Al-Kharaj: Journal of Islamic Economic and Business
Volume 8 (1), 2026
P-ISSN: 2686-262X; E-ISSN: 2685-9300

The Effect of Environmental Management Accounting and Business Strategy on the Sustainable Production Effectiveness of SMEs in Toraja

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Keywords:
Environmental Management Accounting (EMA); Business Strategy; Production; Sustainability; SMEs;

Abstract

Environmental Management Accounting (EMA) is an appropriate approach to support decision-making that considers both economic and environmental aspects simultaneously (Hutagalung & Lumban, 2024; Fitriani & Pandin, 2025; Setiawan & Ghozali, 2016). Increasing competition in the business world forces entrepreneurs to adopt effective strategies and continuously innovate their products to remain competitive and meet customer needs (Kotler & Keller, 2016). Sustainable production effectiveness is measured using indicators such as resource use efficiency, regulatory compliance, waste reduction, and customer satisfaction. The study employed a quantitative approach. Data were collected through the distribution of questionnaires to culinary and craft SMEs in Toraja. Data analysis techniques included validity and reliability tests, as well as linear regression analysis to determine the significance of the influence of the independent variables (EMA and business strategy) on the dependent variable (sustainable production). The results of the study indicate that both EMA and business strategy significantly affect sustainable production in SMEs in Toraja.

INTRODUCTION

Sustainability issues have become a global concern in recent years, not only for large corporations but also for SMEs. Various policies have been implemented to promote sustainability among organizations and communities, including environmentally conscious economic plans in Indonesia (Muhyiddin & Nugroho, 2021). In this context, Environmental Management Accounting (EMA) is considered an appropriate approach to support decision-making that simultaneously considers economic and environmental aspects.

In Indonesia, SMEs play a significant role in the economy, contributing 61.9% to GDP and absorbing 97% of the workforce in 2022 (Sampurno et al., 2021). Based on a recap of SME business scales as of December 31, 2023, in North Toraja Regency, there are 19,194 businesses (Diskominfo, 2024). The SME sector is a strategic component of the national economy, including in the Toraja region. With growing awareness of sustainability issues, local SMEs have begun to adopt environmentally friendly practices, such as using local raw materials, reducing production waste, and managing organic waste.

However, the implementation of EMA is still suboptimal, particularly in the recording, measurement, and reporting of environmental costs, which are essential for managerial decision-making. This information is crucial to help SMEs make more efficient production decisions, save resources, and reduce negative environmental impacts (Hanifah & Budiarto, 2024; Khalid, 2023). Several scholars argue that EMA should go beyond merely measuring and reporting environmental impacts and should also include strategies to mitigate these impacts (Burritt et al., 2019b; Giang et al., 2020a; Liu & Bai, 2022; Maretha, 2024; Putra et al., 2023; Mukwarami, 2023; Sulistiyana & Trihastuti, 2025; Tanjung & Lestari, 2025).

In addition to EMA, an appropriate business strategy is also a crucial factor in supporting the sustainable production effectiveness of SMEs. Business strategies that focus on resource efficiency, environmentally friendly innovation, and sustainability-based product differentiation can provide competitive advantages while meeting the demands of a market increasingly concerned

with environmental aspects (Huang & Li, 2022). Intense competition in the business world forces entrepreneurs to adopt effective strategies or innovate products to compete with other competitors in providing high-quality products that meet customer needs (Tjiptono, 2020). Another challenge arises from growing environmental awareness amid increasingly fierce business competition.

Sustainable production has become a primary goal in implementing environmental accounting. This includes energy efficiency, waste reduction, the use of environmentally friendly materials, and customer satisfaction with responsible business practices. However, in practice, many SMEs face challenges in implementing environmental accounting systems, such as limited human resources, lack of training, and low awareness of its benefits.

Previous studies have focused on environmental disclosure and performance in large companies, as well as the concepts of sustainability accounting and reporting (maechler, 2022; asiaei et al., 2022; susanto & meiryani, 2019; nwandu et al., 2021). However, research specifically examining the implementation of environmental accounting in the creative economy sector, particularly the behavioral intentions of sme owners in indonesia, remains limited. Considering this phenomenon, it is important to investigate the extent to which the implementation of environmental management accounting influences the sustainable production effectiveness of environmentally conscious smes, especially in tana toraja, which has significant potential for developing local culture- and nature-based economic activities.

METHODS

This study employs a quantitative approach through survey methods and statistical analysis. The indicators for each variable are as follows:

1. Environmental Management Accounting (EMA): EMA is a comprehensive approach in managerial accounting that focuses on managing costs associated with environmental issues and raw material waste (Sari & Gantino, 2022). **Indicators:** Prevention costs, detection costs, internal failure costs, external failure costs, and reporting and budgeting.
2. Business Strategy**:** A means to achieve long-term objectives. Companies need to strive for sustainable competitive advantage by continuously adapting to external and internal changes, including skills, capabilities, and available resources (Firmansyah et al., 2023). **Indicators:** Green Differentiation Strategy, Environmentally Friendly Cost Strategy, Sustainable Innovation, Commitment to Local & Cultural Values (Latifah & Soewarno, 2024).

Sustainable Production Effectiveness: Sustainable production effectiveness refers to the level of achievement in optimal production outcomes while considering cost efficiency, waste management, and compliance with environmental regulations, without reducing the product's competitiveness in the market (Ismail, 2022). **Indicators:** Resource use efficiency, regulatory compliance, waste reduction, and customer satisfaction (Ismail & Wahyuni, 2022).

RESULTS AND DISCUSSION

Respondent Characteristics

This study focuses on manufacturing SMEs in the food and beverage sector, specifically restaurants that have their own production kitchens using raw ingredients, carry out daily production processes, manage food waste, used cooking oil, water, and electricity/gas consumption, and make regular bulk purchases of raw materials in Rantepao District. The number

of SMEs registered with the local government of North Toraja Regency is 590. The sample was selected using Slovin's formula.

$$n = \frac{N}{1+N\,e\,2} = \frac{590}{1+590\ (0,1)\ 2} = 86$$

Table 1
Respondent Characteristics

Characteristic	Total	Percentage
Gender		
male	38	44%
female	48	56%
Total	86	100%
Income(Month)		
< Rp 5.000.000	6	7%
Rp 5.000.000 – 10.000.000	30	35%
Rp 10.000.000 -20.000.000	38	45%
>Rp 20.000.000	12	14%
Total	86	100%
Length of Business Operation		
<5 Tahun	33	38%
5-10 Tahun	42	49%
>10 Tahun	11	13%
Total	86	100%

Data Validity Test

Table 2
Data Validity Test

Variable	Item	R-observed	R-table	Notes
X1	X1.1	0,655	0,2120	Valid
	X1.2	0,758	0,2120	Valid
	X1.3	0,783	0,2120	Valid
	X1.4	0,750	0,2120	Valid
	X1.5	0,771	0,2120	Valid
	X1.6	0,785	0,2120	Valid
	X1.7	0,654	0,2120	Valid
	X1.8	0,662	0,2120	Valid
	X1.9	0,638	0,2120	Valid
X2	X2.1	0,595	0,2120	Valid
	X2.2	0,737	0,2120	Valid
	X2.3	0,666	0,2120	Valid
	X2.4	0,565	0,2120	Valid
	X2.5	0,724	0,2120	Valid
	X2.6	0,793	0,2120	Valid
	X2.7	0,696	0,2120	Valid
	X2.8	0,717	0,2120	Valid
	X2.9	0,711	0,2120	Valid
Y	Y.1	0,465	0,2120	Valid
	Y.2	0,578	0,2120	Valid
	Y.3	0,750	0,2120	Valid
	Y.4	0,591	0,2120	Valid
	Y.5	0,586	0,2120	Valid
	Y.6	0,770	0,2120	Valid
	Y.7	0,764	0,2120	Valid

Y.8	0,686	0,2120	Valid
Y.9	0,660	0,2120	Valid
Y.10	0,799	0,2120	Valid

Based on the tests above, it is shown that each statement item in the variables X1, X2, and Y has a calculated r (r-observed) value greater than the critical r (r-table) of 0.2120. Therefore, all statement items are considered valid.

Reliability Test

Table 3
Realibility Test

Variable	Reliability Threshold	Cronbach's Alpha	Notes
X1	0,60	0,822	Reliabel
X2	0,60	0,858	Reliabel
Y	0,60	0,856	Reliabel

Based on the data processing results in Table 3, it is shown that the Cronbach's Alpha values for each variable are greater than 0.60. The Environmental Management Accounting (EMA) variable (X1) has a value of 0.822, the Business Strategy variable (X2) has a value of 0.858, and Sustainable Production Effectiveness (Y) has a value of 0.856. Therefore, the measurement instrument/questionnaire used to assess these three variables in this study is considered reliable.

Significance Test

Partial Test (t-test)

Table 4
Partial Test

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.478	2.809		2.662	.009
	X1	.474	.115	.438	4.111	.000
	X2	.308	.105	.313	2.942	.004

a. Dependent Variable: Y

The partial test (t-test) was conducted to test hypotheses H1, H2, and H3. The decision criteria for the t-test are as follows:

- If sig < 0.05 and t-count > t-table, the hypothesis is accepted.
- If sig > 0.05 and t-count < t-table, the hypothesis is rejected.

Based on the data processing results above, the partial test results are as follows: The significance level used was 5% or 0.05, and the t-table value was calculated as follows:
ttable:df=n−kt_{\text{table}}: df = n - kttable:df=n−k
Where:

- n = number of respondents (86)
- k = number of variables (3)

ttable=86−3=83t_{\text{table}} = 86 - 3 = 83ttable=86−3=83
Based on the degrees of freedom (df), the t-table value is 1.663. The decision regarding the hypotheses is as follows:

1. The Environmental Management Accounting (EMA) variable (X1) has a significance value of 0.000 < 0.05 and a t-count of 4.111 > t-table 1.663; therefore, the hypothesis is accepted.

This indicates that, partially, the EMA variable has a significant effect on the Sustainable Production Effectiveness of SMEs in Toraja.

2. The Business Strategy variable (X2) has a significance value of 0.004 < 0.05 and a t-count of 2.942 > t-table 1.663; therefore, the hypothesis is accepted. This indicates that the Business Strategy variable has a significant effect on the Sustainable Production Effectiveness of SMEs in Toraja.

F-Test for Simultaneous Significance

Table 5
F-Test

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1779.137	2	889.568	36.982	.000[b]
	Residual	1996.503	83	24.054		
	Total	3775.640	85			

a. Dependent Variable: Y

Based on the test results in the table above, the calculated F-value (F-count) is 36.982. The F-table value can be obtained by determining df1 and df2:

df 1 = k-1
df 2 = n-k
a = 5% atau 0,05

Where:

- k = number of variables
- n = number of respondents
- α = significance level (5% or 0.05)

Thus:

df 1 = k-1 = 3-1 = 2
df 2 = n-k = 86- 3 = 83
Maka F_{tabel} =3,11

The F-table value is 3.11. The results show that the significance value is 0.000 < 0.05, and F-count 36.982 > F-table 3.11. This indicates that all independent variables, namely EMA and Business Strategy, simultaneously have a significant effect on the dependent variable, Sustainable Production Effectiveness, in SMEs in Toraja.

Coefficient of Determination (R^2)

Table 6
Results of the Coefficient of Determination (R^2) Tes

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.686[a]	.471	.458	4.905

a. Predictors: (Constant), X2, X1

In Table 6, the R Square (coefficient of determination) value is 0.471, which means that the influence of Environmental Management Accounting (EMA) and Business Strategy on Sustainable Production Effectiveness is 0.471, equivalent to 47.1%, while the remaining 52.9% is affected by other factors not examined in this study. The R value of 0.6865 also indicates a fairly strong relationship between the independent variables and the dependent variable.

DISCUSSION

The Effect of Environmental Management Accounting (EMA) on Sustainable Production Effectiveness in SMEs

Environmental Management Accounting (EMA) has a positive effect on sustainable production effectiveness. This indicates that SMEs that consistently identify, measure, and report environmental costs are able to optimize resource utilization and minimize waste during the production process. Moreover, these findings suggest that SMEs implementing EMA tend to be more efficient, cost-effective, and environmentally friendly (Wijayanti et al., 2021).

The Effect of Business Strategy on Sustainable Production Effectiveness

Business strategy has a positive effect on sustainable production effectiveness. This is because business strategy serves as the direction, goal, and approach for SMEs to achieve a competitive advantage. A clear business strategy can enhance the ability of SMEs to produce efficiently, consistently, and in an environmentally friendly manner. One of the indicators of business strategy is the differentiation strategy, where SMEs that implement it can more easily attract customers, maintain profit margins, increase the added value of their products, and reduce price pressures.

Environmental Management Accounting (EMA) and Business Strategy Simultaneously Affect Sustainable Production Effectiveness in SMEs

The results of the study indicate that EMA and business strategy simultaneously affect sustainable production effectiveness. This means that the combination of environmental cost information and strategic business direction serves as a key factor in enhancing production effectiveness. EMA provides relevant data, while business strategy provides guidance, allowing both variables to create an efficient and sustainable production mechanism.

CONCLUSION

Based on data processing from 86 SME respondents in Tallunglipu District, it can be concluded that the implementation of environmental accounting practices, such as identifying, measuring, and controlling environmental costs, helps SMEs optimize resource utilization, reduce waste, and improve production process efficiency. Thus, EMA plays an important role in supporting the creation of an environmentally friendly and sustainable production system. SMEs with a high level of innovation experience faster processing times, more efficient use of raw materials, lower waste levels, and more stable product quality. This study also demonstrates that the combination of EMA implementation and well-planned business strategies has a stronger impact on the success of sustainable production. The integration of both encourages SMEs not only to focus on economic profits but also to consider environmental and social aspects in a balanced manner.

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