et al., 2025) Therefore, the adoption of green manufacturing in this sector is expected to answer the waste challenge while strengthening the business sustainability of SMEs. This study aims to examine in depth how the implementation of green manufacturing can affect the sustainability of the Food and Beverage SMEs, as well as produce practical and theoretical recommendations in order to encourage more sustainable business practices.

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2. RESEARCH METHOD

2.1 Location and Data Sources

This research was carried out in Bangkalan District, Bangkalan Regency. The selection of this location was carried out purposively, taking into consideration that this area has the highest number of food and beverage SMEs among other sub-districts, which is 2,151. This research lasted for four months from September to December 2025. This research was conducted with a quantitative approach. Data was collected through the distribution of questionnaires to SMEs operating in the Bangkalan District area. The data source in this study comes from primary data.

2.2 Population and Sample

The population in this study includes all food and beverage SMEs operating in Bangkalan District with a total of 2,151. We used the probability sampling method because all members of the population have the same opportunity to be sampled using the cluster sampling technique. The determination of the number of samples was used the lemeshow formula with 15 percent error, This study employed a stratified random sampling approach to ensure proportional representation across SMEs within the target population. The sample size was determined using an a priori power analysis for PLS-SEM (with $\alpha = 0.05$, statistical power = 0.80, and medium effect size), yielding a final sample of 44 respondents. No pre-selection criteria regarding prior green manufacturing adoption were applied to avoid sampling truncation and bias.

Table 1. Determination of Sample Quantity

Type of SMEs	Total Population	Proportion	Total Samples
Micro	2072	94%	41
Small	77	5%	2
Medium	2	1%	1
Total	2151	100%	44

The clusters in the table above are determined by the proportional sampling formula. After the cluster is determined, the non-probability sampling method used is purposive sampling. The criteria used in this study are:

1. Food and beverage SMEs operating in Bangkalan District.
2. SMEs that have been operating for at least six months.
3. SMEs that have an initial understanding or application of the concept of green manufacturing

2.3 Data Analysis

Descriptive analysis was used to identify the characteristics of the respondents and examine each of the variables under study. Descriptive analysis is a data processing method aimed at providing a description, whether in the form of data presentation or conclusions regarding a situation or event (Martias, 2021). The scale range values were obtained from the analysis of ordinal data using a Likert scale (1–5), namely very low, low, moderate, high, and very high. The formula used is as follows:

$$\text{Range Scale} = \frac{\text{Max Score} - \text{Min Score}}{\text{Likert scale}} = \frac{5 - 1}{5} = 0.8$$

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To know how the green manufacturing can affect on enhancing the SME's business sustainability, we used the Structural Equation Modeling-Partial Least Squares (SEM-PLS) method through the help of Smart PLS software version 4.0. This statistical tool is a technique designed to overcome the limitations of multiple linear regression, especially when dealing with conditions such as incomplete data and multicollinearity problems. The steps in the SEM-PLS analysis include the outer model and the inner model. In the outer model, analyses were conducted to assess convergent and discriminant validity as well as reliability, where good indicators exhibit high correlations with the same construct, do not show high correlations with other constructs, and have reliability values above 0.70. Furthermore, in the inner model, the analysis included testing for multicollinearity using the VIF value (<5), structural path coefficients and specific indirect effects were evaluated using a two-tailed bootstrapping procedure with 5,000 resamples. Relationships were considered statistically significant at $p < 0.05$ (corresponding to $t > 1.96$). Directional hypotheses with empirical coefficients of the opposite sign were rejected regardless of their t -statistic values (Hair et al., 2021). The SEM-PLS model developed in this research is shown in Figure 1.

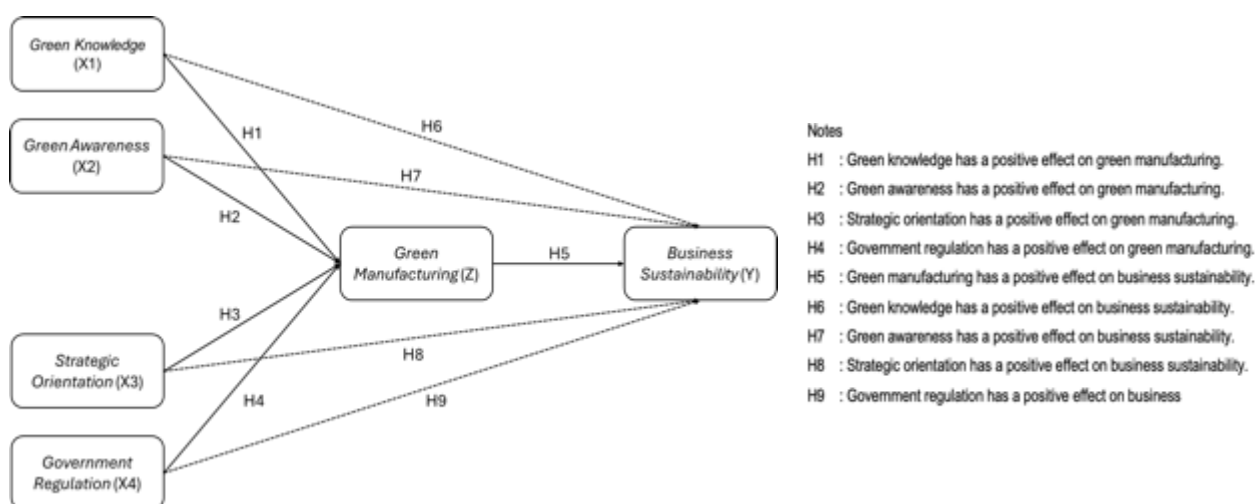


Figure 1. Research Model using SEM-PLS

We also employed the POAC (Plan-Organize-Actuate-Control) management framework to identify the managerial actions that SMEs need to take to follow up on the findings of the descriptive analysis and the impact of green manufacturing on business sustainability, thereby achieving their objectives effectively and efficiently. (Utami et al., 2023).

3. RESULTS AND DISCUSSION

3.1 Respondent Characteristics Based on Demographic and Geographic Conditions

The study was involved 44 SMEs places that were used as respondents and spread across 8 villages in Bangkalan District. The villages that are the location of the research include Kemayoran, Pejagan, Demangan, Kraton, Mertajasah, Mlajah, Bancaran, and Pangeranan Villages, as well as showed in the Figure 2.

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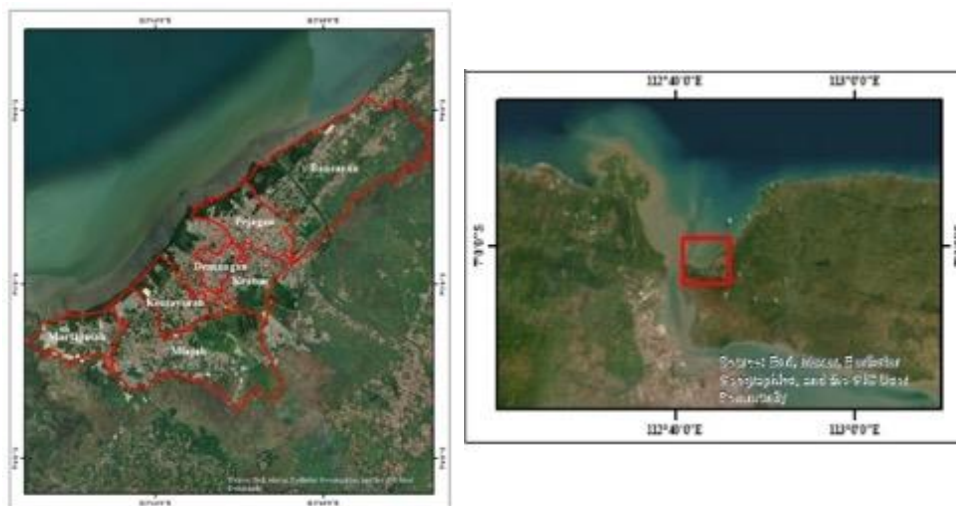


Figure 2. Location of Research (Bangkalan District)

This distribution shows that respondents are not concentrated in one region, but rather include several regions with different demographic and socioeconomic characteristics. Based on the results of data collection, Kemayoran Village is the area with the highest number of SMEs, namely 10 business units (22.73 percent). Furthermore, Pejagan Village and Demangan Village each contributed 9 business units (20.45 percent). Kraton Village is an area with 7 business units (15.91 percent), while Mertajasah Village has 4 business units (9.09 percent). Mlajah Village and Bancaran Village each have 2 business units (4.55 percent), while Pangeranan Village is the area with the least number of respondents, namely 1 business unit (2.27 percent). The respondents used were 44. Detailed details regarding the characteristics of the respondents are presented in Table 2.

Table 2. Respondent's Characteristic

Characteristics	Classification	Frequency	Percentage (%)
Age (years)	15 – 24	3	7
	25 – 34	13	30
	35 – 50	19	43
	> 50	9	20
Gender	Male	19	43
	Female	25	57
Education	Elementary	9	21
	Junior	12	27
	Senior	15	34
	Bachelor	8	18
Type of SMEs	Micro	41	94
	Small	2	5
	Medium	1	1
Employees (quantity)	< 5	38	87
	5 – 10	6	13
Business Experiences (years)	<1	4	9
	1 – 10	30	68
	>10 years	10	23

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The characteristics of the respondents in this study reveal a fairly diverse demographic profile. In terms of age, the majority of respondents—43 percent—belong to the productive age group of 35–50 years, followed by the 25–34 age group at 30 percent. This indicates that most business owners are at a stage in life where they possess a high level of maturity and experience in managing their businesses. In the gender category, female respondents dominate with a percentage of 57 percent, while males account for 43 percent. This aligns with research showing that women play a significant role in the SMEs (Firmansyah et al., 2025). Women are heavily involved in microenterprise activities because they have flexible schedules. In terms of highest level of education, the majority of respondents—34 percent—have a high school education or equivalent. Although the educational level of MSME owners is relatively high, hands-on experience in running a business has a significant impact on their managerial skills and ability to adapt to technological advancements (Nautwima et al., 2025).

3.2 Green Manufacturing Implementation

The green knowledge (GK) has a mean score of 3.932, which falls into the high category; thus, it can be concluded that the respondents possess a high level of knowledge regarding environmentally friendly practices. The strategic orientation (SO) has a mean value of 3.460, which falls into the moderate category. In contrast, the government regulation (GR) has a mean value of 4.174, placing it in the very high category, indicating that government regulations play a significant role in decision-making regarding the implementation of environmentally friendly practices in business. Meanwhile, the green awareness (GA) has an average score of 3.325 and falls into the moderate category. This is similar to the green manufacturing (GM), which has an average score in the moderate category of 3.375. Meanwhile, the business sustainability (BS) has an average score of 3.744 and falls into the high category, indicating that respondents hold a high perception of this variable.

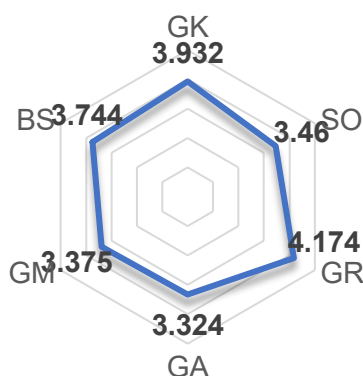


Figure 3. Visualization of Descriptive Analysis for All Variables

Figure 3 shows the mean scores for each variable. The mean scores for green knowledge, strategic orientation, government regulation, and business sustainability are high (>3.41). These results indicate a strong implementation of green knowledge, strategic orientation, government regulation, green awareness, and business sustainability in the operation of Food and Beverage SMEs. Meanwhile, the variables green awareness and green manufacturing fall into the moderate category (>2.61).

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3.3 Structural Equation Modelling-Partial Least Square (SEM-PLS)

3.3.1 Convergent Validity

The convergent validity in this study was evaluated by looking at the value of the loading factor (outer loading) of each indicator to its construct. The results of the testing of the loading factor (outer loading) value for each indicator are presented in Table 3.

Table 3. *Loading Factor (Outer Loading)*

	BS	GA	GK	GM	GR	SO
BS1	0,823					
BS2	0,907					
GA1		0,705				
GA2		0,918				
GK1			0,908			
GK2			0,876			
GK3			0,949			
GM3				0,971		
GM4				-0,497		
GR1					0,872	
GR2					0,886	
SO1						0,887
SO2						0,883
SO3						0,727

The results of the loading factor are presented in table 3, which shows that the indicators BS1, BS2, GA1, GK1, GK2, GK3, GM3, GR1, GR2, SO1, SO2, and SO3 have exceeded the recommended value of > 0.7 so that the data can be said to be valid and have met the convergent validity criteria (Hair et al., 2018). Although the GM4 indicator is not valid in terms of its value > 0.7, it is still used because it has been compiled based on previous literature and research that states that this aspect is part of green manufacturing. Therefore, the indicator is maintained to maintain the integrity of the concept of variables.

3.3.2 Reliability Test

Reliability testing in this study was conducted by examining the Composite Reliability and Average Variance Extracted (AVE) values. The results of the reliability and convergent validity tests are presented in Table 4. Table 4 shows that all variables in this study have an AVE value greater than 0.5, so all variables can be considered valid.

Table 4. Reliability Test

Variables	Composite Reliability	Average Variance Extract (AVE)
BS	0,857	0,750
GA	0,800	0,670
GK	0,936	0,831
GM	0,217	0,595
GR	0,872	0,773
SO	0,873	0,698

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3.3.3 Discriminat Validity Test

The discriminant validity test in this study was conducted using the Fornell–Larcker criterion, which involves comparing the square root of the Average Variance Extracted (AVE) values on the diagonal with the correlation coefficients between constructs. The table above shows the Fornell–Larcker values for each latent variable. The results indicate that the correlations among the latent variables show that no variable has a higher correlation than the others.

Table 5. Fornell-larcker Value

Variables	BS	GA	GK	GM	GR	SO
BS	0,866					
GA	0,627	0,819				
GK	0,446	0,508	0,911			
GM	0,521	0,521	0,294	0,771		
GR	0,408	0,308	0,443	0,311	0,879	
SO	0,788	0,559	0,652	0,693	0,550	0,835

3.3.4 Coefficient of Determination

To determine the extent to which the independent variables explain the dependent variable, an analysis of the coefficient of determination (Adjusted R-squared) was conducted. The results of this test are presented in Table 6

Table 6 Adjusted R-Square

Variabel	R – Square Adjusted	Percentage (%)
Business Sustainability	0,677	67,7
Green Manufacturing	0,528	52,8

The results of the analysis in the table show that the R-squared value for the green manufacturing variable is 0.52. This value indicates that the independent variables—comprising green knowledge (GK), strategic orientation (SO), government regulation (GR), and green awareness (GA)—account for 52% of the variation in green manufacturing. Thus, there remains 48% of variation influenced by factors outside the research model. Meanwhile, the R-square value for the business sustainability variable is recorded at 0.677. This indicates that 67.7% of the variation in business sustainability can be explained by the five main variables.

3.4 Implementation of Green Manufacturing in Food and Beverage SMEs

The results show that the implementation of green manufacturing among food and beverage SMEs in Bangkalan District has not yet been fully implemented but is still in its early stages. The green manufacturing practices adopted by SMEs are simple and context-specific, including reducing the use of single-use plastics—where SME operators typically use rice paper, banana leaves, and cardboard to replace styrofoam, which is considered more hazardous—reusing certain packaging, conserving electricity and water, and controlling production volumes to minimize raw material waste. Some food and beverage SMEs in Bangkalan source their raw materials from local markets and

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farmers. This practice is driven more by cost-efficiency considerations and the business owners' experience than by the implementation of a structured environmental management system.

Conversely, the implementation of technical and formal aspects of green manufacturing—such as the use of certified eco-friendly raw materials, the adoption of environmental management systems, and the utilization of green production technologies—remains very limited. This situation is influenced by limited capital, the predominance of micro-enterprises among respondents, and the focus of SMEs on short-term business sustainability. These findings align with research highlighting that the implementation of green manufacturing or sustainable manufacturing among SMEs still faces significant barriers. This study explains that technical and formal aspects of green manufacturing—such as the use of certified eco-friendly raw materials, the implementation of environmental management systems (ISO 14001), and the utilization of green production technologies—have not yet been widely adopted by small-scale enterprises. This situation is primarily due to the limited internal resources of SMEs, particularly regarding financial capital, technical capabilities, and access to eco-friendly technologies (Alayon et al., 2022). Therefore, green manufacturing in Bangkalan is best understood as a gradual, adaptive process rather than a full-scale green industrial transformation.

3.5 The Impact of Green Manufacturing on Business Sustainability

The relationships between variables in this study were tested using path coefficient analysis, examining the original sample values, t-statistics, and p-values. A relationship was considered significant if the p-value was less than 0.05. The results of the tests for direct and indirect relationships between variables are presented in Table 7.

Tabel 7. Bootstrapping Step

Variables	Original sample (O)	t-statistic	P values	Description
GA -> BS	0,372	2,871	0,002	Significant
GA -> GM	0,263	1,842	0,034	Significant
GK -> BS	-0,270	2,159	0,017	Significant
GK -> GM	-0,331	1,997	0,024	Significant
GM -> BS	-0,230	1,702	0,046	Significant
GR -> BS	-0,028	0,316	0,376	Not Significant
GR -> GM	-0,061	0,503	0,308	Not Significant
SO -> BS	0,931	6,285	0,000	Significant
SO -> GM	0,796	4,654	0,000	Significant
GR -> GM -> BS	0,014	0,455	0,325	Not Significant
SO -> GM -> BS	-0,183	1,593	0,057	Not Significant
GA -> GM -> BS	-0,061	1,085	0,140	Not Significant
GK -> GM -> BS	0,076	1,259	0,105	Not Significant

The results of the bootstrapping analysis indicate that green knowledge has a significant negative effect on green manufacturing. The negative coefficient suggests that an increase in environmental knowledge is actually accompanied by a decrease in the level of green manufacturing implementation. These results contradict the findings of a study by (Sahoo et al., 2023) which states that environmental awareness encourages organizations to manage ecological information more effectively and to enhance green technological innovation as the foundation for implementing green manufacturing. Furthermore, strategic orientation was found to have a positive and significant effect on green manufacturing. This indicates that food and beverage SMEs in Bangkalan prioritize

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environmental aspects as the basis for strategic decision-making over other aspects of orientation. According to interviews conducted with respondents, the environmental conservation measures implemented by food and beverage SME operators in Bangkalan include maintaining the cleanliness of business premises, choosing energy-efficient equipment, reducing the use of single-use packaging, and conserving water and electricity. These results are consistent with the research (Habib et al., 2021) which emphasizes that strategic orientation—through green entrepreneurial orientation, market orientation, and knowledge management orientation—plays a crucial role in promoting the adoption of green manufacturing through green supply chain management (GSCM).

Further analysis indicates that green awareness also has a positive and significant effect on green manufacturing. These results indicate that for SME operators, environmental awareness is not merely an individual's internal understanding but is manifested through active and consistent communication regarding environmental policies—both internally (to employees) and externally (to suppliers and customers)—and that the effectiveness of environmental policy communication plays a major role in supporting the implementation of environmental management systems in SMEs. When policies are communicated consistently, all parties involved understand the standards of eco-friendly behavior that must be adhered to. This is supported by research (Hossain et al., 2020) which states that environmental awareness among owners and managers drives the adoption of green manufacturing practices, including waste management, energy efficiency, and the use of environmentally friendly materials.

The bootstrapping results indicate that green manufacturing has a significant negative effect on business sustainability. This relationship reflects short-term operational and capital trade-offs, where early-stage environmental investments temporarily increase overhead costs for resource-constrained SMEs. Rather than demonstrating that green practices undermine performance, the result highlights that formal green technologies may impose financial friction when implemented without adequate institutional support. This suggests that the implementation of green manufacturing among food and beverage SMEs in Bangkalan has not yet met business capacity, such as due to limitations in available resources. These results contradict previous research (Al-Hakimi et al., 2022) which indicates that green manufacturing can improve the operational performance of SMEs through energy efficiency, waste reduction, and lower production costs, which ultimately support profitability. The analysis results also indicate that green knowledge has a negative and significant effect on business sustainability. The negative coefficient suggests that increased environmental knowledge may reduce business sustainability. This situation may arise when green knowledge creates expectations and demands for environmentally friendly practices that are not commensurate with the capacity or readiness of SMEs to undertake environmental investments.

In contrast, green awareness and strategic orientation have been shown to have a positive and significant impact on business sustainability. These findings indicate that business owners' awareness of the importance of environmental protection and a clear strategic direction can have a tangible impact on business sustainability. Research by (Cheng et al., 2023) This reinforces the idea that environmental awareness plays a crucial role in ensuring sustainability. An understanding of various environmental issues drives the development of initiatives and strategies that are more focused on environmental conservation.

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Furthermore, a strategic orientation helps SME owners make more targeted business decisions, such as streamlining production processes for greater efficiency, avoiding waste, and maintaining good relationships with customers who are increasingly concerned about environmental issues. These conditions directly contribute to improved employee well-being, for example through a safer work environment, greater business stability, and the business's ability to provide more consistent income. This is consistent with research (Hanaysha & Al-Shaikh, 2024) which explains that a strategic orientation that supports sustainable practices can strengthen business relationships with stakeholders and deliver long-term social value.

3.6 Managerial Implication on Enhancing SME's Business Sustainability

The managerial implications of this study were developed using the POAC method (planning, organizing, actuating, controlling). Planning, organizing, actuating, and controlling (POAC) are the primary functions of the management process. These four functions are carried out sequentially and are interrelated to achieve organizational goals effectively and efficiently (Indrawati & Wahirah, 2025).

3.5.1 Planning

The research results indicate that the implementation of green manufacturing actually reduces the sustainability of SMEs, primarily due to limited capital and resources. Therefore, SME operators need to develop a realistic, phased plan for implementing environmentally friendly practices. Planning should prioritize enhancing green awareness and strategic orientation first, such as understanding the long-term benefits of environmentally friendly practices and aligning them with business objectives. SMEs are advised not to immediately adopt expensive green technologies, but rather to plan simple steps, such as reducing production waste or using more efficient materials, as well as developing environmental SOPs. With careful planning, eco-friendly practices will not become a financial burden that disrupt business sustainability.

3.5.2 Organizing

SMEs can adjust the division of tasks and roles to ensure that the implementation of eco-friendly practices runs effectively. Business owners must involve employees or family members working in the SMEs to collectively maintain production cleanliness, reduce raw material waste, and use energy efficiently. Good organization also means integrating eco-friendly practices into daily business activities, rather than treating them as additional tasks. With strong green awareness and a clear business strategic orientation, the implementation of green manufacturing can be carried out simply without adding an excessive workload.

3.5.3 Actuating

SME operators must implement green manufacturing practices in phases appropriate to the business's capabilities. Research findings indicate that the implementation of green manufacturing can have a positive impact on business sustainability. This is supported by research (Angelo et al., 2023) which found that moderate levels of green manufacturing investment have a positive effect on company sales, whereas excessive green manufacturing investment can undermine a company's strategic and competitive focus, resulting in negative effects on the company's economic performance. Therefore, implementation should focus on simple, low-cost actions, such as conserving electricity and water, reusing materials that are still usable, and reducing production

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waste. Business owners also need to set a direct example for employees so that environmental awareness (green awareness) is truly integrated into daily production activities.

3.5.4 Controlling

Monitoring is a crucial step in ensuring that eco-friendly practices do not harm the business. SMEs should conduct simple evaluations on a regular basis, such as by comparing production costs before and after implementing green manufacturing. If it is found that certain practices actually increase costs or hinder operations, SMEs need to make adjustments. Effective monitoring helps SMEs maintain a balance between environmental sustainability goals and business sustainability, ensuring that eco-friendly practices continue to support long-term business viability.

4. CONCLUSION

This study concludes that strategic orientation and environmental awareness are key drivers associated with business sustainability among F&B SMEs. SMEs have implemented several environmentally friendly practices, particularly regarding the use of safe raw materials and energy efficiency in production processes. However, the implementation of other practices, such as the use of recycled materials and more structured environmental management systems, has not yet been optimized. However, the statistical analysis provides no evidence supporting Green Manufacturing as a mediating mechanism, as none of the specific indirect paths achieved statistical significance. Policymakers should focus on lowering implementation costs and strengthening strategic readiness before urging SMEs to adopt formal green production systems

5. REFERENCES

- Afriani, F., Kurniyanto, I. R., Hasan, F., & Suprpti, I. (2025). Green Consumerism: Determinants Of Green Product Purchase Decisions At Kedai Pustaka Coffee Shop, Bangkalan Regency, Madura Island. *Bisnis Tani*, 11(1), 2025. <https://doi.org/10.35308/jbt>
- Alayon, C. L., Säfsen, K., & Johansson, G. (2022). Barriers and Enablers for the Adoption of Sustainable Manufacturing by Manufacturing SMEs. *Sustainability*, 14, 1–34. <https://doi.org/10.3390/su14042364>
- Al-Hakimi, M. A., Al-Swidi, A. K., Gelaidan, H. M., & Mohammed, A. (2022). The Influence of Green Manufacturing Practices on the Corporate Sustainable Performance of SMEs Under the Effect of Green Organizational Culture: A Moderated Mediation Analysis. *Journal of Cleaner Production*, 376. <https://doi.org/10.1016/j.jclepro.2022.134346>
- Alshammari, K. H., & Alshammari, A. F. (2023). Green Innovation and Its Effects on Innovation Climate and Environmental Sustainability : The Moderating Influence of Green Abilities and Strategies. *Sustainability*, 15, 1–21. <https://doi.org/10.3390/su152215898>
- Angelo, V. D., Cappa, F., & Peruffo, E. (2023). Green Manufacturing for Sustainable Development : The Positive Effects of Green Activities , Green Investments , and Non-green Products on Economic Performance. *Business Strategy and the Environment*, 32, 1900–1913. <https://doi.org/10.1002/bse.3226>
- Chazanah, I. N., & Nandiyanto, A. B. D. (2022). Literature of Waste Management (Sorting of Organic and Inorganic Waste) Through Digital Media in Community. *Internasional Journal of Research and Applied*, 2(1), 114–123. <https://doi.org/10.34010/injuratech.v2i1.6731>
- Cheng, C., Ahmad, S. F., Irshad, M., Alsanie, G., Khan, Y., Bani, A. Y. A., Ayassrah, A., & Aleemi, A. R. (2023). Impact of Green Process Innovation and Productivity on Sustainability : The

Penulis, tahun

- Moderating Role of Environmental Awareness. *Sustainability*, 15, 1–19.
<https://doi.org/10.3390/su151712945>
- Filho, W. L., Barbir, J., Özuyar, P. G., Nunez, E., Diaz-sarachaga, J. M., Guillaume, B., Anholon, R., Rampasso, I. S., Swart, J., Velazquez, L., & Ng, T. F. (2022). Assessing Provisions and Requirements for the Sustainable Production of Plastics : Towards Achieving SDG 12 from the Consumers ' Perspective. *Sustainability*, 14, 1–23. <https://doi.org/10.3390/su142416542>
- Firmansyah, D., Maharani, R., Nufal, S., & J, M. D. F. (2025). *Peran Perempuan dalam Meningkatkan Inovasi dan Kreativitas di Sektor UMKM*. 1, 258–263.
- Guzman, B. A., Monteiro, S., David, F., & Rodriguezs, F. M. S. (2023). The Waste Hierarchy at the Business Level: An International Outlook. *Mathematics*, 11, 4574.
<https://doi.org/10.3390/math11224574>
- Habib, M. A., Bao, Y., Nabi, N., Dulal, M., Asha, A. A., & Islam, M. (2021). Impact of strategic orientations on the implementation of green supply chain management practices and sustainable firm performance. *Sustainability (Switzerland)*, 13(1), 1–21.
<https://doi.org/10.3390/su13010340>
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., Black, W. C., & Anderson, R. E. (2018). *Multivariate Data Analysis*.
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Evaluation of the Structural Model. In: Partial Least Squares Structural Equation Modeling (PLS-SEM) Using R. Classroom Companion: Business. Springer, Cham. In *Structural Equation Modeling: A Multidisciplinary Journal* (Vol. 30, Number 1). <https://doi.org/10.1007/978-3-030-80519-7>
- Hanaysha, J. R., & Al-Shaikh, M. E. (2024). Impact of entrepreneurial orientation , marketing capability , and market orientation on business sustainability and corporate reputation. *Discover Sustainability*. <https://doi.org/10.1007/s43621-024-00401-4>
- Hossain, M. I., San, O. T., Ling, S. M., & Said, R. M. (2020). *The Role of Environmental Awareness and Green Technological Usage to Foster Sustainable Green Practices in Bangladeshi Manufacturing SMEs*. 29(7), 3115–3124.
- Indrawati, & Wahirah. (2025). POAC-based Principal Management Model in Planning the PAUD Unit Annual Program. *Journal of Social Science and Economics*, 2(1), 1–12.
<https://doi.org/10.70188/sng54m52>
- Judijanto, L., Hendra, J., & Islam, A. M. (2025). The Role of MSMEs in Realizing the Sustainable Development Goals (SDGs). *West Science Business and Management*, 3(01), 50–55.
<https://doi.org/10.58812/wsbm.v3i01.1746>
- Kurniyanto, I. R., Destiarni, R. P., Zulkhaeriyah, Z., Arifiyanti, N., Husna, H. M., Qoiroh, S. N., Amalia, L., Rahmania, H. K., & Saroh, N. M. (2025). SMEs are Literate in Rules: Intensive Assistance for the Legality of SMEs in Parseh Village, Socah District, Bangkalan Regency. *Jurnal ABDINUS: Jurnal Pengabdian Nusantara*, 9(3), 673–681.
<https://doi.org/10.29407/ja.v9i3.23816>
- Kusumawardani, S. D. A., Kurnani, T. B. A., Astari, A. J., & Sunardi, S. (2024). Readiness in implementing green industry standard for SMEs: Case of Indonesia's batik industry. *Heliyon*, 10(16). <https://doi.org/10.1016/j.heliyon.2024.e36045>
- Limanseto, H. (2025). *Pemerintah Dorong UMKM Naik Kelas, Tingkatkan Kontribusi terhadap Ekspor Indonesia*. Siaran Pers.

Penulis, tahun

- Lubaba, M., Hassan, S., Sultana, M., & Murtoza, S. (2025). Assessment of the Challenges to Implementing Green Manufacturing in the Food and Beverage Industry: an Emerging Economy Perspective. *Waste Management Bulletin*, 3(3).
<https://doi.org/10.1016/j.wmb.2025.100225>
- Malau, A. G., Ekananda, M., & Malau, A. G. (2025). The Impact of M SME ' s on Employment , Investment, and Income. *Economics Development Analysis Journal*, 14(2), 238–254.
<https://doi.org/10.15294/edaj.v14i2.24026>
- Martias, L. D. (2021). Statistika Deskriptif Sebagai Kumpulan Informasi. *Fihris: Jurnal Ilmu Perpustakaan Dan Informasi*, 16(1), 40. <https://doi.org/10.14421/fhrs.2021.161.40-59>
- Munawara, R. N., Rohmah, F., & Mashudi. (2025). Peran UMKM dalam Kontribusi Terhadap Pengangguran dan Kemiskinan: Studi Kasus Kabupaten Bangkalan. *Jurnal Ekonomi Dan Ilmu-Ilmu Sosial*, 3(2), 90–97. <https://doi.org/10.56630/paraduta.v3i2.951>
- Nautwima, J. P., Obrenovic, B., Asa, R. A., Johannes, H. N., & Abueva, N. (2025). *Determinants of technology adoption in small and medium-sized enterprises*. *Sustainable Future*. 10 (100919), 1-10 <https://doi.org/10.1016/j.sftr.2025.100919>
- Rabiu, M. K., & Erben, M. J. (2024). Reducing Single-use Plastic in Everyday Social Practices: Insights From a Living Lab Experiment. *Resources, Conservation & Recycling*, 200(June 2023), 107303. <https://doi.org/10.1016/j.resconrec.2023.107303>
- Sahoo, S., Kumar, A., & Upadhyay, A. (2023). How do green knowledge management and green technology innovation impact corporate environmental performance ? Understanding the role of green knowledge acquisition. *Business Strategy and the Environment*, 551–569.
<https://doi.org/10.1002/bse.3160>
- Sampepajung, D. C., Sarniati, Rifai, M., & Afifah, N. (2023). Analisis Carbon Footprint Pada Umkm Makanan Dan Minuman Melalui Integrasi Lean Dan Green Waste Production. *Jurnal Bisnis, Manajemen Dan Informatik (JBMI)*, 19(3), 223–255. <https://doi.org/10.26487/jbmi.v19i3.22302>
- Santosa, T. A. (2024). Kebijakan Pengendalian Sampah Plastik Terhadap Kelestarian Lingkungan Hidup Di Kota Semarang. *Journal of Politic and Government Studies*, 13(2), 505–524.
- Sonntag, R., Lewis, G. J., & Raszkowski, A. (2022). The Importance of Implementing SDGs by Small and Medium Size Enterprises : Evidence from Germany and Poland. *Sustainability*, 14, 1–14.
<https://doi.org/10.3390/su142416950>
- Utami, K. S., Lestari, D., & Maulana, I. (2024). Entrepreneurship Bisnis Manajemen Akuntansi Strategi green marketing : green awareness , eco label , dan eco brand pada perilaku pembelian. *Entrepreneurship Bisnis Manajemen Akuntansi (E-BISMA)*, 5(2), 407–420.
<https://doi.org/10.37631/ebisma.v5i2.1634>