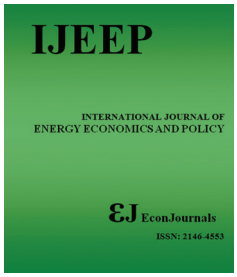

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The Effect of Management Accounting Systems in Influencing Environmental Uncertainty, Energy Efficiency and Environmental Performance

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ABSTRACT

The current investigation analyzes the role of energy efficiency (EEF) and environmental uncertainty in influencing environmental performance (EPR) of Malaysian small and medium enterprises. Our examination endeavors to add to existing studies in a few different ways. To begin with, we shed some light on the specific association that could exist between the utilization of management accounting system (MAS), perceived environmental uncertainty (PEU) and EEF. Furthermore, we look at the consequential impacts of EEF and environmental uncertainty in influencing organizational EPR. The results of the partial least squares structural equation modeling affirm that EEF, PEU and EPR have significantly influenced by MAS. The results of partial least square structural equation modeling also confirm that EEF have positively and significantly influenced on the enviornmental performance of the small and medium size firms in Malaysia. The results further confirm that PEU has no significant impact on EPR in small and medium size enterprises in Malaysia.

Keywords: Management Accounting System, Environmental Uncertainty, Malaysia
JEL Classifications: G32, E01

1. INTRODUCTION

In the presence of extreme deteriorations in the existing environmental conditions, modern businesses are occupied with findings solutions to reduce their role in causing environmental degradation. In this regard, economies from all around the World are keen to adopt the measures of improving ecological condition by practicing eco-friendly business methods. In this regard, the organization's motivation for becoming green is seen to be growing rapidly. The enthusiasm for fulfilling sustainability objectives along with maintaining firm's profitability is resulted from firm's internal consciousness for being environmentally responsible as the decline in environmental condition underlies the potential of affecting future development. In addition, regulations at both national and global level are also compelling the organizations to follow the suitable and eco-friendly methods of forgoing business. Moreover, among the motivating factors behind the rise in sustainability concerns in organizations, is the rise in ecologically sensitive customers and their demand for sustainable and eco-friendly goods and services (Van Beurden and Gössling, 2008; Adegbite, 2017). Hence, the prospect of sustainability is considered imperative in modern business, to ensure environmental health and refrain from generating ecological pressures that can worsen the situation and might hurt the notion of future economical and human survival.

The endurance of information technology has always proved to be obliging in fulfilling businesses and monetary objectives. Similarly, the contribution of information systems has evidenced in supporting organizational needs of information and data accumulation to aid decision making. In this regard, the role of management accounting systems (MAS) are vital in bringing the

consensus among organizational internal needs with externally altering environment (Thabet and Alaeddin, 2018). The literature regarding the significance of environmental management accounting (EMA) in identifying the influence of environmental pressures, such as, excessive energy dependence, harmful emissions, environmental cost controls etc., have been witnessed to increase substantially (Qian et al., 2018; Burritt and Saka, 2006; Jasch, 2003; Burritt et al., 2002; Bartolomeo et al., 2000). The contribution of MAS is efficient in fulfilling two core objectives. First, it helps in fulfilling the goals of ecological and social accounting in reporting organization's ecological disclosures, such as, environmental costs and energy dependence (Parker, 2005; Schaltegger et al., 2013) Second, it aids in the process of determining organizations internal course of improving the quality of ecological management in terms of bringing energy efficiency (EEF) and curtaining environmental uncertainty (Adams, 2002; Burritt et al., 2002).

Witnessing the continuous changing environment and regulation, there exist extreme uncertainty for businesses to plan and project future growth. The presence of higher environmental uncertainty puts pressure on the organizations for the attainment of competitive advantages and improvement in environmental, economic and social performance. Modern businesses are encountered with vast ambiguities in terms of furious competition, scientific discoveries, strict regulations, changing environment, etc. The effective utilization of MAS can enable managers and decision makers to reduce the magnitude of prevailing environmental ambiguities through updated, timely and organized management of internal and external information. Thus, organization's proper usage of MAS can help to reduce the impact of external obscurities in improving managerial perception of environmental uncertainty by providing them the supporting information at the right time (Alaeddin et al., 2018; Adusei, 2018). Similarly, keeping in mind the importance of energy management, businesses are in searching the numerous possibilities of decreasing their dependence on power consumptions or utilizing renewable eco-friendly sources of energy to accommodate their energy needs. This will enable the organizations to play their responsible part in reducing ecological burdens, conforming to government and international regulations and fulfilling the consumer's demand for adopting sustainable practices in the process of delivering goods and services. In doing so, the role of MAS is considered crucial for identifying organizations carbon consumptions and provide awareness for bringing energy efficiencies. Thus, the utilization of MAS can help organizations to expand the course of bringing environmental quality and improve environmental performance (EPR) of the organization.

Keeping in mind the growing importance of MAS in fulfilling the goals of sustainable development, the current examination intended to explore the impact of MAS in decreasing environmental uncertainty and enhancing EEF in Malaysian small and medium enterprises (SMEs). In addition, the current investigation also analyzed the role of EEF and environmental uncertainty in influencing EPR of Malaysian SMEs. Our examination endeavors to add to existing studies in a few different ways. To begin with, we shed some light on the specific association that could exist between the utilization of MAS, perceived environmental uncertainty (PEU) and EEF. Furthermore, we look at the consequential impacts of EEF and environmental uncertainty in influencing organizational EPR. The knowledge resulting from such exhaustive examination would not only help Malaysian SMEs in identifying the critical role of MAS in achieving the goals of sustainable development but also aid the firms in reducing the levels of environmental ambiguities and energy dependence that can enhance organizational costs and affect firm's performance.

The remaining of study is outlined as below. Section two will highlight and review the important literature regarding MAS, environment and performance nexus. Section three will provide instrument development and data collection information. Section four will demonstrate the empirical results and interpretations and lastly, section five will provide conclusion and recommendations.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The role of organizational resources in gaining competitive advantages has been well identified in the literature and theoretical domains of resource-based view (RBV). The fundamental concept of RBV considers organizational resources as a tool to enhance business performance. Such customary resources are multifunctional to augment corporate uniqueness in the form of effective managerial strategies, efficient set of information technologies, physical assets, etc. (Jermsittiparsert et al., 2019). The endurance of having exclusive competencies under RBV framework is motivated to bring feasibility in exploiting external opportunities by utilizing innovative ways through organization's internal resources.

The vital contribution of EMA has enabled businesses in taking advantage of the organization's external environmental demands and opportunities for ecological improvement by adopting efficient accounting information systems. In this regard, several studies found that the proficient administration of company's assets and administrative practices can empower associations and economies to acknowledge eco-accommodating arrangements that tend to abridge environmental burdens. In such manner, economies at present have identified major resolutions for eradicating and decreasing the reliance on adverse industrial methods such as extensive energy dependence that resulted into releasing harmful carbon emissions.

In order to reduce the adversity of carbon emanations, many organizations utilize proper accounting tools to identify organizational carbon contribution and solutions for its decline. In this context, many investigations (Gibassier and Schaltegger, 2015; Schaltegger and Csutora, 2012; Burritt et al., 2011) have recognized the significant contribution of carbon management accounting that helps the firms to record and quantify their direct and indirect contribution to toxic emissions (Lee, 2012). Likewise, Burritt et al. (2011) suggested that the role of accounting in carbon management in revealing and overseeing carbon drifts inside associations not only helps in precise quantification of

carbon trends but also aids management decision making through allowing legitimate data gathering regarding organization's energy dependence and contribution in harmful carbon emanation resulted from energy consumption (Haseeb et al., 2019). Subsequently, the implication of carbon tax is also a crucial step towards curtailing firm's trends of emission (Nordhaus, 2010). Carbon taxation is regarded as one of the productive methods for demoralizing negative impacts of carbon-di-oxide discharge, that is viewed as the real negative component of toxic atmospheric radiations. In this regard, Gao and Chen (2002) established that the powerful administration of carbon tax can engage economies to use environmental accounting in bringing cost-productive arrangement of reducing eco-pressures.

Linking organizational success to firm's hierarchy, external ambiguities and information systems, Gordon and Narayanan (1984) examined the relationship between organizational structure, environmental uncertainty and MAS. The findings of the study revealed that success of information systems and firm's structure are dependent on environmental changes (Ahmed et al., 2017; Ahmad, et al., 2018). The study also established that MAS is significant to influence environmental uncertainty and the decision makers consider uncertainty in external environment to be critical in the process of environmental management. Similarly, In Singapore, Gul and Chia (1994) investigated the association among environmental uncertainty, MAS design, performance and decentralization within organizations. The results of the empirical evidence established that decentralization and MAS are significant to achieve higher performance in the presence of higher environmental uncertainties. On the other hand, in the case of low uncertainties, decentralization and MAS are found to result low performance.

Similarly, the role of information systems has been considered noteworthy to generate firm's competencies and performance on the way to environmental management (Ravichandran et al., 2005; Santhanam and Hartono, 2003; Bharadwaj, 2000). Most dominantly, the prevailing emphasis on environmental MAS in attaining cost effective sustainable solutions is significant to discuss. In this regard, Schaltegger (2018) inspected EMA connections to worldwide natural issues reliant on the notion of planetary limits as it covers key atmospheric issues of worldwide sustainability. Using the qualitative approach, the author concluded that EMA underlies the tendency to prove as an innovative management accounting tool to identify and administer a wide range of systematic methods to aid ecologically useful decision making in organizations.

Focusing on energy culture, Williamson et al. (2010) suggested that systems innovation is basic in driving firm performance. The examination contended that utilization of IT is imperative in drawing in significant aptitudes and accordingly accommodating external ambiguities through attracting efficient workforce to the organization. Sroufe and Gopalakrishna-Remani, (2018) also analyzed fortune 500 organizations to inspect the connection between environment and accounting systems execution. In doing as such, the investigation analyzed the contribution of firm resources in improving the company's performance and sustainability drive (Haseeb et al., 2019). Likewise, Tetiana et al. (2018) illustrated that the techniques and data assembled to fortify administration choices for executing energy effectiveness are huge to offer informative productivity of firm's performance and advancement for the utilization of eco-accommodating innovations with decrease in energy dependence. Similarly, Rotzek et al. (2018) also analyzed the energy culture to identify EEF measures of the modern organizations (Jermsittiparsert et al., 2019). The authors attributed EEF to be the driving force of firm's EPR, industrial production and organization's success.

In India, Hameed (2018), while examining ecological accounting, established that EMA incorporated recognizable proof, estimation and designation of ecological costs. It coordinated such expenses into business choices and distinguished in terms of creating widen models of reducing eco-burdens, such as carbon emanations, energy dependence and helped to build organization's responsible image and reduce the external uncertainties. In addition, the study found that EMA is an essential tool to convey ecological cost to organizational management and leadership to inspire them in recognizing methods for diminishing or staying away from harmful eco-practices, thereby enhance firm performance and competencies. Similarly, in the United States, Hughes et al. (2001) analyzed the significance of organization's recording and disclosure of environmental information and practices and their impact of firm's EPR. The findings of the study concluded that given the augmented awareness for environmental improvement, the firms focus on eco-concerns and management is not only crucial to reduce environmental uncertainties but also significant to define EPR.

In the light of the above mentioned literature, the current study aims to test the following hypotheses:
Hypothesis 1: MAS is significant to influence EEF
Hypothesis 2: MAS is significant to influence PEU
Hypothesis 3: MAS is significant to influence EPR
Hypothesis 4: EEF is significant to influence EPR
Hypothesis 5: PEU is significant to influence EPR.

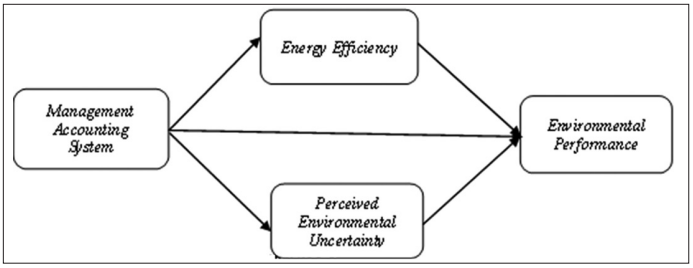
Displayed in Figure 1 is the research model of the current study.

3. METHDOLOGY

3.1. Data Collection and Sample

The methodology of data gathering in the present examination is finished by gathering information from the small and medium size enterprises of Malaysia. Therefore, we select 93 different small

Figure 1: Research model



and medium firms by passing the investigation to the different firms in entire of the 14 Malaysian states. For rapid and smooth data collection process, we translate our instrument into English language and send to the selected SME's. Along these lines, a sum of 327 research instrument was sent utilizing both on the printed copy and soft copy of the research instrument. The method for information gathering acquired a time of almost 3 months, 7 days and got 301 responses with the reaction rate of 92.04%.

3.2. Measures

The ongoing study examined the role of MAS in Influencing Environmental Uncertainty, EEF and EPR in Malaysian SME's. In doing to accomplish this objective, we examine the research model based on prior investigations and the framework is shown in Figure 1. The features of the focused variables are investigated by using the Likert scale method from 1 (Strongly Disagree) to 5 (Strongly Agree). Altogether, present research uses four variables. The variables incorporate into this examination are the MAS, PEU, EEF and EPR. The four items of MAS are picked from the examination of Agbejule (2012). Besides, the four things of EEF are taken from the before investigation of Worrell et al. (2009). The four things of PEU are embraced from the investigation of Agbejule (2012); Gordon and Narayanan, (1984); Jabarullah et al., 2019. Lastly, the current study uses four items of EPR which are adapted from the study of Gholami et al. (2013).

4. DATA ANALYSIS AND DISCUSSION

The data examination of this research is done by utilizing the SmartPLS Version 3.2.8 (Ringle et al., 2015) and Statistical Package for Social Sciences (V-23). A valid information used in the present examination is 279 by clearing univariate and multivariate inconsistencies. The strategy for seeing of univariate and multivariate irregularities are Z-test score and Mahalanobis Distance (D2) by utilizing SPSSS (V-23) and rest of data examination is finished by utilizing SmartPLS. Shown Table 1 is the composition and structure of the valid response of the gathered data used in this examination. Additionally, Table 2 highlight the mean and Pearson's Correlation of the factors used in the present examination. Additionally, to see the issue of multicollinearity, the present study uses Hair et al. (2010) begin that by a wide edge in the Pearson's Correlation examination should under 0.90. Accordingly, affirm the nonappearance of multicollinearity among the factors (Hair et al., 2013; Afshan et al., 2018; Saudi et al., 2019; Sinaga et al., 2019).

Additionally, content validity is attested if the items utilizing in the information examination load with progressive value in their specific factor in comparison with other items showed up in the model, while inner consistency is affirmed if the estimation of Cronbach's alpha and composite reliability value outperforms 0.7 (Hair et al. 2013; Afshan and Sharif, 2016; Jabarullah and Hussain, 2019). Factor loadings and composite reliability appeared in Table 3 which exhibit that a huge part of the items factor loadings is more conspicuous than 0.7 furthermore, these loadings show up in their individual fragments which certifying the inner consistency of the chose items.

Table 1: Descriptive statistics

Descriptive Statistics		Frequency	Percent
Gender			
Valid	Female	56	20
	Male	223	80
	Total	279	100
Age (year)			
Valid	20-30	64	23
	31-40	143	51
	41-50	46	16
	51 and above	26	9
	Total	279	100
Working experience (year)			
Valid	1-5	43	15
	6-10	134	48
	11-15	42	15
	More than 15	60	22
	Total	279	100
Education			
Valid	Undergraduate	49	18
	Graduate	178	64
	Post graduate	30	11
	Others	22	8
	Total	279	100

Source: Authors estimation

Table 2: Means and pearson correlations (N=279)

Variables	Mean	MAS	PEU	EEF	EPR
MAS	3.772	-			
PEU	4.121	0.394**	-		
EEF	4.009	0.378**	0.302**	-	
EPR	4.324	0.334**	0.274**	0.324**	-

**Correlation is significant at the 0.01 level (2-tailed). MAS: Management accounting system, EEF: Energy efficiency, EPR: Environmental performance, PEU: Perceived environmental uncertainty

Additionally, convergent validity educates to what degree an item concerning a particular factor cemented and loaded to an adjacent factor where they assumed to be loaded (Mehmood and Najmi, 2017; Akhir et al., 2018). In the present examination, convergent validity is declared by utilizing an Average Variance Extracted (AVE) for each factor (Fornell and Larcker, 1981; Hussain et al., 2018). They provide the benchmark of more essential than and contrasted with 0.5 for guaranteeing up to the convergent validity. As needs be, AVE in Table 3 is confirming the basic measures.

In the next process, discriminant legitimacy is uncovered as how much an item of an express factor is novel and discriminant from various factors (Frooghi et al., 2015). According to Fornell and Larcker (1981), the discriminant legitimacy is said to be asserted if the AVE square root beats the pair-wise association of the latent variable. As appeared to be Table 4, italic values are the square root of AVE which is outflanking the off-diagonal measures which are the pair-wise relationship of each factor (which are MAS, PEU, EEF and EPR) (Ishak et al., 2018). Table 5 exhibits the factor loadings of different and separate components, along these lines, declaring the cut-off limit. Correspondingly, the discriminant legitimacy is likewise communicated if the Hetro Trait and Mono Trait degree are lower than 0.85 as embraced by Henseler et al. (2015). The results in Table 6 revealed that all variables have discriminant validity.

Table 3: Measurement model results

Factors	Items	Factor loadings	Cronbach's alpha	Composite reliability	AVE
Management Accounting System	MAS1	0.975	0.795	0.786	0.581
	MAS2	0.941			
	MAS3	0.992			
	MAS4	0.965			
Perceived Environmental Uncertainty	PEU1	0.952	0.865	0.873	0.648
	PEU2	0.913			
	PEU3	0.925			
	PEU4	0.918			
Energy Efficiency	EEF1	0.921	0.795	0.786	0.590
	EEF2	0.897			
	EEF3	0.956			
	EEF4	0.865			
Firm Performance	FPR1	0.908	0.817	0.822	0.572
	FPR2	0.898			
	FPR3	0.867			
	FPR4	0.845			

Source: Authors Estimation. MAS: Management accounting system, EEF: Energy efficiency, EPR: Environmental performance PEU: Perceived environmental uncertainty

Table 4: Discriminant validity Fornell-Larcker criterion

Variables	MAS	PEU	EEF	EPR
MAS	0.771			
PEU	0.376	0.813		
EEF	0.399	0.376	0.775	
FPR	0.332	0.432	0.375	0.396

Source: Authors Estimation. MAS: Management accounting system, EEF: Energy efficiency, EPR: Environmental performance, PEU: Perceived environmental uncertainty

Table 5: Results of loadings and cross loadings

Variables	MAS	PEU	EEF	FPR
Management accounting system	0.975	0.348	0.485	0.236
	0.941	0.469	0.370	0.345
	0.992	0.145	0.271	0.313
	0.965	0.482	0.467	0.373
Perceived environmental uncertainty	0.952	0.271	0.332	0.289
	0.913	0.236	0.384	0.591
	0.925	0.145	0.280	0.518
	0.918	0.353	0.318	0.387
Energy efficiency	0.921	0.373	0.320	0.298
	0.897	0.239	0.505	0.325
	0.956	0.239	0.249	0.300
	0.865	0.370	0.463	0.207
Firm performance	0.908	0.310	0.262	0.359
	0.898	0.252	0.382	0.446
	0.867	0.370	0.373	0.414
	0.845	0.482	0.271	0.473

Source: Authors Estimation. MAS: Management accounting system, EEF: Energy efficiency, EPR: Environmental performance, PEU: Perceived environmental uncertainty

In the final step, we applied partial least square framework to investigate hypothesis and model framework which demonstrating path coefficients, t-stats, and theory testing. As demonstrated by Chin's (1998) proposals, a bootstrapping technique using 1000 sub-test was related with affirming the quantifiable essential estimations of all beta coefficient. Table 7 reveals beta coefficients, t-measurements, and their significance value.

Table 7 demonstrated the outcomes of partial least square equation modelling, regression path coefficient, t-statistics, probability values (P-values) and the comments related with the theorized path (Samad et al., 2018). The results of the PLS_SEM affirm that EEF ($\beta = 0.382$, $P < 0.000$), PEU ($\beta = -0.294$, $P < 0.000$),

Table 6: Results of HTMT ratio of correlations

Variables	MAS	PEU	EEF	EPR
MAS				
PEU	0.694			
EEF	0.385	0.739		
EPR	0.489	0.583	0.447	

Source: Authors estimation. MAS: Management accounting system, EEF: Energy efficiency, EPR: Environmental performance, PEU: Perceived environmental uncertainty

Table 7: Results of path coefficients

Hypothesized path	Path coefficient	C.R	P-value	Remarks
EEF←MAS	0.382	4.453	0.000	Supported
PEU←MAS	−0.294	−3.674	0.000	Supported
EPR←MAS	0.381	5.345	0.000	Supported
EPR←EEF	0.331	5.032	0.000	Supported
EPR←PEU	−0.029	−1.247	0.230	Not-Supported

Level of Significance (5% i.e., 0.050)
Source: Authors' Estimation. MAS: Management accounting system, EEF: Energy efficiency, EPR: Environmental performance, PEU: Perceived environmental uncertainty

and EPR ($\beta = 0.381$, $P < 0.000$) have significantly influenced by MAS hence affirming H1, H2 and H3. The results of partial least square structural equation modeling also confirm that EEF ($\beta = 0.331$, $P < 0.000$) have positively and significantly influenced on the enviornmental performance of the small and medium size firms in Malaysia, therefore, confirming H4. The results further confirm that PEU has no significant impact on EPR in small and medium size enterprises in Malaysia.

5. CONCLUSION

The organization's motivation for becoming green is seen to be growing rapidly. The enthusiasm for fulfilling sustainability objectives along with maintaining firm's profitability is resulted from firm's internal consciousness for being environmentally responsible as the decline in environmental condition underlies the potential of affecting future development. In addition, regulations at both national and global level are also compelling the organizations to follow the suitable and eco-friendly methods of forgoing business. Moreover, among the motivating factors

behind the rise in sustainability concerns in organizations, is the rise in ecologically sensitive customers and their demand for sustainable and eco-friendly goods and services (Van Beurden and Gössling, 2008). Hence, the prospect of sustainability is considered imperative in modern business, to ensure environmental health and refrain from generating ecological pressures that can worsen the situation and might hurt the notion of future economical and human survival. Witnessing the continuous changing environment and regulation, there exist extreme uncertainty for businesses to plan and project future growth. The presence of higher environmental uncertainty puts pressure on the organizations for the attainment of competitive advantages and improvement in environmental, economic and social performance. Modern businesses are encountered with vast ambiguities in terms of furious competition, scientific discoveries, strict regulations, changing environment, etc. The effective utilization of MAS can enable managers and decision makers to reduce the magnitude of prevailing environmental ambiguities through updated, timely and organized management of internal and external information. Thus, organization's proper usage of MAS can help to reduce the impact of external obscurities in improving managerial perception of environmental uncertainty by providing them the supporting information at the right time.

Keeping in mind the growing importance of MAS in fulfilling the goals of sustainable development, the current examination intended to explore the impact of MAS in decreasing environmental uncertainty and enhancing EEF in Malaysian SMEs. In addition, the current investigation also analyzed the role of EEF and environmental uncertainty in influencing EPR of Malaysian SMEs. Our examination endeavors to add to existing studies in a few different ways. To begin with, we shed some light on the specific association that could exist between the utilization of MAS, PEU and EEF. Furthermore, we look at the consequential impacts of EEF and environmental uncertainty in influencing organizational EPR. The results of the PLS-SEM affirm that EEF, PEU and EPR have significantly influenced by MAS. The results of partial least square structural equation modeling also confirm that EEF have positively and significantly influenced on the enviornmental performance of the small and medium size firms in Malaysia. The results further confirm that PEU has no significant impact on EPR in small and medium size enterprises in Malaysia.

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