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# An Inclusive Evaluation of Linkage Between Environmental Managerial Accounting and Knowledge Management: Empirical Evidence from Vietnam

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## Abstract

The relationship between applying knowledge management and accepting environmentally managed accounting is more complicated than previous studies suggested. Knowledge management is both an antecedent and a consequence of implementing environmentally managed accounting in the workplace. Nonetheless, none of the prior studies have systematically investigated this relationship. The current article attempted to scrutinize the reciprocated multifaceted tie between environmental managerial accounting and knowledge management by utilizing the methods of directed graph searches as well as directed acyclic graphs. The research data was gathered from 342 publicly-listed corporations in Vietnam's key stock markets. The empirical findings disclose that implementing knowledge management can lead to adopting environmental managerial accounting in business, which is, in turn, an antecedent of accepting knowledge management. More importantly, the current research found that the adoption of knowledge management is the first factor to affect the research model. Nonetheless, the usage of knowledge management in business can, in turn, have a positive effect back to the implementing extent of environmental managerial accounting. The findings are beneficial to scientists and particularly to executives by shedding new insight into this reciprocated bond, which can lead executives to make sound decisions regarding knowledge management and environmental managerial accounting for businesses to acquire competitive advantages.

**Keywords:** Environmental Managerial Accounting, Knowledge Management, Directed Acyclic Graph

**JEL Classification Code:** E01, D83, Q51, Q56

## 1. Introduction

Knowledge has been recognized as one of the most valued organizational assets. It has received an unceasing and increasing consideration on theoretical and practical aspects (Mubarak, 2013). Storage, development, and distribution of knowledge are very significant to organizations; because knowledge is a strategic tool applied to enhance organizational effectiveness (Kittikunchotiwut & Siriyota, 2021). Knowledge management has been confirmed as

the creation, capture, and usage of knowledge to augment organizational performance (Edwards et al., 2005). In addition, the management of knowledge is an important practice of knowledge sharing and catalyzes improving cooperation and exploration (Syed et al., 2021). Sound management of knowledge could help accountants produce, obtain, and utilize knowledge to create the best organizational performance. Accountants, both general and managerial, are frequently involved in knowledge management, as the effective use of information is reflected in overall organizational performance. Many scientists have looked into knowledge management from diverse perspectives. Some of them analyzed the relationship between knowledge management and accounting in general or managerial accounting in particular (Mubarak, 2013; Sori, 2009; Birkett, 1995).

Pressure to manage environmental issues has been increasing, making shareholders concerned due to critical liabilities. Furthermore, environmental issues have been becoming a serious concern over the world because of

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the rising number of obvious environmental threats to our society (Endiana et al., 2020; Tran et al., 2020). To control the environment better, environmentally related managerial practices should be taken into account (Kamruzzaman 2012). According to Lee (2005), managerial accounting can facilitate the controlling processes of environmental issues in various ways. However, several traditional managerial accounting practices cannot deal sufficiently with environmental expenses. Therefore, executives are likely uninformed of environmental expenses, which may provide them no incentive to lessen these costs. Studies show that in many cases, managerial accounting practices expressively undervalue the expense of poor environmental practices. These mentioned practices could misrepresent or distort environmental issues, resulting in executives making poor decisions for businesses and the environment. This results in a failure to improve organizational performance. Managerial accounting is a tool for enhancing organizational performance. Environmental managerial accounting is an effort to incorporate best managerial accounting thinking and practice with best environmental managerial thinking and practice.

To link knowledge management with managerial accounting in general and environmental managerial accounting in particular, the present project takes into account the two key variables, which are the usage of environmental managerial accounting and the use of knowledge management. Salojärvi et al. (2005) confirmed knowledge management as the art of producing value by weighting intangible assets that comprise activities in all the related managerial aspects. It has also been regarded as the process of altering intellectual assets into continuing value for the business. Lately, experts have begun to be interested in the management of knowledge, which makes it become a hot topic in the field of management. Droge et al. (2003) indicated that organizations that constantly control and incorporate knowledge into business activities could attain higher success. In addition, Darroch (2005) asserted knowledge management could deliver a directing instrument to convert organizational resources into competencies. From the perspectives of Wong and Aspinwall (2005), the acceptance and accomplishment of knowledge management can enable managers to obtain various constructive performances. Conversely, the investigation of knowledge management challenges executives, as it is both determined by various variables comprising environmental managerial accounting and one of the significant antecedents of environmental managerial accounting. Managerial accounting in general and environmental managerial accounting take a vital role in offering executives suitable and detailed imperative information, which can help them to deliver better business decisions. Therefore, their organizations may achieve competitive advantages in comparison with competitors. Different researchers (Zandi et al., 2019; Al-Hyari, 2017;

Novas et al., 2012; Gibassier, 2012; Tayles et al., 2002, 2007; Edwards et al., 2005) recommended the adoption of managerial accounting or environmental managerial accounting imposes a reciprocal linkage with the usage of knowledge management.

The reciprocal relation of accepting knowledge management to adopting environmental managerial accounting can choose the process of creating organizational performance (Zandi et al., 2019; Muthuveloo et al., 2017). As a result, investigating the reciprocated association between the abovementioned factors in a united research model and specifying which factor first affects the research model is imperative to the causality of organizational performance, which will maintain sustainability in business. To the best of the author's knowledge, up to now, no projects have explored this mutual causal linkage in the united research model. Consequently, it could be indispensable to systematically examine the multifaceted connection between the use of environmental managerial accounting and the usage of knowledge management in the combined research model. The current study tries to determine which of the two key variables, "the usage of environmental managerial accounting" and "the acceptance of knowledge management," is the first determinant of the research model. It is the first to utilize the directed acyclic graph technique to scrutinize the reciprocal bond of implementing environmental managerial accounting with accepting knowledge management, where it seeks to decide on the first cause of the research model.

The current study will make several contributions to both theoretical and practical aspects. On the theoretical side, the current research argues and explains the reciprocated correlation of using knowledge management with utilizing environmental managerial accounting in the combined model. On the practical side, the empirical findings provide management specialists with a better understanding of the intricate reciprocated tie between accepting knowledge management and using environmental managerial accounting. The empirical outcomes are also beneficial to executives involved in the management of knowledge and environmental managerial accounting by shedding light on the reciprocal relation of adopting environmental managerial accounting to accepting knowledge management in business. Therefore, they could produce better decisions on the extent of adopting environmental managerial accounting as well as management of knowledge in business, which can lead to the best organizational performance. This study is going to continue in this way. A literature review is going to argue and analyze the reciprocal bond between environmental managerial accounting and knowledge management. Subsequently, the research design is going to offer instructions on the collection and analysis of the research data. Next, the empirical results are going to display the empirical findings, followed by the conclusions.

## 2. Literature Review

The intricate mutual relation of using environmental managerial accounting to accept knowledge management is going to be elucidated below. The acceptance of knowledge management is recommended as a determinant resulting in the utilization of environmental managerial accounting in business. Nonetheless, it could be likely established by the utilization of environmental managerial accounting. Alavi and Leidner (2001) referred to knowledge as a state of learning as well as understanding, an objective to be kept and operated, a procedure of employing capability, and a state of approach to information. Knowledge is a valued asset to help an organization undertake business activities greater than their rivals. According to Birkett (1995), the role of knowledge is to sustain a competitive advantage that is connected to the establishment of core competencies. If a firm has the knowledge to carry out work superior to other firms, then it has a core competency. Core competencies exist in various ways, such as an exclusive working technique, a unique approach to communication, as well as unique physical possessions. The competencies of an organization can lead it to make competitive advantages over others, which allows the organization to achieve the best possible performance. In addition, some researchers (Kok, 2007; Sullivan, 2000) inferred knowledge can be created from intellectual capital, which comprises three key vital dimensions which are human, structural as well as customer capital; whereas, others (Klein & Prusak, 1994) described intellectual capital as “valuable knowledge.” Therefore, Edwards et al. (2005) appreciated the management of knowledge and regarded it as a course of producing, seizing, and utilizing knowledge to increase organizational effectiveness because it is one of the managerial practices to manage organizational knowledge in generating competitive advantage that leads to superior organizational performance. Furthermore, numerous previous researchers defined knowledge management acceptance as the degree to which businesses are satisfied with the degree to which knowledge management is accepted in business, resulting in knowledge sharing and usage (Lin & Lee, 2005). The use of environmental managerial accounting, in addition to knowledge management, is a major aspect of the research model.

Managerial accounting is critical to organizations in monitoring business activities by providing executives with valuable business information, which can enable them to make better business decisions. Therefore, they will sustain efficient management of organizational resources. Regarding environmental expenses, managerial accounting plays a significant role in facilitating the management of environmental costs in various ways. One of them is to gather and offer related information. Another is to test different ways of offering that information to

find the most suitable for decision-makers. Managerial accounting could allow executives to decide on how to approach environmental reporting (Lee, 2005). Therefore, the desirable beginning point may be an environmental managerial accounting analysis of a particular stream. Environmental managerial accounting is essential to organizations in providing fast and correct environmental information to simplify managing environmental expenses and improve environmental efficiency (Kamruzzaman, 2012). Environmental managerial accounting has a wide range of applications and benefits, which can be divided into three categories. Eco-efficiency, strategic position, and the overall evolution of management accounting encompass not only information distribution and managerial planning but also a focus on resource efficiency and value creation. The new managerial approaches have influenced the systems of managerial accounting in general and environmental managerial accounting in particular where they have twisted the emphasis of managerial accounting from a humble function of financial management to a complicated function of producing value due to a sound usage of organizational resources (Fullerton & McWatters, 2001). Similarly, Hameed (2018) found that environmental managerial accounting is critical in conveying environmental costs to organizational management to urge them to develop new procedures to reduce environmental pollution and therefore improve organizational efficiency. Thirteen items were used by Christ and Burritt (2013) to evaluate environmental managerial accounting. They evaluated the adoption of environmental management accounting by determining how far firms have progressed from considering to accepting environmental managerial accounting methods.

Environmental managerial accounting has emerged as a key indicator of an organization’s desire to pursue green innovation and knowledge management to attain higher levels of performance (Zandi et al., 2019). Those researchers identified key contributions of environmental managerial accounting to knowledge transfer and green innovation. Bhimani and Roberts (2003) asserted managerial accounting has increasingly been considered one of the important drivers of knowledge management. These scholars tried to call for more research on the tie between the management of knowledge and managerial accounting. Besides, Klein and Prusak (1994) regarded intellectual capital as “valuable knowledge,” while Sullivan (2000) affirmed knowledge is formed from intellectual capital. As a result, the relationship between knowledge management and management accounting is similar to the relationship between intellectual capital and management accounting. Acceptance of managerial accounting in general, and environmental managerial accounting in particular, is stated as a key motivator and result of accepting intellectual capital or knowledge management (Zandi et al., 2019; Gornjak, 2014; Gibassier, 2012; Novas et al., 2012; Sori, 2009;

Tayles et al., 2002, 2007; Edwards et al., 2005; Birkett, 1995; Klein & Prusak, 1994).

In relation to the role of environmental managerial accounting in driving the management of knowledge, Zandi et al. (2019) were interested in scrutinizing the importance of knowledge management (knowledge transfer and green innovation) to organizational performance. However, the emphasis of that research is on the contribution of environmental managerial accounting in determining knowledge transfer and green innovation. The empirical findings confirmed environmental managerial accounting as one of the vital causes of knowledge management. Gornjak (2014) indicated business activities of organizations are recently based on knowledge; consequently, management of knowledge and managerial accounting are a vital part of the corporation and managerial courses. The importance of knowledge is not only in knowledge itself, or the knowledge of the individual and the corporation, but also the knowledge of utilizing procedures in the managing techniques of knowledge that results in competitive advantages. Correspondingly, it could reach managerial accounting. A corporation is likely more effective and competitive by changing the controlling courses of managerial accounting. Gibassier (2012) provided a better understanding of how accounting can attain to augment innovation within corporations. More particularly, that research emphasized how environmental managerial accounting can determine innovation as well as knowledge management.

Regarding the linkage between accounting information methods and management of knowledge, Sori (2009) tried to scrutinize the usage of accounting information practices and their contribution to knowledge management and revealed that the usage of accounting information practices would improve the functions of accounting in business and enhance information value. Automated accounting information practices can boost the process of producing financial reports and deal with human weaknesses in the data processing. Accounting information practices make considerable use of tacit and explicit knowledge to enable firms to make effective business decisions. Novas et al. (2012) investigated the impact of management accounting or environmental managerial accounting on the acceptance of intellectual capital, focusing on the critical function of managerial accounting in the development of intellectual capital. The empirical findings exposed a statistically positive influence of managerial accounting on applying intellectual capital or management of knowledge.

Moreover, Tayles et al. (2007) examined the influence of intellectual capital or management of knowledge on the acceptance of managerial accounting. The results indicated the application of intellectual capital positively determines the acceptance of managerial accounting. Similarly, Tayles et al. (2002) investigated the link between adopting

intellectual capital and using managerial accounting, advising that managers utilize managerial accounting techniques to choose whether or not to employ intellectual capital. With regard to the impact of the implementation of intellectual capital on the acceptance of accounting managerial tools, Edwards et al. (2005) indicated the use of knowledge management can enable managerial accountants to accept managerial accounting practices in business. Birkett (1995) emphasized the change in managerial accounting over the last few years. Traditionally, the emphasis of managerial accounting has been on accounting information. Accounting data was used by managerial accountants to assist in planning and management. Traditional managerial accounting procedures have been called into question. Corporations have begun to integrate suppliers as well customers into the firm's business decisions. Therefore, the linkage of managerial accounting to knowledge management should be established. Additionally, Klein and Prusak (1994) intellectual capital as "knowledge". The above ideas suggest a mutually beneficial relationship between accepting knowledge management and implementing environmental managerial accounting. Overall, it could posit the following research hypotheses.

**H1:** *Environmental managerial accounting adopted for a business likely boosts the acceptance of knowledge management.*

**H2:** *Acceptance of knowledge management likely leads to adopting environmental managerial accounting.*

As above argued, the usage of environmental managerial accounting is both the causality and the effect of accepting knowledge management. However, which of the two variables is the first to affect the reciprocal connection has not been considered and analyzed. The current study employs the model of a directed acyclic graph to decide on which variable first influences the research model. After hypothetically analyzing the complex mutual relation of utilizing environmental managerial accounting to accepting knowledge management, it will elucidate in detail the research design applied to show the gathering and analyses of data.

### 3. Research Design

#### 3.1. Instruments

The implementation of knowledge management (IKM) was evaluated based on five dimensions: (1) distribution of knowledge among managers and juniors - IKM1, (2) distribution of knowledge among coworkers - IKM2, (3) distribution of knowledge across the divisions - IKM3,



(4) efficacious monitoring of diverse sources and forms of knowledge - IKM4, and (5) employing knowledge in everyday usage - IKM5. A five-point measure, varying from “discontented”, “a little discontented”, “a little contented”, “quite contented” to “very contented” with the attainments in each element of knowledge management, was applied to measure the items of knowledge management, based on Lin and Lee (2005). The adoption of environmental managerial accounting (EAM) was measured with thirteen items: (1) identification of environmental expenses – EAM1, (2) assessment of environmental reliant liabilities – EAM2, (3) arrangement of environmental expenses – EAM3, (4) distribution of environmental expenses to production courses – EAM4, (5) distribution of environmental expenses to products – EAM5, (6) enhancement to environmental expense management – EAM6, (7) formation and usage of environmental expense accounts – EAM7, (8) expansion and usage of main environmental indicators – EAM8, (9) product life-cycle expense valuations – EAM9, (10) product inventory evaluations – EAM10, (11) product influence evaluations – EAM11, (12) product enhancing evaluations – EAM12, as well as (13) valuation of potential environmental influences related to capital investment decisions – EAM13. These dimensions are designed with

a five-point scale ranging from “never to consider”, “not to mention”, “preferred to mention”, and “planned to mention” to “under application”, based on Christ and Burritt (2013).

### 3.2. Data Collection

The research data was collected from publicly-listed corporations in Vietnam’s stock markets. Vietnam was taken as a case study since it is one of the fastest emerging nations. Matters associated with environmental destruction have been increasingly serious (Huynh & Lan, 2021). Simple random sampling was used to select 500 companies that are still active. However, this study only received 342 valid responses, meeting the required sample size for analysis (Johnson & Wichern, 2015) and achieving a replying rate of 68.4%. The survey was undertaken with each environment-related executive at every selected corporation. The private data of the respondents is presented in Table 1.

The percentage of males was 57.61%; whereas only 42.39% were female. The percentage of under 25 was 3.51%; while those above 25 to under 35 and above or equal to 55 was 16.96% and 17.25%, respectively. The percentage of 35 to under 45 was 29.82%; whereas 32.46% of the respondents were aged from 45 to under 55. The percentage

**Table 1:** Respondents’ Profile

Characteristics		Frequence	Proportion (%)
Gender	Male	197	57.61%
	Female	145	42.39%
Σ		342	100.00%
Age (years)	Under 25	12	3.51%
	25 to under 35	58	16.96%
	35 to under 45	102	29.82%
	45 to under 55	111	32.46%
	Above or equal to 55	59	17.25%
Σ		342	100.00%
Education	Bachelor	132	38.59%
	Master	191	55.85%
	Doctorate	19	5.56%
Σ		342	100.00%
Working experience (years)	Under 5	22	6.43%
	5 to under 10	90	26.32%
	10 to under 15	111	32.46%
	Above or equal to 15	119	34.79%
Σ		342	100.00%

of master's degree was 55.85%; whereas only 5.56% were doctorate. The percentage of bachelor's degree holders was 38.59%. The working experience of under 5 was 6.43%. In contrast, that of above or equal to 15 was 34.79%. The working experience of 5 to under 10 was 26.32%; while that of 10 to under 15 was 32.46%.

### 3.3. Analytic Procedures

For scale reliability, the current project attempted to assess convergent and discriminant validity. Diverse dimensions need to be considered by evaluating the convergent validity. According to Salloum et al. (2019), convergent indicators consist of the factor loading, Chronbach's  $\alpha$ , composite reliability (CR), and average variance extracted (AVE). Factor loadings, Chronbach's  $\alpha$ s, and CRs had better surpass the 0.7 value, while the AVEs are thought to surpass the 0.5 preferable limits. Differences across factors need to be considered by assessing the discriminant validity. Salloum et al. (2019) stipulated that discriminant measures include Correlation & Square root of AVE analyses, cross-loadings, and Heterotrait-Monotrait analyses. The Square root of the AVE ratio in every measure should surpass the correlation between latent measures. The loading of every scale should surpass

that of its corresponding factor. The Heterotrait-Monotrait ratios should be lower than 0.85. Then, the current research work applied multiple regression to examine causal relations. To consider which factor is the first to affect the research model, this work undertook the directed acyclic graph technique that discriminates real causation from fake causation in a set of data, evidently extricates direct causation from indirect one.

### 4. Empirical Results

The results analyzing the convergent and discriminant validity are displayed in Tables 2 to 5. The figures in Table 2 assess the convergent validity. All of the factor loadings, Chronbach's  $\alpha$ s, and CRs exceed the preferable 0.7 value. Furthermore, the AVEs all surpass the suggested 0.5 value. These findings support the convergent validity of the data. The figures in Tables 3 to 5 evaluate the discriminant validity. Table 3 illustrates the square root of AVE (the diagonal value) in every factor in the correlation matrix above the correlation of latent factors. Table 4 demonstrates loadings of every dimension exceed that of its equivalent factor.

Consequently, those conditions are satisfied. Moreover, the Heterotrait-Monotrait ratios all are less than the 0.85

**Table 2:** Convergent Reliability

Factor	Dimension	Loading	Cronbach's $\alpha$	CR	AVE
IKM	IKM1	0.829	0.893	0.903	0.652
	IKM2	0.840			
	IKM3	0.902			
	IKM4	0.876			
	IKM5	0.751			
EAM	EAM1	0.850	0.897	0.906	0.677
	EAM2	0.819			
	EAM3	0.822			
	EAM4	0.835			
	EAM5	0.887			
	EAM6	0.871			
	EAM7	0.901			
	EAM8	0.841			
	EAM9	0.892			
	EAM10	0.892			
	EAM11	0.841			
	EAM12	0.901			
	EAM13	0.871			

**Table 3:** The Correlation & Square Root of AVE

	<b>IKM</b>	<b>EAM</b>
IKM	0.808	
EAM	0.439	0.823

**Table 4:** Cross-Loading

	<b>IKM</b>	<b>EAM</b>
IKM1	0.829	0.231
IKM2	0.840	0.161
IKM3	0.902	0.209
IKM4	0.876	0.184
IKM5	0.751	0.182
EAM1	0.255	0.850
EAM2	0.208	0.819
EAM3	0.218	0.822
EAM4	0.190	0.835
EAM5	0.194	0.887
EAM6	0.213	0.871
EAM7	0.194	0.901
EAM8	0.154	0.841
EAM9	0.207	0.892
EAM10	0.207	0.892
EAM11	0.154	0.841
EAM12	0.194	0.901
EAM13	0.213	0.871

**Table 5:** Heterotrait-Monotrait

	<b>IKM</b>	<b>EAM</b>
IKM		
EAM	0.321	

**Table 6:** Regression Results

<b>Model</b>	<b>Regression</b>	<b>Regressor</b>	<b><math>\beta</math></b>	<b>S.E.</b>	<b><math>t</math></b>	<b><math>P_t</math></b>	<b><math>R^2</math></b>	<b><math>F</math></b>	<b><math>P_F</math></b>
1	IKM	(Constant)	1.877	0.210	8.932	0.000	0.292	80.958	0.000
		EAM	0.487	0.054	8.998	0.000			
2	EAM	(Constant)	2.314	0.169	13.718	0.000	0.292	80.958	0.000
		IKM	0.395	0.044	8.998	0.000			

thresholds as presented in Table 5, satisfying this condition. Overall, the research data in the model satisfies the convergent and discriminant validity.

Subsequently, multiple regression was carried out to scrutinize the causal linkages in the research model. The results are displayed in Table 6. As regards Model 1, the  $F$  of the model reaches the 26.790 value with  $P_F$  less than 1%; and  $R^2$  indicates that the usefulness of eLearning explains 24.5% of the variance in the adoption of eLearning ( $F = 26.790$ ;  $P_F = 0.000$ ;  $R^2 = 0.245$ ), which demonstrates the goodness of fit for Model 1. The usefulness of eLearning perceived by students positively affects their adoption of eLearning for their study at the 1% statistical significance with the influential coefficient of 0.220 ( $\beta = 0.220$ ;  $t = 5.176$ ;  $P_t = 0.000$ ), which provides statistical support for H1: “Students’ perceived usefulness of eLearning can positively influence their actual adoption of eLearning for training”.

In relation to Model 2, the  $F$  of the model obtains the 71.968 level at the 1% statistical significance; and  $R^2$  shows that the adoption and usefulness of eLearning jointly explain 50.6% of the variance in learning performance ( $F = 71.968$ ;  $P_F = 0.000$ ;  $R^2 = 0.506$ ), indicating the goodness of fit for Model 2. Both the adoption and usefulness of e-learning improve students’ learning performance at a 1% statistical significance with the coefficients of 0.171 and 0.364, respectively ( $\beta = 0.117$  &  $0.364$ ;  $t = 3.033$  &  $10.511$ ;  $P_t = 0.003$  &  $0.000$ ), statistically supporting H2 and H3: “Students’ adoption of eLearning for training can make their learning performance better” and “Students’ perception of the usefulness of eLearning for training can augment their learning performance”.

The causal ties from environmental managerial accounting to knowledge management as well as from knowledge management to environmental managerial accounting were explored by applying multiple regression analyses. The findings of multiple regressions are shown in Table 6. Concerning Model 1, the  $F$  of the model reaches the 80.958 value with  $P_F$  below 1%; and  $R^2$  indicates the acceptance of environmental managerial accounting explains 29.2% of the variance in the implementation

of knowledge management ( $F = 80.958$ ;  $P_F = 0.000$ ;  $R^2 = 0.292$ ), which demonstrates the goodness of fit for Model 1. The acceptance of environmental managerial accounting positively determines the implementation of knowledge management at the 1% statistical significance with the influential coefficient of 0.487 ( $\beta = 0.487$ ;  $t = 8.998$ ;  $P_t = 0.000$ ), which provides statistical support for H1: “Environmental managerial accounting adopted in business likely boosts the acceptance of knowledge management”.

As regards Model 2, the  $F$  of the model has a value of 80.958 at the 1% statistical significance level; and  $R^2$  shows the acceptance of knowledge management explains 29.2% of the variance in the acceptance of environmental managerial accounting ( $F = 80.958$ ;  $P_F = 0.000$ ;  $R^2 = 0.292$ ), indicating the goodness of fit for Model 2. The implementation of knowledge management increases the acceptance of environmental managerial accounting at a 1% statistical significance with the coefficient of 0.395 ( $\beta = 0.395$ ;  $t = 8.998$ ;  $P_t = 0.000$ ), statistically supporting H2: “Acceptance of knowledge management likely leads to adopting environmental managerial accounting”.

The reciprocated bond of using environmental managerial accounting with knowledge management has been analyzed in prior research. However, none of them has investigated which factor first determines the research model. To systematically examine the reciprocated tie of implementing environmental managerial accounting with knowledge management, the directed graph searches as well as directed acyclic graphs were employed. First, the directed graph searches with the LiNGAM algorithm was applied to analyze the reciprocated bond. The LiNGAM algorithm could deal with sets of data where the original causal relations are cyclic.

The empirical results disclose the number of nodes in analysis takes 2, as well as the number of edges takes 2. Both the edges are directed as Figure 1 demonstrated, implying the adoption of knowledge management is causality and also an effect of implementing environmental managerial accounting in business. The LiNGAM model may not designate which edge first affects the relationship. To decide

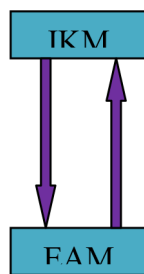


Figure 1: Directed Graph Searches

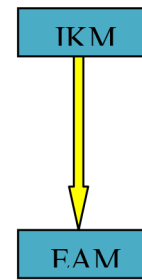


Figure 2: Directed Acyclic Graphs

on which influential direction is the first antecedent of the reciprocated bond, the directed acyclic graph model was used. The empirical outcomes show the causal effect of adopting knowledge management with environmental managerial accounting is first established in the reciprocal link, as Figure 2 illustrated.

Up to now, it could be deemed the bond between the use of knowledge management and the usage of environmental managerial accounting is mutual. These findings support the suggestion that the adoption of knowledge management and the implementation of environmental managerial accounting in business have mutual interaction; where the effect of adopting knowledge management on implementing environmental managerial accounting is the first impact in the reciprocated bond. Overall, the adoption of knowledge management is found as the first factor leading to the implementation of environmental managerial accounting. However, after being affected, the implementation of environmental managerial accounting is also causation for boosting the implementing level of knowledge management in business.

### 5. Conclusion

Earlier research projects have studied the reciprocated bond of accepting environmental managerial accounting with adopting knowledge management. However, none of them have explored which factor is the first one to affect the research model. In addition to the causal links, the current article applied the techniques of directed graph searches and directed acyclic graphs to the first direction in the reciprocated bond between the two main factors. The empirical findings support H1, where the usage of environmental managerial accounting in business likely boosts the acceptance of knowledge management” and also provide support for H2 in which the acceptance of knowledge management likely leads to adopting environmental managerial accounting. Relating to the reciprocated link, the findings reveal, first, the usage of environmental managerial accounting is a driver resulting in adopting knowledge management. Subsequently, higher implementation levels of knowledge management



can augment using environmental managerial accounting to a higher level.

The current paper suggests some contributions to the body of managerial knowledge. It is one of the first to deliver a clearer picture of applying environmental managerial accounting with the usage of knowledge management. Using knowledge management is, first and foremost, a crucial reason for using environmental managerial accounting, which is, in turn, a significant factor imposing a negative impact on the use of knowledge management. Executives will benefit from the current paper since it provides new insight into the relationship between the adoption of environmental managerial accounting and the acceptance of knowledge management. As a result, they will be able to make better decisions on environmental managerial accounting and knowledge management, which will aid in the development of competitive advantages and thus improve organizational performance.

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