The relationship between environmental cost on organisational performance and environmental management system: a structural equation modelling approach

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Abstract

Purpose – *This study aims to examine the relationship between environmental cost (EC) on organisational performance (OPM) through an environmental management system (EMS) as the mediating variable.*

Design/methodology/approach – *A total of 2,600 manufacturers were identified and consequently selected as the entire study population. Additionally, this study used the structural equation modelling technique to identify the mediator effects of EMS between EC and OPM.*

Findings – *The EC and EMS relationship on OPM produced direct and indirect consequences. Hence, it is concluded that manufacturing industry in Malaysia are focused on the OPM when implementing EC and EMS.*

Originality/value – *The model would incorporate EC and EMS implementation on OPM in the Malaysian manufacturing industry. This study could also be advantageous to the industry in improving EC, EMS and OPM.*

Keywords *Environmental cost, Environmental management system, Performance, Manufacturing, Structural equation modelling, Manufacturing industries, Organizational performance, Modelling, Environment*

Paper type *Research paper*

1. Introduction

Manufacturing industry have contributed significantly in strengthening the economies of many countries including developing countries, and they play an important role in the global economy by supplying goods and services. The Malaysian manufacturing industry witnessed an increase in sales by 7.7%, specifically from RM66.6bn in 2017 to RM71.8bn in 2018 (Department of Statistics Malaysia, 2018). Consequently, the industry was deemed to be a vital sector in the local economy. Given the gradual emphasis on manufacturing, research on environmental management accounting was performed in various industries under diverse features (Christ and Burritt, 2013; Smit and Kotzee, 2016).

The environmental cost (EC) was defined as one of the environmental management accounting practices (EMAP) components in managing environmental activities in organisations (Ambe *et al.*, 2015; Rakos and Antohe, 2014; Basuki and Irwanda, 2018; Rounaghi, 2019). Two EC types were identified: implicit and explicit costs. Implicit costs implied administrative costs, employee awareness and the cost of monitoring environmental issues. On the other hand, explicit costs involved technologies, processes and disposal

costs. In this regard, EC encompassed all the costs relevant to the environmental impact of organisational operations.

Past works of literature, such as Tappura *et al.* (2015), Alkisher (2018); and Imtiaz Ferdous *et al.* (2019) researched the factors influencing EMAP (Albelda, 2011; Amiruddin and Pagalung, 2016; Fuzi *et al.*, 2019a; Tashakor *et al.*, 2019). Specifically, EMAP encompassed ECs in assessing the expenditure of environmental protection, waste and energy. In the study context, environmental management system (EMS) significantly influenced organisations through useful environmental information (Massoud *et al.*, 2011; Ronnenberg *et al.*, 2011; Gawaikar *et al.*, 2018; De Camargo Fiorini *et al.*, 2019; Fuzi *et al.*, 2019b). For example, organisations could include EMS as a key element in EMAP and successful organisational tool for work performance (Khalili and Duecker, 2013; Orcos and Palomas, 2019; Pedroso *et al.*, 2020). As EMS remarkably affected organisations with valuable environmental information, organisations could also include the element as a key determinant of EMAP.

On another note, management accounting highlighted the techniques and methods involved in demonstrating financial and non-financial information for better decision-making and organizational performance (OPM) to attain organisational objectives (Lo *et al.*, 2016; Al-Tit, 2017; Fuzi *et al.*, 2019c, Bhuiyan *et al.*, 2020). In this study, OPM denoted an integrated concept concerning the operational outcomes of manufacturing organisations. Hence, management accounting could enhance performance evaluation as a dependent variable of management accounting studies (Wang *et al.*, 2015; Almatrooshi *et al.*, 2016; Baird *et al.*, 2019).

This study uses structural equation modelling (SEM) as the method for data analysis to examine the relationship between EC, EMS and OPM. The SEM is a powerful method to examine the structural relationships among constructs or variables. On the other hand, this study used the SEM analysis method to establish the findings. This research consecutively addressed the following eight research questions:

RQ1. Is there any significant relationship between environmental regulation and EC in the Malaysian manufacturing industry?

RQ2. Is there any significant relationship between environmental safety and EC in the Malaysian manufacturing industry?

RQ3. Is there any significant relationship between management commitment and EC in the Malaysian manufacturing industry?

RQ4. Is there any significant relationship between customer focus and EC in the Malaysian manufacturing industry?

RQ5. Is there any significant relationship between EC and OPM in the Malaysian manufacturing industry?

RQ6. Is there any significant relationship between EC and EMS in the Malaysian manufacturing industry?

RQ7. Is there any significant relationship between EMS and OPM in the Malaysian manufacturing industry?

RQ8. Does EMS mediate the relationship between EC and OPM in the Malaysian manufacturing industry?

2. Literature review

2.1 Hypothesis 1: the relationship between environmental regulation and environmental cost

In Alkisher (2018), environmental regulation and the practice of environmental activities could aid organisations to improve EC and corresponded to San *et al.* (2018) who

highlighted environmental regulation as the determinant factor for the organizational integration of EC measurement. Thus, this study investigated the relationship between environmental regulation and EC in the Malaysian manufacturing industry. Following past discussions, it was also predicted that ER might be significantly related to EC in the Malaysian manufacturing industry. The discussion consequently led to the following study hypothesis that reflected the environmental regulation and EC relationship:

H1. There is a positive and significant relationship between environmental regulation and EC.

2.2 Hypothesis 2: the relationship between environmental safety and environmental cost

Efficient environmental safety implementation in decision-making activities could be further enhanced. For example, Tappura *et al.* (2015) proposed that organisations were prone to implement environmental safety for EC improvement. For example, the industry could enhance EC (cost savings) following a heightened awareness that environmental safety potentially enhanced EC in the Malaysian manufacturing industry. Hence, the following hypothesis was developed:

H2. There is a positive and significant relationship between environmental safety and EC.

2.3 Hypothesis 3: the relationship between management commitment and environmental cost

Setthasakko (2015) stated that management commitment significantly affected EC development as a key determinant of EC implementation. In Phan *et al.*'s (2017) study on Australian organisations, it was revealed that management commitment significantly influenced EC. The revelation also outlined the significant role of management commitment in elevating organisational managers' awareness of environmental issues for EC enhancement. Based on the aforementioned discussions, management commitment was crucial in EC implementation within organisations, particularly in the Malaysian manufacturing industry. Predictably, management commitment would emerge as a vital factor in enhancing organisational intentions and improving EC in the industry. Hence, this study formulated the following hypothesis that reflected the management commitment and EC relationship:

H3. There is a positive and significant relationship between management commitment and EC.

2.4 Hypothesis 4: the relationship between customer focus and environmental cost

Following Delmas and Toffel (2004), customers supported organisations to minimise environmental impacts in decision-making, such as EC. Additionally, Burritt *et al.* (2002) mentioned that customer focus was one of the contributing factors to EC reduction and notably influenced customer focus on EC. Moreover, the findings corresponded to Alkisher (2018) who suggested that customer focus remarkably affected EC for EC improvement, such as cost-efficiency. The escalating pressure from stakeholder groups, such as customers also enhanced EC. Thus, the customer focus and EC relationship were predicted to be positive and significant in the Malaysian manufacturing industry. In this regard, the customer focus and MC relationship was reflected in the following hypothesis:

H4. There is a positive and significant relationship between customer focus and EC.

2.5 Hypothesis 5: the relationship between environmental cost and organisational performance

Based on Al-Mawali *et al.* (2018), a positive EC–OPM relationship demonstrated that EC potentially enhanced OPM in the manufacturing industry (Amoako *et al.*, 2017). A significant

relationship was observed between the variables, wherein EC was prone to be positively related to OPM. Thus, this study evaluated EC efficiency by examining the EC–OPM relationship. The investigation proved crucial as EC application potentially enhanced OPM in managing environmental impacts, particularly in the Malaysian manufacturing industry. In this vein, EC implementation could catalyse organisational improvement in evaluating OPM. The following hypothesis reflected the EC–OPM relationship:

H5. There is a positive and significant relationship between EC and OPM.

2.6 Hypothesis 6: the relationship between environmental cost and environmental management system

Regarding EC enhancement, EMS provided a method to assist organisations in evaluating the environmental activities in organisations (Famiyeh *et al.*, 2014). As such, EC was positively related to EMS in improving environmental management within the Malaysian manufacturing industry for EMS improvement (Phan and Baird, 2015). Specifically, EMS aimed to catalyse organisational control on environmental impacts and evaluate environmental management for continuous improvement. Hence, the following hypothesis was developed:

H6. There is a positive and significant relationship between EC and EMS.

2.7 Hypothesis 7: the relationship between environmental management system and organisational performance

Farok and Searcy (2015) performed a study in China to investigate the EMS–OPM relationship. The study findings revealed that the EMS application was positively and significantly associated with OPM. In other words, OPM could be improved through EMS implementation in organisations. Notably, this study was performed among Malaysian manufacturers from 346 organisations. In this vein, the study hypothesis was developed as follows:

H7. There is a positive and significant relationship between EMS and OPM.

2.8 Hypothesis 8: the relationship between environmental cost, environmental management system and organisational performance

Through EMS implementation, EC and OPM could be improved within the Malaysian manufacturing industry to attain environmental goals. For example, Phan and Baird (2015) demonstrated that EC and EMS were associated with environmental improvements in the organisation, specifically concerning environmental activities, procedures and processes for environmental policy development. Hence, the study hypothesis was developed as follows:

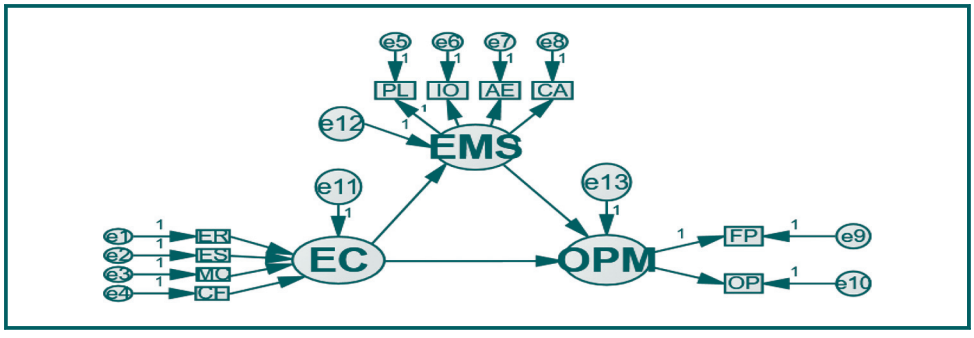
H8. EMS has a mediating effect on the EC–OPM relationship.

3. Methodology

The SEM model was developed following relevant works of literature and suggested hypotheses (Figure 1).

Specifically, a survey questionnaire was designed to demonstrate the study objectives (Fuzi *et al.*, 2017; Moustaghfir *et al.*, 2020). For example, the EC scale was evaluated with 25 items adapted from Tappura *et al.* (2015), Alkisher (2018); and Schaltegger (2018). In contrast, the EMS scale was evaluated using 20 items adapted from Feng and Wang (2016) and Ong *et al.* (2016). Meanwhile, the OPM scale was evaluated using ten items adapted from Saunila (2014) and Adebanjo *et al.* (2016). Lastly, 55 items were used within three constructs (Appendix). The study respondents (2,600 manufacturers selected as the whole

Figure 1 Proposed research model



population) were required to complete a questionnaire using a seven-point Likert scale (ranging from "very low" to "very high").

Factor analyses, such as exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), were also used to investigate the study constructs. The principal component analysis with varimax rotation was used in EFA performance. For example, the appropriateness of the study in EFA was assessed with Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity (Bartlett's test). Particularly, CFA was conducted to investigate the overall measurement model for quality, fit and construct validity.

The measurement model verification was performed before evaluating the structural model with AMOS (Bhatia and Awasthi, 2018). Before fully assessing the relationship with SEM, CFA was duly performed to evaluate each construct scale (Bagozzi and Yi, 2012; Sardi *et al.*, 2020). As such, this study consisted of evaluating the goodness-of-fit indices concerning the structural model and analysing the hypothesised relationships of EC, EMS and OPM. Notably, the SEM technique was used in assessing the mediating value of EMS on EC and OPM. Hence, the direct and indirect effects of EC, EMS and OPM were observed.

4. Results

The proposed KMO value of 0.50 and significant Bartlett's test value reflected data acceptability in factor analyses (Chawla and Saxena, 2016; Habidin *et al.*, 2018). In Williams *et al.* (2012), total variance explained greater than 50% was accepted. Table 1 below presents the KMO, Bartlett's test and total variance explained results for EC, EMS and OP.

As presented in Table 2, the primary instrument for reliability was Cronbach's coefficient alpha with the proposed value of 0.70 (Abdullah *et al.*, 2017; Patel and Desai, 2018) following the Cronbach's alpha rule of thumb (Abdullah *et al.*, 2017; Fuzi *et al.*, 2018).

In the study context, the factor loading was considered good with the accepted level of 0.6 and p-value < 0.001 (Awang, 2015). Additionally, the CFA results demonstrated the fitness

Table 1 Summary results of KMO, Bartlett's test and total variance explained

	EC	*EMS*	*OPM*
KMO	0.876	0.780	0.902
Bartlett's test			
Approx. Chi-square	5,149.746	904.616	481.121
df	153	190	45
Sig.	0.000	0.000	0.000
Total variance explained(%)	75.818	72.163	76.054

Table 2 Cronbach's alpha results for EC, EMS and OPM

Measurement	*No. of items*	*Alpha values*	*Item for deletion*
EC	5	0.949	None
Drivers of EC			
Environmental regulation	5	0.874	None
Environmental safety	4	0.863	None
Management commitment	4	0.875	None
Customer focus	5	0.864	None
EMS			
Planning	5	0.798	None
Implementation and operation	5	0.857	None
Auditing and evaluation	5	0.837	None
Checked and corrected action	5	0.896	None
OPM			
Financial performance	4	0.855	None
Operational performance	4	0.882	None

indices and factor loading of all the accepted items. The fitness indices were attained under the proposed level, whereas the factor loading for all items was above 0.6. A total of 51 items were applicable in evaluating EC, EMS and OPM implementation. Table 3 presents the summary results of CFA for EC, EMS and OPM.

Figure 2 presents the model of the relationship between EC, EMS and OPM. Specifically, the results following the goodness-of-fit indices demonstrated good-fit data (χ^2/df = 2.811, GFI = 0.952, AGFI = 0.924, CFI = 0.970, TLI = 0.960 and RMSEA = 0.068) as presented in Table 4.

The findings revealed an indirect effect (0.304) with p (0.015) < 0.05. The implementation of EMS could be regarded as a partial mediator (Hair *et al.*, 2011; Antunes *et al.*, 2017) on EC and OPM. As the finding indicated a positive and partially mediated relationship, *H8* was supported in this study and corresponded to Solovida *et al.* (2015).

5. Discussion

The study outcomes supported the hypothesis that positive and significant relationships between ER and EC existed (*H1* = 0.400, $p < 0.001$). For example, Jamil and Mohamed (2017) mentioned that the factors impacting EC implementation were ER. In this vein, ER potentially resulted in EC adoption following the need for regulatory compliance. Furthermore, the results were in line with Latan *et al.* (2018) in proposing that ER significantly affected EC in organisational management. An increase in ER potentially enhanced EC in minimising environmental impacts (Alkisher, 2018) following the contingency theory that ER affected EC

Table 3 Summary results of CFA for EC, EMS and OPM

Index	*Model fit*	*EC*	*EMS*	*OPM*	*Remarks*
χ^2/df	<3	2.910	2.924	1.881	Acceptable
GFI	>0.8	0.874	0.888	0.978	Acceptable
AGFI	>0.8	0.841	0.857	0.958	Acceptable
CFI	>0.9	0.934	0.941	0.992	Acceptable
TLI	>0.9	0.924	0.932	0.988	Acceptable
RMSEA	<0.08	0.070	0.070	0.047	Acceptable
P-value	<0.001	0.000	0.000	0.000	Acceptable

Figure 2 Relationship between EC, EMS and OPM

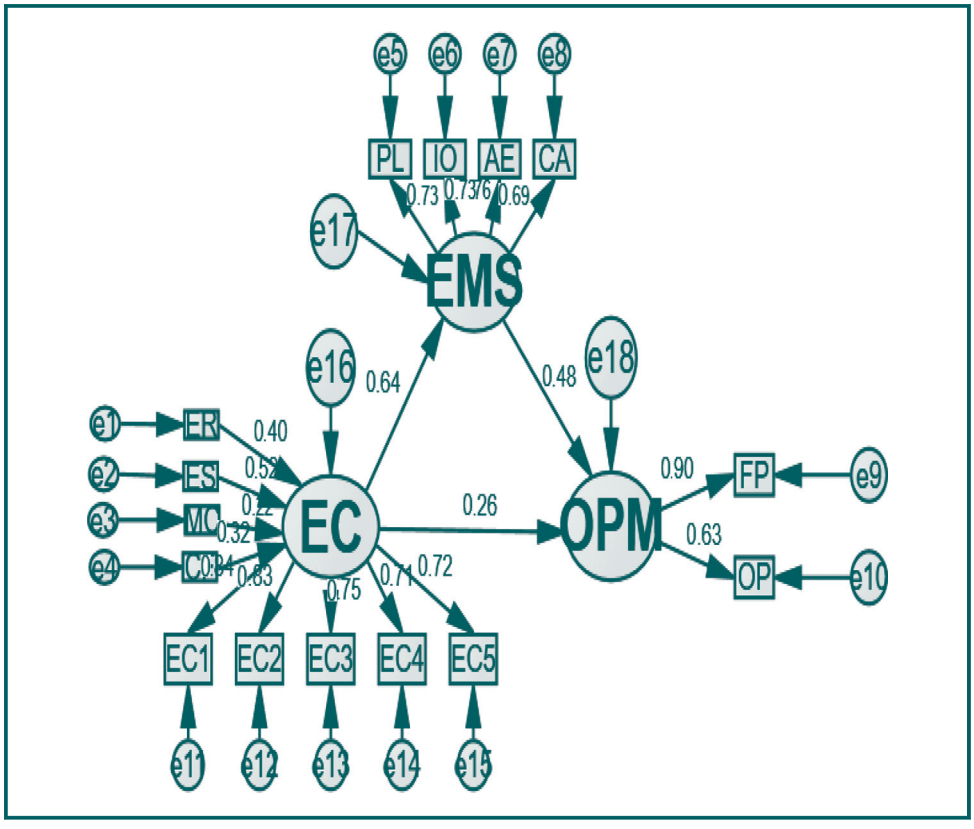


Table 4 Regression weights of the relationship between EC, EMS and OPM

	Unstandardised estimate	*Standardised estimate*	p-*value*
EC ← ER	0.265	0.400	***
EC ← ES	0.333	0.525	***
EC ← MC	0.159	0.223	***
EC ← CF	0.205	0.318	***
EMS ← EC	0.619	0.637	***
OPM ← EMS	0.676	0.478	0.015
OPM ← EC	0.356	0.259	***

(San *et al.*, 2018). Thus, the results corresponded to the contingency theory regarding the ER–EC relationship.

The ES–EC relationship outcome ($H2 = 0.525$, $p < 0.001$) denoted a positive and significant ES–EC relationship. The findings were also supported by Tappura (2015) who proposed that organisations would more likely implement ES to enhance EC. The study findings provided empirical evidence that ES influenced EC. In a broader EMAP context, ES implementation involved EC-oriented information. Given that the MC–EC relationship was positive and significant, the study findings supported the hypothesis that a positive and significant relationship between MC and EC existed ($H3 = 0.223$, $p < 0.001$). The Malaysian manufacturing industry would be more willing to implement EC with a greater degree of MC, thus implying that EC implementation was influenced by MC. The finding corresponded to

Latan *et al.* (2018) and San *et al.* (2018), wherein MC impacted EC as an environmentally committed MC provided EC-oriented information. Thus, MC was a determinant factor of EC enhancement in the Malaysian manufacturing industry.

The study findings also demonstrated a positive and significant relationship between CF and EC (*H4* = 0.318, $p < 0.001$). In this vein, the Malaysian manufacturing industry encouraged EC improvement with an increase of CF. Regarding EC, stakeholder (customer) pressure on organisations significantly influenced EC improvement intentions. The study findings also corresponded to Alkisher (2018) in suggesting that CF notably impacted EC. Consequently, CF became a more crucial component in organisational decision-making to enhance EC, specifically in the Malaysian manufacturing industry. Meanwhile, the result for *H5* was supported (*H5* = 0.259, $p < 0.001$). Following *H5*, a positive and significant relationship between EC and OPM existed in the Malaysian manufacturing industry. For example, EC was significantly related to OPM in reducing cost and increasing environmentally friendly products and environmental protection (Magara *et al.*, 2015). Organisations could also elevate environmental awareness that potentially led to an organisational emphasis on EC and OPM enhancement, specifically in the Malaysian manufacturing industry.

Following the contingency theory, *H6* was supported (*H6* = 0.637, $p < 0.001$) based on the positive and significant EC–EMS relationship. Additionally, past studies consistently denoted the significant EC–OPM relationship (Al-Mawali *et al.*, 2018). For example, the EC provided monetary information on OPM management and enhancement. The result for *H7* regarding EMS and OPM was supported (*H7* = 0.478, a *p*-value of 0.015) with the *p*-value below 0.05. The outcome was in line with past studies (Seetharaman *et al.*, 2007) to a certain extent in demonstrating a direct EC–EMS relationship. *H8* was recommended in assessing the mediating effect of EMS on EC and OPM. Specifically, the EC, EMS and OPM outcome was 0.304 with p (0.015) < 0.05. As the *p*-value between EC and OPM was below 0.05, EMS could be regarded as a partial mediator and corresponded to past studies (Solovida *et al.*, 2015; Neves *et al.*, 2017). The study findings also contributed to EC and EMS by indicating the relationship between organisational performance variables.

6. Conclusion

Theoretically, the contingent variables played a crucial role in determining EC, EMS and OPM in line with the contingency theory. This empirical study involved the development and verification of EC drivers (ER, ES, MC and CF) and EMS and OPM dimensions using the SEM technique. This study has attempted to enhance our understanding of the effect of EMS on OPM in Malaysian manufacturing industry. The findings from this study also provide a useful guideline for organizations, specifically their managers, in improving the EC, EMS and OPM. The study can also assist manufacturing industries to conduct EMS by providing elements of OPM and can serve as a guideline to select appropriate EC and to improve OPM. The findings indicate that the manufacturers in Malaysia perceive that EMS is the key factor which can significantly improve OPM. This study has shown that empirical test results prove that the implementation of EC and EMS has improved the OPM for Malaysian manufacturing industry. The interaction could be used by managers in performance evaluation and provided useful insights for the government to generate new policies that enhanced organisational performance. Based on the findings obtained in this study, the study concludes that government policies are significant factors required to enhance OPM. Conclusively, the overall study findings affirmed that contingency theory (through model fit determination) could better explain, assess and comprehend the relationship between EC, EMS and OPM in the Malaysian manufacturing industry. The gathered data were consequently evaluated using AMOS-SEM to incorporate EC, EMS and OPM implementation as a model in the Malaysian manufacturing industry.

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