Integrating Environmental Management Accounting in the Link between Environmental Strategy and Performance: Empirical Evidence of Electrical and Electronic Industry

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Abstract: Environmental issues have captured the attention of most organisations today due to the requirements to comply with environmental regulations and stakeholders' pressure to create value and achieve sustainable performance. Prior researchers have extensively emphasised using environmental management accounting (EMA) as one of the tools that may suffice in addressing environmental issues. This study aimed to examine environmental strategy as one of the factors that can solve the challenges prior studies discovered to implement EMA to enhance environmental performance effectively. Therefore, this study investigated the relationship between environmental strategy and EMA adoption to improve environmental performance. A quantitative research approach was adopted using the questionnaire survey method to collect data. Data were gathered from the members of the Malaysian electrical and electronic industry and the Electrical and Electronics Association of Malaysia (TEEAM). A simple random sampling technique was utilised for the sample selection, and the data were analysed by applying structural equation modelling using the partial least squares approach (PLS-SEM). The findings offer evidence that environmental strategy has a significant positive influence on EMA and environmental performance. Besides, EMA has a significant positive influence on environmental performance. Evidence indicates that EMA mediates between environmental strategy and environmental performance.

Keywords: Environmental Management Accounting, Environmental Strategy, Environmental Performance, Electrical and Electronic Industry.

1. INTRODUCTION

Implementing an environmental strategy on a global scale is necessary to ensure continuous improvement in addressing the significant environmental issues associated with the negative impacts of various industrial activities (Gunarathne, Lee, and Hitigala Kaluarachchilage 2023). The strategy's initiatives include implementing organisational policies with the objectives to minimise waste, energy, and water consumption, implementing environmental management systems, and utilising sustainable green resources (Solovida and Latan 2017; Liu and Zhang 2022). The environmental strategy has gained management's attention in most organisations due to the global environmental issues associated with climate change, greenhouse gas emissions, the requirement to comply with environmental regulations, and stakeholders' pressure towards ecological issues (Journeault, De Rongé, and Henri 2016). The strategy involves incorporating environmental information through a set of approaches to help organisations minimise the industrial impact on the natural environment (Latan et al. 2018). A substantial proactive environmental strategy has a crucial ability to implement environmentally-friendly products, processes, and technologies (Ryszko 2016). According to Dragomir (2020), an effective proactive environmental strategy aims to incorporate environmental costs without harming profitability to react to legal and social pressures appropriately. Concurrently, organisations can gain competitive advantage through environmental development and industrial processes invention that leads to eco-sustainability. These initiatives will increase the capability and environmental contribution of the organisation's employees and offer options for more responsible consumption.

Appiah et al. (2020) asserted that the attention given to the influence of environmental strategy might cover three different areas in an organisation: its price, product, and stakeholders' relationships. Environmental accounting information is vital in an environmental strategy when making pricing decisions (Appiah et al. 2020). Environmental management accounting (EMA) practices help support the strategy and provide essential environmental-related cost information (Christ and Burritt 2013; Al-Mawali 2018). Furthermore, the primary benefit of implementing EMA is to over-

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come the deficiency of conventional management accounting systems, as EMA practices have a better capability to identify relevant costs, thus, providing accurate environmental costs (Christ and Burrit 2013; Gunarathne et al. 2023). Al-Mawali et al. (2018) and Latan et al. (2018) discovered a notable result concerning EMA in perceiving companies' environmental costs. A company that heavily relies on EMA could achieve significant advantages by improving product quality, which would give the firm a competitive edge (Dunk 2007).

Nevertheless, environmental strategies require organisations to possess enormous resources and skills, such as physical assets, technologies, and people (Sharma 2000). Based on investigations into the five largest energy companies in the world, Ruka and Rashidirad (2019) identified that implementing the environmental strategy requires adopting new production technologies in the operational process. Aragón-Correa et al. (2008) highlighted that organisations lacking resources might be unable to develop appropriate or proactive environmental strategies. This study contributes to the research area to examine the relationship between environmental strategy and EMA adoption and whether the implementation of EMA will enhance environmental performance. Additionally, this study resolved the mixed findings on the relationship between environmental strategy and EMA (Ferreira, Moulang, and Hendro 2010; Solovida and Latan 2017; Gunarathne et al. 2023). The inconsistent findings suggested that more research is needed to gain a deeper understanding of the relationship between environmental strategy and the use of EMA. Additionally, Ferreira et al. (2010) argued that the key driver of EMA use was industry, as evidence from their research demonstrated a strong and significant effect for the industry in EMA use, regardless of organisational size.

The present study examined the effect of environmental strategy on the use of EMA, specifically by providing empirical evidence from the Malaysian electrical and electronic industry. By focusing on a single industry, this research provides valuable insights into the relationship between environmental strategy and EMA by highlighting the industry's role in understanding their association. As one of the most important industries in Malaysia, the government strongly emphasises keeping this industry up to date with the latest technological advancements. Moreover, advanced technology may potentially enhance the reliability of environmental cost information (Ahmad and Zabri 2015; Kablan 2020; Rasit et al. 2022). Prior research has highlighted that EMA implementation might vary across organisations due to the complexities of environmental management strategies (Gunarathne et al. 2023). Firms require relevant accounting information for various decision-making and control purposes. Thus, specific management accounting tools, such as EMA, are suitable to ensure that the implementation of environmental initiatives is effective. Additionally, empirical evidence from this research on the electrical and electronic industry may provide significant insight from the contingency theory perspective on the effectiveness of EMA implementation (Rasit et al. 2022; Gunarathne et al. 2023).

The remaider of this paper is organised in the following structure: The subsequent section provides the integration of the existing literature review on environmental strategy, EMA, and environmental performance. The section also includes hypotheses development based on the literature review, the study's underlying theories, and the research framework development. The subsequent sections discuss the research methodology, results, and data analysis summarising the findings, the study's limitations, and suggestions for future research.

2. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

2.1. Theoretical Background

Prior research has presented varying perspectives on the relationship between management accounting systems and strategy. The most well-known contingency theory view of management control systems was by Chenhall (2003), who asserted that the accounting systems in organisations should be aligned or suit with the organisation's contingencies. The assumptions of the contingency theory-management accounting relate to the idea that no specific universally applicable accounting system is suitable for all organisations under all circumstances. The accounting system adopted should be able to adapt to the organisation's contingencies, which are the external and internal factors, including firm strategy. As environmental issues increase, EMA is becoming highly important for environmental decisions and activities. Thus, accounting systems, such as EMA, will act as decision-control tools to provide managers with relevant environmental information in accomplishing organisational objectives to ensure successful environmental strategy implementation.

In order to reduce or control the influence of a key contingency factor, the uncertain environment, this research focused on a single industry, thus enabling the examination of strategy on EMA and performance to provide more realistic findings (Burgess, Ong, and Shaw 2007). This study is inspired by the conventional view of linking the accounting system, EMA, to firm strategy. In implementing the strategy, EMA use is critical in providing relevant and reliable environmental information to support the strategy (Ferreira et al. 2010; Solovida and Latan 2017; Al-Mawali et al. 2018). Although prior studies empirically identified the direct relationship between environmental strategy and EMA, the findings have been inconsistent. For example, Christine et al. (2019) and Latan et al. (2018) identified that the strategy has a significant relationship with EMA, whereas Ferreira et al. (2010) identified no relationship between both.

Similar to several other research (Latan et al. 2018; Slovida and Latan 2017), the link between environmental strategy can also be explained from the perspectives of the Natural Resource Based View (NRBV) theory proposed by Hart (1995). The NRBV generally explains how a company's environmental activities help the company achieve sustainable competitive advantages (Wijethilake, Munir, and Appuhami 2016). In this study, the company's environmental activities are referred to as activities initiated based on its environmental strategy. According to Latan et al. (2018), a sustainable development strategy helps reduce environmental degradation and reassures continuous environmental performance in the future. As many researchers argued, an effec-

tive environmental strategy can be a key source of sustainable competitive advantage if it meets the criteria of being valuable, rare, difficult to imitate, and non-substitutable by competitors (Ryszko 2016; Solovida and Latan 2017; Latan et al. 2018).

Solovida and Latan (2017) also stated that a company's environmental strategies that are different from other companies could help improve its environmental and financial performance. Differentiation created in the firm's environmental initiatives may assist firms in creating more value, thus gaining a competitive advantage better than others. Therefore, the NRBV theory provides support for explaining the relationship between the outcome of environmental strategy and the adoption of EMA within the context of this research which focuses primarily on a specific industry, the electrical and electronic companies, to examine how environmental performance can be enhanced.

2.2. Environmental Strategy and Environmental Management Accounting (EMA)

Applying environmental strategies offers great assistance in gathering comprehensive environmental accounting information (Qian and Burritt 2009). Parker (1997) conducted among the earliest studies on environmental strategy and EMA through the contingency theory perspective. One of the subjects discussed by the author assessed the outcome of the development of corporate environmental strategies. The results arrayed the possibility of environmental strategy influencing the EMA complexity. A later study by Latan et al. (2018) provided further evidence of the positive and significant influence between environmental strategy and EMA use. Latan et al. (2018) mentioned that a company using EMA needs to ensure that the accounting functions are assimilated with environmental strategies. The more a corporate strategy prioritises environmental issues, the greater its influence on adopting and using EMA (Latan et al. 2018).

Le, Nguyen, and Phan (2019) similarly suggested that improving environmental strategies for highly accurate environmental information can lead to positive changes in the management accounting system, including EMA. This suggestion is based on a study conducted on the construction material manufacturing enterprise in Vietnam. The result showed that a positive environmental strategy motivated environmental manager to practice EMA actively. By focusing on the environmental strategy, Ruka and Rashidirad (2019) identified that successfully developing and implementing an environmental strategy leads to the companies' sustainable development. Christ and Burritt (2013) suggested that EMA involvement is highly likely when the company integrates environmental activities into their everyday business activities.

Although extant research has investigated the relationship between environmental strategy and a company's performance, as discussed above, some studies have investigated how environmental strategy impacts EMA use. For instance, Solovida and Latan (2017) highlighted that it is essential for each company to have a proactive environmental strategy development since the implementation of appropriate environmental strategies has a significant influence on EMA use. A study conducted in Poland by Ryszko (2016) found that implementing proactive environmental strategies can yield valuable knowledge for determining best practices in environmental management. Based on previous studies, it is wise to infer that companies which actively integrate environmental issues into their strategic plans and goals are more likely to adopt EMA practices (Christ and Burritt 2013). Therefore, the current study proposes the following hypothesis:

H1: There is a positive relationship between environmental strategy and EMA adoption.

2.3. Environmental Management Accounting (EMA) and Environmental Performance

Physical and monetary information are important components of environmental information used in EMA. Physical environmental information refers to the information on the flow of energy, water, materials, and wastes. The information also emphasises the total volume of waste and energy consumption. Monetary environmental information relates to environmental costs and earnings, such as the material costs of the product and non-product output, waste and emission control costs, environmental research costs, development costs, sales from scrap and wastes, and recycling subsidies (Christ and Burritt 2013). Implementing EMA enables the organisation to obtain environmental operation information (Amir and Chaudhry 2019). A significant association exists between environmental performance, the sequential use of EMA, and top management commitment. Early researchers have suggested that companies should implement environmental accounting practices to promote sustainability (Larrinaga-Gonzalez and Bebbington 2001; Springett 2003).

Information from EMA can be used in determining product costing and pricing, investment decisions, performance measurement systems, budgeting, and environmental reporting. Allocating the environmental cost to the right activity or product would help improve product pricing decisions. Contrarily, conventional management accounting pools the environmental costs in overhead accounts and finally increases the products' price and is unable to provide sufficient information related to environmental management (Ismail, Ramli, and Darus 2014).

Organisational performance can increase through EMA integration (Zorpas 2010). Organisations emphasising environmental or green practices may attract more customers since customers today have higher environmental awareness of green products and concurrently choose businesses that uphold environmental protection practices. In an effort to improve environmental performance, companies must prioritise implementing EMA policies. Many prior researchers discovered a significant positive relationship between EMA and environmental performance (Doorasamy and Garbharran 2015; Phan, Baird, and Su 2018). Phan et al. (2018) examined the link between specific EMA tools, namely environmental activity management, which covers three levels: environmental activity analysis, environmental activity cost analysis, and environmental activity-based costing on environmental performance in Australian organisations. The result indicated significant relations between environmental management activities, particularly EMA, as a vital tool to enhance environmental performance.

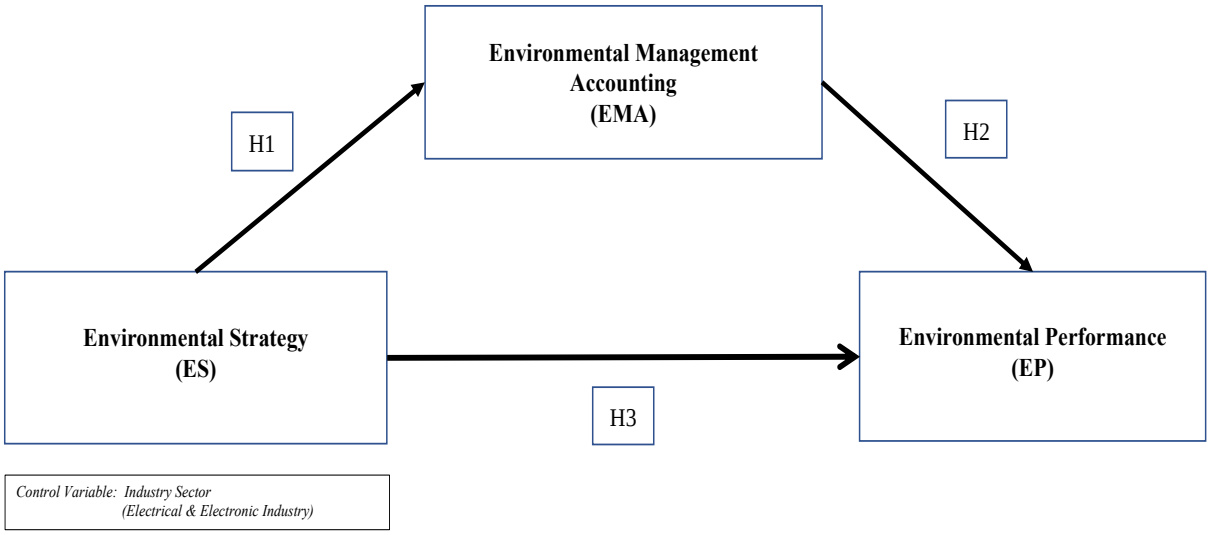

Fig. (1). Conceptual framework of the research.

(Note: ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting).

Doorasamy and Garbharran (2015) investigated the use of EMA and identified environmental costs and their impact on environmental performance. The evidence revealed that EMA could improve a company's environmental and economic performance by providing managers with precise values of environmental costs. Quantitative research on Italian companies found that EMA use helps improve environmental performance based on emission reductions and increased performance movements better than competitors (Daddi et al. 2011). Amir and Chaudhry (2019) stated that implementing EMA motivates managers and top management to focus on sustainability, which positively impacts environmental performance. Therefore, based on the evidence discussed from prior research, the following hypothesis is proposed:

H2: There is a positive relationship between EMA adoption and environmental performance.

2.4. Environmental Strategy and Environmental Performance

Environmental strategy is defined as a set of approaches companies take to minimise the industrial impact on the natural environment (Latan et al. 2018). A previous study identified that a proactive environmental strategy is crucial for implementing environmentally-friendly products, processes, and technologies (Ryszko 2016). In particular, the researchers stated that economic and environmental performances were significantly impacted by environmental strategy. A study on small firms in Spain found that companies with stronger environmental strategies showed greater commitment to environmental enhancement (Aragón-Correa et al. 2008; Christine et al. 2019).

Christine et al. (2019) provided evidence that environmental strategy has significantly and positively impacted both economic and environmental performance. The results implied that a firm's efficient environmental policies improve environmental performance and boost organisational and economic performance. Environmental performance reflects a company's attention and awareness of its environmental management by efficiently utilising its resources (Haninun, Lindrianasari, and Denziana 2018). A prior study by Dilla et al. (2019) discovered that environmental performance and assurance information greatly affected investment interest and investors' quantity judgments on environmental management. These investors need to have strong environmental responsibility views.

According to Nishitani and Kokubu (2020), better environmental performance is a key inspiration for companies to succeed in business. Many researchers in the current literature stream discuss and investigate the nexus of environmental strategy and company performance. For example, Aragón-Correa et al. (2008) and Christine et al. (2019) studied the relationship between the environmental strategy of small and medium enterprises and firm performance.

Claver-Cortés et al. (2007) demonstrated opposing results where environmental strategy did not strongly impact the hotel industry's performance in Spain. In a recent study, Latan et al. (2018) discovered several drivers of EMA and their impact on a company's environmental performance. Based on the data collected from Indonesian companies listed on the Indonesian Stock Exchange, EMA has been shown to be an effective tool for linking environmental strategy and positively impacting a company's environmental performance. Thus, the current study proposes the following hypothesis:

H3: There is a positive relationship between environmental strategy and environmental performance.

2.5. Conceptual Framework

The study's research model is presented in Fig. 1 below. The model includes environmental strategy, EMA, and environmental performance. The model proposes the role of EMA as a mediating effect in the link between environmental strategy and environmental performance.

3. RESEARCH METHODOLOGY

3.1. Sample and Data Collection

The primary data collection method was employed in this study by distributing questionnaires as an instrument to gather information from the respondents. The questionnaires were prepared on Google Forms and distributed through email to the electrical and electronic companies listed in The Electrical and Electronics Association of Malaysia (TEEAM). The TEEAM is a representative body of Malaysia's electrical and electronics industries. According to MITI (2018), the industry has been given the primary focus in the National Policy on Industry 4.0 (Industry4WRD), thus, keeping it up to date with current strategies and technologies. With government initiatives and support and the achievement gained (MATRADE 2021), the industry is recognised as experiencing better technological advancement than other industries in Malaysia. Advanced technology is significantly associated with EMA implementation and enhanced cost information (Ahmad and Zabri 2015; Rasit et al. 2022). To date, TEEAM is classified according to its business activities, namely manufacturing and trading, engineering construction, and services. The questionnaires adopted are validated survey instruments from prior studies. The questionnaire was distributed to an individual manager, who works closely with management accounting matters of the sample company, to ensure data reliability. Out of the 180 questionnaires distributed through email, only 75 were returned, representing a 41.7% response rate. According to Cooper and Schindler (2001), mail questionnaires with a minimum response rate of 30% are considered acceptable.

3.2. Measurements of Variables

The quantitative research approach was adopted in this study, whereby data were collected using the questionnaire survey. This study has adopted all the questions which have been tested and validated by prior researchers, such as Latan et al. (2018) and Christine et al. (2019). The questionnaire is divided into four sections. The first section gathers information related to the demographic information of the respondents and companies. The subsequent sections include the questions relevant to the research variables. The dependent variable is environmental strategy, which is measured based on instruments developed by Latan et al. (2018) and Christine et al. (2019). The measurements related to the environmental strategy consider four elements: ISO certification, the company's investment in research and development, long-term environmental commitment, and the key performance indicators (KPIs) recognised in four main categories, namely air, waste, water, and energy. A five-point Likert scale ranging from strongly disagree to strongly agree (1: strongly disagree to 5: strongly agree) was utilised to determine the environmental strategy implemented in the respondents' companies.

The questionnaire measuring the EMA comprises 13 questions adopted from Latan et al. (2018). The questions identify whether EMA provides useful environmental information to the companies. The data collected in this section is based on a five-point Likert scale that ranges from "most inaccurate" to "most accurate" (1: most inaccurate to 5: most accurate). The companies' environmental performance is measured based on seven questions adopted from Latan et al. (2018). The data collected in this section is also based on a five-point Likert scale that ranges from "not at all" to "large extent" (1: not at all to 5: large extent). The interpretation of the five-point Likert scale is highlighted in advance in every section to ensure that the respondents understand the method of answering the questions.

3.3. Hypothesis Testing

In terms of data analysis, this study used the partial least squares (PLS) path modelling method and structural equation modelling (SEM). The PLS-SEM is a distinct and powerful analysis method that explores the interaction between prediction and theory testing (Hair et al. 2019). According to Henseler, Ringle, and Sinkovics (2009), PLS path models are defined into two linear equations: the inner and outer models. By using such terms, Tenenhaus et al. (2005, p. 161) described the PLS path model to include two models: (1) a measurement model or outer model relating the manifest variables (MV) to their own latent variable (LV) and (2) a structural model or inner model relating some endogenous LVs to other LVs. The PLS model does not have any goodness-of-fit criterion. Thus, the validity and reliability assessment would provide sufficient evidence to indicate model fit (Henseler et al. 2009). The PLS models were analysed and interpreted in two stages: (1) the reliability and validity assessment of the measurement model and (2) the structural model assessment (Fornell and Larcker 1981; Henseler et al. 2009). Moreover, several preliminary tests were conducted in this study, such as descriptive analysis, reliability test, and normality test. The reliability test performed using Cronbach's alpha revealed that all alpha values were above the minimum acceptable threshold of 0.70. The Cronbach's alpha for environmental strategy, EMA, and environmental performance were 0.872, 0.974, and 0.954, respectively. Thus, the results indicate that the reliability of all the variables is acceptable.

4. DATA ANALYSIS AND RESULTS

4.1. Descriptive Analysis

Table 1 presents the descriptive statistics results of the main variables. The mean scores for environmental strategy, EMA, and environmental performance were 3.77, 3.48, and 3.82, respectively.

Table 1. Descriptive Statistics of the Main Variables (n = 75).

Variables	Mean	SD	Actual Range		Theoretical Range	
			Min	Max	Min	Max
Environmental Strategy	3.77	0.92	1.75	5.00	1.00	5.00
EMA	3.48	0.86	2.00	5.00	1.00	5.00
Environmental Performance	3.82	0.86	1.14	5.00	1.00	5.00

Table 2. Evaluation of First-Order Reflective Measures (n = 75).

Constructs	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	AVE
Environmental Strategy (ES)	ES1	0.731	0.877	0.917	0.736
	ES2	0.895			
	ES3	0.948			
	ES4	0.843			
Environmental Performance (EP)	EP1	0.873	0.955	0.963	0.789
	EP2	0.823			
	EP3	0.839			
	EP4	0.939			
	EP5	0.846			
	EP6	0.926			
	EP7	0.962			
Environmental Management Accounting (EMA)	EMA1	0.887	0.977	0.979	0.785
	EMA2	0.796			
	EMA3	0.848			
	EMA4	0.935			
	EMA5	0.872			
	EMA6	0.837			
	EMA7	0.904			
	EMA8	0.913			
	EMA9	0.881			
	EMA10	0.894			
	EMA11	0.948			
	EMA12	0.946			
	EMA13	0.846			

4.2. Measurement Model Evaluation (Outer Model)

The measurement models should be assessed for reliability and validity (Henseler et al. 2009). According to Hulland (1999), to ensure the adequacy of the measurement model, the model must be assessed based on the following: (a) the reliability of each individual item, (b) the convergent validity of individual construct, and (c) discriminant validity. The indicator loadings, composite reliability (CR), and the average variance extracted (AVE) of the reflective constructs were assessed. The results of outer loadings, Cronbach's alpha, composite reliability, and AVE for each item are presented in Table **2**. As shown in Table 2, the internal consistency is satisfied, referring to Cronbach's alpha and composite reliability values. The convergent validity is based on factor loading and AVE. Items of the construct with factor loading 0.6 and above remain as it does not affect the AVE results.

The AVE results for the constructs are all above 0.4, which indicates that indicator reliability is accepted. According to Hair et al. (2014), all loadings above the recommended value of 0.70 are retained (Hair et al. 2014). Thus, the variables achieved the required reliability and convergent validity. The model is subsequently assessed for its discriminant validity. In order to establish discriminant validity, the items in the model should have stronger loadings on their own constructs than on other constructs. The average variance shared between each construct and its items should be greater than the average variance shared between one construct and other constructs (Fornell and Larcker 1994).

As presented in Table **3**, all variables exhibit adequate and satisfactory discriminant validity. The square root of AVE (diagonal) is greater than the correlations (off-diagonal) for all reflective constructs. The results of the Fornell-Larcker criteria for the first-order measurement model are shown in Table 3. The value of the off-diagonal elements is smaller than the value of the square root of AVE. Therefore, each

latent construct measurement was found to discriminate against the other. Additionally, VIF was used to examine if collinearity exists among constructs. The results of VIF shown in the table below are not violated (VIF < 5.0).

Table 3. Discriminant Validity using Fornell and Larcker Criterion.

	ES	EP	EMA
ES	0.858		
EP	0.758	0.888	
EMA	0.459	0.532	0.886

Note: ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting

Table **4** shows the value of heterotrait-monotrait (HTMT) discriminant assessment. The result indicated that HTMT values obtained for each construct are below 0.90. Thus, the discriminant validity for the model has been established between the two reflective constructs.

Table 4. Discriminant Validity (Heterotrait-Monotrait Ratio (HTMT))

	ES	EP	EMA
ES			
EP	0.811		
EMA	0.500	0.539	

Note: ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting

4.3. Structural Model Evaluation (Inner model)

After the reliability and validity of outer model estimations were established, the second step of the PLS path model was to evaluate the impact of the independent variable on the dependent variable. In the structural model, relationships between environmental performance (dependent variable) and environmental strategy (independent variables) were tested. The path model's statistical significance is based on the structural model's path coefficient.

4.3.1. Main Path Model

Prior to the structural model assessment, the variables were tested for lateral multicollinearity. Table 5 depicts the lateral collinearity test results. All values of inner VIF for the variables (environmental strategy, environmental performance, and EMA) to assess lateral multicollinearity did not exceed 5.0. The result implies that lateral multicollinearity is not a concern in this study (Hair et al. 2017).

Table 5. Lateral Collinearity Assessment for Main Path Model.

	Inner VIF		
	ES	EP	EMA
ES		1.267	
EP			1.000
EMA		1.267	

Note: VIF = Variance Inflation Factor, ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting

The study has developed three (3) direct hypotheses for the relationship between constructs. In order to assess the significance level, the SmartPLS bootstrapping tool was used to produce t-statistics for all paths. Based on the path coefficients in Table **6**, all three (3) relationships are at the 0.05 level with a t-value ≥ 1.645. Evidently, the predictor of environmental strategy ($\beta = 0.651$, $p < 0.01$) is positively related to environmental performance and explains 61.8% of the variance in environmental performance. Hence, the results support H1. Besides, the R^2 value of 0.618 is also higher than Cohen's (1988) recommended value of 0.26, thus indicating a substantial model. Additionally, the predictor of environmental strategy ($\beta = 0.459$, $p < 0.01$, $R^2 = 0.210$) is positively associated with EMA and the predictor of EMA ($\beta = 0.459$, $p < 0.01$, $R^2 = 0.210$) is positively related to environmental performance. Hence, H2 and H3 are supported.

Subsequently, the effect of sizes (f^2) was measured. According to Sullivan and Feinn (2012), the p-value only indicates if the effect exists but does not reveal the size of the effect. The effect of size (substantive significance) and p-value (statistical significance) are key results for reporting and interpreting studies. Cohen's (1998) guideline is employed to assess the effect of the size. The values of 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively (Cohen 1988). As observed in Table **5**, environmental strategy (0.876) has a large effect on producing R^2 for environmental performance (0.618). Besides, EMA (0.112) also has a large effect on producing R^2 for environmental performance (0.618). Similarly, EMA (0.267) significantly produces R^2 for environmental strategy (0.210).

In addition, the research model's predictive relevance was assessed using the blindfolding procedure. The blindfolding procedure is a resampling method that systematically removes and estimates the items' every data point in the reflective measurement model of an endogenous construct. This method is applied to compare the original values with the predicted values. If the prediction is close to the original values, indicating a small prediction error, the path model has high prediction accuracy. If the Q^2 value is larger than 0, the model has predictive relevance for an endogenous construct (Fornell and Cha 1994; Hair et al. 2017). Both Q^2 values for environmental performance ($Q^2 = 0.422$) and environmental strategy ($Q^2 = 0.528$) are more than 0, indicating that the model has adequate predictive relevance.

4.3.2. Mediation Analysis

The bootstrapping analysis has revealed that $\beta = 0.651$ is significant, with t-values of 7.052 for all indirect effects. The indirect effects of 95% Boot CI Bias Corrected: [LL = 0.438, UL = 0.756], do not straddle a zero in between, indicating there is mediation. Thus, the mediation effects are statistically significant. The mediation analysis results are presented in Table **7**. The bootstrapping of mediation analysis shows that

Table 6. Hypotheses Testing on Main Path Model.

Hypotheses	Relationship	Std Beta	Std Error	t-value	p-value	Decision	Confidence Interval		R^2	f^2	Q^2
							5%	95%			
H1	ES -> EP	0.651	0.092	7.052	0.000	Supported	0.438	0.756	0.618	0.876	0.422
H2	ES -> EMA	0.459	0.465	0.105	0.000	Supported	0.093	0.392	0.210	0.267	0.528
H3	EMA -> EP	0.233	0.089	2.627	0.004	Supported	0.266	0.619	0.618	0.112	0.698

Note: ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting.

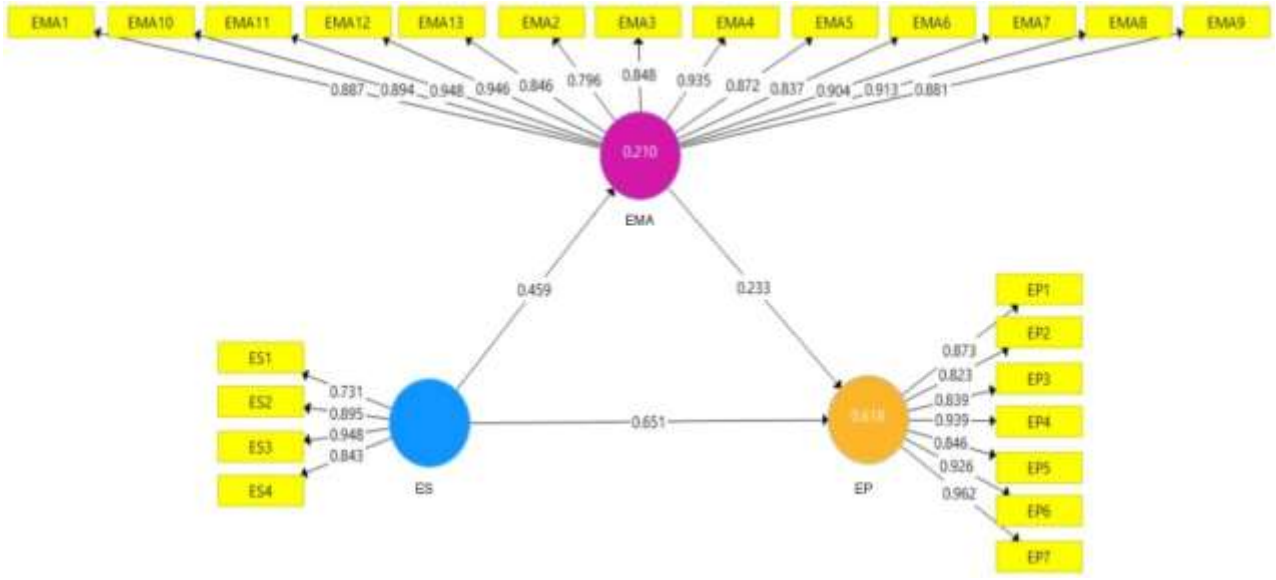

Fig. (2). Structural model assessment for main path model (p* < 0.01).
(Note: ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting).

Table 7. Hypothesis Testing for Mediation.

Hypothesis	Relationship	Std Beta	Std Error	t-value	p-value	Confidence Interval		Decision
						LL	UL	
H4	ES->EMA->EP	0.107	0.053	2.018	0.022	0.045	0.212	Supported

Note: ES = Environmental Strategy, EP = Environmental Performance, EMA = Environmental Management Accounting.

the indirect effect (EMA -> Environmental Strategy -> Environmental Performance) was significant with a t-value more than 1.96 ($p < 0.05$). The 95% confidence interval of the indirect effect of the Bias-Corrected bootstrap [LL = 0.045, UL = 0.212] does not overlap a zero between both indexes, indicating a mediating effect (Preacher and Hayes 2004, 2008). Thus, the mediation effects are statistically significant. Therefore, H4 was supported.

5. DISCUSSION

The study's results provide useful insights into EMA implementation and contribute to the lack of empirical evidence on EMA. As stated earlier, EMA is an emerging area of concern among practitioners and academicians worldwide in response to the demand for ecological environment conservation (Christ and Burritt 2013; Gunarathne et al. 2023). Furthermore, there is currently a trend of high stakeholder demand and expectations for managers to prioritise addressing environmental issues and implementing effective environmental performance evaluation systems in their organisations (Gunarathne et al. 2023; Burritt et al. 2019). The current research addresses the research questions by examining whether environmental strategy may lead to EMA implementation. Additionally, the objective of the research is to examine the mediating role of EMA, as firms that have established their environmental strategy may require tools, such as EMA, to accurately gather relevant environmental information and ensure the successful execution of the strategy. The capability to gather information and make the right decision enhances environmental performance.

In order to address the research objectives and questions, several hypotheses linking environmental strategy, EMA, and environmental performance were constructed. The first hypothesis proposes an association between environmental strategy and EMA. The results indicate a significant and positive relationship between environmental strategy and EMA. The results imply that tools that can assist in decision-making are needed to execute the environmental strategy

successfully and manage environmental initiatives. Environmental accounting information contributes to achieving environmental strategies and management initiatives.

The statistical result of environmental strategy aligns with prior studies (Christ and Burritt 2013; Latan et al. 2018; Al-Mawali et al. 2018; Amir and Chaudhry 2019) where environmental strategy was found to have a positive association with EMA usage levels. The result proposed that environmental strategy has a direct impact on EMA adoption. The environmental strategy involves proper planning on managing environmental issues to minimise the impact of business operations on the natural environment. Proper planning through environmental strategy helps identify the environment-related information regarding a specific business operation area useful for EMA adoption (Sari et al. 2021). Thus, the findings proposed that managers should incorporate an environmental strategy to a greater extent to improve EMA adoption efficiency.

Secondly, EMA usage may potentially lead to enhance firms' environmental performance. The EMA is a recent development of a management accounting system (Schaltegger, Bennett, and Burritt 2006), where the tool can modify conventional management accounting systems. The environmental accounting information may assist companies in improving environmental benefits and fulfilling bigger environmental expectations (Solovida and Latan 2017). The hypothesis testing on the relationship between EMA and environmental performance indicates a statistically significant relationship between the variables. The results imply that effective EMA can improve environmental performance by monitoring environmental costs throughout the business operation, monitoring the use and costs of natural resources, and ensuring that capital investment decisions consider environmental information.

Latan et al. (2018) stated that the information from EMA is used for decision-making for constant improvement in environmental performance. Nevertheless, Christine et al. (2019) mentioned that EMA adoption could provide internal and external data related to the environment and be used to support environmental decisions and corporation decisions. This association is favoured by Appiah et al. (2020), who stated that EMA plays a very significant part in attaining perfect environmental performance. The EMA enables the evaluation of environmental performance through a company's analysis system, using financial and non-financial indicators provided by EMA (Appiah et al. 2020). In addition, as EMA focus on the environment, using the accounting tools will encourage organisations to innovate their processes and leads to environmentally friendly management activities (Sari et al. 2021).

Thirdly, the results support the hypothesis for the link between environmental strategy and environmental performance. The empirical evidence from this study is consistent with prior research supporting the view from the contingency theory perspective that implementing environmental strategy leads to the environmental initiatives implementation towards achieving visions and objectives (Gunarathne and Lee 2021; Christ and Burritt 2013; Gunarathne et al. 2023). Gunarathne et al. (2023) highlighted the difference between companies that follow a proactive strategy and those with a reactive strategy. The accounting tools adopted differ between companies depending on the extent of their strategy, as the initiatives implemented are more extensive for companies with a proactive strategy. Proactive corporate environmental strategies may improve a company's environmental performance as the effort will be directed towards developing a more established performance measurement system to address environmental issues (Rodrigue, Magnan, and Boulianne 2013).

This research offers a further understanding of EMA's role as an important tool for environmental strategy execution. Organisations must critically implement EMA to provide environmental cost information to improve environmental performance. This study emphasises new insights from companies in the electrical and electronic sector on how environmental initiatives and resources could be directed to enhance environmental performance. The links between environmental strategy, effective EMA use, and enhanced environmental performance are supported from the perspectives of both contingency theory and resource-based theory. Specifically, organisations in the electrical and electronic sectors with strength in their environmental strategy can combine their efforts with effective EMA to address environmental challenges and improve their environmental performance (Solovida and Latan 2017). Focusing solely on the electrical and electronic sectors can reduce and exclude a key contingency factor of high uncertainty, resulting in more reliable findings within the research scope (Burgess et al. 2007).

6. CONCLUSION

This research provides empirical evidence and new insight into the role of EMA in the environmental strategy implementation context in organisations. Additionally, the evidence from this research is significant for representing Malaysian companies and providing a unique perspective on single-industry companies, specifically within an emerging economy context. The research contributes both theoretical and managerial implications. The research findings contribute to the literature from the perspectives of contingency and resource-based view theories. The findings are consistent with prior studies whereby environmental strategy positively and significantly influenced EMA use (Qian and Burritt 2009; Solovida and Latan 2017; Latan et al. 2018; Le et al. 2019; Gunarathne et al. 2023).

Latan et al. (2018) mentioned that the accounting functions should be integrated with the environmental strategies when a company implements EMA. Greater attention given to environmental issues through environmental strategy helps improve proficiency in managing the EMA tools to provide better accuracy in environmental information on an ongoing basis (Qian and Burritt 2009; Latan et al. 2018). Furthermore, Le et al. (2019) proposed that environmental strategies facilitate the functional use of EMA due to the availability of strategic goals and environmental information, such as environmental costs and environmental benefits. The environmental strategy allows the management to contemplate actions to be taken in detail to reduce the environmental impact and increase the financial advantage. The information from environmental strategies could also encourage companies to

find solutions for useful EMA adoption and potential sustainable operations.

This study makes several contributions to academic research on EMA in Malaysia. Based on the results, this study provides empirical evidence concerning the significant positive relationship between environmental strategy and EMA adoption in the Malaysian electrical and electronics industry. The electrical and electronic industry is important in the Malaysian economy (MATRADE 2021). For the industry to sustain and stay competitive, appropriate tools and practices should be implemented to support relevant decision-making and goals. Environmental strategy implementation in organisations was also found to be closely related to ISO certification, possibly due to ISO requirements and ISO certification that relate to real improvement in environmental and business performance. Besides, the positive relationship is likely due to environmental strategies that stress the importance of identifying and recognising the financial impacts of emerging environmental issues (Le et al. 2019; Appiah et al. 2020). This study recommends that companies in the electrical and electronics industry should prioritise environmental sustainability and take action to address related issues. Specifically, manufacturing organisations should ensure that they dedicate adequate resources and effort to achieving their environmental goals.

Despite the significant findings of this study, several limitations must be considered. Firstly, the interpretation of the results and discussion is based on a relatively small sample size where the data collected only consider Malaysian electrical and electronic companies. Nevertheless, as per Avkiran and Ringle (2018), the sample size is still adequate for management accounting. Secondly, the questions on the environmental strategy used in this study were adopted from a prior study that covers only four areas of the environmental strategy implemented in the companies generally. Future research may obtain detailed information on the environmental strategy implemented in the companies. Future research should consider other industries in Malaysia, such as environmentally sensitive ones, to investigate the relationship between environmental strategy and EMA adoption to better understand environmental strategy effectiveness and its impact on EMA adoption. It also reflects the participants' viewpoints, which reduces bias in answering the survey.

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