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Article information:

To cite this document:

Nursyazwani Mohd Fuzi, Nurul Fadly Habidin, Sharul Effendy Janudin, Sharon Yong Yee Ong, (2018) "Critical success factors of environmental management accounting practices: findings from Malaysian manufacturing industry", Measuring Business Excellence, <https://doi.org/10.1108/MBE-03-2018-0015>

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<https://doi.org/10.1108/MBE-03-2018-0015>

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Critical success factors of environmental management accounting practices: findings from Malaysian manufacturing industry

Nursyazwani Mohd Fuzi, Nurul Fadly Habidin, Sharul Effendy Janudin and Sharon Yong Yee Ong

Abstract

Purpose – The purpose of this paper is to identify the critical success factors of environmental management accounting practices in Malaysian manufacturing industry.

Design/methodology/approach – A pilot study was carried out on a sample of 60 manufacturing companies from Malaysian manufacturing industry. A survey instrument including 25 measurement items was designed to identify the level of environmental management accounting practices implementation in the Malaysian manufacturing industry. Descriptive statistical analysis and reliability analysis were used to analyze the data with SPSS software.

Findings – Findings indicate that environmental safety is one of the critical success factors that play the key role in ensuring the safety awareness at workplace. Companies in the manufacturing industries need to obtain critical success factors of environmental management accounting practices implementation to enhance performance, particularly for Malaysian manufacturing industry.

Research limitations/implications – The limitation of this study has been the difficult to find the literature on environmental management accounting practices in the Malaysian manufacturing industry. Another limitation is this study only conducted to 60 manufacturing companies from Malaysian manufacturing industry.

Practical implications – For practical implications, the development of instruments in this study may be valuable tools to evaluate Environmental Management Accounting Practices (EMAP) in Malaysian manufacturing industry. This study also provides important guidelines for Malaysian manufacturing industry to implement EMAP. This research finding would provide new insights for the critical success factors of EMAP to improve performance in Malaysian manufacturing industry.

Originality/value – This study makes a new contribution to environmental management accounting practices in Malaysian manufacturing industry. This study also provides important information for decision makers involved in environmental management accounting practices implementation and also provides useful reference for future researchers in this research area.

Keywords Performance, Manufacturing industry, Critical success factors, Reliability analysis, Environmental management accounting practices

Paper type Research paper

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Received 9 March 2018
Revised 12 September 2018
Accepted 26 November 2018

The researchers would like to acknowledge the Ministry of Higher Education (MOHE) for the financial funding of this research and Research Management and Innovation Centre (RMIC), Universiti Pendidikan Sultan Idris (UPSI) for Research University Grant (RUG).

1. Introduction

The manufacturing industry is one of the strategic industries in the Malaysian manufacturing sector. This is because organizations of the manufacturing sector needs to enhance sustainability and to improve the productivity (Bahri *et al.*, 2017). Ministry of International Trade and Industry noted that manufacturing companies need to analyze issues related to

manufacturing ecosystem in Malaysia and also related to technology in the manufacturing industry. However, in a developing country like Malaysia, environmental management is still at early stage in promoting environmental practices in the industry (Sidek and Backhouse, 2014). Jamil *et al.* (2015) supported that manufacturing companies has not received much attention about Environmental Management Accounting Practices (EMAP) by researchers.

From a global perspective, Malaysia has highlighted the environmental issues in manufacturing organizations. Malaysia has realized that environmental management is important in the manufacturing industry (Sidin and Sham, 2015). This is because Malaysian manufacturing industry is concerned about environmental issues to achieve sustainable development. Due to this, it is important to the manufacturing industry to address the environmental issues, particularly for Malaysian manufacturing industry. Most importantly, this study may concern regarding the environment especially in environmental management accounting practices to address environmental issues. However, Malaysia is still implementing the best practices in environmental management accounting (Mokthsim and Salleh, 2014). Thus, the researcher chose the manufacturing industry in the study to improve the environmental management accounting practices and performance in the organization.

EMAP is one of the practices that can assist organizations to manage the environmental issues (Ibrahim and Jaafar, 2016). To improve EMAP, environmental awareness functions in improving environmental management in the organization (Ribeiro *et al.*, 2012). Several previous studies (Digalwar *et al.*, 2013; Ismail *et al.*, 2014; Chen *et al.*, 2015; Christ *et al.*, 2016) have implemented EMAP in the manufacturing industry. According to this, most of the manufacturing industries have applied EMAP; thus, the implementation of EMAP is important to this study for managing the environmental management to become more efficient. As suggested by Nyirenda *et al.* (2011), EMAP helps to increase interest in the manufacturing industry to improve environmental management such as reducing emission, energy efficiency and water usage. Besides, EMAP focuses on environmental information related to materials, energy, water and also information of environmental costs (Tanc and Gokoglan, 2015; Ariffin, 2016). Therefore, EMAP is beneficial for Malaysian manufacturing industry to manage the environmental management including energy efficiency, reduce pollution abatement and efficient cleaner production. Table I shows the summary of EMAP conducted in manufacturing industries and different countries.

EMAP refers to the environmental management in the company's operations, long-term planning and quality management. In other words, EMAP explains the systematic use of business management toward environmental issues (Mokhtar *et al.*, 2014). Therefore, EMAP is one of the practices that can assist organizations to manage the environmental issues.

Regarding to this, EMAP's main goal is to obtain useful information for decision-making. EMAP refers to the practices in determining the use of materials, energy and environmental

Table I The summary of EMAP conducted in manufacturing industries and different countries

| <i>Findings</i> | <i>Countries</i> | <i>Authors</i> |
|---|------------------|--------------------------------|
| EMAP can increase the environmental awareness, environmental knowledge, skills of employees, and manager commitment | Spain | Albelda (2011) |
| EMAP reduces environmental costs and risks for decision-making in the production process | Malaysia | Jalaludin <i>et al.</i> (2011) |
| EMAP improve environmental management such as reduce pollution, waste, energy and materials | South Africa | Nyirenda <i>et al.</i> (2011) |
| EMAP can increase the profitability and performance of the company | India | Debnath (2014) |
| EMAP assists management with environmental decision-making | Nigeria | Madawaki (2014) |

cost in the process of decision-making to protect the environment (Vasile and Man, 2012; Mohamed and Jones, 2014; Singh *et al.*, 2016; Henri *et al.*, 2016). 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.

In summary, EMAP is one of the practices that can assist the Malaysian manufacturing industry to improve the environmental management accounting and performance to achieve the environmental objectives and goals. Thus, the aim of this study is to identify the critical success factors of EMAP in Malaysian manufacturing industry.

This paper is organized as follows. Section 2 provides the literature review about the overview of EMAP and critical success factors of EMAP. This is followed by Section 3 to analyze the data. Next, the Section 4 presents the results of the data analysis and also includes the discussion. Finally, this study concludes the findings and provides the future directions of the study in Section 5.

2. Literature review

EMAP is one of the environmental management has been implemented in the accounting field. Ibrahim and Jaafar (2016) defined EMAP as an instrument which helps organizations in improving environmental management and environmental information to the stakeholders. Companies have begun to face the stakeholder concerns regarding the environmental impact in the organization. This is because the implementation of EMAP is important in managing the environmental management to reduce a negative impact on the environment. Thus, companies are striving to make more effective and efficient, and using the resources to ensure sustainability in the environment.

Moreover, EMAP can contribute to improving environmental awareness, reducing environmental impacts, and benefits that can enhance environmental management (Doorasamy and Garbharran, 2015). In this regards, organizations can gained some benefits through the implementation of EMAP. These benefits include complying with the environmental legislation, controlling the resources used, improving productivity, increasing profitability, company's reputation, competitive advantage, environmental decision-making, reducing environmental costs and environmental risks, as well as improving in EMAP for Malaysian manufacturing industry. Therefore, the implementation of EMAP can be concerned in the Malaysian manufacturing industry. EMAP implementation helps companies to improve the environmental benefits and achieve better performance, especially for Malaysian manufacturing industry.

Critical success factors are one of the ways to help organization gain the information requirements of managing their organizations. One of the ways of critical success factors is to improve company's objectives, decision-making and measuring performance to achieve company's goals. Hence, critical success factors are important to the achievement of organization goals. To be successful in implementing EMAP, this study can explores the critical success factors for EMAP, particularly in Malaysian manufacturing industry. Based on the previous literature review (Lee, 2015), these factors that might affect the successful of EMAP are divided into five dimensions. The authors summarized the critical success factors of EMAP as follows:

1. environmental cost;
2. environmental regulation;
3. environmental safety;
4. management commitment; and
5. customer focus.

Environmental cost represents a main dimension of EMAP. Environmental cost represents a main dimension of EMAP. There are several different ways to determine the environmental cost in the literature (Velasquez *et al.*, 2015; Yahya *et al.*, 2016) which are to identify the cost such as production processes, products costs, cost management, and savings related to the environmental cost and product improvement. Companies are identifying environmental cost to increase the management and financial decision. Petcharat and Mula (2012) pointed out that environmental cost can measure the reduction of input materials, energy and waste in reducing production costs. Thus, environmental cost is one of the dimensions of EMAP related to the practices of environmental management.

During the 1970s, environmental regulation plays an important role in addressing environmental issues. In terms of environmental regulation, it is influencing in EMAP and environmental information. In the environmental regulation context, the manufacturing cost has increased due to environmental compliance (Gemmell and Scott, 2013). In this regard, by implementing of environmental regulation, organizations can develop environmental programs which assisted to reduce environmental impacts, reduce environmental costs and achieve environmental goals. Therefore, environmental regulation is required in improving EMAP by complying with the legislation, particularly for Malaysian manufacturing industry.

Environmental safety refers to the safety awareness to enable industries to conduct in a secure environment to improve the company's performance (Line and Albrechtsen, 2016). The tendencies of improving environmental safety are mostly applied by complying with the environmental standards and safety requirements on the company's operation. For this reason, there is a need for implementing the EMAP regarding to the environmental safety requirements. Thus, the implementation of EMAP is related to environmental safety on the basis of findings from relevant literature. In the manufacturing industry, employers should ensure that the guidelines and procedures for environmental safety can reduce the effect of environmental issues (Taufek *et al.*, 2016). Environmental safety also assists the organization to implement safety in EMAP to improve the environmental management. The successful management requires relevant information especially environmental information for decision-making that related to environmental safety in the organizations. Hence, the organizations must be aware of the importance of environmental safety in the manufacturing industry.

Management commitment refers to the involvement of employers and employees to achieve organizational goals (Gunarathne and Lee, 2015). According to Kim *et al.* (2015), management commitment engages and supports in managing the environmental management. This is because management commitment can support for EMAP implementation to improve environmental management. Management commitment also refers to create an organizational culture that affecting employees in the company. In other words, management commitment can support environmental management regarding environmental issues, environmental activities and environmental programs in the organization. Due to this, management commitment can encourage employees to engage in environmental initiatives. In addition, management commitment is seen to be an important role in environmental decision-making. The involvement of management commitment from top management is considered as one of the most important dimension of EMAP implementation for improving environmental management, particularly for Malaysian manufacturing industry. Therefore, management commitment is an important dimension for EMAP to enhance environmental management in Malaysian manufacturing industry.

Customer focus is defined as customer needs and satisfaction in achieving the organizational goals (Mokhtar, 2013). Regarding this, customer focus is one of the important dimensions that organizations need to give their attention and to meet customer requirements, particularly for Malaysian manufacturing industry. Specifically, by pointing out the customer focus dimension that can influence the customer involvement, this study

prompts the awareness of companies on the customer focus that can assist the companies to improve the EMAP. Due to this, customer focus can meet customer requirements and customer satisfaction and encourages environmental friendliness to enhance the EMAP, particularly for Malaysian manufacturing industry.

In conclusion, the EMAP dimension can be applied for Malaysian manufacturing industry as it consists of environmental cost, environmental regulation, environmental safety, management commitment and customer focus. Thus, EMAP can be implemented for examining whether the organization has been successful in reducing environmental issues, particularly for Malaysian manufacturing industry.

3. Methodology

This study used a quantitative approach to identify the critical success factors of EMAP in Malaysian manufacturing industry. This study uses descriptive analysis to analyze the data. First, this study consisted of questions related to the respondent's profile. In this study, the questionnaire comprised demographic information (types of ownership, industrial sector, number of employees, current position, current position (years) and quality systems certification). Second, the questionnaire was designed to examine the implementation of EMAP for Malaysian manufacturing industry. In this study, EMAP consisted of five dimensions (environmental cost, environmental regulation, environmental safety, management commitment and customer focus) and 25 measurement items as shown in Appendix. This study used items with a seven-point Likert scales ranging from (1 = very low, 7 = very high) for measuring the EMAP. Thus, the total of 25 items survey questions were designed to obtain the respondents for Malaysian manufacturing industry.

An expert validation was conducted to assess the validity of the content by requesting feedback consisting of comments, clarity, and quality of each item. The final draft of the questionnaire would be sent to the experts (local university academicians and manufacturing experts) of EMAP. The expert panels had evaluated the questionnaires as shown in Table II.

A pilot study is an initial step in the research, and it is used for all research studies. The importance of the pilot study is to enhance the quality and the efficiency of the main research (Hazzi and Maldaon, 2015; Fuzi *et al.*, 2017). According to Whitehead *et al.* (2015), a reasonable sample size of at least 30 or greater is preferable for a pilot study. However, Johanson and Brooks (2009) pointed out that a sample size that range from 10 to 15 is good enough in providing for pilot study. Therefore, the sample size is important for conducting the pilot study and to check the instruments used.

Cronbach's alpha provides a measure of the internal consistency of the scale used between 0 and 1 to test the reliability of the analysis (Cronbach, 1951; Tang *et al.*, 2014). The

Table II Panel of experts (Feedback)

| <i>Name</i> | <i>Position of experts</i> |
|-----------------------------------|--|
| <i>Academician (EMAP Experts)</i> | |
| DRM | Lecturer (Management Accounting), University Utara Malaysia, Malaysia |
| DFS | Lecturer (Management Accounting), University Malaysia Terengganu, Malaysia |
| DRMS | Lecturer (Accounting), University Utara Malaysia, Malaysia |
| <i>Manufacturing Experts</i> | |
| ZSZ | Section Manager, Vendor Improvement and Education Vendor |
| MVN | General Manager, Likom Caseworks Sdn Bhd |

acceptable values of Cronbach's alpha are ranges from 0.70 to 0.90 (Mohamad *et al.*, 2013). Cronbach's alpha is measured to determine the internal consistency of each item and can be used to evaluate the quality of the instruments in the study. For this study, the instrument will test for reliability analysis using Cronbach's alpha.

In the pilot test, 60 questionnaires were coded and analyzed with IBM Statistical Package Social Sciences (SPSS) Statistics version 22 software and the reliability of the instrument was tested. In this study, an online survey was conducted by distributing the questionnaires. Out of the 100 questionnaires sent to the respondents, only 60 were received and used for a pilot study. The respondents who were currently participating in the manufacturing industry and their information would be used in the pilot test. Data were carried out of 60 manufacturing companies from Malaysian manufacturing industry. The manufacturing sector consists of automotive/machinery, plastics/rubber/metal, food/tobacco, electrical/electronics and chemical/woods. The researcher choose the respondents from the people who held the top management position, middle management and others in the companies such as the managing director, manufacturing manager and accountant about the EMAP of the companies.

4. Results and discussion

Table III shows the demographic information including types of ownership, industrial sector, number of employees, current position, current position (years) and quality systems certification. This section contains six key questions that comprised demographic information (types of ownership (100 per cent local and 100 per cent foreign), industrial sector (automotive/machinery, plastics/rubber/metal, food/tobacco, electrical/electronic, chemical/woods and others), number of employees (less than 100, between 100 to 200,

| Table III Demographic information (<i>n</i> = 60) | | | |
|---|-----------------------|------------------|------------|
| <i>Characteristics</i> | <i>Measurement</i> | <i>Frequency</i> | <i>(%)</i> |
| Types of ownership | 100% local | 40 | 66.67 |
| | 100% foreign | 20 | 33.33 |
| Industrial sector | Automotive/Machinery | 23 | 38.33 |
| | Plastics/Rubber/Metal | 15 | 25.00 |
| | Food/Tobacco | 9 | 15.00 |
| | Electrical/Electronic | 6 | 10.00 |
| Number of employees | Chemical/Woods | 4 | 6.67 |
| | Others | 3 | 5.00 |
| | Less than 100 | 30 | 50.00 |
| | Between 100 to 200 | 15 | 25.00 |
| Current position | Between 200 to 300 | 10 | 16.67 |
| | More than 300 | 5 | 8.33 |
| | Senior management | 15 | 25.00 |
| | Middle management | 40 | 66.67 |
| Current position (years) | Others | 5 | 8.33 |
| | Less than 1 year | 5 | 8.33 |
| | 1 to 3 years | 10 | 16.67 |
| | 3 to 6 years | 15 | 25.00 |
| Company certified to quality system standard ^a | More than 6 years | 30 | 50.00 |
| | ISO 9001:2008 | 30 | 50.00 |
| | ISO/TS 16949 | 10 | 16.67 |
| | ISO 14001 | 15 | 25.00 |
| | OHSAS 18001 | 5 | 8.33 |
| | None | 10 | 16.67 |
| | Others | 0 | 0.00 |

^aNote: Some companies have more than one certification

between 200 to 300 and more than 300, current position (senior management, middle management and others), period of current position (less than 1 year, 1 to 3 years, 3 to 6 years, and more than 6 years) and, finally, quality systems certification (ISO 9001:2008, ISO/TS 16949, ISO 14001, OHSAS 18001, none and others).

First, the measure of demographic information is the types of ownership. The majority of the companies involved were fully owned by Malaysians (66.67 per cent) and followed by 33.33 per cent was owned by foreigners. This result presents that majority of these companies are owned by Malaysian residents.

The respondents come from companies with different industrial sectors in the manufacturing industry. The types of industrial sectors are categorized into six categories. There are automotive/machinery, plastics/rubber/metal, food/tobacco, electrical/electronic, chemical/woods and others. Among the six types of industrial sectors, most companies were from the automotive/machinery with 38.33 per cent. This was followed by plastics/rubber/metal with 25.00 per cent, food/tobacco (15.00 per cent), electrical/electronic (10.00 per cent), chemical/woods (6.67 per cent) and finally others industrial sectors (5.00 per cent). This result shows that majority of these companies from automotive/machinery sectors.

The next survey question focused on the number of employees. In total, 50.00 per cent of the companies had less than 100 employees, while 25.00 per cent of the companies had between 100 and 200 employees. A total of 16.67 per cent of the companies had between 200 and 300 employees and 8.33 per cent had more than 300 employees.

As for the aspect of respondents' position, 66.67 per cent held middle management post, 25.00 per cent of Malaysian respondents held senior management posts, and this was followed by others positions at 8.33 per cent.

Meanwhile, respondents holding the current position (years) for more than 6 years was 50.00 per cent, the position between 3 and 6 years was 25.00 per cent, the position between 1 and 3 years was 16.67 per cent, and the position held for less than 1 year was 8.33 per cent. This shows that the respondents are sufficiently knowledgeable regarding the EMAP implementation.

For the certification, some companies had more than one certification. In total, 50.00 per cent of the companies had ISO 9001:2008 certification, while 25.00 per cent had ISO 14001 certification. 16.67 per cent had ISO/TS 16949 certification, while 8.33 per cent had OHSAS 18001 certification. Thus, the study suggests that most of the manufacturing companies concerned that EMAP are important for global sustainability in the future.

Based on the Cronbach's alpha rule of thumb, the rule indicated that the range between 0.70 and 0.80 was considered as a good reliability. The range between 0.80 and 0.90 was also considered as very good reliability (Tang *et al.*, 2014). From the results, all items were indicated as a good reliability with the Cronbach's alpha value at more than 0.70. Table IV presents the pilot results of reliability analysis for EMAP dimensions.

From the result as shown in Table IV, the reliability analysis for environmental cost shows that the alpha value at 0.949. This value of 0.949 is ranged from 0.80 to 0.90, and this is a very good reliability of the five items which were measured on environmental cost. Next, the reliability analysis for the environmental regulation presented the alpha value at 0.874. This value of 0.874 within the range of 0.80 to 0.90, and this is also a very good reliability of the five items measured on environmental regulation. Meanwhile, the reliability analysis for environmental safety shows the alpha value at 0.829. The value of 0.829 is ranged between 0.80 and 0.90, and this indicates a very good reliability of the five items which measuring environmental safety. For management commitment, the reliability analysis is 0.868, which is between the range of 0.80 and 0.90. It shows that the reliability analysis is good concerning the five items for measuring management commitment. Finally, the reliability

Table IV Pilot results of reliability analysis for EMAP dimensions

| <i>Dimensions</i> | <i>No. of items</i> | <i>Alpha (α) values</i> | <i>Item for deletion</i> | <i>Alpha (α) if item is deleted</i> |
|--------------------------|---------------------|---|--------------------------|---|
| <i>EMAP</i> | | | | |
| Environmental cost | 5 | 0.949 | None | 0.949 |
| Environmental regulation | 5 | 0.874 | None | 0.874 |
| Environmental safety | 5 | 0.829 | None | 0.829 |
| Management commitment | 5 | 0.868 | None | 0.868 |
| Customer focus | 5 | 0.864 | None | 0.864 |
| Total | 25 | | | |

analysis for customer focus indicates that the alpha value is 0.864. This value of 0.864 is the between the range of 0.80 and 0.90, and this is a very good reliability of the five items which measured customer focus. All reliability analysis of EMAP dimension showed good alpha values and (α) value within the range of 0.829 and 0.949. In conclusion, the reliability analysis of the pilot data indicated that all the dimensions have alpha (α) value more than 0.7 (range from 0.829 to 0.949). Hence, it would be used to collect the actual data in Malaysian manufacturing industry.

Next, the results show all means for critical success factors of EMAP in [Table V](#). The overall mean for each factor was obtained to identify the level of EMAP implementation in Malaysian manufacturing industry.

As presented in [Table V](#) and [Figure 1](#), the mean values range from 4.394 to 4.227 which is good for EMAP implementation. The two highest critical success factors of EMAP are environmental safety (4.394) and management commitment (4.383). Next, critical success factors of EMAP are customer focus (4.343), environmental regulation (4.283) and environmental cost (4.227). It indicates that environmental safety is given the highest mean score in Malaysian manufacturing industry.

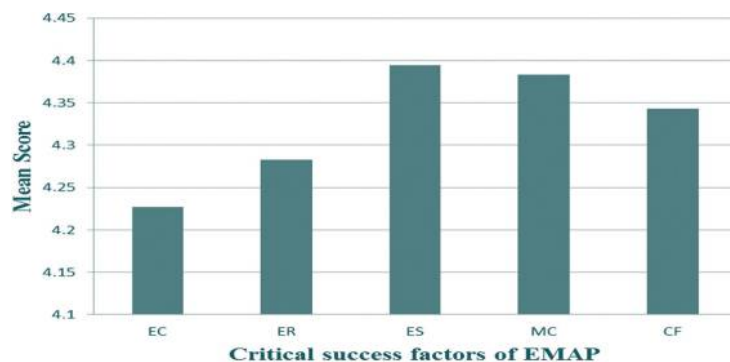
Based on the findings, environmental safety is important factor in the EMAP for Malaysian manufacturing industry. This is because manufacturing companies have mentioned that the safety plays an important role to the employees to protect the safety and health. This is supported by [Taufek et al. \(2016\)](#) stated that environmental safety awareness is important to secure environment to improve the company's performance. It means that environmental safety is one of the important factors and can be beneficial to the manufacturing industry by improving EMAP for Malaysian manufacturing industry. Hence, most companies focused on the environmental safety for giving the best practices to the organization especially for employees and customers.

The next important critical success factor of EMAP is management commitment. According to [Hanaysha \(2016\)](#), management commitment plays a role in managing the environmental management and also to encourage employees to be involved in the environment. Regarding to this, management commitment is one of the most important to the EMAP in Malaysian manufacturing industry. This is because management commitment can lead to favorable company outcomes and to achieve the company's goals. Therefore, the management commitment can enhance the organizational performance by implementing EMAP in Malaysian manufacturing industry.

Meanwhile, the third highest critical success factor of EMAP is customer focus. Customer focus has a positive impact on the company to fulfill customer needs and satisfaction ([Pekovic et al., 2016](#)). The authors stated that customer focus is a one of the key dimension of EMAP because it reflects the core of the management concept. Hence, customer focus is

Table V Average rating for critical success factors of EMAP

| Factors | Mean | Average mean | Rank |
|--------------------------------------|-------|--------------|------|
| <i>Environmental cost (EC)</i> | | 4.227 | 5 |
| EC1 | 4.250 | | |
| EC2 | 4.183 | | |
| EC3 | 4.200 | | |
| EC4 | 4.217 | | |
| EC5 | 4.283 | | |
| <i>Environmental regulation (ER)</i> | | 4.283 | 4 |
| ER1 | | | |
| ER2 | 4.150 | | |
| ER3 | 4.117 | | |
| ER4 | 4.500 | | |
| ER5 | 4.133 | | |
| <i>Environmental safety (ES)</i> | | 4.394 | 1 |
| ES1 | 4.417 | | |
| ES2 | 4.450 | | |
| ES3 | 4.455 | | |
| ES4 | 4.383 | | |
| ES5 | 4.267 | | |
| <i>Management commitment (MC)</i> | | 4.383 | 2 |
| MC1 | 4.350 | | |
| MC2 | 4.667 | | |
| MC3 | 4.167 | | |
| MC4 | 4.367 | | |
| MC5 | 4.365 | | |
| <i>Customer focus (CF)</i> | | 4.343 | 3 |
| CF1 | 4.117 | | |
| CF2 | 4.500 | | |
| CF3 | 4.133 | | |
| CF4 | 4.517 | | |
| CF5 | 4.450 | | |

Figure 1 Critical success factors of EMAP in Malaysian manufacturing industry

Notes: EC = Environmental cost; ER = Environmental regulation; ES = Environmental safety; MC = Management commitment; CF = Customer focus

also important successful factor to achieve company objectives with regard to attract customers to improve the organizational performance.

On the other hand, the two lowest of critical success factors of EMAP are environmental regulation and environmental cost. This is supported by [Christ and Burritt \(2013\)](#) who noted that environmental regulations plays an important role in addressing environmental issues such as costs, waste, production and environmental procedures. This is because some companies are not considered about the environmental regulation ([Gemmell and Scott, 2013](#)). Thus, environmental regulation can be considered as important dimension of EMAP to solve the environmental problems in Malaysian manufacturing industry.

Finally, the lowest of critical success factor of EMAP is environmental cost. From the findings, environmental cost is essential of EMAP implementation. Companies are identifying environmental cost based on the financial decision ([Yahya et al., 2016](#)). Apart from that, environmental cost is important to Malaysian manufacturing industry regarding to the material, energy, water and emissions which can be reduced to improve the environmental performance.

Based on the results, environmental safety is one of the critical success factors that play the key role in ensuring the safety awareness at workplace. Companies in the manufacturing industries need to obtain critical success factors for the successful EMAP implementation to enhance performance, particularly for Malaysian manufacturing industry. Hence, the results of this study indicate that five critical success factors of EMAP are valid and reliable in Malaysian manufacturing industry.

5. Conclusion

Based on the empirical data survey, the two factors of environmental safety and management commitment have been shown to be the successful factors for EMAP implementation in Malaysian manufacturing industry. Based on the reliability analysis, all factors of EMAP were accepted for this study. Therefore, the results of this study indicated that five of critical success factors for EMAP (environmental cost, environmental regulation, environmental safety, management commitment, customer focus) were valid and reliable in Malaysian manufacturing industry.

For practical implications, the development of instruments in this study may be valuable tools to evaluate EMAP in Malaysian manufacturing industry. This study also provides important guidelines for Malaysian manufacturing industry to implement EMAP. This research finding would provide new insights for the critical success factors of EMAP to improve performance in Malaysian manufacturing industry.

Meanwhile, the limitation of this study has been difficult to find the literature on EMAP in Malaysian manufacturing industry. Another limitation is this study only conducted to 60 manufacturing companies from Malaysian manufacturing industry. Agenda for future research, the authors are looking at the relationship between EMAP, information system and performance in Malaysian manufacturing industry.

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Appendix. Survey instrument

Environmental management accounting practices

Extent to which your organization uses:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.

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