

Environmental management accounting practices and organizational performance: the mediating effect of information system

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Abstract

Purpose – The purpose of this paper is to examine the mediating effect of information system (IS) on the relationship between environmental management accounting practices (EMAP) and organizational performance (OPM) for Malaysian manufacturing industry.

Design/methodology/approach – This study is based on survey data collected from 395 manufacturing companies in Malaysia. Validity and reliability analyses were performed using IBM SPSS and structural equation modeling was used to test the research hypotheses.

Findings – The results indicated that EMAP positively and significantly to IS and OPM. This study also found that IS partially mediates the relationship between EMAP and OPM. This study also found that IS partially mediates the relationship between EMAP and OPM.

Research limitations/implications – This study has a number of limitations that need to be addressed in future research. First, the population and sample of survey respondents are only targeted in the Malaysian manufacturing industry. Second, this research only uses the survey technique and is conducted in the Malaysian manufacturing industry. Third, the limitation of this study would concern the difficulty to find EMAP and IS relationship literatures in the Malaysian manufacturing industry. However, the researchers consider that there is greater scope for investigation on the EMAP, IS and OPM relationships for Malaysian manufacturing industry.

Originality/value – This study contributes to the existing body of knowledge by examining the mediating effect of IS on the relationship between EMAP and OPM for Malaysian manufacturing industry. Thus, it is expected that the results of this study have given valuable insight of the relationship between EMAP, IS on OPM for Malaysian manufacturing industry.

Keywords Environmental management accounting practices, Information system, Performance, Manufacturing, Structural equation modeling

Paper type Research paper

1. Introduction

Environmental issues have become one of the increasing issues in recent years at national and international levels. Some of the focus of environmental issues includes air pollution, water, chemical wastes and global warming conducted by industrial activities. Since the 1980s, the accounting profession and accountants have begun to play an important role in attempting to solve environmental problems, and management accounting also addresses the environment issues (Christ and Burritt, 2013). To improve environmental management accounting practices (EMAP), environmental awareness functions in improving the environmental management in the organization. EMAP is a challenge faced by management accounting related to environmental activities (Qian *et al.*, 2015). The implementation of EMAP is still weak in the manufacturing industry, especially in developing countries such as Malaysia (Jamil *et al.*, 2015). EMAP play an important role in the practice

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to manage the environmental activities in the manufacturing industry. Thus, this current study argues that the implementation of EMAP is important to improve the performance for Malaysian manufacturing industry.

Furthermore, EMAP has been implemented in the organization to overcome the limitations of conventional management accounting in providing information relating to environmental management (Fuzi *et al.*, 2019b). Christ and Burritt (2013) supported that EMAP can manage the environmental activities in ways such as saving costs, improving environmental processes and enhancing the environmental improvement of the organization. In this regard, EMAP is a practice that can assist organizations to manage environmental activities to achieve good performance, especially for Malaysian manufacturing industry.

To improve EMAP, information system (IS) is one of the current solutions for evaluating, monitoring and planning to manage the environment and performance, particularly in the manufacturing industry (Gimenez *et al.*, 2015; Habidin *et al.*, 2018a). However, Spencer *et al.* (2013) stated that there is a lack of empirical research in the literature on IS. Because of this, this study needs to investigate the relationship between EMAP, IS and organizational performance (OPM). IS as mediating variable was chosen because IS can be related to the EMAP and OPM to improve environmental management accounting for Malaysian manufacturing industry. This study addresses to fill the gap on IS by using a mediation approach for Malaysian manufacturing industry.

Manufacturers and suppliers face the challenge of improving the OPM in the manufacturing industry. To improve the OPM of the manufacturing industry, the industry can improve product energy consumption, material usage or recycling to increase the operation of the company. Performance measurement can be identified by the OPM indicators to improve the environmental management in the manufacturing industry. Several studies have examined that OPM is beneficial not only for the environment but also for the overall performance of the organization (Almatrooshi *et al.*, 2016). By implementing OPM, the companies can achieve environmental goals which can be applied for Malaysian manufacturing industry.

In addition, fewer studies attempted to examine the mediating effect of IS on the relationship between EMAP and OPM for Malaysian manufacturing industry. Thus, in this research, there are four questions to be answered:

1. Is there any significant relationship between EMAP and OPM for Malaysian manufacturing industry?
2. Is there any significant relationship between EMAP and IS for Malaysian manufacturing industry?
3. Is there any significant relationship between IS and OPM for Malaysian manufacturing industry?
4. Is there a mediating effect of IS on the relationship between EMAP and OPM for Malaysian manufacturing industry?

This paper is organized as follows: Section 2 presents a literature review based on the previous studies. Section 3 provides the methodology. The results and discussion are provided in Section 4. Finally, conclusion is presented in Section 5.

2. Literature review

EMAP is to promote companies to adopt environmental practices for managing the issues related to the environment. It highlights that the EMAP can assist companies to manage the environmental issues in the organization. Additionally, EMAP provides the environmental information to increase and evaluate the performance (Fuzi *et al.*, 2019a). Hence, EMAP

could be an effective instrument to manage environmental management activities in the organization. The authors summarized the elements of EMAP:

- environmental cost;
- environmental regulation;
- environmental safety;
- management commitment; and
- customer focus.

The implementation of IS in environmental management has become a significant demand nowadays with the rapid growth of environmental information (Meacham *et al.*, 2013). In this study, IS dimensions focused on technology and processes for managing the environmental management for Malaysian manufacturing industry. Considering the implementation of IS, it is important for Malaysian manufacturing industry to adopt an IS that can manage environmental information and can be used as a tool for better and efficient environmental management.

Some studies have focused on financial and operational performance in OPM (Antony and Bhattacharyya, 2010; Skarzauskiene, 2010; Waal, 2010; Rompho, 2018). In this study, one of the dimensions of OPM is financial performance. Performance measurement through financial performance has been used to evaluate the organization's financial matters. Another dimension of OPM is operational performance. In the manufacturing industry, operational performance is an important measurement in terms of production, cost and processes. Jayamaha *et al.* (2011) stated that operational performance can measure the OPM which involves operational activities to address environmental issues.

2.1 Research framework

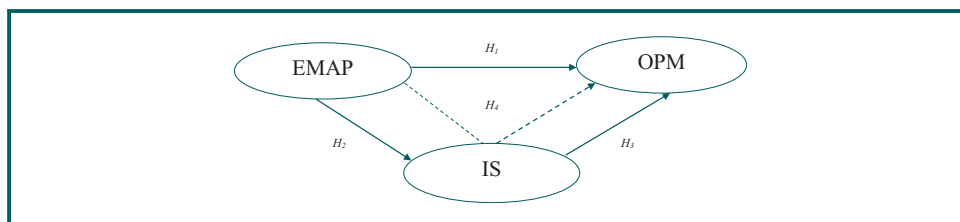
The research model aims to examine IS as mediator variables of the relationship between EMAP and OPM for Malaysian manufacturing industry. To understand the relationship between EMAP, IS and OPM for Malaysian manufacturing industry, the following hypotheses will be used and tested. Figure 1 represent the research framework proposed by the researchers.

As seen in Figure 1, three hypotheses are direct relationship ($H1$, $H2$, and $H3$) and one hypothesis ($H4$) is indirect relationship. Thus, the mediating effect of IS on the relationship between EMAP and OPM is proposed in this study.

2.2 Hypotheses development

This study is attempted to test the EMAP and OPM relationships through the mediating effect of IS using structural equation modeling (SEM) technique. There are four research hypotheses to be examined as discussed below:

Figure 1 The research model



2.2.1 Environmental management accounting practices and organizational performance. EMAP has implications for the OPM in terms of financial and operational performance to reduce environmental issues in the industry (Al-Mawali *et al.*, 2018). In this regard, the relationship between EMAP and OPM can improve environmental management accounting, particularly for Malaysian manufacturing industry. Hence, the implementation of EMAP can assist the organization to determine the measurement of OPM.

Nor *et al.* (2016) examined the relationship between EMAP and financial performance of the Malaysian listed companies. The results indicated that there is a significant relationship between these variables. Thus, it can be concluded that there was a significant relationship between EMAP and OPM from the previous studies. Based on the literature review, the following hypothesis is proposed:

H1. There is a positive and direct significant relationship between EMAP and OPM.

2.2.2 Environmental management accounting practices and information system. Stanciu *et al.* (2011) conducted a research in Romania and indicated that EMAP is part of the practice in implementing environmental management accounting and it has a relationship with IS to address environmental issues. Besides, IS implementation can assist organizations to improve EMAP, especially for Malaysian manufacturing industry. Hence, EMAP is likely to be significantly related with IS for Malaysian manufacturing industry.

IS also provides technology that can be used in assessing environmental information to make decisions for Malaysian manufacturing industry. By implementing EMAP and IS, it can improve the environmental management accounting for Malaysian manufacturing industry to reduce the environmental issues. Based on the discussion above, the following hypothesis is formulated:

H2. There is a positive and direct significant relationship between EMAP and IS.

2.2.3 Information system and organizational performance. In the manufacturing industry, IS is important in managing the environment, especially for information technology. Melville (2010) conducted a research in USA supporting the use of IS to improve OPM of the organization. This is because IS can assist the organization to monitor, improve and evaluate OPM in the manufacturing industry. Meacham *et al.* (2013) conducted a research in USA among 159 manufacturing managers and results indicated that IS had a significant relationship to OPM in the manufacturing industry. This study supports that IS can improve OPM in achieving the company's goal. The results indicated that the implementation of IS will result in good performance especially for OPM. This is a reasonable expectation for Malaysian manufacturing industry to implement IS, thus resulting in better performance. Therefore, all these findings lead to the following hypothesis:

H3. There is a positive and direct significant relationship between IS and OPM.

2.2.4 The mediating effect of information system on the environmental management accounting practices and organizational performance relationship. This hypothesis is specified for an indirect relationship between EMAP and OPM through the mediating effect of IS for Malaysian manufacturing industry. Spencer *et al.* (2013) conducted a research in Australia by engaging 200 companies and results showed that the indirect relationship of EMAP and OPM can be determined by using IS as a mediating variable. The results concluded that IS partially mediates between these variables. To improve EMAP and OPM, IS can be used to support the information technology for Malaysian manufacturing industry. Therefore, this study suggests that the implementation of IS is useful for decision-makers in improving the EMAP and OPM. Based on the discussion above, the following hypothesis is formulated:

H4. There is a positive and indirect significant relationship between EMAP, IS and OPM.

3. Methodology

The data for this study were collected through a survey technique, using an adopted and adapted instrument from previous studies to measure variables specified within the suggested framework, namely, EMAP, IS and OPM. This study comprises 25 questions about EMAP (environmental cost, environmental regulation, environmental safety, management commitment and customer focus). In specific, the measurement of EMAP was divided into environmental cost (five items), environmental regulation (five items), environmental safety (five items), management commitment (five items) and customer focus (five items). The scale of EMAP was measured using 25 items adapted from [Ferreira et al. \(2010\)](#), [Taufek et al. \(2016\)](#) and [Alkisher \(2018\)](#). For the EMAP, 25 items instrument were selected for this study.

Meanwhile, the IS comprised ten questions, technology (five items) and processes (five items). The scale of IS was measured using ten items adapted from [Ochara et al. \(2014\)](#) and [Mandal and Bagchi \(2016\)](#). Therefore, IS dimensions with ten measurement items were selected for this study.

Finally, OPM measurement with ten questions which is financial performance (five items) and operational performance (five items) for Malaysian manufacturing industry. The scale of OPM was measured using ten items adapted from [Jimenez et al. \(2013\)](#) and [Adebanjo et al. \(2016\)](#). Thus, ten items instrument for OPM were selected for this study (see [Appendix](#)).

This study used items with a seven-point Likert scale (1= very low, 7 = very high) for measuring EMAP and IS. Meanwhile, respondents were asked to rate their responses on seven-point scales for OPM, where "1 - strongly disagree," "2 - disagree," "3 - somewhat disagree," "4 - neither agree nor disagree," "5 - somewhat agree," "6 - agree" and "7 - strongly agree." In the present study, there were three construct variables for EMAP, IS and OPM and measurement items using an adopted/adapted instrument from previous studies were used to measure variables specified as shown in [Table I](#).

The population of this study consisted of all manufacturing industries in Malaysia, the total number of which is 2,600 ([Federation of Malaysian Manufacturers Directory, 2017](#)). In this study, an online survey was conducted by distributing the questionnaires to all manufacturers that were listed in the Federation of Malaysian Manufacturers Directory 2017. This is because online survey-based questionnaires are practical for a large sample ([Ponto, 2015](#)). More importantly, a majority of the previous studies in the manufacturing industry have also used the online survey to collect data ([Abdul-Rashid et al., 2017](#)). The questionnaires were distributed to the respondents using online survey tool as well as through email followed by telephone calls to increase the response rate. The questionnaire was enclosed with a cover letter for explaining the importance of this study and for confidentiality of the answers. Out of the 2,600 questionnaires sent to the respondents, 395 were received from manufacturing companies, and 395 valid responses were used for the final analysis.

In determining the reasonable sample size, the suggested minimum sample size for this study is about 200 ([Oke et al., 2012](#)). However, the sample size of 200 is a critical size for testing hypotheses and models using SEM ([Habidin et al., 2018b](#)). On the other hand, [Hair et al. \(2011\)](#) recommended a minimum of 100-500 as a reasonable sample size to test the research hypotheses by using SEM analysis. SEM is used to test the relationships between endogenous and exogenous variables ([Habidin et al., 2018b](#)) as proposed in the research hypotheses. SEM was chosen as statistical analysis techniques because of the applicability to test a comprehensive model. This is because SEM not only provides an assessment of the model fit in terms of the reliability and validity of each construct tested, but also performs overall model, which includes the direct and indirect relationship. Therefore, this study used SEM as statistical analysis technique.

Table I Measurement items

Codes	Item descriptions	Authors
<i>EMAP</i>		
EC1	Identifies environment related costs	Ferreira <i>et al.</i> (2010)
EC2	Allocates environment related costs to production processes	
EC3	Allocates environment related costs to products	
EC4	Creates and uses environment related costs accounts	
EC5	Improves the environment-related costs management	
ER1	Organization addresses environmental issues	Alkisher (2018)
ER2	Organization complies with the regulations	
ER3	Organization monitors the environmental regulation	
ER4	Organization complies with the environmental procedures	
ER5	Organization is committed to environmental regulation	
ES1	Organization considers environmental safety	Taufek <i>et al.</i> (2016)
ES2	Organization improves safety awareness	
ES3	Organization complies with the environmental safety	
ES4	Organization provides safety requirement	
ES5	Organization understands the procedures for environmental safety	
MC1	Employees consider environmental issues	Alkisher (2018)
MC2	Committed with the environmental activities	
MC3	Supports environmental management	
MC4	Encourages environmental programs	
MC5	Involves environmental decision-making	
CF1	Organization is committed to create satisfied customers	Ferreira <i>et al.</i> (2010)
CF2	Organization is committed to provide value to customers	
CF3	Organization meets customer requirements	
CF4	Organization encourages environmentally friendly practices to customer	
CF5	Customers give feedback on quality and delivery of performance	
Codes	Item descriptions	Authors
<i>IS</i>		
TCH1	Providing information technology in the organization	Mandal and Bagchi (2016)
TCH2	Providing data collection in the organization	
TCH3	Providing data processing in the organization	
TCH4	Applying database software in the organization	
TCH5	Supporting information technology for decision-making	
PRS1	Organization is concerned about production processes	Ochara <i>et al.</i> (2014)
PRS2	Organization monitors the operation processes	
PRS3	Organization evaluates the production processes	
PRS4	Organization provides processes development	
PRS5	Organization improves processes efficiency	
<i>OPM</i>		
FP1	Increased sales growth	Jimenez <i>et al.</i> (2013)
FP2	Improved profit growth	
FP3	Increased operating income	
FP4	Increased return on investment	
FP5	Reduced costs	
OP1	Increased product quality	Adebanjo <i>et al.</i> (2016)
OP2	Improved operational processes	
OP3	Increased operational efficiency	
OP4	Increased amount of goods delivered on time	
OP5	Reduced operational costs	
Notes: EC = environmental cost, ER = environmental regulation, ES = environmental safety, MC = management commitment, CF = customer focus, TCH = technology, PRS = processes, FP = financial performance, OP = operational performance		

4. Results and discussion

The measurement instrument for EMAP, IS and OPM was started with exploratory factor analysis (EFA). The EFA started with the Kaiser–Meyer–Olkin (KMO) greater than 0.50 (Beavers *et al.*, 2013) and the Bartlett's test ($p < 0.001$) had been applied to check the strength of inter-correlations among all items. Second, EFA used the total variance explained

to determine for all items with Eigenvalues > 1 (Fuzi et al., 2018). Rotated component matrix results were used to identify each item factor that was acceptable for the factor loading greater than 0.40 (Fuzi et al., 2018). Some items were deleted if the factor loading was less than 0.40. Table II shows the summary results of EFA for EMAP, IS and OPM.

Next, reliability of the EMAP, IS and OPM was evaluated using Cronbach's alpha. Acceptable values of reliability of the EMAP, IS and OPM, with alpha values > 0.70 as satisfactory internal consistency (Aloini et al., 2015; Fuzi et al., 2017). Table III presents the results of reliability analysis for EMAP, IS and OPM.

The data collected by using confirmatory factor analysis to test the measurement model of EMAP, IS and OPM. The Chi-square over degrees of freedom (χ^2/df) < 3.00, goodness of fit index (GFI) and adjusted goodness of fit index (AGFI) \geq 0.80, comparative fit indexes (CFI) and Tucker Lewis index (TLI) \geq 0.90, and root mean square error approximation (RMSEA) \leq 0.08 as recommended values (Goswami and Kumar, 2018).

The model fit indices by using AMOS 22 and the data reasonable and acceptable for EMAP ($\chi^2 = 640.162$, $df = 220$, $\chi^2/df = 2.910$, p -value = <0.001, GFI = 0.874, AGFI = 0.841, CFI = 0.934, TLI = 0.924 and RMSEA = 0.070). The goodness-of-fit indices for IS ($\chi^2 = 66.916$,

Table II Summary results of EFA

	Findings	No. of items Before analysis	After analysis	Remarks
EMAP	KMO = 0.885, Bartlett's test of sphericity was significant at $p < 0.001$, total variance explained = 76.369 and factor loadings > 0.40, except ES4 and MC3	25 items	23 items	Two items of EMAP (ES4 and MC3) have been deleted
IS	KMO = 0.857, Bartlett's test of sphericity was significant at $p < 0.001$, total variance explained = 71.947 and factor loadings > 0.40, except PRS4	10 items	9 items	One item of IS (PRS4) has been deleted
OPM	KMO = 0.918, Bartlett's test of sphericity was significant at $p < 0.001$, total variance explained = 75.250 and factor loadings > 0.40	10 items	10 items	No item deleted
Total items: 45 items			42 items	

Table III Results of reliability analysis

Dimensions	No. of items	Alpha values	Findings
<i>EMAP:</i>			
Environmental cost (EC)	5	0.926	EC, ER, ES, MC, CF, and alpha values > 0.70, range between (0.867-0.928)
Environmental regulation (ER)	5	0.910	
Environmental safety (ES)	4	0.867	
Management commitment (MC)	4	0.895	
Customer focus (CF)	5	0.928	
<i>IS:</i>			
Technology (TCH)	5	0.899	TCH and PRS, alpha values > 0.70, range between (0.872-0.899)
Processes (PRS)	4	0.872	
<i>OPM:</i>			
Financial performance (FP)	5	0.912	FP and OP, alpha values > 0.70, range between (0.912-0.916)
Operational performance (OPM)	5	0.916	
Total	42		

df = 26, $\chi^2/df = 2.574$, $p\text{-value} = <0.001$, GFI = 0.964, AGFI = 0.938, CFI = 0.979, TLI = 0.971 and RMSEA = 0.063). Lastly, the goodness-of-fit indices for OPM ($\chi^2 = 69.587$, df = 34, $\chi^2/df = 2.047$, $p\text{-value} = <0.001$, GFI = 0.966, AGFI = 0.945, CFI = 0.988, TLI = 0.984 and RMSEA = 0.052). These results indicated a good fit. Thus, goodness-of-fit indices can be used to examine the model fit. Figures 2-4 present the path diagram of measurement model for EMAP, IS and OPM.

Before testing the research hypotheses for final model of EMAP, IS and OPM, the normality assumption was assessed using the skewness and kurtosis values. All variables that measure for the skewness values within the range between ± 1 (Garson, 2012) were acceptable. Thus, the normality assessment for EMAP, IS and OPM was acceptable. The result of skewness and kurtosis values are presented in Table IV.

The results for the final model of the relationship between EMAP, IS and OPM for H1, H2, H3 and the mediating testing (H4) explained the findings of the research hypotheses of this study. The final model fits indices and the data were acceptable as shown in Figure 4. Meanwhile, the standardized regression weight of the relationship between EMAP, IS and OPM is presented in Table V.

Based on Figure 5, the standardized regression weight for H1 was 0.530 and significant ($p < 0.001$). This supported H1 that EMAP had a positive and direct significant relationship on OPM for Malaysian manufacturing industry. Thus, H1 was accepted for this study. This result was supported by the findings of Al-Mawali et al. (2018). Thus, the implementation of EMAP can assist the Malaysian manufacturing industry to determine the measurement of OPM.

Figure 2 EMAP model

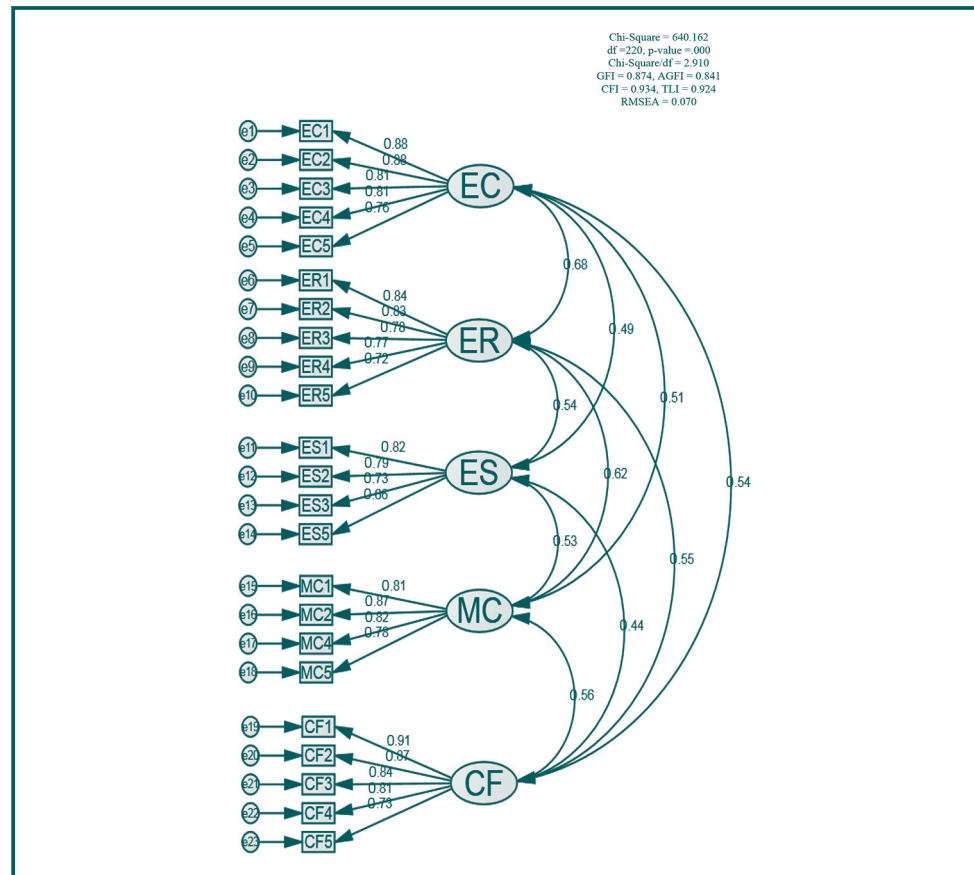


Figure 3 IS model

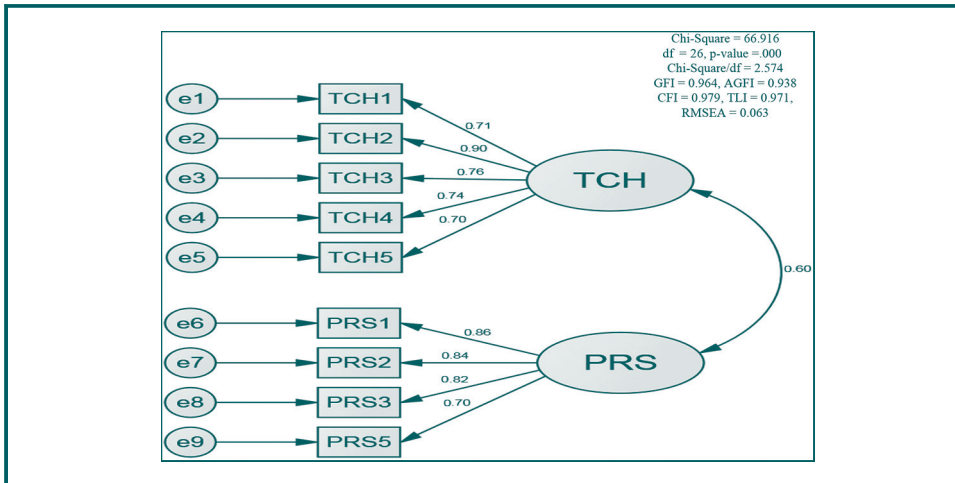
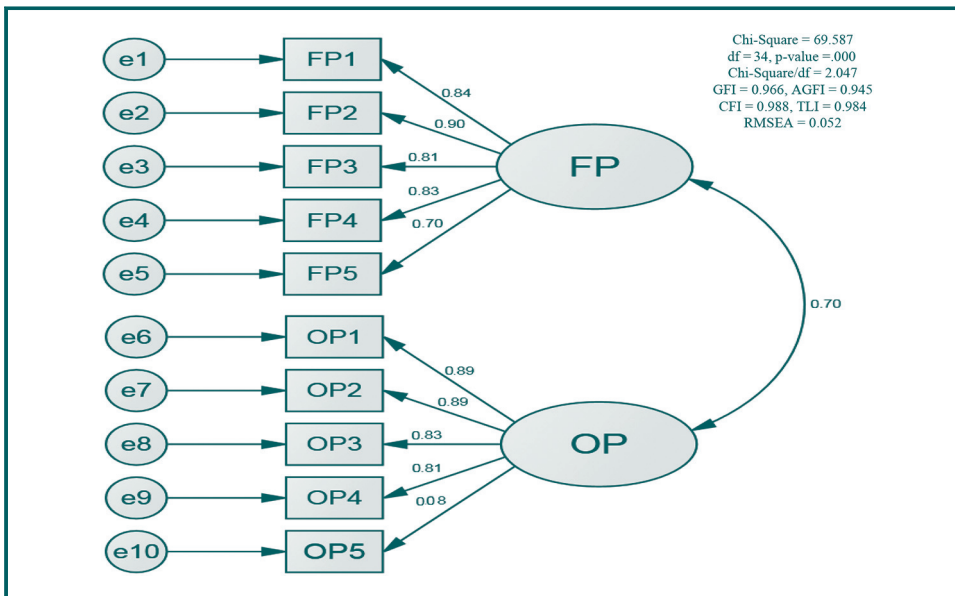


Figure 4 OPM model



The standardized regression weight for $H2$ of EMAP and IS was 0.601 and significant ($p < 0.001$). The result supported $H2$ that EMAP had a positive and direct effect on IS. Thus, $H2$ was accepted. This result was supported by the findings of [Moghadam and Hashempur \(2016\)](#) which stated that EMAP had positive impact on IS. Therefore, the relationship between EMAP and IS could be positive and significant for Malaysian manufacturing industry.

The standardized regression weight for $H3$ of IS and OPM was 0.287 and significant ($p < 0.05$). The result supported $H3$ that IS had a positive and direct effect on OPM. Thus, $H3$ was accepted. This result was supported by the findings of [Spencer et al. \(2013\)](#), [Meacham et al. \(2013\)](#) and [Gimenez et al. \(2015\)](#) which stated that IS had positive impact on OPM. The results showed that the implementation of IS had a significant and positive relationship on OPM.

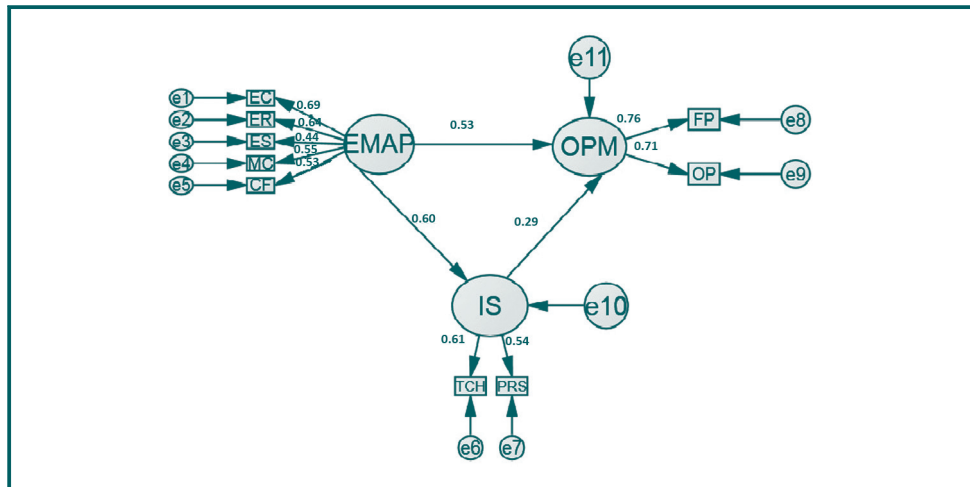
Table IV Assessment of normality

	EMAP	IS	OPM
Skewness	0.441	0.626	0.307
Kurtosis	0.071	0.727	-0.415

Table V Regression weights of EMAP, IS and OPM

			Standardized estimate	p-value
IS	←	EMAP	0.601	***
OPM	←	IS	0.287	0.020
OPM	←	EMAP	0.530	***
CF	←	EMAP	0.533	***
MC	←	EMAP	0.548	***
ES	←	EMAP	0.443	***
ER	←	EMAP	0.636	***
EC	←	EMAP	0.688	***
PRS	←	IS	0.544	***
TCH	←	IS	0.613	***
FP	←	OPM	0.758	***
OP	←	OPM	0.705	***

Note: *** $p < 0.001$

Figure 5 EMAP, IS and OPM models

To test whether IS was mediator of EMAP on OPM relationship, the effect analysis of EMAP, IS and OPM are presented in [Table VI](#).

[Table V](#) shows that the results of indirect effect for EMAP for OPM were 0.174 which is significant p -value (0.020) was less than 0.05. It showed that IS is considered as a partial mediator. This finding supports H_4 , which stated that the EMAP implementation toward OPM was increased through mediating effect of IS. Thus, H_4 was accepted for this study. This result was supported by the findings of [Spencer et al. \(2013\)](#). IS as a mediating variable was chosen because IS could be supported with EMAP and OPM to improve the environmental management accounting for Malaysian manufacturing industry. Therefore,

Table VI Effect analysis of EMAP, IS and OPM

	Direct effect			Indirect effect			Total effect		
	EMAP	IS	OPM	EMAP	IS	OPM	EMAP	IS	OPM
IS	0.601	0.000	0.000	0.000	0.000	0.000	0.601	0.000	0.000
OPM	0.530	0.287	0.000	0.174	0.000	0.000	0.704	0.287	0.000

this study provides evidence that IS partially mediated the relationship between EMAP and OPM for Malaysian manufacturing industry. Based on the findings, it was shown that *H1–H4* were accepted and the summary of hypotheses results is listed in [Table VII](#).

5. Conclusion

This study aims to examine the mediating effect of IS on the relationship between EMAP and OPM for Malaysian manufacturing industry. This study was used to test the hypothesized relationships of EMAP, IS and OPM. In this regard, the research findings confirmed that the mediating effect occurred in the relationship of EMAP and OPM via IS. Regarding this, IS provides many positive outcomes in terms of increasing environmental management accounting, reducing environmental cost and enhancing environmental improvement of the organization to achieve environmental objectives and goals for Malaysian manufacturing industry.

The findings of this study have given valuable insight of the relationship between EMAP and IS on OPM for Malaysian manufacturing industry. The model developed in this study can be used as a guideline by manufacturers in Malaysia to implement a new approach which incorporates EMAP, IS and OPM. The findings from this study can be used by policymakers to identify which of the EMAP implemented by manufacturers in Malaysia requires support in terms of policies, regulations and practices. A growing number of manufacturers are recognizing to improve their OPM by incorporating EMAP and IS in the organization. Therefore, this study can be used by academicians and practitioners to increase their knowledge of EMAP, IS and OPM, which in turn would enable them to assist the Malaysian manufacturing industry to improve environmental management accounting. It would be

Table VII Summary of hypotheses results

Hypotheses	Hypotheses statement	Results	Decision
H1	There is a positive and direct significant relationship between EMAP and OPM	Positive (0.530) and significant at $p < 0.001$	Supported
H2	There is a positive and direct significant relationship between EMAP and IS	Positive (0.601) and significant at $p < 0.001$	Supported
H3	There is a positive and direct significant relationship between IS and OPM	Positive (0.287) and significant with p -value < 0.05	Supported
H4	There is a positive and indirect significant relationship between EMAP, IS, and OPM	IS from EMAP for OPM was (indirect effect, 0.174) significant with p -value < 0.05	Supported (IS partially mediates the relationship between EMAP and OPM)

interesting to examine the moderating role of different dimensions of EMAP in future work. Therefore, the findings from this study provide a useful guideline for other industries in Malaysia in making decisions concerning the EMAP implementation.

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Appendix. Survey instrument

Environmental management accounting practices

Extent to which your organization uses

Environmental Cost

- Organization identifies environment related costs.
- Organization allocates environment related costs to production processes.
- Organization allocates environment related costs to products.
- Organization creates and uses environment related costs accounts.
- Organization improves the environment related costs management

Environmental Regulation

- Organization addresses environmental issues.
- Organization complies with the regulations.
- Organization monitors the environmental regulation.
- Organization complies with the environmental procedures.
- Organization is committed to environmental regulation.

Environmental Safety

- Organization considers environmental safety.
- Organization improves safety awareness.
- Organization complies with the environmental safety.
- Organization provides safety requirement.
- Organization understands the procedures for environmental safety

Management Commitment

- Employees consider environmental issues.
- Employees are committed with the environmental activities.
- Management commitment supports environmental management.
- Management commitment encourages environmental programs.
- Management commitment involves environmental decision-making.

Customer Focus

- Organization is committed to create customer satisfied.
- Organization is committed to provide value to customers.
- Organization meets customer requirements.
- Organization encourages environmentally friendly practices to customers.
- Customers give feedback on quality and delivery of performance.

Information system

Extent to which your organization uses these technology?

- Providing information technology in the organization.
- Providing data collection in the organization.
- Providing data processing in the organization.
- Applying database software in the organization.
- Supporting information technology for decision-making.

Extent to which your organization uses these processes?

- Organization is concerned about production processes.
- Organization monitors the operation processes.
- Organization evaluates the production processes.
- Organization provides processes development.
- Organization improves processes efficiency.

Organizational performance

Financial Performance

- Increased sales growth.
- Improved profit growth.
- Increased operating income.
- Increased return on investment.
- Reduced costs.

Operational Performance

- Increased product quality.
- Improved operational processes.
- Increased operational efficiency.
- Increased amount of goods delivered on time.
- Reduced operational costs.

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