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Sustainability Management Accounting in Achieving Sustainable Development Goals: The Role of Performance Auditing in the Manufacturing Sector

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Abstract: This study aims to examine the implementation of Sustainable Development Goals (SDGs) in the manufacturing sector in Indonesia, one of the largest contributors of carbon emissions. This sector needs to implement sustainability as outlined in SDG 9: Sustainable Industrialization and Innovation, and SDG 12: Sustainable Consumption and Production Patterns. However, developing countries often experience difficulties in promoting the implementation of SDGs due to insufficient maturity in their manufacturing sector. This research empirically examines the relationship between Sustainability Management Accounting (SMA) and Environmental Management Systems (EMS) to determine whether these two variables can improve Organizational Performance (OP) in the Indonesian manufacturing sector. A quantitative method with data collection using survey methods through questionnaires was employed. In this study, 325 respondents were sampled and Structural Equation Modelling (SEM) analysis was used to examine the data. The study's findings reveal a significant and positive link between SMA and EMS, as well as between these two variables and OP. The findings indicate that EMS plays a mediating role in the relationship between SMA and OP in the Indonesian manufacturing sector. This research highlights the importance of SMA and EMS as tools for promoting SDGs in the manufacturing industry in developing countries.

Keywords: sustainable accounting management; sustainable development goals; environmental management systems; organizational performance; manufacturing companies

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1. Introduction

The manufacturing industry plays a crucial role in driving Indonesia's economic growth as it makes a major contribution to increasing export earnings and wider employment opportunities. The manufacturing sector provided employment opportunities to 1.2 million individuals in 2021, raising the total number of workers to 18.7 million. This indicates a growth of approximately 7% in comparison to the 2020 workforce of 17.48 million [1]. The manufacturing industry has been steadily boosting Indonesia's Gross Domestic Product (GDP) each year, with the industrial sector remaining the top contributor to the national GDP since 2010. However, the manufacturing industry can also cause environmental problems, such as excessive waste, exploitation of natural resources, and excessive use of energy, if not regulated properly. Therefore, it is very important to implement sustainability projects in the manufacturing sector to address the environmental problems that may be caused by the industry. However, as a developing country, Indonesia often experiences difficulties in promoting sustainable implementation because it has not yet attained sufficient maturity. Developing countries require more time and effort to implement sustainable measures compared to developed countries that have reached maturity in economic and social terms [2–4]. Therefore, greater efforts are needed to accelerate the process of change towards sustainability in developing countries such as Indonesia. Apart from that, in the context of the manufacturing industry in developing countries, companies tend not to place the focus on the use of Sustainability Management Accounting (SMA) [5,6].

There are some problems in the implementation of sustainable practices in management accounting in the manufacturing sector [5,7–9]. Furthermore, Lieder and Rashid [10] stated that manufacturing companies' ability to perform their industrial activity in a sustainable manner and maintain a competitive edge is impacted by contingent risks. Likewise, Indonesia's manufacturing sector has trouble efficiently applying SMA [11–14]. More specifically, Burritt et al. [11] stated that incremental path-specific changes are vital for complex sustainability in the manufacturing industry in Indonesia, and diverse environmental management accounting tools foster cleaner practices, rejecting material flow cost accounting alone. Limited resources, inadequate government policies, and lack of company awareness and commitment to implementing sustainable practices are the main factors causing difficulties in implementing SMA in the manufacturing sector [15,16]. The manufacturing sector relies heavily on efficient sustainability practices to ensure the long-term survival of companies [17–19]. SMA is becoming an important tool for companies in managing resources and minimizing negative impacts on the environment [6]. Applying SMA can assist companies in improving their Organizational Performance (OP) in terms of operational efficiency, cost savings, and improving the company's image in the eyes of consumers [20,21]. By implementing efficient sustainability practices, companies can increase the efficiency of resource use and reduce production waste, thereby saving production costs and increasing profitability [22].

Rounaghi [23] found that SMA can help organizations identify environmental risks and opportunities, as well as measure the environmental impact of their operations. Asiaei et al. [24] found that implementing SMA practices helped the company reduce its environmental impact by identifying areas for improvement and setting targets for reducing resource consumption. Fuzi et al. [3] found that SMA can have a positive impact on the environmental performance of manufacturing firms. Burritt et al. [11] and Sheng et al. [25] found that SMA can help organizations identify the environmental impact of their supply chain and develop strategies to reduce it. Ikram et al. [26], Purwanto [27], and Daddi et al. [28] explain that an Environmental Management System (EMS) is a framework designed to help organizations monitor, assess, and enhance their environmental practices. This suggests that, by implementing an EMS, companies can identify, measure, and monitor the environmental impacts of their activities, as well as develop strategies to reduce these impacts. Phan and Baird [29], Voinea et al. [30], and Ikram et al. [26] stated that EMS can assist organizations in increasing the efficiency of resource use, reducing waste and emissions, and improving compliance with environmental regulations. According to Phan et al. [31], the EMS provides a direction and framework for environmental management in the manufacturing sector. Lee et al. [32] suggests that more companies in Indonesia implement EMS to improve OP.

In terms of Sustainable Development Goals (SDGs), the implementation of sustainability practices by manufacturing companies, which are one of the largest producers of global greenhouse gas emissions, is directly related to SDG 12 [33], which aims to ensure sustainable consumption and production patterns [34]. Manufacturing companies that embrace sustainable practices are considered socially and environmentally responsible, leading to increased consumer appeal and public trust [35]. Therefore, it is important for manufacturing companies to adopt SMA practices and EMSs to support SDGs and encourage corporate, social, and environmental responsibility to achieve the SDGs [36–39], especially in areas such as climate action, responsible consumption and production, and sustainable cities and communities. In this context, the objectives of this study are to empirically examine the effect of SMA on OP by using EMSs as a mediating variable in the Indonesian manufacturing sector, which is an important stakeholder in Sustainable Development Goals. The theoretical contribution of this research is significant, as it provides empirical evidence regarding the implementation of sustainability and the use of SMA in the manufacturing sector in developing countries such as Indonesia. As demonstrated by Burritt et al. [11], the use of EMS in developing countries such as Indonesia has been largely neglected by researchers and companies, as most technical and conceptual developments have been focused on Western, industrialized nations, and there has been little research into how EMS tools are adopted within organizations over time. Therefore, this study contributes to bridging the knowledge gap in the literature regarding the relationship between EMSs, SMA, and OP in developing countries. The findings of this study shed light on the importance of implementing sustainable development goals and the role of EMSs in improving OP and SMA. The study's results provide valuable insights into the factors that contribute to the adoption and implementation of sustainability in the manufacturing sector in developing countries, which can be useful for policymakers, managers, and industry practitioners. The study also contributes to bridging the knowledge gap in the literature regarding the relationship between EMSs, SMA, and OP in developing countries.

2. Theoretical Framework and Hypothesis

Zvezdov, and Schaltegger [40] defined Sustainability Management Accounting (SMA) as the evaluation, interpretation, and communication of a corporation's social and environmental effects. It encompasses the actions that have a significant influence on the economic, environmental, and societal performance of a business. Previous studies suggest that SMA has a significant impact on EMS. According to Al-Darrab et al. [41], the implementation of safety, quality, and EMSs in Saudi Arabian industries is positively affected by the use of SMA. Johnstone [42] indicate that the implementation of SMA can be beneficial for achieving environmental objectives and goals. It is suggested that EMSs provide methods, such as evaluating environmental activities, to help organizations improve sustainability management. Massoud et al. [43] find that the perceptions of EMSs in the Mexican manufacturing sector are linked to the adoption of SMA practices. Hariz and Bahmed [44] report that the assessment of EMS performance in Algerian companies, certified ISO 14001, is influenced by the use of SMA. Additionally, de Oliveira Neves et al. [45] conclude that the analysis of EMS based on ISO 14001 in the North American continent is facilitated by SMA. These findings suggest that SMA plays a critical role in enabling organizations to effectively manage their environmental impacts and achieve EMS objectives. By integrating SMA and EMSs, the manufacturing industry can contribute to the achievement of sustainable development, environmentally responsible policies, and innovative solutions [26]. This suggests that the manufacturing industry could benefit from SMA and EMSs to manage sustainability improvements effectively. Furthermore, the findings from Asiaei et al. [24] and Sheng et al. [25] highlight the need for organizations to adopt both practices and collaborate with stakeholders to address sustainability challenges. Therefore, the integration of SMA can have a significant impact on EMS by helping organizations identify environmental risks and opportunities, measure their environmental impact, and develop strategies for improving environmental performance [3,46]. Thus, the following hypothesis is proposed:

H1. *Sustainability Management Accounting has a significant effect on Environmental Accounting Systems.*

Abele et al. [47] investigated the effects of SMA and OP on Indonesian manufacturing companies and concluded that adopting SMA is very important for organizations that wish to improve their performance and achieve greater success by internalizing SDGs in organizational targets, because there is a positive correlation between SMA and OP. In addition, Beitzen-Heineke et al. [48] found that SMA can address environmental issues effectively and promote OP and financial results in the industry. SMA has significant implications for improving OP, reducing environmental impact, and improving financial performance in the industry. Sahoo [49] conducted a recent study in China and discovered that applying SMA can have a number of advantages, such as improved reputation and competitiveness, optimal resource use, increased productivity, and increased profitability, which ultimately improves OP. Based on the available literature, it is proposed that SMA can assist organizations in identifying and improving OP metrics. Thus, the second hypothesis in this study is as follows:

H2. *Sustainability Management Accounting has a significant effect on organizational performance.*

Rounaghi [23] refers to Environmental Accounting Systems (EMS) as a series of tasks that enhance the capabilities of accounting systems to recognize, document, and communicate the impacts of environmental damage and pollution. It relies on integrating the environment as a form of capital and factoring in environmental expenses as a legitimate type of cost when conducting financial and computational procedures. EMSs have also been widely adopted to manage environmental issues and improve environmental performance. Ikram et al. [26] showed that the adoption of an EMS can improve OP. Fuzi et al. [3] found that there is a significant correlation between variables in the industrial sector. A significant association between EMS and OP was revealed by Herghiligiu et al. [50], who observed a similar pattern. Herghiligiu et al. [51] identified factors that determine the quality of EMS implementation in Romanian organizations and found that adopting an EMS will help organizations operate better. Zobel and Malmgren [52] found that EMS approach improved industrial energy efficiency. Ullah [53] studied the adoption of EMS in Malaysia's manufacturing organizations. According to Fuzi et al. [3], the application of EMSs has improved OP in the manufacturing sector. Therefore, the following hypothesis is proposed:

H3. *Environmental Accounting System has a significant effect on organizational performance.*

Johnstone [42] stated that the adoption of SMA practices can enhance organizational performance by improving the effectiveness and efficiency of environmental management practices and optimizing the use of resources. Moreover, studies (e.g., [3,24,54]) have shown that EMS can play a critical role in facilitating the integration of SMA practices into the organizational decision-making process and provide a framework for measuring, monitoring, and reporting sustainability performance. Thus, EMS can act as a mediator for the relationship between SMA and OP. Various studies have investigated the mediating effect of EMS on the relationship between SMA and OP. Asiaei et al. [24] utilized survey data obtained from publicly listed companies in Iran and discovered that environmental management accounting is able to mediate the firm's sustainability green capitals with environmental performance. Solovida and Latan's [5] study in Indonesia found that the implementation of an EMS leads to better evaluation and management of sustainability, which ultimately leads to improved OP. More specifically, Solovida and Latan [5] found a significant positive relationship between SMA, EMS, and OP. Chaudhry and Amir [55] and Jiang et al. [56] revealed that EMS plays a mediating role in the relationship between SMA and environmental performance, which in turn positively influences OP. Jell-Ojobor and Raha [57] found a positive relationship between EMS and OP, and they also pointed out that environmental performance mediates this relationship. The study conducted by Fuzi et al. [3] indicated that the correlation between organizational performance and SMA is moderated by environmental management. Additionally, there is an indirect association between SMA and OP ($\beta = 0.271$, $p < 0.05$), which is mediated by the implementation of an EMS. These studies provide evidence for the importance of implementing an EMS in improving OP. After examining the findings from previous studies, the following proposition is suggested as a potential hypothesis:

H4. *Environmental Accounting Systems are able to mediate the effect of sustainability management accounting on organizational performance.*

This study examines the relationships between EMSs, OP, and SMA variables in order to better comprehend the hypotheses presented above. Therefore, the presentation of the framework in this study can be seen in Figure 1 below:

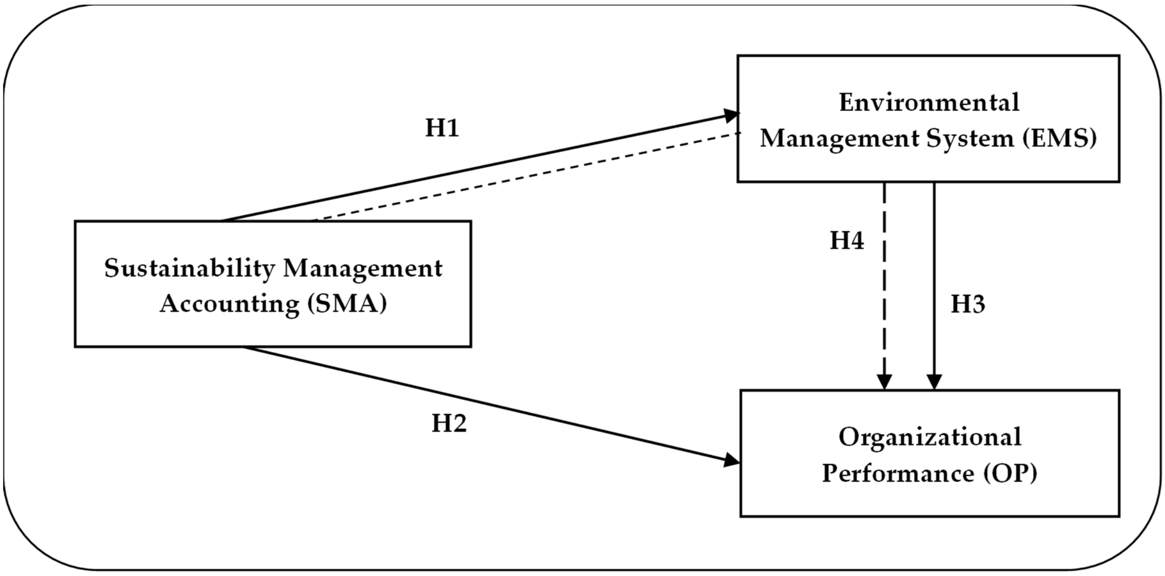

Figure 1. Research Framework.

3. Method

This study focuses on the manufacturing sector and uses a sample of Indonesian companies sourced from the Indonesia Stock Exchange in October to December 2022. IDX-listed manufacturing companies are categorized into different sectors which include Basic Industry and Chemical Sector, Consumer Goods Industry Sector, and Miscellaneous Industry Sector. In order to gather information about SMA, EMSs, and OP, researchers interviewed a specific sample of people in top management roles, including managing directors, quality control managers, manufacturing managers, and accountants. Environmental expenses, environmental regulations, environmental safety, management commitment, and customer focus are the five dimensions used to evaluate SMA by adopting the model and measurements from Fuzi et al. [3]. These five dimensions each consist of 25 different items that have been taken from Al-Mawali et al. [58]. The four categories and 20 specific actions that make up Environmental Accounting System (EMS) are drawn from Ann et al. [59] and cover planning, implementation and management, auditing and evaluation, and remedial measures. Organizational Performance (OP) consists of two aspects, namely financial performance and operational performance, requiring a total of 10 measurements that are adapted from Sari et al. [60].

This study employed a quantitative methodology. The manufacturing organizations that participated in the study were obtained using online survey tools, e-mail, and telephone calls, and the data were collected using a survey method. The survey was conducted to collect the perspectives of Indonesian producers, consisting of a total of 55 questions. Questionnaires were distributed to respondents in assessing the opinions of respondents with a Likert scale of 1 to 7, where 1 means strongly disagree and 7 means strongly agree. After the six-month period, a total of 344 surveys were collected. However, upon initial inspection, 19 anomalies were identified in the data set, related to various statistical assumptions such as assumptions of multivariate, normality, linearity, homoscedasticity, and multicollinearity. Finally, 325 questionnaires that were deemed to be trustworthy were examined for this investigation. Structural Equation Modeling (SEM) analysis was used in this study's data analysis.

According to Verma and Verma [61], a sample size of 335 is suitable where it is generally recommended to have a sample size of 200–400 participants to determine an appropriate sample size. Using Structural Equation Modeling (SEM) in testing research hypotheses, a reasonable sample size ranges from 100 to 500 participants. This study suggests utilizing a covariance-based structural equation model (CB-SEM) to examine the relationship between endogenous and exogenous variables in order to test the fundamental hypotheses. CB-SEM is a popular analytical technique due to its ability to evaluate direct and indirect effects, as well as estimate sample parameters simultaneously and improve model representation by reducing measurement error through confirmatory factor analysis (CFA). Therefore, the statistical analysis technique used in this study is CB-SEM. In order to ensure the reliability and validity of the survey, steps were taken during the analysis of the research included in this study, including evaluating construct reliability, face validity, and content validity, to make sure the survey items accurately captured the variables explored.

4. Research Results

Through the Exploratory Factor Analysis (EFA) test, this study undertakes a preliminary evaluation of three distinct sets of variables, namely the aspects of SMA, EMSs, and OP. In this analytical test, the KMO measure was used to ensure the suitability of the data and the intercorrelation between items was assessed using the Bartlett roundness test (with a significant value being < 0.001). In the next step, PUS uses the total variance described to determine the number of items with an Eigenvalue greater than one. Then, the component matrix undergoes rotation to identify item factors that are loaded accordingly. The results of the Exploration Factor Analysis (EFA) test can be seen in Table 1 below:

Table 1. Exploration Factor Analysis Test (EFA).

Indicator	KMO Bartlett's Value	Total Variance Explained	Information
Sustainability Management Accounting (SMA)	0.869	65.60	Significant
Environmental Management System (EMS)	0.873	72.05	Significant
Organizational Performance (OP)	0.891	67.17	Significant

The Exploration Factor Analysis (EFA) test results (Table 1) reveal that the EFA test has a significant value for every indication. Then, three measures were put into place to lessen the possibility of distortion coming from the gathering of data in a single event, in order to mitigate the potential influence of a common method bias. First, the measurement items are modified by including items from various sources while maintaining the confidentiality of the respondents. Then, data were collected from the manufacturing CEO, who is known to have a high level of certification for quality system standards. Finally, all measuring items were used in an exploratory factor analysis to run Harman's single factor test. According to exploratory factor analysis accounting for less than 50% of the variation, the results of the common method bias test demonstrate that there is no joint method bias [62].

Additionally, a Confirmatory Factor Analysis (CFA) or Goodness of Fit test was conducted on the variable measurement model of SMA, EMSs, and OP to further ensure the accuracy and credibility of the data gathered for this study. This analysis test aims to assess the reliability and validity of the measurement model. These measures were used to evaluate the goodness of fit and obtain statistically robust results. The results of the CFA analysis test showed that the measurement model met the criteria for assessing construct validity and reliability, as evidenced by a positive fit index including RMSEA (0.062), χ^2/df (2.625), TLI (0.945), CFI (0.952), GFI (0.907), AGFI (0.879), and p-value (0.000), which all met the specified limits. As can be seen in Table 2 below, these findings suggest that the measurement model is appropriate for evaluating concept validity and reliability.

Table 2. Goodness of Fit.

Indices	Cut of Value	Result	Information
RMSEA	<0.08	0.072	Significant
χ^2/df	<3.00	2.578	Significant
TLI	>0.90	0.917	Significant
CFI	>0.90	0.904	Significant
GFI	>0.80	0.916	Significant
AGFI	>0.80	0.854	Significant
p-value	<0.001	0.000	Significant

Table 3 is to confirm construct validity, specifically focusing on convergent validity. This involves the analysis of item loading, composite reliability, and extracted mean variance (AVE) in the measurement model. Table 3 shows that the average value of evaluation (AVE), composite reliability score, and standard deviation of the loading factor for each construct are all above the limits of 0.70 and 0.50, as established by Hair et al. [63] and Samsudin et al. [64]. Table 3 below provides further information.

Table 3. Validity and Reliability Test.

Indicator		Std. Loading Factor	Critical Ratio (CR)	Average Variance Extracted (AVE)
Sustainability Management Accounting (SMA)				
Management Commitment	MAC1	0.710	0.897	0.654
	MAC2	0.857		
	MAC3	0.747		
	MAC4	0.768		
	MAC5	0.792		
Customer Focus	CUF1	0.767	0.902	0.731
	CUF2	0.859		
	CUF3	0.754		
	CUF4	0.810		
	CUF5	0.709		
Environmental Cost	ENC1	0.816	0.911	0.690
	ENC2	0.759		
	ENC3	0.726		
	ENC4	0.807		
	ENC5	0.770		
Environmental Regulation	ENR1	0.758	0.876	0.751
	ENR2	0.809		
	ENR3	0.719		
	ENR4	0.762		
	ENR5	0.755		

Table 3. *Cont.*

Indicator		Std. Loading Factor	Critical Ratio (CR)	Average Variance Extracted (AVE)
Environmental Safety	ENS1	0.736	0.988	0.756
	ENS2	0.865		
	ENS3	0.731		
	ENS4	0.781		
	ENS5	0.794		
Environmental Management System (EMS)				
Planning	PLN1	0.759	0.894	0.766
	PLN2	0.812		
	PLN3	0.722		
	PLN4	0.837		
	PLN5	0.769		
Implementation and Operation	IAO1	0.817	0.889	0.739
	IAO2	0.793		
	IAO3	0.753		
	IAO4	0.765		
	IAO5	0.764		
Auditing and Evaluation	AAE1	0.722	0.930	0.709
	AAE2	0.729		
	AAE3	0.734		
	AAE4	0.821		
	AAE5	0.815		
Checking and Correction Action	CCA1	0.748	0.897	0.709
	CCA2	0.815		
	CCA3	0.787		
	CCA4	0.811		
	CCA5	0.804		
Organizational Performance (OP)				
Financial Performance	FIP1	0.724	0.903	0.744
	FIP2	0.743		
	FIP3	0.768		
	FIP4	0.803		
	FIP5	0.789		
Operational Performance	OPP1	0.771	0.890	0.731
	OPP2	0.851		
	OPP3	0.719		
	OPP4	0.847		
	OPP5	0.796		

To determine if the independent factors have a meaningful impact on the dependent variable, a regression test of the relationship between the variables is used to test the hypothesis. Three hypotheses about the relationships between variables are examined in this study using regression analysis to examine the influence of SMA on EMSs, the influence of SMA on OP, and the influence of EMSs on OP.

The regression analysis results in Table 4 indicate that the first hypothesis, which asserts the SMA effects on EMS, achieves a significant value of 0.05. Thus, it can be concluded that the study's first hypothesis is empirically supported. The second hypothesis, which claims that SMA has a considerable impact on OP, achieves a significance value of 0.05, indicating that it is likewise acceptable. A significant value of 0.000 was obtained for the third hypothesis' claim that EMS affects OP. This *p*-value is still below the threshold that allows for the hypothesis to be accepted. Thus, this study's third hypothesis can therefore also be accepted. The experiment to ascertain if EMSs can act as a buffer between the indirect effects of SMA on OP is summarized in Table 5.

Table 4. Regression test.

Hypothesis			Unstd. Estimate	Std. Estimate	*p*-Value	Information
Environmental Management System	←	Sustainability Management Accounting	0.726	0.572	0.000	Significant
Organizational Performance	←	Sustainability Management Accounting	0.763	0.519	0.001	Significant
Organizational Performance	←	Environmental Management System	0.738	0.517	0.000	Significant

Table 5. Indirect Effect.

	Sustainability Management Accounting (SMA)	Environmental Management System (EMS)	Organizational Performance (OP)
Environmental Management System (EMS)	-	-	-
Organizational Performance (OP)	0.260	-	-

The results of the indirect effect test using EMS indicators, which function as a mediator in the relationship between SMA and OP, yield an indirect effect value of 0.260. The threshold value of >0.038 that is needed for the hypothesis to be accepted is already exceeded by this number. Thus, EMS might act in part as a mediator in this case. The relationship between SMA and OP is mediated by EMSs. Therefore, it can be concluded that the fourth hypothesis of this study, which postulates that EMSs may act as a mediator in the relationship between SMA and OP, is accepted.

The first hypothesis of the study is accepted based on the results of the first hypothesis, which are supported by a result of 0.529 and a significance level of $p = 0.005$. This indicates a high association between SMA and EMSs. Previous research also confirmed the direct influence of SMA on EMSs, in line with the research of de Oliveira Neves et al. [45] and Fuzi et al. [3], which emphasizes the close relationship between SMA and EMSs. Businesses can effectively enhance their SMA processes by using EMS as a framework. The statistics support the second hypothesis of this study, which states that there is a significant and positive effect of SMA on OP. This result is consistent with earlier studies, such as those by Zyznarska-Dworczak [65], who also discovered a link between SMA and OP. Russell et al. [66] also demonstrates the significance of the link between these variables.

The third hypothesis was also tested, and the results indicate a relationship between EMSs and OP that is statistically significant with a correlation of 0.167 and a *p*-value of 0.038, which is less than the threshold of 0.050. If the third hypothesis is correct, it means that EMS has a big part to play in how well the relationships with OP emerge. This result is in line with studies by Fuzi et al. [3] and Herghiligiu et al. [50], which found a substantial correlation between EMS and OP. As a result, it is advised that businesses in this sector think about putting an EMS in place to enhance OP. Additionally, the indirect impact test findings for the fourth hypothesis yielded a value of 0.260 (> 0.038). The association between SMA and OP can be somewhat mediated by EMS if the p value is less than 0.05. As a result, it is crucial to adopt EMSs and SMA to enhance OP [67]. Organizations, particularly those in the Indonesian manufacturing sector, might benefit from using an EMS as a standard operating procedure to enhance SMA and OP.

5. Conclusions

The study's finding showed a significant and positive effect of Sustainability Management Accounting on EMSs. There is also a significant and positive correlation between SMA and OP. Additionally, there is a significant and positive correlation between EMS and OP. Testing the mediating effect showed that EMS plays a role in mediating the relationship between SMA and OP.

As a managerial implication, businesses need to think about developing an EMS as a framework for improving SMA practices and OP in the context of Indonesia's manufacturing industry. Manufacturing businesses can increase operational productivity and efficiency while achieving sustainability goals as outlined in SDGs targets by integrating an EMS into daily operations. In a setting that is always changing, the industry may enhance their SMA by knowing these relationships. Additionally, the practical ramifications of this study offer helpful suggestions for companies in the manufacturing sector to embrace SMA and EMS, and enhance OP. In addition, policymakers can utilize the findings to control and execute how Indonesian producers are using sustainable management accounting.

The findings offer empirical evidence to strengthen the role of SMA that manufacturers can use as a reference for implementing cutting-edge methods that incorporate it to enhance the performance of EMS and OP. Theoretical implications of the study's findings suggest that the integration of SMA into organizational decision-making can contribute to better EMSs and overall OP. This supports the notion that sustainable development is no longer exclusively about environmental conservation, and more about the integration of social, environmental, and economic considerations into organizational decision-making. By implementing SMA, organizations can prioritize sustainable practices and better track their progress towards SDG targets.

This study also has a number of limitations, including the fact that, despite covering a wide range of industries, it only uses surveys and is only applicable to Indonesia's publicly-listed manufacturing industry. One limitation of this research is the potential for biased responses from participants due to social desirability bias, where individuals may answer questions in a way that portrays themselves or their company in a more positive light. Additionally, the sample size of respondents may not be representative of the entire manufacturing sector in Indonesia. The use of survey methods may also limit the depth of information obtained compared to other research methods such as case studies or interviews. Moreover, the research focuses only on the manufacturing sector and does not examine other industries contributing to carbon emissions and climate change in Indonesia. Finally, this study does not explore the potential barriers to implementing EMSs and SMA in the manufacturing sector in Indonesia.

A future research agenda for this topic could include a more in-depth investigation into the barriers to implementing sustainability practices in the manufacturing sector in Indonesia. This could involve interviews with company executives and stakeholders to gain a better understanding of the cultural, societal, and economic factors that may hinder the implementation of sustainability practices. Another possible future research direction could be to explore the relationship between SMA practices and supply chain management in the manufacturing sector in Indonesia. This could involve investigating the extent to which sustainability practices are integrated into the supply chain and the impact of such integration on OP. Additionally, future research could focus on examining the role of government policies and incentives in promoting sustainability practices in the manufacturing sector in Indonesia. Such research could help identify ways to overcome the lack of maturity and promote the implementation of sustainability practices in developing countries such as Indonesia.

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