Environmental management accounting practices, environmental management system and environmental performance for the Malaysian manufacturing industry

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Abstract: The aim of this study is to examine the relationship between environmental management accounting practices (EMAP), environmental management system (EMS) and environmental performance (EP) for the Malaysian manufacturing industry. EMAP and EMS is one of the important strategic management accounting to improve the EP in the manufacturing industry. This study is using a structural equation modelling (SEM) technique to test the relationship between EMAP, EMS, and EP for the Malaysian manufacturing industry. Indeed, the SEM technique enables the researcher to

test the relationship between EMAP, EMS, and EP structural model for Malaysian manufacturing industry. Based on the proposed conceptual model, research hypotheses were developed. Therefore, this study would provide new insights for the environmental management accounting area including EMAP and EMS in order to improve EP for the Malaysian manufacturing industry.

Keywords: environmental management accounting practices; EMAP; environmental management system; EMS; environmental performance; environmental cost; auditing; financial performance; operational performance; structural equation modelling; SEM; manufacturing industry; Malaysia.

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1 Introduction

According to Hooi (2016), the manufacturing industry contributes 7.3% to the Malaysian economy in 2014. However, Malaysian government is targeting GDP growth to reach between 5% and 6% per annum from 2016–2020 (Malaysian Investment Development Authority, 2017). Accordingly, GDP growth in Malaysian economy is important for Malaysian manufacturing industry to enhance the higher performance. Thus, Malaysian manufacturing industry plays a vital role to the Malaysian economy and to achieve the better performance. Malaysia has realised that environmental management is important in the manufacturing industry (Sidin and Sham, 2015). This is because Malaysian manufacturing industry is concerned in environmental issues in order to achieve sustainable development. However, Malaysia is still implementing the best practices in environmental management accounting (Mokthsim and Salleh, 2014). Thus, the researcher chose the manufacturing industry as the study because to improve the environmental management accounting practices (EMAP) and performance in the organisation.

One of the practices that need to be considered in this study is EMAP. This is because the implementation of EMAP is still lacking in organisation, especially in developing countries, like Malaysia. According to Jamil et al. (2015), there is still a lack of EMAP implementation on the environmental impact and environmental awareness within the organisation. The authors stated that EMAP is one of the important strategic management accounting to improve the performance in the manufacturing industry. Therefore, there is a significant gap in this study on EMAP for the Malaysian manufacturing industry. Furthermore, EMAP has been implemented in the organisation to overcome the limitations of conventional management accounting that less in providing information relating to environmental management (Debnath, 2014; Ismail et al., 2014; Gunarathne and Lee, 2015; Ariffin, 2016; Christ et al., 2016; Johnstone, 2018).

Given the implementation of EMAP in managing the environmental impact for Malaysian manufacturing industry, the adoption of environmental management system (EMS) has begun to attract the interest of researchers in this study. The EMAP plays a significant role in implementing the EMS in order to manage environmental activities for the Malaysian manufacturing industry. This is supported by Phan and Baird (2015) who indicate that EMS is a systematic approach for managing the environment in the manufacturing industry. By improving EMAP, EMS can be used as guidelines for improving environmental management practices for Malaysian manufacturing industry.

Previous research also suggests that the implementation of EMS can improve the EMAP in the manufacturing industry (Massoud et al., 2011). At the same time, EMS can improve the performance of the organisation (Khalili and Duecker, 2013; Rasid et al., 2014). Thereby, EMS is one of the mediating variables that used in this study as a guideline for Malaysian manufacturing industry in order to improve the EMAP and performance.

In relation to that, this study also focused on environmental performance (EP). According to Bran et al. (2011), EP refers to measure outcome that influences the extent of performance measurement used in organisations (Rae et al., 2015; Bhuiyan and Hooks, 2016). In particular, EP measurement is essential in the manufacturing industry, particularly for the Malaysian manufacturing industry (Dubey et al., 2017). By measuring EP, Malaysian manufacturing industry can achieve environmental objectives and leads to improved performance.

Thus, this study is using a structural equation modelling (SEM) technique to test the relationship between EMAP, EMS, and EP for the Malaysian manufacturing industry. Therefore, the objective of this study is to examine the relationship between EMAP, EMS, and EP for the Malaysian manufacturing industry.

2 Literature review

2.1 Environmental management accounting practices

In 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; Solovida and Latan, 2017). In order to improve EMAP, environmental awareness functions in improving environmental management in the organisation (Marelli, 2015; Jarvenpaa and Lansiluoto, 2016). Many

countries have used EMAP to address the environmental issues and provide environmental information through management accounting theories and practices.

Most of the research is related to EMAP and focused on the manufacturing industry (Jamil et al., 2015). This is because the manufacturing industry has realised the environmental issues resulting from the operations carried out. This may help in reducing environmental impacts, enhancing environmental programs, environmental management, and performance. The implementation of EMAP in manufacturing industries operating in Malaysia may help to reduce environmental issue. Thus, EMAP is one of the practices that can assist the Malaysian manufacturing industry to improve the environmental management accounting and performance in order to achieve the environmental objectives and goals.

2.1.1 Definition of EMAP

EMAP refers to the practices in determining the use of materials, energy, and environmental cost in the process of decision making to protect the environment (Singh et al., 2014; Henri et al., 2016; Russell et al., 2017). EMAP provides the development of practices and policies on reducing pollution, materials, costs, and recycling. Thus, EMAP can provide the information to meet all of the requirements for decision making. Table 1 presents the definition of EMAP by different authors.

Table 1 Definition of EMAP by different authors

Definition of EMAP	*Authors*
EMAP is a tool that can identify and quantify the environmental management.	Debnath et al. (2011)
EMAP include management activities in allocating environmental costs and control, environmental reporting, and performance measurement.	Ismail et al. (2014)
EMAP is a tool that can help to enhance environmental performance and environmental information for stakeholders.	Jamil et al. (2015)
EMAP is an environmental management initiative to make decisions in executing environmental strategies.	Gunarathne and Lee (2015)
EMAP refers to the tools to manage the impact of environmental management activities in the organisation.	Ibrahim and Jaafar (2016)
EMAP is a practice that can reduce the waste of energy, materials, and costs used in producing goods and services.	Phan et al. (2018)

2.1.2 EMAP dimension

Based on previous studies (Aurora and Geanina, 2012; Bracci and Maran, 2013; Madawaki, 2014; Lee, 2015; Taufek et al., 2016), this study focused on EMAP dimensions (environmental cost, environmental regulation, environmental safety, management commitment, and customer focus). A summary of research findings on EMAP dimension is given in Table 2.

Table 2 The summary research findings on EMAP dimension

Dimension	*Findings*	*Authors*
Environmental cost	Identifies environment related costs.	Velasquez et al. (2015) and Yahya et al. (2016)
	Allocates environment related costs to production processes.	
	Allocates environment related costs to products.	
	Creates and uses environment related costs accounts.	
	Improves the environment related costs management.	
Environmental regulation	Complies with the regulations.	Bracci and Maran (2013) and Gemmell and Scott (2013)
	Monitors the environmental regulation.	
	Complies with the environmental procedures.	
	Improves environmental regulation.	
Environmental safety	Improves environmental awareness.	Line and Albrechtsen (2016) and Taufek et al. (2016)
	Complies with the environmental safety.	
	Provides safety requirement.	
Management commitment	Improve procedures for environmental safety.	Mistry et al. (2014) and Gunarathne and Lee (2015)
	Improves environmental programs.	
	Involved in environmental decision making.	
Customer focus	Reduces environmental issues.	Mustak et al. (2016) and Nuseir and Madanat (2017)
	Improves customer satisfaction.	
	Improves customer requirements.	
	Encourages environmentally friendly.	

2.2 Environmental management system

EMS defined the procedures, organisational structures, and resources in determining and implementing environmental policies. EMS is a transparent and procedures in achieving the organisation's objectives in determining environmental goals, policies, and guidance in the organisation (Steger, 2000; Perez et al., 2007). In this study, it is suggested that the Malaysian manufacturing industry to implement EMS in the organisation in order to improve the performance.

The implementation of EMS provides benefits in the organisation. For instance, many organisations stated that the implementation of EMS can reduce environmental risk, complies with environmental legislation, and improves the use of resources and employees, and protects reputation of the company (Phan and Baird, 2015; Yang and Zhang, 2017). Thus, EMS is a systematic approach that can assist organisations to enhance the environmental management, particularly for the Malaysian manufacturing industry.

EMS is an environmental benchmark by using the principle of planning, doing, checking, and acting in order to improve the EP. This is supported by Singh et al. (2016) who mentioned that the implementation of EMS can improve the EP in the organisation. It is suggested that the implementation of EMS can be applied in the Malaysian manufacturing industry in order to improve the performance.

2.2.1 EMS dimensions

In this study, EMS dimensions consist of planning (PL), implementation and operation (IO), auditing and evaluation (AE), and checking and correction action (CA). Most of these dimensions are adopted and adapted based on EMS implementation (Hariz and Bahmed, 2013; Low et al., 2015; Salvado et al., 2015; Singh et al., 2015; Feng et al., 2016; Mardini and Tahat, 2017). Table 3 presents the measurement of EMS dimensions.

Table 3 Measurement of EMS dimensions

EMS	*Measurement*	*Authors*
PL	Environmental aspects and to achieve the objectives and targets.	Kasim (2015)
IO	EMS documentation, operational control, and environmental awareness.	Feng et al. (2016)
AE	Audit evidence and to evaluate the organisation in managing EMS.	Searcy et al. (2012)
CA	Checking to resolve environmental issues and correct the problems of the organisation.	Tung et al. (2014)

2.3 Environmental performance

Manufacturers and suppliers face the challenge of improving the EP in the manufacturing industry. The importance of environmental goals can be measured by the EP for environmental improvement in the manufacturing industry (Jones, 2005; Yasin et al., 2016). In order to improve the EP of the manufacturing industry, the industry can improve product energy consumption, material usage, or recycling to increase the operation of the company. Thus, this study has focused on the EP for the Malaysian manufacturing industry.

According to Ferreira et al. (2012), EP consists of two elements to measure the efficiency and effectiveness of environmental management and evaluate the performance of the organisation. On the other hand, the EP measurement explains on how to conduct the required measurement. Hence, EP can be used to perform environmental measurement for the Malaysian manufacturing industry.

EP can also be measured in order to increase the company's performance, particularly for the Malaysian manufacturing industry. This is suggested by Dubey et al. (2017) who stated that performance measurement can be identified by the EP indicators to improve the environmental management in the manufacturing industry. Several studies have examined that EP is beneficial not only for the environment but also for the overall performance in the organisation (Bocken et al., 2013; Alvarez et al., 2014; Adebanjo et al., 2016; Fuzi et al., 2017). By implementing EP, the companies can achieve environmental goals which can be applied for the Malaysian manufacturing industry.

2.3.1 EP dimensions

Some studies have focused on financial and operational performance (OP) in EP (Kuye and Sulaimon, 2012; Campos et al., 2015; Nehete et al., 2016). In order to measure EP, the Malaysian manufacturing industry can measure the performance based on the financial and OP. As such, in this study, EP focuses on financial and OP for the Malaysian manufacturing industry.

In this study, one of the dimensions of EP is financial performance (FP). Performance measurement through FP has been used to evaluate the organisation's financial matters (Rebelato et al., 2017; Deswanto and Siregar, 2018). The measurement criteria in term of finance are determining the efficiency and effectiveness in measuring the performance (Miguel and Campos, 2013). Thus, FP can be used to encourage organisations to improve the performance of the organisation, particularly for the Malaysian manufacturing industry.

Marie et al. (2014) and Brierley (2016) pointed out that FP also measures two elements of profitability, namely gross profit and return on investment. This is supported by Adebanjo et al. (2016) who suggested that organisations can determine FP in terms of profitability and growth in sales to increase financial measurement. Hence, FP can be improved with a good performance, mainly in EP for the Malaysian manufacturing industry.

Another dimension of EP is OP. In the manufacturing industry, OP is an important measurement in terms of production, cost, and processes. OP represents the performance measurement to assess and monitor the operations of the activities (Nehete et al., 2016). Hence, OP can assist organisations to make decision in measuring the performance for Malaysian manufacturing industry.

Duarte et al. (2011) pointed out that OP is beneficial to the manufacturing industry for improving the performance in terms of reducing operational cost, increasing processes, and operational efficiency. According to Saunila (2014), OP is related to the results of productivity and quality in order to increase the performance of the organisation. OP is also related to the measurement of the operational cost in the manufacturing industry (Golini et al., 2016). This is because OP is an important dimension for manufacturers in measuring the performance in the Malaysian manufacturing industry. This is supported by Zopf and Guenther (2015) who stated that OP can measure the EP which involves operational activities in order to address environmental issues.

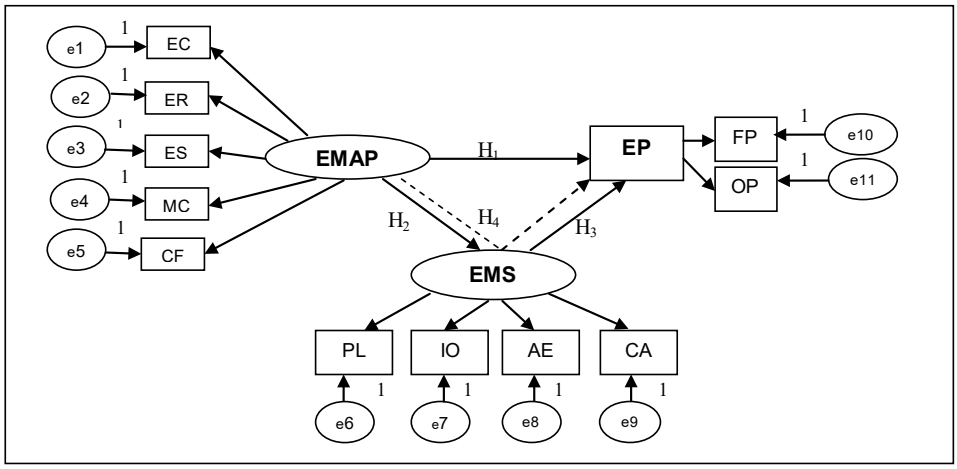
Therefore, this study focused on two dimensions of EP, namely FP and OP in order to achieve the higher performance for Malaysian manufacturing industry. It is important to focus on FP and OP in improving EP for the Malaysian manufacturing industry.

3 Conceptual model and hypotheses

The research model aims to examine the relationship between EMAP, EMS, and EP for Malaysian manufacturing industry. Figure 1 represents the research framework proposed by the researcher.

As seen in Figure 1, the overall conceptual research model for the study had been modified to incorporate all specified dimensions and variables. Based on the relationship above, the model of the relationship between EMAP, EMS, and EP included the direct relationship and indirect relationship. The mediating variables for this study are EMS. In conclusion, EMS can be considered as mediating variables between EMAP and EP by using analysis on mediator research model. To understand the relationship of EMAP, EMS, and EP for Malaysian manufacturing industry, the following hypotheses were set up to be tested. These hypotheses were stated based on a numbering from H_1 to H_4 by using the SEM method. Therefore, the model proposed the relationships between EMAP, EMS, and EP for the Malaysian manufacturing industry.

Figure 1 A proposed conceptual model



Notes: EMAP = environmental management accounting practices; EMS = environmental management system; EP = environmental performance; EC = environmental cost; ER = environmental regulation; ES = environmental safety; MC = management commitment; CF = customer focus; PL = planning; IO = implementation and operation; AE = auditing and evaluation; CA = checking and correction action; FP = financial performance; OP = operational performance.

3.1 Hypothesis 1: the relationship between EMAP and EP

Previous studies stated that there is a relationship between EMAP and EP (Rasi et al., 2014; Qian et al., 2015). The authors found that EMAP leads to better EP. Solovida and Latan (2017) mentioned that the implementation of EMAP assist the organisation to improve the EP in the manufacturing industry such as reducing environmental costs, improving the environmental management, enhancing use of renewable sources, and reducing material.

Furthermore, Henriques and Sadorsky (2013) noted that EMAP has significant relationship with EP in order to reduce environmental cost, increase environmentally friendly products, and improve environmental protection. EMAP can assist organisations to improve the EP in terms of reducing the environmental costs and environmental issues. In this regard, EMAP play a vital role in managing the EP for the Malaysian manufacturing industry. Thus, this study contributes to examine the relationship between EMAP and EP for the Malaysian manufacturing industry. Based on the reviews of literature, the following hypothesis is proposed:

H_1 There is a positive and direct significant relationship between EMAP and EP for the Malaysian manufacturing industry.

3.2 Hypothesis 2: the relationship between EMAP and EMS

EMAP and EMS are closely related to improve the environmental management. The implementation of EMAP is related to the development of EMS in the manufacturing industry (Pun and Hui, 2001). This is because EMS helps in improving EMAP to meet

the objective of the company. In order to improve the EMAP, an organisation can apply the EMS as a guideline for the Malaysian manufacturing industry. The effectiveness of EMS can assist an organisation to manage EMAP in the manufacturing industry. Sroufe (2003) found that EMAP is positively related to the EMS in the manufacturing industry. EMS is utilised to manage the environmental management in the manufacturing industry. By implementing EMS, it leads to better compliance with environmental requirements in the manufacturing industry.

In other words, the adoption of EMS is to develop and improve EMAP more efficiently and effectively (Prajogo et al., 2014). The authors stated that EMAP are positively related to EMS. These practices can improve the production process, reduce waste, and reduce environmental pollution in the manufacturing industry. This can be achieved through the EMS to evaluate the environmental impact in the organisation, especially for the Malaysian manufacturing industry. Therefore, EMS plays a vital role as a tool for EMAP to improve the procedures, legislation, and structures for the Malaysian manufacturing industry. Based on the reviews of literature, the following hypothesis is formulated:

H_2 There is a positive and direct significant relationship between EMAP and EMS for the Malaysian manufacturing industry.

3.3 Hypothesis 3: the relationship between EMS and EP

Searcy et al. (2012) noted that EMS implementation can improve EP such as managing environmental impacts, enhancing environmental awareness, improving operations of company, and reducing environmental costs. Furthermore, EMS is based on the continuous improvement to control the environmental activities and also related to the EP (Zobel and Malmgren, 2016). The implementation of EMS can assist the organisation in order to improve EP, particularly for the Malaysian manufacturing industry. Thus, EMS refers to the methods of the organisation for managing the environment and to enhance the EP for the Malaysian manufacturing industry.

This is supported by Low et al. (2015) who pointed out that EMS implementation on manufacturing organisations in Malaysia had improved EP. In this regard, EMS has the potential to improve EP for the Malaysian manufacturing industry. Therefore, this study proposes that EMS can enhance EP for the Malaysian manufacturing industry. Based on the reviews of literature on EMS and EP, the following hypothesis is proposed:

H_3 There is a positive and direct significant relationship between EMS and EP for the Malaysian manufacturing industry.

3.4 Hypothesis 4: the relationship between EMAP, EMS, and EP

This study utilises EMS as a mediator in the relationship between EMAP and EP for the Malaysian manufacturing industry. EMS is an important tool in managing environmental issues in the organisation. Solovida et al. (2015) proposed that there was a positive and significant relationship between EMAP, EMS, and EP. This is because EMS helps organisations to evaluate operations of environmental management, especially for the Malaysian manufacturing industry. Hence, this study aims to examine the indirect relationship between EMAP and EP through the use of EMS for Malaysian manufacturing industry.

Prajogo et al. (2014) also maintained that EMS can improve the relationship between EMAP and EP. In other words, EMS can develop and maintain the EMAP in the organisation. Thus, EMS is significant in EMAP and EP for the Malaysian manufacturing industry. Salvado et al. (2015) proved that there was a significant relationship to EP. This meant that EMS was supposed to show impact on the EMAP and EP for the Malaysian manufacturing industry. Accordingly, EMS had a positive relationship between EMAP and EP for the Malaysian manufacturing industry.

Moreover, EMS is a useful approach for improving the EMAP and EP for the Malaysian manufacturing industry. Burja (2012) pointed out that the use of EMS had a significant relationship with EP. This is because EMS implementation has a link between EP for monitoring and controlling the environmental impact of the organisation. The implementation of EMAP and EMS is significant to improve EP of the organisation (Jalil et al., 2016). It is necessary for organisations to implement EMS in order to enhance EMAP and EP for the manufacturing industry, such as reducing the environmental cost, increasing the quality of environmental management, reducing materials and energy consumption, and evaluating environmental impacts of the processes. Therefore, EMS implementation can be considered to improve EMAP and EP for the Malaysian manufacturing industry. Based on the reviews of literature, the following hypothesis is proposed:

H_4 There is a positive and indirect significant relationship between EMAP, EMS, and EP for the Malaysian manufacturing industry.

4 Methodology

The aim of this study is to examine the relationship between EMAP, EMS, and EP for Malaysian manufacturing industry. This study used a quantitative approach to test the model and research hypothesis. As a quantitative study, questionnaires were distributed to the respondents. A set of survey questionnaire had been designed to ensure most of the issues covered EMAP, EMS, and EP for Malaysian manufacturing industry. In this study, EMAP consisted of five dimensions (environmental cost, environmental regulation, environmental safety, management commitment, and customer focus). Meanwhile, EMS consisted of four dimensions which include planning, IO, AE, and checking and CA. Finally, EP consisted of two dimensions (FP and OP). Thus, the survey questions were designed to obtain the respondents for Malaysian manufacturing industry.

The population in this study focused on the manufacturing industry. The population of Malaysian manufacturing sectors comprised 2,700 manufacturing companies (Federation of Malaysian Manufacturers Directory, 2016). Data will be collected using a questionnaire survey from 2,700 manufacturing companies selected from the FMM Directory 2016. The manufacturing sector consists of automotive/machinery, electrical/electronics, plastics/rubber/metal, chemical/wood, and food/tobacco. The researcher chose the respondents from the people who held the top management position in the companies such as the managing director, quality control manager, manufacturing manager, and accountant about the EMAP, EMS, and EP of the companies.

This study utilised the statistical package for social sciences (SPSS) version 22.0 software and SEM version 21.0 to perform statistical analysis from data surveys. For SPSS, descriptive statistics analysis was used to determine the percentage and frequency

distribution in order to analyse the data of the sample. Next, the SEM approach refers to a statistical techniques used to analyse the data. SEM is used to test the relationships between independent variables and dependent variables as proposed in the research hypotheses. SEM consists of the measurement model and structural model. The measurement model includes the relationships between the constructs and the structural model refers to the direction of the relationships of all variables.

As suggested by Krejcie and Morgan (1970), the appropriate sample size from 2,700 population is 335. In determining the reasonable sample size, the suggested minimum sample size for this study is about 200–400 (Fuzi et al., 2013; Habidin et al., 2016). However, the sample size of 200 is a critical size for testing hypotheses and models using SEM (Wolf et al., 2013, Habidin et al., 2014; Fuzi et al., 2015). The recommended values of goodness of fit indices are depicted in Table 4.

Table 4 Recommended values of goodness-of-fit indices

Goodness of fit indices	*Recommended values*
Chi-square over degrees of freedom (X^2/df)	<3.00
Goodness of fit index (GFI)	≥0.90
Adjusted goodness of fit index (AGFI)	≥0.80
Comparative fit indexes (CFI)	>0.90
Tucker Lewis index (TLI)	≥0.90
Root mean square error approximation (RMSEA)	≤0.08

To perform SEM, analysis of moment structure (AMOS) version 22.0 software was used in this study. As suggested by Sen et al. (2015), the model fit of this study was assessed by the six criteria such as Chi-square over degrees of freedom (X^2/df), goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit indexes (CFI), Tucker Lewis index (TLI), and root mean square error approximation (RMSEA). Thus, to determine whether to accept or reject a hypothesis model, the goodness-of-fit indices can be used to examine the model fit.

According to this study, there is a indirect relationship between EMAP and EP through the implementation of EMS. Therefore, the research hypotheses were developed to examine the relationship among variables by using the SEM method. Regarding to this, the authors using SEM method to examine the indirect effects of EMAP, EMS, and EP.

5 Conclusions

In this study, EMAP is a challenge faced by management accounting related to environmental activities. EMAP and EMS are important for the Malaysian manufacturing industry to improve the EP. Based on proposed model, research hypotheses were developed. Thus, the aim of this study is to examine the relationship between EMAP, EMS, and EP for Malaysian manufacturing industry. In order to achieve the success and sustain the environmental improvement, the relationship between EMAP, EMS, and EP can be important for the Malaysian manufacturing industry.

In terms of the theoretical aspects, EMS is mediating variables in the relationship between EMAP and EP for Malaysian manufacturing industry. The implementation of

EMS is significant for Malaysian manufacturing industry based on the EMAP theory. For managerial aspects, EMAP play an important role in the practice to manage the environmental activities in the manufacturing industry. To meet the requirement of EMAP, the implementation of EMS in the manufacturing industry can assist the organisation in managing, measuring, and improving the environmental management of the operations. Hence, EMS provides the guidelines for Malaysian manufacturing industry in order to improve the EMAP and EP. Therefore, this research finding would provide new insights for the environmental management accounting area including EMAP, EMS, in order to improve EP for the Malaysian manufacturing industry.

Firstly, limitation of this study has been difficult to find literature on EMAP, EMS, and EP for the Malaysian manufacturing industry. Another limitation is the population and sample of survey respondents are only targeted on Malaysian manufacturing industry. The future direction of this study is to design a questionnaire, which will be used for pilot study in the Malaysian manufacturing industry.

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