Environmental Management Accounting System Adoption and Sustainability Performance: Triple Bottom Line Approach

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ABSTRACT

Sustainability development is an ongoing issue facing corporations. With the rapid development of industry, environmental pollution is becoming more prominent globally. Therefore, environmental accountability has become a crucial aspect of corporate social responsibility in the effort to mitigate harm to the environment. The evolving global economy has pressured Malaysian companies to improve their sustainability performance and be accountable towards the environment and society. The Environmental Management Accounting System (EMAS) can enhance sustainability by evaluating financial and physical environment-related information. This research examined the level of EMAS adoption based on the social issue life cycle theory and its impact on sustainability performance, based on a triple bottom line approach. A total of 205 questionnaires were collected from public listed companies (PLCs) in Malaysia. Data were analysed through partial least squares structural equation modelling. The finding indicated EMAS adoption in Malaysia are in the learning phases reflecting that the extent of adoption is moderate. Specifically, this research found that EMAS adoption significantly impacted the economic, environmental and social performance. This research is noteworthy to companies, policymakers and environmental regulatory bodies in understanding the level of EMAS adoption in Malaysia. The research concluded that EMAS is essential in promoting the dimensions of sustainable competitive advantage within organizations.

Keywords: Environmental Management Accounting System (EMAS), Social Issue Life Cycle Theory, Economic Performance, Environmental Performance, Social Performance, Public Listed Companies

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INTRODUCTION

The globalization of the world economy has had a positive impact on our lives. Nevertheless, the rise of globalization has had its drawbacks to the environment in the form of wastage and pollution such as air, noise, water, soil and land contamination which have contributed to global warming and damage to the earth's ecological cycle. The growing environmental crisis has led to an increased focus on public health. The World Health Organization (WHO) estimated that about a quarter of all human diseases today are due to continuous exposure to environmental pollution. For example, two factory owners were detained for illegally dumping chemical waste into the Kim Kim River in Johor, Malaysia (Chee et al., 2019). The toxic fumes released from the chemical waste dumped into Kim Kim River left 260 people ill and resulted in the closure of 111 schools. In recent years, the social and environmental responsibility of companies has been the focus of media attention partly because of concerns about environmental hazards such as climate change and greenhouse gas emissions (Yahaya & Abidin, 2020). Typically, public listed companies consume significant amounts of resources such as energy, water and non-durable items due to their business characteristics and services (Ahmad et al., 2020). These companies that only focus more on profitability as an indicator of business performance have entirely ignored an organization's responsibility towards society and the environment. Thus, stakeholders encourage companies to focus more on environmental issues and evaluate sustainability performance. Considering this call and the urgency to make people aware of using natural resources sustainably, the burden has now fallen on the corporate level. Business sectors must operate without negatively impacting society, the community and the environment.

The Environmental Management Accounting System (EMAS) was developed as a corrective innovation to address the limitations of conventional management accounting systems as these did not provide truthful information on environment-related cost management (Hossain, 2019). Through EMAS adoption, companies can measure financial and non-financial environmental information beyond the ordinary perspective which tends to lump environmental costs into the overhead costs (Doorasamy & Nyahuna, 2021). Hence, EMAS can assist companies in managing environmental problems better and improving how companies treat the

environment (Asiri et al., 2020). Despite the widely recognized benefits, EMAS adoption is still lagging among companies in developing countries such as Malaysia (Che Ku Kassim et al., 2021; Rasit et al., 2020). This poor adoption of EMAS represents the main problem of this research. In addition, it is unclear how EMAS adoption could impact sustainability performance. Moreover, Zaradat et al. (2021) affirmed that environmental accounting development had not been studied empirically sufficiently in developing countries. Primarily, this research aimed to determine the level of EMAS adoption from a social issue life cycle perspective. Secondly, this research aimed to examine the impacts of EMAS adoption on sustainability performance among public listed companies in Malaysia.

LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Environmental Management Accounting System (EMAS)

An environmental management accounting system is a new innovative concept and an extension of the conventional management accounting system. Regardless of its lack of clear definition, EMAS can be defined as the identification, allocation, generation and use of physical and monetary information to assist business decision-making that can drive sustainable business development (Fuadah et al., 2021; Phan et al., 2017; Mokhtar et al., 2016). EMAS adoption leads companies to create more efficient and effective strategies to obtain competitive economic advantages. The conventional management accounting systems have many cognitive limitations related to environmental information and only emphasised on the profitability perspective. Conventional management accounting systems disregard the generation of environmental information as this invisible cost is generally recognized as an indirect cost of the products or services (Doorasamy & Nyahuna, 2021). Many organizations misinterpreted both costs and benefits in environmental management leading to significant failures in identifying and preventing environmental issues. As a result, many opportunities for environmental improvement and cost reduction are lost in the organization (Le et al., 2019). Through the adoption of EMAS, environmental information lumped in the overhead accounts can be identified, measured and reported.

Environmental reporting is an accounting field innovation related to the provision of environmental information to internal and external stakeholders. EMAS could address both monetary and physical aspects of environmental accounting (Zandi & Lee, 2019). Physical environmental management accounting (PEMA) includes water and energy flow. In contrast, monetary environmental management accounting (MEMA) measures the costs of the company's consumption of natural resources and the costs of controlling or preventing environmental damages (Jamil & Mohamed, 2017; Mokhtar et al., 2016). Prior researchers stipulated that the adoption of EMAS can assist the organization in realizing extensive cost savings, enriching attractiveness and improvement on business performance (Rahman et al., 2021; Pratiwi et al., 2020; Rasit et al., 2019). Nevertheless, little is known about EMAS adoption among public listed companies in Malaysia.

EMAS Adoption in Public Listed Companies

To return a healthier earth for future generations, Malaysia is trying its best to achieve sustainable goals as outlined under the UN-adopted 2030 Agenda. It seems that companies in Malaysia have taken bold steps in environmental practices and sustainable activities (Susskind et al., 2020). The Malaysian government is committed to maintaining, preserving and enhancing its public listed companies through various green initiatives. Despite implementing various environmental regulations, it is disappointing that these laws and policies have not been potentially reaching the objective of protecting the environment from human impacts. Therefore, Agustia et al. (2019) stated that companies need a holistic system like EMAS to achieve a win-win approach for both the planet and business. In Malaysia, public listed companies serve as the economy's backbone and play a crucial role in every commercial concern ranging from telecommunications, transportation, construction, industrial products, energy and financial services. Chaturangani and Hemathilake (2019) reported that having a proper environmental accounting practice is crucial for companies' better environmental performance. However, most of the prior research on EMAS has centred more on environmentally sensitive industries such as the manufacturing industry (Rasit et al., 2019; Jamil & Mohamed, 2017). A review of the management accounting literature has shown that the environmentally less sensitive industry has not focused on EMAS-related research. Nevertheless, it is believed that additional research in the public listed companies is required to provide different insights into the potential adoption of EMAS.

Social Issue Life Cycle Theory

This research utilized the social issue life cycle theory to determine the EMAS adoption phases among public listed companies. This theory suggests that a company's response to social matters includes environmental impacts. A company's response is not a sequence of random changes but is an ongoing determination to find the most satisfactory solution to the problem. Prior research suggested that there are three phases where an issue evolves from an "insignificance" stage through an 'increased concern" phase to the last phase, where a recognized solution for the problem is accessible (Zyglidopoulos, 2003). Mokhtar et al. (2014) and Nasi et al. (1997) summarised the three phases of the social issue life cycle: policy, learning and commitment. In Malaysia, Alrazi et al. (2009) found inadequate support for the applicability of the social issue life cycle theory. So in which phases of the social issue life cycle theory do public listed companies in Malaysia find themselves?.

Triple Bottom Line (TBL) Approach

Elkington (1997) proposed the triple bottom line (TBL), comprising the planet, people and profits to address the issue of sustainability. According to Elkington (1997), the TBL approach could simultaneously lead an organisation to perform economic prosperity, environmental quality and social justice. The TBL thus consists of three Ps: profit, people and planet. "Profit" is the economic value created by the organization after deducting the cost of all inputs including the cost of capital. "People" pertains to fair and beneficial business practices toward labour, the community and the region where a corporation conducts its business. Finally, "Planet" refers to sustainable environmental practices to reduce its ecological footprint and carefully manage its energy consumption and non-renewable. The word "triple" highlights the importance of providing equal attention to all three dimensions rather than more on financial results (Yenidogan et al., 2016). Unfortunately, most sustainability literature has focused on economic performance with little focus on integrating environmental and social performance into it (Hussain et al., 2018). The TBL adds social and environmental dimensions to the traditional economic results to measure a company's performance from a sustainable perspective (Tate & Bals, 2018). Thus, sustainability is a necessary practice for the survival of modern corporations (Alameeri et al., 2017).

Research Framework

The research framework shows the relationship between the independent and dependent variables. This research utilized the social issue life cycle theory proposed by Mokhtar et al. (2016) as an underlying theory. The level of EMAS adoption was then identified based on the social issue life cycle phases: policy, learning and commitment. This research framework depicts EMAS adoption that may impact sustainability performance among public listed companies in Malaysia. The independent variable was EMAS adoption while the dependent variable was sustainability performance from the triple bottom line approach comprising economic, environmental and social performance. Figure 1 shows the research framework for this research.

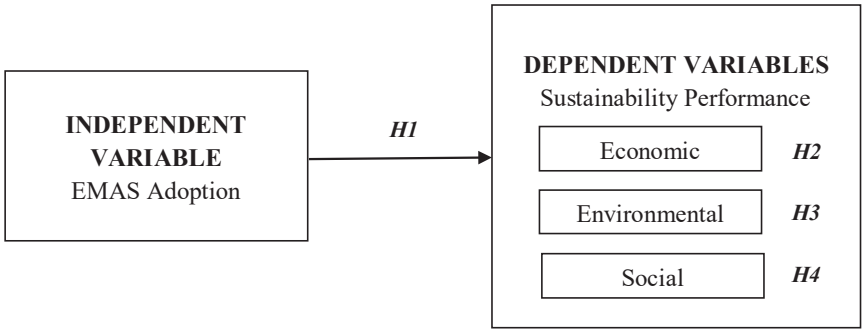

Figure 1: Research Framework

EMAS Adoption and Sustainability Performance

Companies need to radically change how they do business to make our planet sustainable. The triple bottom line (TBL) is often used to measure the sustainability of an organization. TBL is becoming prominent for assessing a company's economic, environmental and social achievements. A study by Lu and Taylor (2018) indicated that the objective of EMAS adoption is to keep organizations responsible for environmental and financial considerations. Many studies focus on the relationship between EMAS adoption and economic performance (Solovida & Latan, 2017) but few investigated environmental and social performance. Past studies viewed EMAS as a managerial technology that creates and drives companies' values to a higher level of environmental and economic value (Appannan et al., 2020). EMAS also helps companies achieve different strategic and environmental goals

necessary in the modern business world to survive and grow efficiently (Singh et al., 2020; Seman et al., 2019; Saeidi et al., 2018). These benefits include improving corporate decision-making, cost reduction, stimulation of innovation and enhancement of organizational competitiveness which will eventually improve the organization's bottom line.

H1: There is a significant impact between EMAS adoption and sustainability performance among PLCs in Malaysia

EMAS Adoption and Economic Performance

Economic performance can be defined as the change in the financial state of an organization as the result of the application of the managerial decision made by the players in an organization (Pratiwi et al., 2020). The adoption of EMAS can increase managers' environmental awareness and help overcome their ignorance of the high operating costs (Ong et al., 2020). Companies can tackle long-run benefits by adopting environmental management such as EMAS (Gomez-Conde et al., 2019). Furthermore, EMAS adoption could also assist organizations in saving and recognizing environmental costs (Saeidi et al., 2018). By adopting EMAS, effective use of raw materials helps companies to minimize costs of raw materials, disposal costs and waste generation. Likewise, adopting EMAS ultimately helps companies to develop better accounting and financial decisions favourable to the growth and success of the company (Chaundhry & Amir, 2020). A study done by Larojan and Thevaruban (2014) reported that EMAS application correlates positively with the economic performance of the listed manufacturing companies in Sri Lanka. Disclosures of accounting information on environmental management positively impact a company (Saikon & Pramote, 2017). Rahman et al. (2021) also supported that adopting EMAS is a critical tool to meet the competitive financial advantage. Thus, this research proposed the hypothesis as follows:

H2: There is a significant impact between EMAS adoption and economic performance among PLCs in Malaysia.

EMAS Adoption and Environmental Performance

Environmental performance can be defined as the achievement of environmental-related company impact (Christine et al., 2019). The adoption

of EMAS has a significant positive impact on the quality of disclosure and carbon management (Qian et al., 2018). Effective environmental strategies can be valuable, rare and difficult to imitate if the resources or capabilities that cannot be replaced can generate a sustainable competitive advantage. This result is consistent with previous research (Phan et al., 2017), revealing a significant positive impact between EMAS adoption and environmental performance. The adoption of EMAS had allowed companies to reduce costs and improve their environmental performance while playing a significant role in the long run towards sustainable development and eco-efficiency (Fuadah et al., 2021). Rasit et al. (2020) reported a significant positive relationship between EMAS adoption and environmental performance in reducing harmful environmental impact and effectiveness in consuming natural resources. Furthermore, Fuzi et al. (2021) also discovered that EMAS adoption could assist organizations in improving environmental management by providing helpful information. Based on these studies, the hypothesis was as follows:

H3: There is a significant impact between EMAS adoption and environmental performance among PLCs in Malaysia.

EMAS Adoption and Social Performance

Social performance refers to business activities focusing on the impacts and outcomes for society, stakeholders and communities (Rasit et al., 2019). Companies should engage in purely voluntary activities such as philanthropic activity including a contribution of resources by a business organization that improves the quality of life of the surrounding community. Social performance indicators include health and safety incidents, health and safety practices, economic welfare and growth (Beske et al., 2015). However, lack of research focused on social aspects linking environmental management practices and social performance (Tate & Bals, 2018). EMAS can enhance internal decision-making and improve relations with all stakeholders, including better recruitment and retention of employees (Rasit et al., 2020). According to a Michelon et al. (2013) survey, 90% of customers would refrain from doing business with a company if no corporate social responsibility plan existed. Therefore, it could be concluded that the company's performance evaluation without considering social costs does not give an accurate picture of its performance (Sariannidis et al., 2018). Hence, the following hypothesis was developed:

H4: There is a significant impact between EMAS adoption and social performance among PLCs in Malaysia.

RESEARCH METHODOLOGY

This research adopted the quantitative approach that uses descriptive analysis and research hypotheses testing. The research population was public listed companies on the Main Market of Bursa Malaysia. The public listed companies were chosen as these companies have a massive impact on the environment due to their business activities (Razak et al., 2020; Mokhtar et al., 2016). According to Bursa Malaysia, 776 companies were identified which made out the total number for the entire population for this research. Table 1 below summarises the population of this research based on the environmental sensitivity industry.

Table 1: Sector Representation of the Population

Sector	No. of Companies	Percentage (%)
Environmentally sensitive:		
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
Total of environmentally sensitive	475	60.95
Environmentally less sensitive:		
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 environmentally less sensitive	**301**	**39.05**
Total of population	**776**	**100.00**

The companies' contact information was obtained from the Main Market of Bursa Malaysia website. Cluster and simple random sampling methods were used to ensure that the target samples were included in the

research. This sampling technique is the most straightforward and less complex (Sekaran & Bougie, 2016). The unit of analysis was an organization and the target respondents for this research comprised the chief financial officer (CFO), finance director, finance manager and project manager. This research only sent the questionnaire to one respondent to represent one organization. They were assumed to have pertinent knowledge of the organization's environmental and sustainability accounting information. A structured questionnaire was adopted from Jamil and Mohamed (2017) to collect data from the respondents. In addition, several follow-up emails and phone calls were made to get their responses. Of all the questionnaires distributed, 205 were considered usable responses, giving a 26.42% response rate. The low response rate was expected despite the increased awareness of environmental sustainability. The data in this research was recorded and analysed using the Statistical Package for the Social Sciences (SPSS) Version 28. This research used descriptive analysis to analyse the data and hypotheses testing using the partial least square structural equation modelling (PLS-SEM).

DATA ANALYSIS AND MEASUREMENT OF VARIABLES

Respondent's Profile

Descriptive statistics were computed to describe the sample. Table 2 highlights the demographic analysis. The finding showed that most of the respondents were public listed companies in the central region (56.59%), which comprised several states in Malaysia, such as Selangor, Kuala Lumpur and Negeri Sembilan. Hence, companies classified within environmentally sensitive industries accounted for 54.15% of the sample while those classified within environmentally less sensitive industries accounted for 45.85%. The findings also indicated that most of these companies had been operating for more than 15 years comprising 163 respondents (79.51%). This indicated that most companies where the respondents were employed were at the maturity stage of growth.

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
Environmental Sensitivity Industries	Sensitive	111	54.15
	Less sensitive	94	45.85
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

For the environmental management system (EMS) certificate, 83 respondents (40.49%) stated that their companies adopted ISO 14001 to measure, evaluate and improve their environmental performance. According to Salim and Padfield (2017), large companies commonly have adopted ISO 14001 to manage their environmental performance. The result showed that the highest number of respondents who participated in the questionnaire survey were 153 finance managers (74.63%). This was followed by 29 project managers (14.15%) and 15 finance directors (7.32%). However,

only 2 chief financial officers completed the questionnaire survey with a percentage of 0.98%. There were also 6 respondents from the accounting department, such as an account manager (1 respondent), accountants (4 respondents) and an account executive (1 respondent) that also participated in this research which represented 2.65%. Regarding the years in their current position, most of the respondents had 4 to 6 years of working experience, consisting of 109 respondents (53.17%). It showed that respondents can manage environmental matters with their experience and were sufficiently knowledgeable regarding organizational practices. The result showed that 154 respondents (75.12%) stated that their companies had allocated some budget costs for environmental-related activities. This showed that public listed companies in Malaysia were aware that environmental activities are vital for global sustainability in the future (Jamil & Mohamed, 2017).

EMAS Adoption

All of the variables were measured on a 5-point Likert-type scale. Adopting the measurement of this variable from Jamil & Mohamed (2017), respondents were asked to measure on a scale of 1 (not at all) to 5 (to a great extent) for the extent of EMAS adoption. The closest mean score of 5 indicated that EMAS was extensively adopted in public listed companies. The ranking represents the mean scores for EMAS in descending order according to the most extensively adapted to the least adopted by public listed companies. Using the EMAS adoption score, companies were clustered into three social issue life cycle phases: policy, learning and commitment. Thus, the companies with mean scores greater than or equal to 3.6 were categorized as in the commitment phase, which showed a high extent of EMAS adoption (Mokhtar et al., 2014). If the companies with mean scores between 2.0 and 3.59 were categorized as in the learning phase, they showed a moderate extent of EMAS adoption. In contrast, the companies with mean scores below 2.0 were classified as in the policy phase, which showed a low extent of EMAS adoption. This measurement was self-developed and guided by the approach used by Nasi et al. (1997).

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

Item	Mean			Ranking
	Sensitive Industries	Less Sensitive Industries	Overall	
Physical EMA (PEMA)	3.69	2.69	3.23	1
Monetary EMA (MEMA)	3.49	2.71	3.14	2
Overall Mean	3.59	2.70	3.18	

As in Table 3, the finding showed that physical EMA (PEMA) had the highest mean (3.23) compared to monetary EMA (MEMA) (3.14). This result implied that most public listed companies tended to adopt PEMA practice more than MEMA practice. This result is consistent with Jamil et al. (2015) that most SME manufacturing companies in Malaysia tend to practice PEMA compared to MEMA. Mat Yusoh and Tuan Mat (2020) also supported these findings as most Malaysian hotel companies tend to adopt PEMA compared to MEMA. Most companies focus more on physical-related environmental activities than the costing process (Doorasamy & Nyahuna, 2021). Overall, the mean scores for both MEMA adoption and PEMA adoption showed a moderate level among the public listed companies in Malaysia. From a social issue life cycle perspective, EMAS adoption among public listed companies in Malaysia was in the learning phase, as indicated by the overall mean (3.18) reflecting the earlier finding that the extent of EMAS adoption was moderate. Companies are in the learning phase once environmental awareness begins to become widespread. Usually, an environmental specialist or professional is hired to implement the company's environmental policy. However, environmental issues have not become significant in companies' economic decisions.

From the environmental sensitivity industry perspective, the mean scores for PEMA and MEMA adoption showed that companies in environmentally sensitive industries tend to adopt more EMAS practices than companies in environmentally less sensitive industries. Mokhtar et al. (2016) also reported that the mean score of EMAS adoption for companies in environmentally sensitive industries was higher than those of less sensitive industries. Mokhtar et al. (2016) also stated that the EMAS adoption in environmentally sensitive industries was beyond mere innovation. Even though most of the respondents have allocated some budget for environmental activities, the result suggested that the adoption of EMAS was not at an encouraging level. The result strongly supports this

statement that the mean scores for all EMAS adoption were three on average indicating a moderate adoption level within the organization.

Table 4: Descriptive Statistics for MEMA Practices (N=205)

Item	MEMA Practices	Mean	Std. Dev	Min	Max
MEMA1	Environmental cost accounting.	3.37	0.87	2	5
MEMA2	Post-investment of individual environmental projects.	3.27	0.83	1	5
MEMA3	Environmental target costing.	3.22	0.91	1	5
MEMA4	Environmental lifecycle costing.	3.20	0.82	1	5
MEMA5	Post assessment of relevant environmental costing decisions.	3.16	0.84	1	5
MEMA6	Environmentally induced capital expenditure and revenue.	3.13	0.86	1	5
MEMA7	Monetary environmental operational budgeting.	3.12	0.87	1	5
MEMA8	Monetary environmental capital budgeting.	3.11	0.83	1	5
MEMA9	Environmental lifecycle target pricing.	3.07	0.86	1	5
MEMA10	Environmental long-term financial planning.	3.05	0.93	1	5
MEMA11	Monetary environmental project investment appraisal.	3.04	0.92	1	5
MEMA12	Environmental lifecycle budgeting.	3.03	0.88	1	5
MEMA13	Relevant environmental costing.	3.00	0.89	1	5

Table 5: Descriptive Statistics for PEMA Practices (N=205)

Item	PEMA Practices	Mean	Std. Dev	Min	Max
PEMA1	Lifecycle inventories.	3.51	0.97	1	5
PEMA2	Material flow assessment.	3.40	0.96	1	5
PEMA3	Energy flow assessment.	3.38	0.95	2	5
PEMA4	Post assessment of short-term environmental impact.	3.25	0.99	1	5
PEMA5	Lifecycle analysis.	3.22	0.89	1	5
PEMA6	Environmental capital impact assessment.	3.16	0.93	1	5
PEMA7	Physical environmental investment appraisal.	3.16	0.87	1	5
PEMA8	Physical environmental budgeting.	3.15	0.87	1	5
PEMA9	Long-term physical environmental planning.	3.15	0.96	1	5
PEMA10	Relevant environmental impacts.	3.08	0.96	1	5
PEMA11	Post-investment assessment of physical environmental investment appraisal.	3.07	0.87	1	5

Table 4 and Table 5 shows the result of each item of MEMA and PEMA, where the highest four scores in MEMA were on the practice of environmental cost accounting (3.37), post-investment of individual environmental projects (3.27), environmental target costing (3.22) and environmental lifecycle costing (3.20). While the highest scores in PEMA were on the lifecycle inventories (3.51), material flow assessment (3.40), energy flow assessment (3.38) and post-assessment of short-term environmental impact (3.25).

Sustainability Performance

This research examined the impacts of EMAS adoption on sustainability performance. The scale used was the 5-point Likert-type scale, ranging from 1 (strongly disagree) to 5 (strongly agree) to determine the frequency of perceived value that may have been created by adopting EMAS in the recent past do so soon. The measurements developed by Ramli and Ismail (2013) and Cankaya and Sezen (2019) were adopted for economic performance since their study employed perceptual performance measurement to determine sustainability performance. In this research, environmental performance was also incorporated as part of sustainability performance and the measurement was adopted by Jamil et al. (2015). Furthermore, social performance was also incorporated as value created in the organization. This research measured social performance using items adopted from Ahi and Searcy (2015) and Cankaya and Sezen (2019).

As in Table 6, the result shows that economic performance had the highest mean (3.90), followed by environmental performance (3.80) and social performance (3.68). Moreover, this research found that companies in environmentally sensitive industries were more likely to implement a greater extent of EMAS adoption than those in environmentally less sensitive industries (Mokhtar et al., 2016). Thus, the result showed that companies in environmentally sensitive industries had a better sustainability performance due to the greater extent of EMAS adoption than companies in environmentally less sensitive industries. The results of the descriptive statistics for each sustainability performance comprised of economic, environmental and social performance are reported in Table 7.

Table 6: Overall Result of Descriptive Statistics for Sustainability Performance (N=205)

Item	Mean			Ranking
	Sensitive Industries	Less Sensitive Industries	Overall	
Economic Performance	4.09	3.68	3.90	1
Environmental Performance	4.08	3.48	3.80	2
Social Performance	3.92	3.40	3.68	3

Table 7: Descriptive Statistics for Sustainability Performance (N=205)

Item	Sustainability Performance	Mean	Std. Dev	Min	Max
	Economic Performance				
ECP1	Increase in operating profit.	4.00	0.77	2	5
ECP2	Decrease in the cost of energy consumption.	3.97	0.74	1	5
ECP3	Increase in return on investment.	3.95	0.77	2	5
ECP4	Decrease in the cost of material purchased.	3.94	0.80	2	5
ECP5	Decrease in the fee for waste discharge.	3.92	0.85	2	5
ECP6	Increase in cash flow.	3.90	0.75	1	5
ECP7	Increase in return on assets.	3.87	0.78	1	5
ECP8	Improvement in earnings per share.	3.82	0.80	1	5
ECP9	Increase in revenue.	3.75	0.77	2	5
	Environmental Performance				
ENP1	Reduction in the use of energy.	4.00	0.74	2	5
ENP2	Reduction in the use of water.	3.90	0.83	1	5
ENP3	Reduction of wastewater emissions.	3.88	0.87	2	5
ENP4	Reduction in the use of non-renewable resources.	3.85	0.89	2	5
ENP5	Reduction of solid waste.	3.84	0.83	2	5
ENP6	Reduction in the use of toxic inputs.	3.84	0.82	2	5
ENP7	Reduction of emissions to air.	3.80	0.78	2	5
ENP8	Reduction of landscape damage	3.80	0.83	2	5
ENP9	Reduction of smell/ odour emissions.	3.75	0.80	1	5
ENP10	Reduction of soil contamination.	3.72	0.93	2	5
ENP11	Reduction of noise.	3.67	0.85	2	5
ENP12	Reduction in the risk of severe accidents	3.58	0.92	2	5
	Social Performance				
SOP1	Improvement in community health and safety.	3.77	0.87	2	5
SOP2	Improvement in occupational health and safety of employees.	3.76	0.78	1	5
SOP3	Improvement in relations with community stakeholders.	3.71	0.87	2	5
SOP4	Improvement in customer satisfaction.	3.69	0.76	1	5
SOP5	Reduction in community complaints.	3.67	0.84	2	5

SOP6	Improvement in the company's image in the eyes of its customers.	3.61	0.87	2	5
SOP7	Improvement in overall stakeholder welfare or betterment.	3.57	0.69	1	5

Partial Least Squares Structural Equation Modeling (PLS-SEM)

PLS-SEM was used to check the reliability and validity of items and constructs, correlation values, multiple regression analysis and the significance of the hypothesised relationships. PLS-SEM is relevant for this study as the primary objective of applying structural equation modelling is to predict and explain target constructs. Thus, preliminary testing needs to be fulfilled to prepare the data for analysis. Using better instruments will ensure more accuracy in results and enhancing the scientific quality of the research. Therefore, normality, reliability, validity and factor analysis were conducted to assess the goodness of the measures developed. Before conducting data analyses for the hypotheses testing, the field data of 205 participants were examined for common method variance (CMV). Because the total variance explained based on the Harman single factor test was less than 50%, it was concluded that common method variance did not occur in the field data set of this research. PLS-SEM analysis acquires assessing the measurement model and the structural model. The details for the two stages of the model are discussed in the following sections.

The Measurement Model

The assessment of the measurement model involved the evaluation of indicator reliability, internal consistency, convergent validity and discriminant validity. The statistical analysis results are shown in Table 8 and Figure 2 shows the modified measurement model.

Table 8: Summary of Measurement Model (N=205)

Constructs	Indicators	Loadings	Composite Reliability (CR)	Average Variance Extracted (AVE)
		> 0.60	> 0.70	> 0.50
EMAS Adoption	MEMA1	0.796	0.888	0.584
	MEMA2	0.763		
	MEMA3	0.656		
	MEMA4	0.722		
	MEMA5	0.737		
	MEMA6	0.731		
	MEMA7	0.747		
	MEMA8	0.745		
	MEMA9	0.783		
	MEMA10	0.772		
	MEMA11	0.768		
	MEMA12	0.793		
	MEMA13	0.735		
	PEMA1	0.802		
	PEMA2	0.782		
	PEMA3	0.792		
	PEMA4	0.778		
	PEMA5	0.794		
	PEMA6	0.789		
	PEMA7	0.764		
	PEMA8	0.796		
	PEMA9	0.761		
	PEMA10	0.754		
	PEMA11	0.766		
Economic Performance	ECP2	0.711	0.866	0.519
	ECP4	0.725		
	ECP6	0.706		
	ECP7	0.747		
	ECP8	0.682		
	ECP9	0.746		

Environmental Performance	ENP1	0.771	0.925	0.507
	ENP2	0.710		
	ENP3	0.733		
	ENP4	0.723		
	ENP5	0.656		
	ENP6	0.747		
	ENP7	0.724		
	ENP8	0.682		
	ENP9	0.682		
	ENP10	0.745		
	ENP11	0.676		
	ENP12	0.690		
Social Performance	SOP1	0.709	0.898	0.557
	SOP2	0.776		
	SOP3	0.795		
	SOP4	0.690		
	SOP5	0.740		
	SOP6	0.775		
	SOP7	0.734		

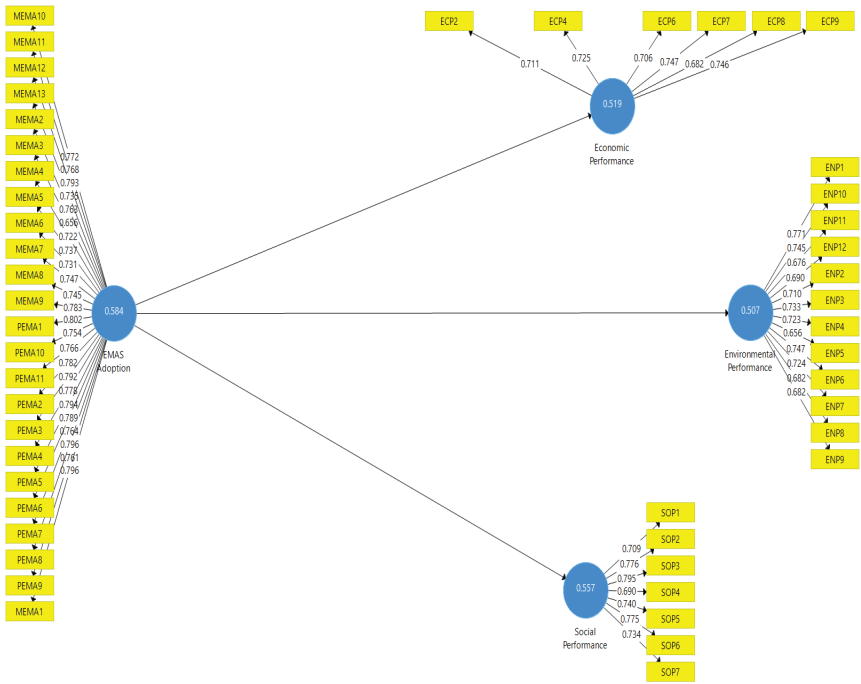

Figure 2: The Modified Measurement Model

Indicator Reliability

To assess indicator reliability, Hair et al. (2014) suggest that the item's outer loading should be at least 0.60. A generally accepted rule is 0.60-0.70 indicates an acceptable level of reliability (Hair et al., 2017). Outer loading between 0.40 and 0.70 should be considered for removal from the scale only when deleting the indicator increases the composite reliability or the average variance extracted (AVE). Following these criteria, three items of economic performance with low outer loading were excluded from the initial measurement model. These items related to the improvement in revenue (ECP1), return on investment (ECP3), and company cash flow (ECP5) in the past three years. This research argues that items related to increasing operating profit (ECP2) might already measure those items indirectly. The results showed outer loadings after removing "ECP1 = 0.654", "ECP3 = 0.587" and "ECP5 = 0.612".

Internal Consistency

Internal consistency was measured using "composite reliability (CR)". Internal consistency reliability defines the consistency of the results delivered in a test to ensure that the various items measured different constructs and delivered consistent scores. According to Sekaran and Bougie (2016), the composite reliability value should be > 0.70 because < 0.60 shows a lack of internal consistency reliability, 0.60-0.70 is acceptable in exploratory research and 0.70-0.90 is satisfactory. In this research, the composite reliability for all constructs had a value more than the threshold of 0.70. This indicated all constructs achieved internal consistency reliability.

Convergent Validity

Convergent validity is evident when each measurement item correlates strongly with its intended theoretical construct. To establish convergent validity, the outer loadings of the indicators and average variance extracted (AVE) should be considered. AVE is defined as the grand mean value of the squared loadings and is equivalent to the communality of a construct. Sufficient convergent validity is achieved when a construct's AVE value is at least 0.50 (Hair et al., 2014). In this research, all constructs had achieved the minimum AVE threshold after modification. Therefore, the measurements for all constructs had an acceptable level of convergent validity.

Discriminant Validity

Discriminant validity is the extent to which a construct is distinct from other constructs by empirical standards. Discriminant validity was assessed using the Heterotrait-Monotrait Ratio of Correlations (HTMT) (Hair et al., 2014). Discriminant validity can be established when the HTMT value is below 1.0. As in Table 9, the result proved that the HTMT values of the constructs were below 1.0. Hence, the discriminant validity of the constructs is supported. The construct did not share the same concept and they were discriminant.

Table 9: Heterotrait-Monotrait Ratio of Correlations (HTMT) Values

Constructs	EMAS Adoption	Economic Performance	Environmental Performance	Social Performance
EMAS Adoption				
Economic Performance	0.683			
Environmental Performance	0.873	0.669		
Social Performance	0.842	0.579	0.865	

Collinearity Issues

Collinearity indicates that the predictor (independent) variables might be highly inter-correlated. The path coefficient might be biased if the estimation involves significant levels of collinearity among the predictor constructs. Variation inflation factor (VIF) was used to test for collinearity. The results indicated that all of the VIF were below the recommended threshold value of 5.0 indicating no collinearity issue existed.

The Structural Model

The structural model also called the inner model, reflects the relationships between the latent variables (Hair et al., 2014). Upon completing the assessment regarding the validity and reliability of the measurement model, the structural model is applied to test the relationship between the constructs (endogenous and exogenous) and assess how strong the model is. By performing a bootstrap procedure, PLS-SEM enables the testing of the hypothesis using path analysis. As in Table 10, the result showed the significant impact between EMAS adoption and sustainability performance comprised of economic, environmental and social performance.

Table 10: Path Coefficients Result (EMAS Adoption and Sustainability Performance)

Relationship	Path Coefficient	Std. Deviation	T Statistic	P-Value
EMAS Adoption -> Sustainability Performance	0.86	0.02	44.73	0.00**
EMAS Adoption -> Economic Performance	0.61	0.05	13.05	0.00**
EMAS Adoption -> Environmental Performance	0.82	0.02	35.78	0.00**
EMAS Adoption -> Social Performance	0.78	0.03	24.53	0.00**

**significant at 1% level

The result of this research is consistent with prior studies that also found a significant impact between EMAS adoption and sustainability performance (Rahman et al., 2021; Pratiwi et al., 2020; Christine et al., 2019). This finding confirmed that companies could improve their sustainability performance with EMAS adoption and ensure that the company remains sustainable.

Predictive Accuracy of Model

The "coefficient of multiple determinations (R^2)" measures the model's predictive accuracy and is calculated as the squared correlation between a specific endogenous construct's actual and predicted values. Table 11 presents the result of an assessment of the coefficient of multiple determination. The R^2 value for the modified measurement model was 0.744 for sustainability performance. This implied that 74.4% of the total variance in sustainability performance can be explained and predicted by the exogenous construct linked to it, respectively. On the other hand, the R^2 value for economic performance was 0.373, explaining that 37.3% of the total variance in the economic performance can be explained and predicted by the exogenous construct linked to it, respectively. Next, for environmental and social performance, 67.8% and 60.7% of total variation were explained by all linked constructs.

Table 11: R^2 Values for Initial and Modified Model

Constructs	R^2	R^2 adjusted
Sustainability Performance	0.744	0.742
Economic Performance	0.373	0.370
Environmental Performance	0.678	0.677
Social Performance	0.607	0.605

Effect Size (f^2)

The "effect size (f2)" is a measure of the impact of a specific exogenous construct on an endogenous construct. The effect size of the structural model was evaluated to determine whether the increase in R2 is relative to the proportion of variance that remains unexplained in the endogenous construct (Hair et al., 2014). The f2 measures the influence a selected predictor construct has on the R2 values of an endogenous construct. According to Hair et al. (2017), f2 value of 0.35 = substantial, 0.15 = medium and 0.02 = small. The f2 results are presented in Table 12. This is consistent with the path coefficient result in this research.

Table 12: Effect Size (f^2) Values

Relationship	f^2 Values	Effect Size
EMAS Adoption -> Sustainability Performance	2.901	Substantial
EMAS Adoption -> Economic Performance	0.594	Substantial
EMAS Adoption -> Environmental Performance	2.109	Substantial
EMAS Adoption -> Social Performance	1.545	Substantial

Note: 0.02- small effect size, 0.15- medium effect size, 0.35- substantial effect size

Blindfolding and Predictive Relevance (Q^2)

The last step in assessing the structural model is to examine Stone-Geisser's predictive relevance value (Q^2). Q^2 measures the extent to which the model's prediction is successful, and a value of $Q^2 > 0$ confirms the presence of predictive relevance (Hair et al., 2014). As Q^2 measurement is only applicable for endogenous constructs with a reflective measurement model specification and endogenous single-item constructs, the blindfolding procedure in SmartPLS provides Q^2 values only for sustainability performance comprised of economic performance, environmental performance and social performance. The results showed the values of Q^2

were greater than 0 for all constructs as per Table 13. Hence, it is confirmed that the structural model exhibited predictive relevance for the endogenous construct.

Table 13: Predictive Relevance (Q^2) Values

Constructs	SSO	SSE	Q^2 (=1-SSE/SSO)
Sustainability Performance	5,125.00	3,685.16	0.28
Economic Performance	1,230.00	1,010.19	0.18
Environmental Performance	2,460.00	1,677.72	0.32
Social Performance	1,435.00	850.66	0.41

Table 14: Result of Hypotheses Testing

Hypotheses	Findings
H1: There is a significant impact between EMAS adoption and sustainability performance among PLCs in Malaysia.	Supported
H2: There is a significant impact between EMAS adoption and economic performance among PLCs in Malaysia.	Supported
H3: There is a significant impact between EMAS adoption and environmental performance among PLCs in Malaysia.	Supported
H4: There is a significant impact between EMAS adoption and social performance among PLCs in Malaysia.	Supported

This research tested four hypotheses (H1, H2, H3 and H4). Based on Table 14, EMAS adoption had a significant impact with sustainability performance among the public listed companies in Malaysia, thus supporting H1. This finding is consistent with Doorasamy and Nyahuna (2021) and Mohamed and Jamil (2018) observed that the company is more likely to have better sustainability performance when adopting EMAS in their organizations. For that reason, the need to make EMAS adoption mandatory for all public listed companies in Malaysia should be considered by policymakers. The finding confirmed the significant impact between EMAS adoption and economic performance among Malaysian PLCs. Thus, H2 is supported. This result is consistent with Rahman et al. (2021) and Okegbe and Ofurum (2019) found that companies adopting EMAS can use environmental information to save costs on their production processes. The findings also show that EMAS adoption exposes hidden environmental opportunities such as enhanced waste management practices, minimization of material and energy consumption and opportunities for recycling materials (Larojan & Thevaruban, 2014).

This research provides evidence of the significant impact between EMAS adoption and environmental performance among the public listed companies in Malaysia, thus supporting H3. This finding is consistent with Qian et al. (2018) who found that EMAS adoption can provide information about promoting cleaner production and enhancing sustainable development. Fuzi et al. (2021) and Christine et al. (2019) also reported a significant positive relationship between EMAS adoption and environmental performance to reduce negative environmental impact and the use of natural resources. The companies seem to value environmental information because it supports them in creating long-term shareholder value by avoiding any violation of environmental regulations. The finding confirmed the significant impact between EMAS adoption and social performance among Malaysian PLCs. Hence, H4 is supported. This finding is consistent with Rasit et al. (2020) who concluded that EMAS adoption has a positive relationship with the social performance of Malaysian PLCs. Management accounting practices such as EMAS adoption can help companies meet current generations' needs without compromising future generations' needs (Sariannidis et al., 2018). As a result, EMAS adoption could contribute to society's social progress, enhancing both the standard of living and the quality of life

DISCUSSION

EMAS is an effective tool to overcome environmental problems and mitigate the negative impact on the environment due to business operations. In recent years, the importance of the sustainability agenda among public listed companies has become inevitable. As per the first objective of the research, the findings implicated that most of the public listed companies in Malaysia were in the learning phase and have moderate adoption of EMAS. The public listed companies in Malaysia may also use the findings of this research that the level of EMAS adoption was not at an encouraging level. However, most of the companies in this research have some environmental-related budgets. This finding concluded that the commitment of Malaysian public listed companies to EMAS adoption still needs to be improved. The need for companies operating in environmentally sensitive and less sensitive to have a behavioural change is essential in this path as they are responsible for safeguarding the environment

This research examined the impact of EMAS adoption on sustainability performance. As per the second objective of the research, the finding reported that EMAS adoption had a significant impact with all elements of sustainability performance, including economic, environmental and social performance in the context of public listed companies in Malaysia. Furthermore, this research also found that most companies implementing EMAS can gain a cost-saving advantage due to enhanced process efficiency, reduced usage of raw materials and waste disposal (Rahman et al., 2021). Pratiwi et al. (2020) also reported that EMAS adoption positively impacts financial efficiency. Therefore, to be genuinely sustainable, companies must look at other triple bottom line dimensions, such as environmental and social performance (Tate & Bals, 2018).

Apart from that, applying social issue life cycle theory provides valuable information to the present knowledge by exploring more explanations for EMAS adoption level in an unexplored context in Malaysia. The moderate adoption of EMAS might be due to insufficient environmental knowledge and skills that restrict the integration of environmental aspects into the management accounting system (Latif et al., 2020; Bouliane et al., 2018). Thus, finance managers, accountants and project managers are encouraged to participate in training related to environmental management. They also need to be updated with the latest development of EMAS so that this tool can be applied among public listed companies in Malaysia. Furthermore, professional bodies such as ACCA, CIMA, ICAEW and MICPA should promote environmental management accounting and provide a better framework for environmental practices.

CONCLUSIONS, IMPLICATIONS, AND LIMITATIONS

With the increasing call for sustainability, the importance of sustainable performance has become increasingly prominent. This research examines the impact of EMAS adoption on sustainability performance among Malaysian PLCs. The findings suggest that EMAS is a valuable and essential tool to provide environment-related information to boost corporate sustainability performance. This research contributes to the body of knowledge in management accounting by providing current insights into both literature and research methodologies. Incorporating the social issue life cycle theory,

this research provides empirical evidence of the EMAS adoption level from Malaysian PLCs' perspective.

This research emphasizes the imperative role of various authorities in championing environmental sustainability (Jamil & Mohamed, 2017). Therefore, the government should update and enforce environmental regulations to prevent public listed companies from causing adverse environmental impacts. This research also suggests that respective bodies must create awareness of environmental management through education programs. Moreover, the Ministry of Natural Resources, Environment and Climate Change should promote EMAS adoption by issuing specific environmental guidelines and better enforcement of the environmental regulations in Malaysia. Furthermore, authorities in the capital market such as Bursa Malaysia should make environmental reporting a mandatory listing rule. Bursa Malaysia also should provide guidance documents and training on environmental reporting to offer reassurance and promote the environmental commitment of companies operating in Malaysia. Moreover, tax authorities can stimulate companies' interest by applying favoured green tax incentives.

Despite the contributions of this research to the growing body of literature on EMAS, limitations are almost inevitable which will offer an excellent platform for future research. The result of this quantitative research may not have captured an in-depth understanding of the subject phenomena. Besides that, unreliability and inaccuracy in data collection could happen because some of the respondents may answer the questionnaire without reading and interpreting the contents and this caused invalid data. For future research, qualitative approaches such as case studies, in-depth interviews and experimental designs may provide in-depth and detailed knowledge that further strengthens the findings of the survey-based approach. In addition, future researchers also can investigate the factors that could influence EMAS adoption in various countries. Regardless of these limitations, the findings of this research make a valuable contribution to the existing management accounting literature by providing a helpful understanding of the EMAS adoption level in Malaysia. From the results, it can be summarized that companies with significant EMAS adoption will increase sustainable performance development which leads these companies to survive in the long term.

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