MULTIDISCIPLINARY SCIENTIFIC RESEARCH
BJMSR VOL 9 NO 4 (2024) P-ISSN 2687-850X E-ISSN 2687-8518
Available online at https://www.cribfb.com
Journal homepage: https://www.cribfb.com/journal/index.php/BJMSR
Published by CRIBFB, USA

THE IMPACTS OF ENVIRONMENTAL MANAGEMENT ACCOUNTING SYSTEM (EMAS) ADOPTION PHASES ON SUSTAINABILITY PERFORMANCE: A SOCIAL ISSUE LIFE CYCLE THEORY APPROACH

Nirman Noor Afiqi Mat Yusoh [(a)] *Tuan Zainun Tuan Mat* [(b)1] *Azizah Abdullah* [(c)]

[(a)] *Senior Assistant Director, Department of Environment, Ministry of Natural Resources and Environmental Sustainability, Malaysia; E-mail: nirman@doe.gov.my*
[(b)] *Associate Professor, Fakulti Perakaunan, Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, Malaysia; E-mail: tuanz693@uitm.edu.my*
[(c)] *Fakulti Perakaunan, Universiti Teknologi MARA Shah Alam, Malaysia; E-mail: aziza588@uitm.edu.my*

ARTICLE INFO

Article History:

Received: 27th May 2024
Reviewed & Revised: 27th May to 30th August 2024
Accepted: 1st September 2024
Published: 11th September 2024

Keywords:

Environmental Management Accounting System (EMAS), Policy Phase, Learning Phase, Commitment Phase, Sustainability Performance

JEL Classification Codes:

G32, F65, L66, L25, M41

Peer-Review Model:

External peer review was done through double-blind method.

ABSTRACT

Environmental problems have emerged as a critical concern requiring proactive intervention from corporations. The accelerating pace of industrialization has exacerbated environmental degradation, highlighting the significant impact of business operations on the environment. Nevertheless, more than conventional management accounting systems are needed to address contemporary business operations' evolving demands, particularly concerning environmental issues. This study addresses these issues by examining the impacts of the Environmental Management Accounting System (EMAS) adoption phases on sustainability performance among publicly listed companies (PLCs) in Malaysia. This study employs the social issue life cycle theory to measure EMAS adoption phases and the triple bottom line for sustainability performance. This study uses survey data gathered from 205 PLCs in Malaysia, focusing on chief financial officers (CFOs), finance directors, finance managers, and project managers. Cluster and simple random sampling techniques were employed to obtain a representative sample. Analytical methods include analysis of variance, Tukey's post hoc test and ordinary least squares regression analysis. The findings reveal that most companies are in the learning phase of EMAS adoption. The study shows a significant negative impact of EMAS adoption during the policy phase on sustainability performance. Conversely, EMAS adoption has an insignificant positive impact on sustainability performance in the learning phase. However, the findings suggest that the commitment phase of EMAS adoption significantly and positively impacts improved sustainability performance. This study contributes to existing knowledge by emphasizing the need to enhance organizational awareness of EMAS adoption and facilitating more effective management of environmental issues to achieve superior sustainability performance.

INTRODUCTION

Current global economic activities have yielded adverse outcomes, including the depletion of natural resources and negative impacts on human health (Mengzhuo & Noordin, 2022). This situation has spurred a growing public awareness of sustainable development, leading to significant stakeholder demands for companies to adopt cleaner and safer environmental practices (Sandamini & Dissanayake, 2022). Businesses now bear accountability beyond their fundamental stakeholder responsibilities (Asa'd et al., 2024). Consequently, companies must continuously balance economic performance with social accountability and environmental security to uphold corporate sustainability in a highly competitive market.

As Malaysia progresses towards an industrialized economy, it faces substantial challenges in avoiding environmental issues. Malaysia grapples with several problems, such as biodiversity degradation, climate change, hazardous waste management, exploitation of natural resources, and pollution (Che Ku Kassim et al., 2022; Razak et al., 2020). Public listed companies (PLCs) typically consume significant amounts of resources such as energy, water, and non-durable items due to the nature of their business operations. The business sector in Malaysia is also a significant contributor to environmental pollution, particularly through the discharge of untreated or inadequately treated industrial effluents. The escalating deterioration of the environment, coupled with the increasing scarcity of natural resources, has created significant

[1]*Corresponding author: ORCID ID: 0000-0001-7319-0798*

https://doi.org/10.46281/bjmsr.v9i4.2245

To cite this article: Yusoh, N. N. A. M., Mat, T. Z. T., & Abdullah, A. (2024). THE IMPACTS OF ENVIRONMENTAL MANAGEMENT ACCOUNTING SYSTEM (EMAS) ADOPTION PHASES ON SUSTAINABILITY PERFORMANCE: A SOCIAL ISSUE LIFE CYCLE THEORY APPROACH. *Bangladesh Journal of Multidisciplinary Scientific Research*, *9*(4), 25-38. https://doi.org/10.46281/bjmsr.v9i4.2245

pressure on companies to integrate environmental management practices into their operational frameworks. This pressure is compounded by the growing concern of key stakeholders, including customers, suppliers, investors, non-governmental organizations (NGOs), and government agencies. These concerns have catalyzed a global demand for businesses to mitigate their negative environmental impacts.

Thus, companies must be intensely concerned about environmental issues and reassess their sustainability performance (Bresciani et al., 2023). In response to these heightened expectations, companies have been compelled to explore and adopt various environmental management strategies, elevating environmental sustainability to a central component of strategic management. The limitations of conventional management accounting systems, particularly their inability to furnish relevant information on environmental issues for managerial decision-making, have led to the emergence of a specialized field known as Environmental Management Accounting System (EMAS) (Rahmawati et al., 2024; Ferdous et al., 2019). EMAS is recognized as a new practice that effectively identifies and manages environmental costs (Hasan et al., 2024). Furthermore, EMAS is a critical tool that provides managers with essential information for planning, decision-making, and controlling environmental practices within organizations.

However, previous studies indicate that EMAS adoption needs to be stronger, particularly in developing countries (Gerged et al., 2024; Mokhtar et al., 2016). Despite the relevance of this emerging field, existing literature has yet to investigate the impact of EMAS on sustainability performance thoroughly. The evolving global business landscape has pressured Malaysian companies to enhance their organizational performance and accountability to stakeholders and the environment. Businesses must now balance economic, social and environmental considerations (Solovida & Latan, 2021). The integration of environmental factors into corporate decision-making processes is essential for fostering resource conservation and reducing pollution (Abdelhalim et al., 2023)

Consequently, this study aims to identify the phases of EMAS adoption through the lens of social issue life cycle theory. Additionally, it examines the impacts of these EMAS adoption phases on the sustainability performance of PLCs in Malaysia. Through this dual focus, the study contributes valuable insights into the dynamic interplay between EMAS adoption and sustainability performance, offering a nuanced perspective particularly relevant to the Malaysian corporate context. The study utilizes several analytical techniques, including Analysis of Variance (ANOVA), Tukey's post hoc test, and Ordinary Least Squares (OLS) regression analysis, to examine the impact of EMAS adoption phases (learning, policy, and commitment) on sustainability performance among PLCs in Malaysia. These analytical methods collectively enable a comprehensive evaluation of how each phase of EMAS adoption affects sustainability performance. The findings reveal that EMAS adoption during the policy phase significantly harms sustainability performance. In contrast, the learning phase (Faisal-E-Alam, 2024) shows a small, insignificant positive effect. However, the commitment phase of EMAS adoption significantly improves sustainability performance. This study contributes to understanding by demonstrating the varying impacts of EMAS adoption phases on sustainability performance, particularly in the context of PLCs in Malaysia. This insight can guide managers in strategically planning and implementing EMAS to align with their sustainability goals.

The remaining paper structure includes Section Two, which reviews the literature on the relationship between EMAS adoption phases and sustainability performance. Section Three details the study's methodology, including the sample selection and data analysis techniques. Results are presented in Section Four and the study's discussions and conclusions are provided in Section Five.

LITERATURE REVIEW

Environmental Management Accounting System (EMAS)

EMAS is a comprehensive corporate environmental management method designed to enhance organizations' sustainability performance and mitigate environmental impacts (Burritt et al., 2023). EMAS encompasses identifying, measuring, allocating, and integrating environmental costs within business operations (Schaltegger et al., 2022). Scholars argue that conventional management accounting systems fail to provide adequate information for managing environmental costs (Che et al. et al., 2022). Traditional systems often allocate environmental costs to general overhead accounts, resulting in potential environmental-related costs obscured within indirect costs (Doorasamy & Nyahuna, 2021).

The need for relevant environmental information can help corporate decision-makers make informed and rational decisions (Rahmawati et al., 2024; Mokhtar et al., 2016). Thus, EMAS is regarded as a practice that aligns corporate activities with environmental considerations (Zandi & Lee, 2019). EMAS delivers both Physical Environmental Management Accounting (PEMA) information, which includes data on energy, water, and material usage, and Monetary Environmental Management Accounting (MEMA) information, which covers environment-related costs, earnings, and savings (Hasan et al., 2024). Accurate information flow facilitates the transformation of business resources into optimal investments and decisions (Swalih et al., 2024; Burritt et al., 2019). This study defines EMAS as generating, analyzing and utilizing monetary and physical environment-related information to enhance sustainability performance.

EMAS Adoption among Malaysian Public Listed Companies

The adoption of the EMAS has significant potential to assist Malaysian industries in addressing environmental challenges (Razak et al., 2020). The perceived benefits of EMAS have motivated organizations to adopt this practice to enhance their competitive advantage (Swalih et al., 2024; Ariffin, 2020). Companies with superior sustainability performance can achieve long-term financial and social benefits and improve their decision-making capabilities (Abdelhalim et al., 2023). Additionally, EMAS aids companies in measuring environmental impacts and allocating costs related to income and savings derived from environmental activities (Indrani et al., 2020). Despite these benefits, the adoption of EMAS in Malaysia remains relatively low compared to other Asia-Pacific countries (Rasit et al., 2020; Razak et al., 2020). Previous studies on EMAS adoption in Malaysia have been limited in scope, particularly concerning the factors influencing adoption. This study

addresses the gap by exploring the phases of EMAS adoption and their impact on sustainability performance in a developing country.

Social Issue Life Cycle Theory

This theory posits that a company's reaction to social issues, including environmental impacts, is not a series of random changes but a constant effort to discover the most adequate solution to the problem. Prior research suggests that issues evolve through three distinct phases: from an "insignificance" stage, through an "increased concern" phase, to a final phase where a recognized solution is accessible (Zyglidopoulos, 2003). However, most studies have concentrated on EMAS adoption, neglecting to investigate the specific phases of EMAS adoption, namely policy, learning, and commitment (Mokhtar et al., 2014). Thus, the social issue life cycle theory presents a suitable framework for examining the impact of EMAS adoption phases on sustainability performance among PLCs in Malaysia. This study aims to fill existing gaps by determining whether the various phases of EMAS adoption negatively or positively impact sustainability performance.

Policy Phase

In the policy phase, environmental issues typically emerge as primary management concerns. Companies often need more formal strategies to address these issues, as immediate stakeholder expectations are not a pressing priority. Instead, management commonly issues a general statement or policy affirming the company's commitment (Mokhtar et al., 2014). This phase marks the beginning of organizational recognition of the issue's importance and the initiation of discussions to develop appropriate policies and strategies.

Learning Phase

In the learning phase, the company exhibits increased attentiveness to environmental matters. Consequently, a professional is often appointed to assist in developing the company's environmental strategy once awareness of environmental problems becomes more prominent (Mokhtar et al., 2014). However, environmental policy must still be integrated into the business's decision-making process (Zyglidopoulos, 2003). This suggests that companies address environmental issues primarily for legitimization purposes.

Commitment Phase

In the commitment phase, environmental matters become the responsibility of top management. Consequently, sustainability issues are integrated into business decision-making and performance appraisals (Mokhtar et al., 2014). Additional environmental reporting is implemented to inform stakeholders about the company's environmental performance. Companies adopt the EMAS extensively to manage environmental matters, as traditional management accounting systems are insufficient for providing comprehensive environmental information (Schaltegger et al., 2022; Burritt et al., 2019).

Elements of Sustainability Performance

The triple bottom line (TBL) concept can be applied regionally by communities to foster sustainable economic development (Solovida & Latan, 2021). TBL has become necessary for evaluating a company's economic, environmental, and social performance. Companies must consider the aspects of prosperity, the planet, and people to achieve sustainability. Adopting EMAS provides companies with a competitive advantage and enhances the value of corporate social responsibility (Swalih et al., 2024; Gunarathne et al., 2021). While many studies focus on the relationship between EMAS adoption and economic performance (Kong et al., 2022; Solovida & Latan, 2017), few investigate its impact on environmental and social performance. The TBL framework clarifies that an organization focusing solely on profit while neglecting people and the planet will not succeed in the long term.

Economic Performance

Economic performance can be defined as the change in the financial state of an organization resulting from the managerial decisions made by its key players (Pratiwi et al., 2020). Economic variables should address the bottom line and money flow, referring to the company's financial performance over a specific period and its ability to manage and control resources (Mengzhuo & Noordin, 2022). The primary goal of an organization is to create and maximize shareholder value (Deb et al., 2023). Thus, a company's success in capitalist industries hinges on its economic performance. Consequently, strategic planning initiatives and critical corporate decisions aim to maximize profits while decreasing costs and alleviating risks (Burritt et al., 2023; Solovida & Latan, 2021).

Environmental Performance

Environmental performance can be defined as achieving company impacts related to environmental issues (Deb et al., 2023; Christine et al., 2019). The essence of environmental performance is interpreted as the impact of a company's environmental activities (Bresciani et al., 2023; Latan et al., 2018). Environmental variables should quantify natural resources and indicate prospective influences on their sustainability. Furthermore, environmental practices have consistently been practical tools guiding organizations toward sustainability while fulfilling their environmental responsibilities (Asiaei et al., 2021; Mayndarto & Murwaningsari, 2021).

Social Performance

Social performance refers to the social dimensions of a community or region, including access to social resources, health and well-being and quality of life (Rasit et al., 2020). Companies increasingly embrace sustainability and focus on creating value for all stakeholders impacted by business decisions, including customers, employees, and community members (Stephan et al., 2016). Solovida and Latan (2021) stated that social performance has become critical for companies to survive and succeed. Progressive companies have faced criticism for issues related to people or working surroundings, underscoring that sustainability also embraces the social dimension.

EMAS Adoption in the Policy Phase and Sustainability Performance

In the policy phase, companies need a formal strategy to address the environmental matter, as meeting public expectations is insignificant (Zyglidopoulos, 2003). The management usually reacts to such matters by presenting a general statement or policy about the business's promise. Furthermore, there needs to be a systematic analysis of the problem, and more organizational action has emerged in response to the issue. Therefore, it is rational to assume that companies in the policy phase are unlikely to adopt EMAS as an environmental matter is a managerial concern (Mokhtar et al., 2014). The unavailability of information on environmental impacts resulting from the entity's activities will produce decisions that will later negatively affect the image and corporate sustainability (Baker et al., 2023; Fuzi et al., 2021). Latan et al. (2018) have established the role of EMAS adoption in providing the management with more accurate cost information and positively affecting the environmental performance of Indonesian companies. Based on the findings of these studies, the hypothesis is formulated as follows:

H_1: EMAS adoption in the policy phase has a significant impact on sustainability performance among PLCs in Malaysia.

- *H_{1a}: EMAS adoption in the policy phase has a significant impact on economic performance among PLCs in Malaysia.*
- *H_{1b}: EMAS adoption in the policy phase has a significant impact on environmental performance among PLCs in Malaysia.*
- *H_{1c}: EMAS adoption in the policy phase has a significant impact on social performance among PLCs in Malaysia.*

EMAS Adoption in the Learning Phase and Sustainability Performance

From the perspective of the social issue life cycle theory, companies in the learning phase moderately adopt EMAS. Furthermore, environmental professional members are commonly appointed to implement the environmental strategy (Mokhtar et al., 2014). Still, these environmental matters are yet to be incorporated exclusively into business decision-making, even though the awareness of environmental problems is accelerating. Research by Mokhtar et al. (2014) found that EMAS adoption is in the learning phase when most organizations have environmentally qualified employees to manage environmental issues arising from their business activities. Likewise, this information from an environmental perspective is likely helpful in developing effective management practices, leading to innovation (Rasit et al., 2020). Appannan et al. (2022) and Christine et al. (2019) also reported that environmental strategy positively drives the company's environmental performance. Therefore, the following hypothesis is developed:

H_2: EMAS adoption in the learning phase has a significant impact on sustainability performance among PLCs in Malaysia.

- *H_{2a}: EMAS adoption in the learning phase has a significant impact on economic performance among PLCs in Malaysia.*
- *H_{2b}: EMAS adoption in the learning phase has a significant impact on environmental performance among PLCs in Malaysia.*
- *H_{2c}: EMAS adoption in the learning phase has a significant impact on social performance among PLCs in Malaysia.*

EMAS Adoption in the Commitment Phase and Sustainability Performance

From the view of the social issue life cycle theory, companies in the commitment phase are extensively adopting EMAS. EMAS adoption has been found to improve the sustainability performance of companies (Burritt et al., 2023; Christine et al., 2019). In the commitment phase, the solution to environmental problems is integrated into the strategic business plan (Mokhtar et al., 2014). These environmental issues have become part of the manager's accountabilities (Fuadah et al., 2021). This phase is referred to as the proactive or innovative change stage. Prior studies found a positive perception that EMAS adoption will affect the organization's value added (Swalih et al., 2024). Furthermore, the study of environmental management by Phan et al. (2017) also revealed that implementing EMAS significantly impacts a company's environmental performance. Pratiwi et al. (2020) also found a positive influence between EMAS adoption and corporate sustainability. Thus, this study proposes the following hypothesis:

H_3: EMAS adoption in the commitment phase has a significant impact on sustainability performance among PLCs in Malaysia.

- *H_{3a}: EMAS adoption in the commitment phase has a significant impact on economic performance among PLCs in Malaysia.*
- *H_{3b}: EMAS adoption in the commitment phase has a significant impact on environmental performance among PLCs in Malaysia.*
- *H_{3c}: EMAS adoption in the commitment phase has a significant impact on social performance among PLCs in Malaysia.*

Research Framework

This study is grounded in the social issue life cycle theory articulated by Mokhtar et al. (2016). The research framework delineates the phases of EMAS adoption and their potential impacts on sustainability performance within PLCs in Malaysia. The independent variable under examination encompasses the phases of EMAS adoption, precisely the policy, learning, and commitment phases. The dependent variable, sustainability performance, is evaluated through its economic, environmental, and social dimensions. The research framework is illustrated in Figure 1.

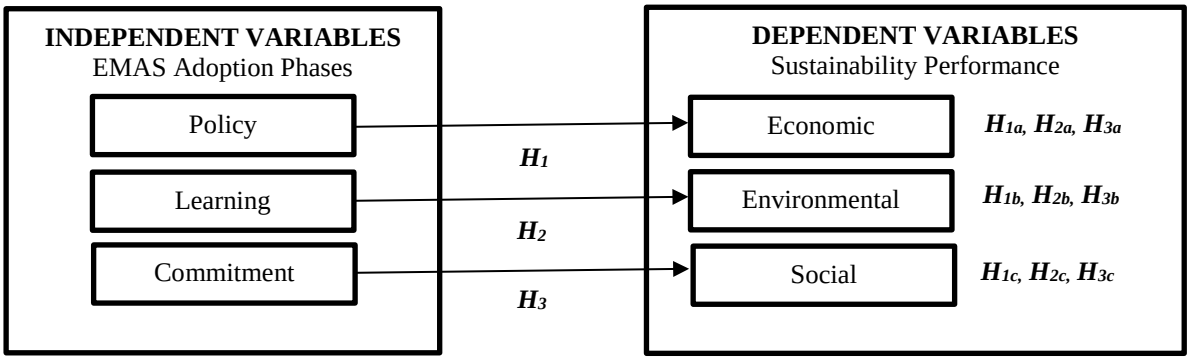

Figure 1. Research Framework

MATERIALS AND METHODS

Sample Selection

The research population comprised publicly listed companies (PLCs) in the Main Market of Bursa Malaysia, as outlined in Table 1. Contact details for these companies were obtained from the Bursa Malaysia website. The unit of analysis was the organization, and the study specifically targeted key decision-makers within these PLCs, including Chief Financial Officers (CFOs), finance directors, finance managers, and project managers. These individuals were chosen based on their expertise and involvement in environmental management and corporate sustainability initiatives.

The study employed a combination of cluster and simple random sampling techniques to ensure a representative sample. Initially, PLCs were categorized into clusters according to their respective industry sectors. From these clusters, a random sample was selected to ensure diverse industry representation, thereby enhancing the generalizability of the findings. Follow-up efforts, including emails and phone calls, were made to improve response rates.

Data was collected using a structured questionnaire adapted from Jamil et al. (2015), chosen for its efficacy in reaching geographically dispersed respondents (Mokhtar et al., 2016). The questionnaire measured the phases of EMAS adoption (learning, policy, and commitment) and their impact on sustainability performance, assessed through the triple bottom line framework. Covariates such as company size and industry type were controlled for in the analysis to isolate the effects of EMAS adoption phases on sustainability outcomes.

A cross-sectional research design was utilized, with data collected from the sampled PLCs at a single point in time. This approach allowed for examining the relationships between EMAS adoption phases and sustainability performance without the influence of temporal changes. The study did not implement direct interventions but focused on analyzing the natural variations in EMAS adoption and their impact on sustainability outcomes.

Table 1. Sector Representation of the Population

Sector	No. of Companies	Percentage (%)
Construction	52	6.73
Energy	31	3.30
Industrial Products and Services	221	28.63
Plantation	42	5.67
Property	97	12.66
Transportation and Logistics	32	3.96
Consumer Products and Services	168	21.90
Financial Services	31	4.09
Health Care	14	1.72
Real Estate Investment Trusts (REITs)	17	2.24
Technology	43	5.41
Telecommunications and Media	16	2.11
Utilities	12	1.58
Total of Population	776	100.00

The final sample comprised 205 PLCs, representing a 26.42% response rate. This sample size, determined through power analysis, is sufficient for robust statistical analysis, ensuring adequate power for detecting significant effects in regression and ANOVA tests. This response rate aligns with previous studies on similar populations and topics (Ong et al., 2020; Razak et al., 2020) and is considered acceptable for statistical testing. The data were recorded and analyzed using Statistical Package for the Social Sciences (SPSS) Version 28, with descriptive analysis summarising the dataset and hypothesis testing conducted via Ordinary Least Squares (OLS) regression analysis.

RESULTS

Respondent's Profile

The data were collected and verified for completeness and accuracy before analysis. Table 2 presents the demographic analysis. The results indicate that most respondents are from PLCs located in the central region (56.59%). Furthermore, most of these companies have been operational for over 15 years, with 163 respondents (79.51%) reflecting that they are in the maturity stage of their growth. Regarding environmental management systems (EMS), 83 respondents (40.49%) reported that their companies are implementing ISO 14001 to assess, evaluate, and enhance their environmental performance, aligning with the tendency of larger companies to adopt this standard (Salim & Padfield, 2017).

The survey saw participation predominantly from finance managers, with 153 responses (74.63%). This was followed by 29 project managers (14.15%) and 15 finance directors (7.32%). Only 2 Chief Financial Officers (0.98%) completed the survey. Additionally, 6 respondents from the accounting department included 1 account manager, four accountants, and one account executive, making up 2.65% of the sample. Most respondents have 4 to 6 years of experience in their current positions, totalling 109 respondents (53.17%), indicating their capability to manage sustainability matters and familiarity with organizational practices. Furthermore, 154 respondents (75.12%) reported that their companies had allocated budgets for environmental-related activities, underscoring the recognition of the importance of environmental initiatives for future global sustainability (Baker et al., 2023).

Table 2. Demographic Analysis (N=205)

Variables		Frequency	Percentage (%)
Location of Companies	Central Region: Selangor, Kuala Lumpur, Negeri Sembilan	116	56.59
	East Cost: Pahang, Terengganu, Kelantan	28	13.66
	Southern Region: Melaka, Johor	25	12.20
	Northern Region: Perlis, Kedah, Pulau Pinang, Perak	25	12.20
	Sabah	6	2.93
	Sarawak	5	2.44
Years of Operation	More than 15 years	163	79.51
	11 to 15 years	35	17.07
	6 to 10 years	5	2.44
	Less than 5 years	2	0.98
EMS Certificate	ISO 14001	83	40.49
	ISO 9001	70	34.15
	Planning to have	29	14.15
	None	23	11.22
Position	Finance manager	153	74.63
	Project manager	29	14.15
	Finance director	15	7.32
	Others (Account manager, Accountant, Account executive)	6	2.93
	Chief finance officer	2	0.98
Years of Experience	4 to 6 years	109	53.17
	1 to 3 years	78	38.05
	6 to 10 years	18	8.78
Allocation of Environmental Cost	Yes	154	75.12
	No	51	24.88

EMAS Adoption

All variables were assessed using a 5-point Likert-type scale. Following the measurement approach outlined by Jamil et al. (2015), respondents rated the extent of EMAS adoption on a scale from 1 (not at all) to 5 (to a great extent). A mean score close to 5 signifies extensive adoption of EMAS among PLCs. The ranking reflects the mean scores for EMAS adoption in descending order, from the most extensively adopted to the least adopted practices by PLCs. Table 3 indicates that PEMA has a higher mean score (3.23) than MEMA (3.14). This suggests that PLCs generally adopt PEMA practices more extensively than MEMA practices. The preference for PEMA is likely due to a greater emphasis on physical environmental activities over the costing processes (Doorasamy & Nyahuna, 2021). Tables 4 and 5 present the detailed results for each item of PEMA and MEMA.

Table 3. Overall Result of Descriptive Statistics for EMAS Adoption (N=205)

EMAS Adoption	Mean	Ranking
Physical EMA (PEMA)	3.23	1
Monetary EMA (MEMA)	3.14	2

Table 4. Descriptive Statistics for PEMA Practices (N=205)

PEMA Practices	Mean	Std. Dev	Min	Max
Lifecycle inventories.	3.51	0.97	1	5
Material flow assessment.	3.40	0.96	1	5
Energy flow assessment.	3.38	0.95	2	5
Post assessment of short-term environmental impact.	3.25	0.99	1	5

Lifecycle analysis.	3.22	0.89	1	5
Environmental capital impact assessment.	3.16	0.93	1	5
Physical environmental investment appraisal.	3.16	0.87	1	5
Physical environmental budgeting.	3.15	0.87	1	5
Long-term physical environmental planning.	3.15	0.96	1	5
Relevant environmental impacts.	3.08	0.96	1	5
Post-investment assessment of physical environmental investment appraisal.	3.07	0.87	1	5

Table 5. Descriptive Statistics for MEMA Practices (N=205)

MEMA Practices	Mean	Std. Dev	Min	Max
Environmental cost accounting.	3.37	0.87	2	5
Post-investment of individual environmental projects.	3.27	0.83	1	5
Environmental target costing.	3.22	0.91	1	5
Environmental lifecycle costing.	3.20	0.82	1	5
Post assessment of relevant environmental costing decisions.	3.16	0.84	1	5
Environmentally induced capital expenditure and revenue.	3.13	0.86	1	5
Monetary, environmental, and operational budgeting.	3.12	0.87	1	5
Monetary environmental capital budgeting.	3.11	0.83	1	5
Environmental lifecycle target pricing.	3.07	0.86	1	5
Environmental long-term financial planning.	3.05	0.93	1	5
Monetary environmental project investment appraisal.	3.04	0.92	1	5
Environmental lifecycle budgeting.	3.03	0.88	1	5
Relevant environmental costing.	3.00	0.89	1	5

Based on the EMAS adoption score, companies were classified into three social issue life cycle phases: policy, learning, and commitment. Companies with mean scores of 3.60 or higher were classified as being in the commitment phase, indicating a high extent of EMAS adoption (Mokhtar et al., 2014). Those with mean scores between 2.00 and 3.59 were categorized in the learning phase, reflecting a moderate extent of EMAS adoption. Companies with mean scores below 2.00 were classified in the policy phase, representing a low extent of EMAS adoption, as per Mokhtar et al. (2014).

Table 6 presents the distribution of EMAS adoption phases among PLCs in Malaysia. The results reveal that most companies (59.51%) are in the learning phase, which aligns with the earlier finding of a moderate extent of EMAS adoption. The relatively small proportion of companies in the commitment phase suggests that accountants' involvement in environmental initiatives remains limited. This observation supports the earlier notion that the role of accounting in environmental matters is still minimal.

Table 6. EMAS Adoption Phases among Malaysian PLCs (N=205)

Phases	Overall Mean	No. of Companies	Percentage (%)	Ranking
Learning Phase	2.01 to 3.59	122	59.51	1
Commitment Phase	≥ 3.60	56	27.31	2
Policy Phase	≤ 2.00	27	13.17	3
Total		205	100.00	

Sustainability Performance

This study examines the impact of EMAS adoption phases on sustainability performance. The study employs a five-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to gauge the perceived value created by EMAS adoption in the recent past. Economic performance metrics are based on the measurements developed by Ramli and Ismail (2013) and Cankaya and Sezen (2019), which utilize perceptual performance assessments to evaluate sustainability performance. This study adopts the measurement approach established by Jamil et al. (2015) for environmental performance. Social performance is assessed using items from Ahi and Searcy (2015) and Cankaya and Sezen (2019). Table 7 reveals that economic performance achieved the highest mean score (3.90), followed by environmental performance (3.80) and social performance (3.68). Table 8 details Malaysian PLCs' economic, environmental, and social performance items.

Table 7. Overall Result of Descriptive Statistics for Sustainability Performance (N=205)

Sustainability Performance	Mean	Ranking
Economic Performance	3.90	1
Environmental Performance	3.80	2
Social Performance	3.68	3

Table 8. Descriptive Statistics for Sustainability Performance (N=205)

Items	Mean	Std. Dev	Min	Max
Economic Performance				
Increase in operating profit.	4.00	0.77	2	5
Decrease in the cost of energy consumption.	3.97	0.74	1	5
Increase in return on investment.	3.95	0.77	2	5
Decrease in the cost of material purchased.	3.94	0.80	2	5

Decrease in the fee for waste discharge.	3.92	0.85	2	5
Increase in cash flow.	3.90	0.75	1	5
Increase in return on assets.	3.87	0.78	1	5
Improvement in earnings per share.	3.82	0.80	1	5
Increase in revenue.	3.75	0.77	2	5
Environmental Performance				
Reduction in the use of energy.	4.00	0.74	2	5
Reduction in the use of water.	3.90	0.83	1	5
Reduction of wastewater emissions.	3.88	0.87	2	5
Reduction in the use of non-renewable resources.	3.85	0.89	2	5
Reduction of solid waste.	3.84	0.83	2	5
Reduction in the use of toxic inputs.	3.84	0.82	2	5
Reduction of emissions to air.	3.80	0.78	2	5
Reduction of landscape damage	3.80	0.83	2	5
Reduction of smell/ odor emissions.	3.75	0.80	1	5
Reduction of soil contamination.	3.72	0.93	2	5
Reduction of noise.	3.67	0.85	2	5
Reduction in the risk of severe accidents	3.58	0.92	2	5
Social Performance				
Improvement in community health and safety.	3.77	0.87	2	5
Improvement in occupational health and safety of employees.	3.76	0.78	1	5
Improvement in relations with community stakeholders.	3.71	0.87	2	5
Improvement in customer satisfaction.	3.69	0.76	1	5
Reduced community complaints.	3.67	0.84	2	5
Improvement in the company's image in the eyes of its customers.	3.61	0.87	2	5
Improvement in overall stakeholder welfare or betterment.	3.57	0.69	1	5

Hypotheses Testing

Analysis of Variance (ANOVA)

One-way analysis of variance (ANOVA) was employed to assess whether there are statistically significant differences in the means of sustainability performance across the three phases of EMAS adoption. The results indicate the commitment phase has the highest mean sustainability performance score (mean=4.31). Table 9 presents the overall mean scores for each EMAS adoption phase among PLCs in Malaysia.

Table 9. Descriptive Statistics for EMAS Adoption Phases (N=205)

Variables	N	Mean	Std. Dev.	Std. Error	95% Confidence Interval for Mean		Min	Max
					Lower Bound	Upper Bound		
Policy Phase	27	2.63	0.18	0.03	2.56	2.70	2.33	2.97
Learning Phase	122	3.82	0.31	0.03	3.76	3.87	3.02	4.48
Commitment Phase	56	4.31	0.25	0.03	4.24	4.37	3.90	4.78
Total	205	3.80	0.57	0.04	3.72	3.88	2.33	4.78

Table 10. One-Way Analysis of Variance (ANOVA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	51.46	2	25.73	327.80	0.00
Within Groups	15.86	202	0.08		
Total	67.31	204			

A Tukey post hoc test revealed that the mean sustainability performance was significantly higher in the commitment phase (p=0.00), followed by the learning phase (p=0.00) compared to the policy phase (p=0.00).

Table 10 shows a significance value of 0.000 (p = .000), below the 0.01 threshold, indicating a significant difference in sustainability performance means across the EMAS adoption phases. However, ANOVA alone does not specify which groups differ from each other. To address this, the Multiple Comparisons table, which includes Tukey's post hoc test results, provides detailed insights into the specific group differences, as outlined in Table 11.

Table 11. Multiple Comparison

(I) EMAS Adoption	(J) EMAS Adoption	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Policy	Learning	-1.18*	0.06	0.00	-1.33	-1.04
	Commitment	-1.67*	0.07	0.00	-1.83	-1.52
Learning	Policy	1.18*	0.06	0.00	1.04	1.33
	Commitment	-0.49*	0.05	0.00	-0.56	-0.38
Commitment	Policy	1.67*	0.07	0.00	1.52	1.83
	Learning	0.49*	0.05	0.00	0.38	0.60

Accordingly, the mean plot in Figure 2 illustrates the average sustainability performance for the three phases of EMAS adoption. The commitment phase exhibits the highest mean sustainability performance compared to the learning and policy phases. At the commitment stage, environmental issues are addressed at the top management level. Thus, it can be concluded that comprehensive EMAS adoption leads to enhanced sustainability performance, including cost reduction and minimized environmental pollution (Swalih et al., 2024; Adu-Gyamfi et al., 2020).

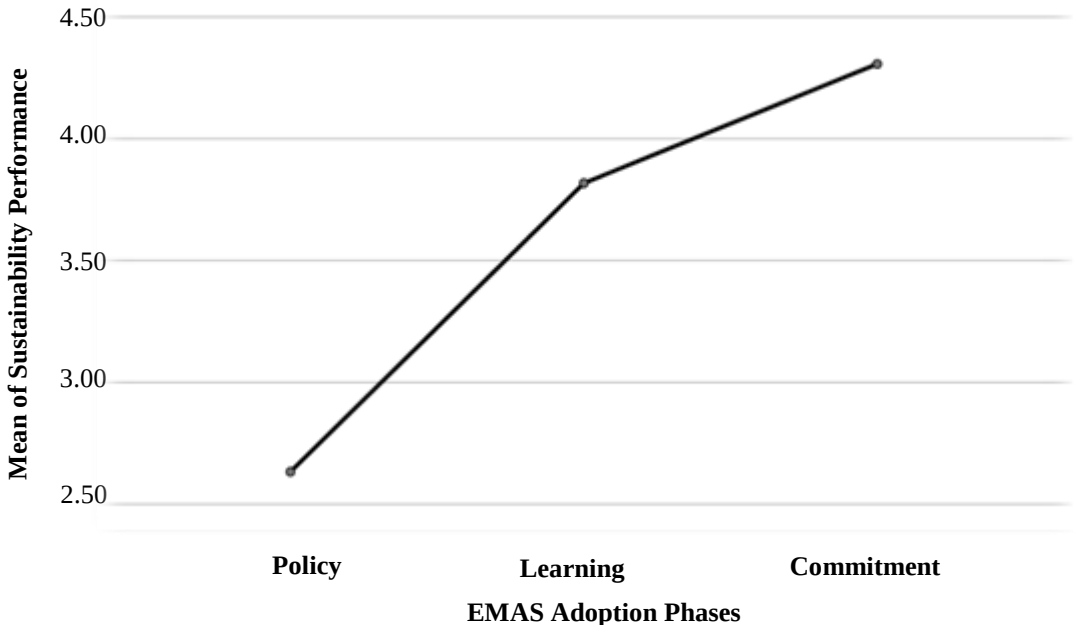

Figure 2. Mean Plot

Ordinary Least Squares (OLS) Regression Analysis

This study examines the impact of EMAS adoption phases on sustainability performance among Malaysian PLCs using Ordinary Least Squares (OLS) regression analysis. Analyzing data collected from Malaysian PLCs aims to provide empirical evidence on how the progression through EMAS adoption phases correlates with improvements in economic, environmental, and social performance.

EMAS Adoption in the Policy Phase and Sustainability Performance

Table 12. Coefficient Table (EMAS Adoption in the Policy Phase)

Variable	Beta	Std. Error	T statistic	P-value
Policy Phase and Sustainability Performance				
Constant	3.97	0.03	150.66	0.00
Policy Phase	-1.34	0.07	-18.45	0.00
Policy Phase and Economic Performance				
Constant	4.05	0.04	91.33	0.00
Policy Phase	-1.06	0.12	-8.71	0.00
Policy Phase and Environmental Performance				
Constant	3.98	0.03	119.49	0.00
Policy Phase	-1.49	0.09	-16.30	0.00
Policy Phase and Social Performance				
Constant	3.90	0.04	103.88	0.00
Policy Phase	-1.47	0.10	-14.17	0.00

Table 12 reveals that all relationships are statistically significant at the 1% level. Specifically, EMAS adoption in the policy phase has a significant negative impact on sustainability performance among PLCs in Malaysia (B=-1.34, p=0.00). This negative impact is observed across economic performance (B=-1.06, p=0.00), environmental performance (B=-1.49, p=0.00) and social performance (B=-1.47, p=0.00).

EMAS Adoption in the Learning Phase and Sustainability Performance

Table 13. Coefficient Table (EMAS Adoption in the Learning Phase)

Variable	Beta	Std. Error	T statistic	P-value
Learning Phase and Sustainability Performance				
Constant	3.77	0.06	60.03	0.00
Learning Phase	0.05	0.08	0.59	0.55
Learning Phase and Economic Performance				
Constant	3.86	0.08	51.18	0.00

Learning Phase	0.07	0.09	0.72	0.47
Learning Phase and Environmental Performance				
Constant	3.74	0.07	50.90	0.00
Learning Phase	0.06	0.09	0.67	0.50
Learning Phase and Social Performance				
Constant	3.70	0.08	48.01	0.00
Learning Phase	0.01	0.10	0.10	0.92

Table 13 shows that EMAS adoption in the learning phase positively impacts sustainability performance among PLCs, although this impact is not statistically significant at the 5% level (B=0.05, p=0.55). Similarly, the positive impacts of EMAS adoption in the learning phase on economic performance (B=0.07, p=0.47), environmental performance (B=0.06, p=0.50), and social performance (B=0.01, p=0.92) are also not statistically significant.

EMAS Adoption in the Commitment Phase and Sustainability Performance

Table 14. Coefficient Table (EMAS Adoption in the Commitment Phase)

Variable	Beta	Std. Error	T statistic	P-value
Commitment Phase and Sustainability Performance				
Constant	3.60	0.04	91.22	0.00
Commitment Phase	0.71	0.08	9.42	0.00
Commitment Phase and Economic Performance				
Constant	3.76	0.05	70.18	0.00
Commitment Phase	0.52	0.10	5.12	0.00
Commitment Phase and Environmental Performance				
Constant	3.56	0.05	75.07	0.00
Commitment Phase	0.77	0.09	8.59	0.00
Commitment Phase and Social Performance				
Constant	3.48	0.05	70.34	0.00
Commitment Phase	0.82	0.09	8.77	0.00

Table 14 indicates a significant positive impact of EMAS adoption in the commitment phase on sustainability performance among PLCs (B=0.71, p=0.00). This positive impact is significant across economic performance (B=0.52, p=0.00), environmental performance (B=0.77, p=0.00) and social performance (B=0.82, p=0.00). All relationships in this phase are statistically significant at the 1% level.

Table 15. Result of Hypotheses Testing

	Hypotheses	Findings
$\mathbf{H_1}$	EMAS adoption in the policy phase has a significant impact on sustainability performance among PLCs in Malaysia.	Supported
$\mathbf{H_{1a}}$	EMAS adoption in the policy phase has a significant impact on economic performance among PLCs in Malaysia.	Supported
$\mathbf{H_{1b}}$	EMAS adoption in the policy phase has a significant impact on environmental performance among PLCs in Malaysia.	Supported
$\mathbf{H_{1c}}$	EMAS adoption in the policy phase has a significant impact on social performance among PLCs in Malaysia.	Supported
$\mathbf{H_2}$	EMAS adoption in the learning phase has a significant impact on sustainability performance among PLCs in Malaysia.	Not Supported
$\mathbf{H_{2a}}$	EMAS adoption in the learning phase has a significant impact on economic performance among PLCs in Malaysia.	Not Supported
$\mathbf{H_{2b}}$	EMAS adoption in the learning phase has a significant impact on environmental performance among PLCs in Malaysia.	Not Supported
$\mathbf{H_{2c}}$	EMAS adoption in the learning phase has a significant impact on social performance among PLCs in Malaysia.	Not Supported
$\mathbf{H_3}$	EMAS adoption in the commitment phase has a significant impact on sustainability performance among PLCs in Malaysia.	Supported
$\mathbf{H_{3a}}$	EMAS adoption in the commitment phase has a significant impact on economic performance among PLCs in Malaysia.	Supported
$\mathbf{H_{3b}}$	EMAS adoption in the commitment phase has a significant impact on environmental performance among PLCs in Malaysia.	Supported
$\mathbf{H_{3c}}$	EMAS adoption in the commitment phase has a significant impact on social performance among PLCs in Malaysia.	Supported

Table 15 summarizes the results of the hypothesis testing. The research framework indicates a significant negative impact of EMAS adoption in the policy phase on sustainability performance. The findings support all proposed hypotheses (H_1, H_{1a}, H_{1b}, and H_{1c}). This negative impact reflects the lack of urgency among companies in the policy phase to address environmental issues, such as energy consumption and waste minimization. Consequently, these companies are unlikely to achieve better sustainability performance in the short term. EMAS adoption often incurs costs, with benefits such as reputational enhancements, reduced environmental liabilities, and increased competitive advantage materializing over the long term (Burritt et al., 2023; Salim & Padfield, 2017).

In the learning phase, environmental awareness starts to gain traction, and companies may hire environmental specialists to implement policies. However, environmental concerns have yet to influence economic decisions significantly. Although the study provides evidence of a positive impact of EMAS adoption in the learning phase on sustainability performance, this relationship is statistically insignificant. Therefore, the findings do not support hypotheses H_2, H_{2a}, H_{2b} and H_{2c}. Companies in this phase are unlikely to achieve sustainable performance as environmental policies have not yet been fully integrated into decision-making processes despite increasing awareness of environmental issues (Mokhtar et al., 2014).

During the commitment phase, environmental concerns are integrated into business decision-making and managed by line managers. The study confirms a significant positive impact of EMAS adoption in the commitment phase on sustainability performance among Malaysian PLCs, supporting hypotheses H_3, H_{3a}, H_{3b}, and H_{3c}. Companies in this phase view EMAS adoption as a proactive approach to managing sustainability issues and achieving social legitimacy. The

findings demonstrate that sustainability performance improves as companies progress through the social issue life cycle's policy, learning, and commitment phases. Companies that actively engage in sustainability practices and integrate environmental considerations into their business policies are likely to gain a competitive advantage, enhance decision-making, and advance their environmental performance (Pratiwi et al., 2020).

DISCUSSIONS

Over recent decades, industrial development has generated significant wealth and prosperity but has also led to unintended ecological degradation (Gunawardena & Dissanayake, 2021). Consequently, businesses are now compelled to be accountable for their environmental impact to remain competitive and drive profitability amidst increasing competition. Adopting EMAS can help businesses identify and mitigate their negative environmental impacts (Kong et al., 2022; Mayndarto & Murwaningsari, 2021). In alignment with the first objective of this study, findings indicate that most companies are in the learning phase, reflecting a moderate extent of EMAS adoption among PLCs in Malaysia. Specifically, both PEMA and MEMA are adopted to a moderate degree (Razak et al., 2020; Rasit et al., 2020). This suggests a need for professional associations to organize seminars and conferences to enhance managers' and accountants' awareness and establish effective learning mechanisms for EMAS adoption.

The study also examines the impact of EMAS adoption phases on sustainability performance using the triple bottom line approach, which encompasses economic, environmental, and social performance. According to the study's second objective, regression analysis results reveal a significant negative impact of EMAS adoption in the policy phase on sustainability performance. Additionally, the research shows an insignificant positive impact of EMAS adoption in the learning phase on sustainability performance. In contrast, a significant positive impact is observed for EMAS adoption in the commitment phase, indicating that companies in this phase achieve better sustainability performance compared to those in the policy and learning phases. The Ordinary Least Squares (OLS) regression analysis supports the hypothesis that companies in more advanced phases of EMAS adoption tend to report better sustainability outcomes. These findings corroborate previous studies that reported a positive effect of EMAS adoption on sustainability performance (Solovida & Latan, 2021; Tran et al., 2020).

The findings of this study align with several prior studies that have demonstrated a positive link between EMAS adoption and sustainability performance. For instance, previous research by Kong et al. (2022) in China also found that companies with advanced environmental management systems exhibited superior environmental performance. Similarly, studies in other emerging economies, such as Ghana, South Africa, and Bangladesh, have shown that adopting comprehensive environmental management practices can lead to improved sustainability metrics (Deb et al., 2023; Doorasamy & Nyahuna, 2021; Adu-Gyamfi et al., 2020). Even though prior studies reveal that EMAS adoption contributes positively towards sustainability performance, its effectiveness might be moderated by internal and external organizational factors. The discrepancy between the findings could be attributed to Malaysia's distinct regulatory environment and market conditions, where regulatory pressures and public expectations for sustainability practices may differ.

Moreover, this study contributes to the literature by applying the social issue life cycle theory to explain the varying impacts of EMAS adoption phases. Unlike some prior studies that treat EMAS adoption as a binary variable (adopted vs. not adopted), this study's approach of examining different adoption phases offers a more nuanced understanding of how the depth and maturity of EMAS influence sustainability performance. This perspective must be explored in existing literature, making it a valuable addition to the discourse on environmental management accounting in emerging markets.

CONCLUSIONS

This study examines the impact of EMAS adoption on the sustainability performance of PLCs in Malaysia. For theoretical implications, this study advances the understanding of EMAS by examining its adoption phases through the lens of social issue life cycle theory. The study enriches the existing literature by demonstrating the varying impacts of EMAS adoption phases on sustainability performance. It offers empirical evidence that the commitment phase of EMAS adoption significantly enhances sustainability performance, contributing to the theoretical discourse on how structured environmental management practices influence corporate sustainability. It provides new insights into how EMAS adoption can be strategically managed to enhance sustainability performance in the Malaysian context.

The adoption of EMAS is increasingly essential due to the limitations of conventional management accounting systems. This study reveals that most companies are in the learning phase, indicating a moderate level of EMAS adoption. The moderate level of adoption may be attributed to insufficient knowledge and awareness of environmental management among the respondents. From a managerial perspective, the study highlights the critical importance of progressing through the EMAS adoption phases. Managers should know that premature adoption (e.g., during the policy phase) can negatively impact sustainability performance. Conversely, a well-established commitment to EMAS can significantly improve sustainability outcomes. This insight can guide managers in strategically planning and implementing EMAS to align with their sustainability goals.

As recommendations for practice, companies should approach EMAS adoption in phases, ensuring that each phase is fully understood and integrated before moving on to the next. This phased approach can mitigate the potential negative impacts during the policy phase. Companies should allocate resources and foster organizational commitment to environmental management to maximize the positive impact on sustainability performance. Furthermore, organizations should invest in training programs to increase managers' and employees' awareness and understanding of EMAS. This will facilitate smoother transitions between adoption phases and enhance overall sustainability efforts. Companies also need to

regularly monitor and assess the effectiveness of EMAS practices across different phases to ensure alignment with sustainability objectives and make necessary adjustments.

These findings can guide the Malaysian government in refining policies, incentivizing companies to adopt greener practices, and effectively managing environmental costs. Reviewing the Environmental Quality Act 1974 could enhance penalties for companies that fail to meet their environmental responsibilities. Governments can develop and enforce stricter regulations that mandate the adoption of EMAS across industries. The government can ensure that companies systematically address environmental concerns by creating clear guidelines and setting minimum standards for EMAS adoption. Moreover, these financial incentives can encourage more companies to move beyond the learning and policy phases into the commitment phase, where sustainability impacts are more substantial.

Additionally, professional bodies can organize training workshops and certification programs to educate key decision-makers, such as CFOs and managers, on the benefits and implementation of EMAS. These programs can provide the technical knowledge required to integrate environmental accounting into business practices fully. Creating platforms for companies to share best practices and experiences with EMAS can help disseminate knowledge and encourage wider adoption. By doing so, these bodies can help build a stronger foundation for sustainability practices across industries.

Despite its valuable contributions to both theory and practice, this study has certain limitations. Notably, the data collection method and sample size present significant challenges. The survey approach is susceptible to errors and non-response bias, with potential issues of unreliability and inaccuracy as some respondents may have answered without thoroughly considering the questions, leading to invalid data. Furthermore, the low response rate among Malaysian PLCs limits the generalizability of the findings. Therefore, future studies could address these limitations by expanding the sample size and incorporating mixed methods to provide a more comprehensive analysis of EMAS adoption. Future studies could also expand the scope to include a broader range of industries or geographical locations to test the generalizability of the findings. Additionally, longitudinal studies could offer insights into the long-term effects of EMAS adoption on sustainability performance. Exploring qualitative aspects of EMAS adoption, such as organizational culture and stakeholder engagement, could also provide a more comprehensive understanding of its impacts. Regardless of these limitations, this study provides insights into EMAS adoption phases in Malaysia and highlights the need for further promotion of this practice among businesses. The study demonstrates the potential and necessity of EMAS for improving sustainable development in Malaysia, showing significant impacts on management processes.

Author Contributions: Conceptualization, N.N.A.M.Y., T.Z.T.M. and A.A.; Methodology, N.N.A.M.Y. and T.Z.T.M.; Software, N.N.A.M.Y.; Validation, N.N.A.M.Y, T.Z.T.M and A.A.; Formal Analysis, N.N.A.M.Y.; Investigation, N.N.A.M.Y.; Resources, N.N.A.M.Y., T.Z.T.M. and A.A.; Data Curation, N.N.A.M.Y.; Writing – Original Draft Preparation, N.N.A.M.Y.; Writing – Review & Editing, N.N.A.M.Y.; Visualization, T.Z.T.M.; Supervision, T.Z.T.M. and A.A.; Project Administration, T.Z.T.M. and A.A.; Funding Acquisition, T.Z.T.M. Authors have read and agreed to the published version of the manuscript.

Institutional Review Board Statement: Ethical review and approval were waived for this study, due to that the research does not deal with vulnerable groups or sensitive issues.

Funding: The authors received no direct funding for this research.

Acknowledgments: Not Applicable

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to restrictions.

Conflicts of Interest: The authors declare no conflict of interest.

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