

Knowledge of Agricultural Extension Services and Environmental Management Accounting: Mediating Role of Belief Based Factors in Farmers

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The purpose this current study is to analyse the influence of knowledge on agricultural extension services (KAES) on environmental management accounting (EMA) and to assess the role of belief-based factors between KAES and EMA. To analyse the interconnecting role of belief-based factors, subjective norms, attitudes and perceived behaviour controls have been examined between the two. This study focuses on Thailand where data was collected from 300 farmers. Data collection focused on farmers' knowledge of agricultural extension services, attitudes, subjective norms, perceived behavioural controls and EMA through a survey instrument. Purposive sampling and questionnaires were used and subsequent data analysis applied Confirmatory Factor Analysis and Structural Equation Modelling to achieve and test results. Study findings reveal that knowledge of agricultural extension services has significantly positive influence on the EMA. Furthermore, the subjective norms and attitudes of farmers play a significant role between KAES and EMA. It was determined that PBC was a significant arbitrator in their relationship. The current study has important implications for future researchers and farmers.

Key words: *knowledge of agricultural extension services, environmental management accounting, attitude, subjective norms, perceived behavioural control.*

Introduction

Environmental management accounting (EMA) has become an important topic for modern researchers because of its critical role in the success of a company (Jermsittiparsert, Sutduean, & Sutduean, 2019a, 2019b; Somjai & Jermsittiparsert, 2019; Sriyakul, Umam, & Jermsittiparsert, 2019). EMA refers to the identification, assemblage and analysis of two key kinds of information required for decision making. The first type of information collected, assembled and analysed for decision making in EMA is physical information about the use of resources and energy, movements and rates of resources. The second type of information involved in EMA is monetary information that relates to environment costs, savings and revenues (Burritt, Schaltegger, Ferreira, Moulang, & Hendro, 2010).

This information is necessary for actual and environmental success of a firm. The concept of environmental accounting was developed and used in the 1960s and 1970s to address growing concerns around environmental and natural resources. In light of increasing environmental concerns, traditional accounting is being replaced by environmental accounting increasing its importance in theoretical as well as practical terms (Kapardis & Setthasakko, 2010; Vasile & Man, 2012).

Firms worldwide are seeking different ways to enhance their environmental management accounting and, as such, many researchers are attracted towards this topic in order to highlight antecedents, consequences and issues in EMA. EMA carries greater weight to traditional management accounting because the latter simply focuses on the management of the “assets, revenues, costs and other items sold and valued in the market”. Importantly, EMA focuses on assets, revenues, costs and other items sold and valued in the market along with the non-marketed “assets, yield, costs”. The role of EMA in agriculture is particularly imperative because the agricultural sector is mostly concerned with the use and management of natural resources (Jamil, Mohamed, Muhammad, & Ali, 2015; Sands, Lee, & Gunarathne, 2015).

This paper focuses on two key intentions of EMA; i.e. AES and belief-based factors.

Figure 1. Theory of planned behaviour in Agriculture (Source: SLU)

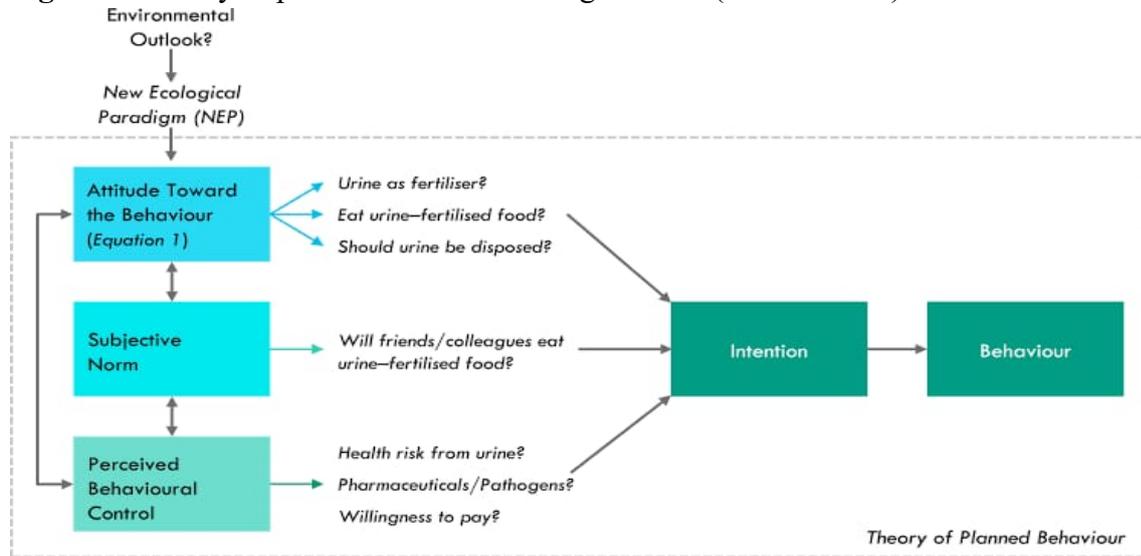


Figure 1 above presents a simplified theory of planned behaviour and shows that how attitude, control behaviour and subjective norms affect intentions and behaviours. For proper EMA to exist, agricultural firms and farmers must have a proper knowledge of agricultural extension services, attitudes, norms and control behaviour in order to satisfy environmental concerns.

Studies on the importance of EMA have contributed to the literature and highlight different aspects and factors. However, the antecedents of EMA in agriculture have gained limited focus in former studies. The knowledge of farmers about agricultural extension services has been ignored in terms of its role in EMA. In a contemporary and changing business environment, agricultural extension has become crucial and farmers must have knowledge of agricultural extension services. Past studies have highlighted that the knowledge of agricultural extension services (KAES) brings many benefits to firms. However, the particular outcome of KAES in terms of improved EMA has been overlooked in previous studies (Aker, 2011; Benin et al., 2011; Labarthe & Laurent, 2013).

To address this gap in existing literature about EMA and KAES, the study's first objective has been to analyse the impact of "knowledge of agricultural extension service" on "environmental management accounting". It is believed that this objective will significantly assist governments, farmers and agencies who struggle to enhance structural, managerial and financial EMA.

An analysis of KAES in EMA practices reveals there to be considerable belief-based factors at play because the attitudes, behaviours, and norms of farmers determine EMA. Previous studies have demonstrated that different belief-based factors are regarded as important predictors of

EMA. For example, the norms, attitudes and behavioural controls are considered to be important antecedents of EMA in firms (Tashakor, 2019).

‘Attitudes’ refers to the attitude of farmers about EMA. Environmental concerns associated with agriculture have increased worldwide and subsequently farmers have developed positive attitudes towards EMA as a practice (Lagerkvist, Shikuku, Okello, Karanja, & Ackello-Ogutu, 2015; Sands et al., 2015). Perceived behavioural control is also of great importance in this regard because it refers to the control or right to direct the work and behaviour of workers (Greaves, Zibarras, & Stride, 2013). Subjective norms refer to the standards of behaviour that are determined by societal pressure. It is argued that the growing environmental concerns increase societal pressure on farmers to adopt EMA for the sake of satisfying these concerns (Papagiannakis & Lioukas, 2012).

The increasing importance of environmental concerns strengthens the need for EMA because it addresses the natural values and assets that cannot be handled through traditional management accounting. Therefore, there is need to highlight and explain the factors that can develop EMA.

The second objective of this study is to analyse the role of belief-based factors, including attitudes, subjective norms and perceived behavioural control between knowledge of agricultural extension and EMA.

Literature Review

Knowledge of Agricultural Extension Services and EMA

McCullough and Matson (2016) defined the scientific practices related to knowledge of agricultural extension services (KAES) in relation to environmental management accounting (EMA). The study’s authors explain that knowledge based systems form a network of linked terms associated with agricultural services and environment management. These include various individuals, variables and participating organisations to enhance farming practices in the field. Knowledge related to the environment and farming has played a vital role in gradually fostering agricultural development and with a clear emphasis on EMA.

Fu and Akter (2016) explore the green revolution program of wheat and corn. Essentially, the entire agricultural sector was included in this green revolution network and delivered diverse changes in the agricultural and farming sectors. This change was achieved via the introduction of current and emerging technologies, methodologies and knowledge system participation and information flow. Research priorities also played a key role in bringing about change.

From an international perspective, farmers characterise extension theory (Ju et al., 2009) by demonstrating the latest farming and agricultural practices. Researchers believe that this theory

initiates innovation in farming and agricultural markets. Additionally, leads farmers to develop, adapt and apply new ideas to ensure producers access appropriate information.

Another theory applied to the development of agricultural extension is planned behaviour (TPB) on whose basis various studies develop a structural model to analyse latest techniques.

KAES have developed market and environmental trends because of a shift in knowledge, information, evaluated policies and latest price transfers. KAES and EMA work together in light of environmental challenges, among them, droughts, floods and crop diseases. Agricultural services can only be extended if environmental management and development receive sufficient funds and generate approximately double the revenue. Sustainability will be achieved if the former recommendation is implemented. Particular studies (Klerkx & Proctor, 2013) investigate innovative farmers who are seen as a positive influence in broadening production and sustainability in the agricultural sector.

Earlier studies (Smith & Siciliano, 2015) suggest that agricultural extension is the purpose of technical research and understanding of agricultural practices through cultivator teaching. Primarily, agricultural extension is known as the 'delivery of information inputs to farmers'. KAES does not only refer to teaching farmers how to increase productivity but rather to the transference of critical research from the lab to the field, using conventional methods and techniques. EMA approaches have a positive influence on the development of agricultural extension. This is because of international food security and nutrition intervention advancing old techniques, information and labour of farming and agricultural region.

International policies and reforms (Clark et al., 2016) address sustainability and agricultural improvements against international standards. The purpose of such policies and reforms is to increase the rate of crop production and growth value. Researchers (Dlodlo & Kalezhi, 2015) discovered that agricultural extension depends on three major factors: technology transfer, experienced advisors and assisting farmers and buyers. However, EMA requires transparency and accountability in favour of KAES. In addition, to prevent the deterioration of the natural environment, different strategies were established to secure the natural environment from destruction. In this instance, KAES was employed to prevent all types of agricultural and environmental difficulties.

Thus, the following hypothesis is proposed:

H1: That knowledge of Agricultural Extension Services has a significant impact on Environmental Management Accounting.

Mediating Role of Attitude

Former studies (Bennett & James, 2017) suggest that farmers, as well as producers and buyers, are important in maintaining sustainability and environmental consistency in the agricultural sector. They provide deep insight into the role of attitudes represented by farmers. Such insights could also help farmers design effective EMA practices that include agricultural functioning and extension services.

Extension and Planned Behaviour theories work simultaneously to understand the effects of farmers' behaviours and attitudes on the advancement of KAES and EMA. Farmer attitudes focus on performance and atmosphere. The concerns of producers, or cultivators, revolve around sustainability requirements, the value of environmental resources, stakeholders' engagement and customer supply chains.

Farmers' attitudes change as a result of financial and economical contexts as such variables are out of their control. Researchers Liu, Bruins, and Heberling (2018) revealed that innovators or practitioners develop different tools to achieve sustainability. Farmers, however, are more interested in sustainability intervention and production performance. Their main focus is to increase the total growth and production of crops on yearly basis. To do this, they have to use diverse methods, ingredients, fertilizers and pesticides to secure crops from destruction or damage.

Farmers' attitudes have to be serious, discerning, and deliberate and focused on practices and functioning agricultural extension services. Studies (Negatu, Kromhout, Mekonnen, & Vermeulen, 2016) suggest that farmers are decision makers who are responsible for the coordination of highly interdependent activities. Farmers' attitudes and behaviours depend on experience, skill, ability and capability. Attitudes are considered as the product of behavioural-beliefs which act as an overall evaluation of favourable or unfavourable farmer or innovators' interests.

Research suggests that if a farmer is educated as well as well experienced, than they will definitely have a positive impact on KAES. In turn, this will further enhance the development of EMA. In light of governmental and environmental negligence and reforms, farmers are portrayed as empowered change makers in agricultural extension regions. It is in this context that farmers place less importance on the development of environmental and agricultural sustainability.

More recent studies (Fu & Akter, 2016) present evidence about the gradual effects of climate change and how twenty-first century farmers are confronted with this new challenge. This

research explores and presents significant implications for knowledge, information and advisory services, including both demand and supply in the agricultural sector.

Thus, the following hypothesis is proposed:

H2: That farmer attitudes have a significant mediating role between KAES and EMA.

Mediating Role of Subjective Norm

Past studies (Zeweld, Van Huylenbroeck, Tesfay, & Speelman, 2017) examine the association between Subject Norm (SN) and the influence it has on KAES and EMA practices and beliefs. SN comprises perceived behaviours and pressures that are influenced by social pressures and, in turn, affect target pressure. SN functions effectively mediate between the sustainability of agricultural extension services and environmental development capability. SN is often determined by a set of normative beliefs which are influenced by an individual's motivation and capability. Personal behaviour is also an influential part of SN as it impacts KAES and EMA.

Agricultural information is also considered an important rural development package for the developing and under developed economies. However, agricultural sectors have a wide influence on SN, which positively influences KAES and EMA. More importantly, SN causes an increase in agricultural production and improved marketing and distribution strategies. Development in this sector usually focuses on lifestyle which has a positive correlation to the reduction of poverty. An improvement in the economy is achieved through improvements in people's attitudes, behaviour and beliefs. SN improves because of socio-cultural, economic and institutional factors. An additional study (Verma & Sinha, 2018) illustrates an increase in SN because of higher levels of agricultural information provided to farmers and practitioners. Evidently, agricultural information generates greater awareness among farmers about the latest agricultural technologies and methodologies.

SN concept categorised into scientific, commercial and legal information for the per capita improvement in farming yield and production growth. Normative beliefs and the motivation of farmers and producers have a significant impact on the behaviour of people. This category of information acts as a positive influence on farmers, extension workers and policy makers.

Thus, the following hypothesis is proposed:

H3: That the Subjective Norm has a significant mediating role between KAES and EMA.

Mediating Role of Perceived Behavioural Control

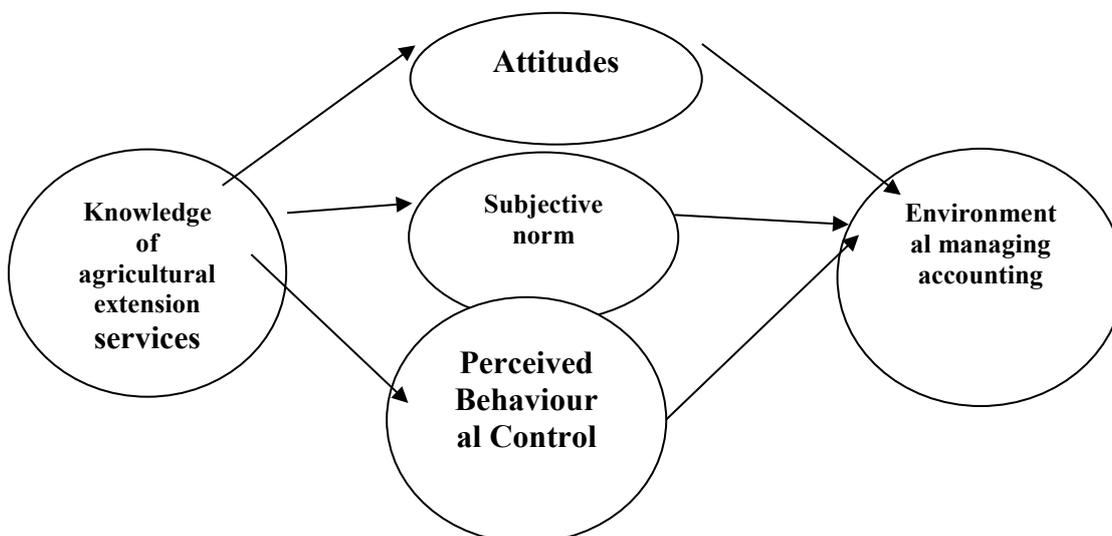
Studies (Gholamhossein Abdollahzadeh, Sharifzadeh, & Damalas, 2016) present that perceived behavioural control (PBC) refers to person's own behaviour and beliefs. These are tasks given to people in the agricultural sector and depend on the ease and difficulty of PBC. Theory of planned behaviour also focuses on the application of PBC and is taken to be the way in which a person's beliefs about resources and obstacles are relevant to performance and behaviour. PBC acts with KAES and EMA to explain the concept of behaviour and the intention to comply. TBP is environmental activism and encourages PBC for greater involvement in agricultural extension services and environmental groups. Such sets of behaviour should receive greater research attention.

PBC demonstrates the sway individual beliefs and behaviours (Senger, Borges, & Machado, 2017) have over environment. Moreover, it suggests whether specific tasks will be easy or difficult to complete. Agricultural information (Zeweld et al., 2017) is also associated with rural and urban farmers and the frequency and utilisation of KAES and EMA processes. However, previous studies (Gholamhossein Abdollahzadeh, Sharifzadeh, & Damalas, 2015) discuss existing problems faced by rural farmers; challenges that are being solved using contemporary SN methods, attitudes and PBC, in partnership with KAES and EMA.

Thus, the following hypothesis is proposed:

H4: That Perceived Behavioural Control has a significant mediating role between KAES and EMA.

Framework:



Methodology

Population and Sampling

In terms of sampling, it is important to be mindful of the sampling size as stipulated by Hazen et al. (2015). Further consideration needs to be given to structural equation modelling for analysis and, in this respect, the sample size must be large. In this study, sample size has been selected on the bases of Klein's (2015) idea in which the figures you obtain from the formula number of items*10, is an acceptable sample size. 300 respondents were selected for the purposes of this investigation and were provided a questionnaire to complete. Of the 290 responses, 281 responses were deemed to be valid. Purposive sampling was used for farmers as they are the subject of this inquiry.

Data Collection and Procedures

A questionnaire was used as a data collection instrument in this quantitative study. Given that the audience of the questionnaire were Thai farmers, Thai was used as this was the most easily understood language. The scale used in questionnaire had already been used by other researchers, so content validity was the only check necessary prior to distribution. The researcher self-administered the questionnaire because of low literacy. This approach allowed the researcher to provide any necessary assistance and clarification to farmers participating in the sampling.

Validity, Reliability and Common bias

SPSS and AMOS have been used in order to assess reliability and validity respectively. To assess the reliability, SPSS has been used to examine the criteria such as Cronbach's α larger than 0.7 (Chin, 1998). AMOS has been used in order to assess the convergent validity and three kinds of criteria has been used to examined that such as (i) item loading (λ) larger than 0.70 (ii) composite construct reliability larger than 0.80 and (iii) average variance extracted (AVE) larger than 0.50 used to assess the convergent validity. Moreover, AMOS has also been used to assess the discriminant validity between constructs by examining the criteria such as square root of AVE should be larger than all other constructs.

The set of variables in this study are knowledge of agriculture extension services, environmental management accounting, attitude, subjective norms and perceived behavioural control. To control risk, Harman's single factor test has been used by the researcher. This test was conducted to check whether variance could be accounted for by one single factor. Results revealed that constructs extracted had different factors: 89% of total variance had been

explained by a factor solution and 21% of variance explained by the first factor. A single factor does not account for bulk of variance while ensuring inexistence of the common bias method.

Measures

Data collection was via a self-administered questionnaire and adapted from previous studies. The first variable - knowledge of agriculture extension - concerns fifteen items adapted from the study of Aker (2011). Three mediators of the study were attitude, subjective norms and perceived behaviour control and their scales were adapted from Utami (2017). With thirteen items, the dependent variable - environmental management accounting - was measured by adapting the scale from Saeidi, Othman, Saeidi, and Saeidi (2018).

Hypothesis Testing

Testing identified hypotheses is an essential part of methodology and, in this instance, was done through structural equation modelling run on AMOS. SEM has been used for the purposes of path analysis for testing hypotheses related to agriculture extension services knowledge, environmental management accounting, and farmers' basic beliefs around attitude, subjective norms and behavioural control. In the path analysis, the standardised coefficient and significance of the relationship was analysed in order to check which relationship had the most significance or not. In doing this, the intention was to determine which hypothetical relationship should be acceptable or not.

Research Findings

To investigate the relationship between Knowledge of Agricultural Extension Services and Environmental Management Accounting and the Mediating Role of Belief Based Factors in Farmers, data was collected from 300 respondents. 281 responses were analysed. The analysis did not consider missing responses and/or blank responses.

The findings show that 117 male and 164 females participated in the sampling. 242 respondents were aged 20 to 25; 42 respondents were aged 25 to 30; 9 were aged 31 to 40 and the remaining were older than 40 years. 23 respondents were undergraduate, 134 graduate, 114 held a Master's degree and the remaining 10 indicated other types of education.

Factor Analysis and Reliability Test

It is a prerequisite to confirm and check the reliability of data before hypothesis testing. The following Table indicates the reliability value measured by Cronbach alpha:

Table 1: Psychometric Properties

Constructs	No of items	Cronbach alpha
AT	3	0.917
SN	3	0.849
BC	3	0.711
AES	15	0.917
EMA	13	0.937

Table 1 above shows the reliability of each construct and was checked by running the Cronbach Alpha test. Cronbach Alpha presents the internal consistency of each item for each construct. If the Cronbach alpha value for all constructs is more than .70, data reliability is satisfied.

Convergent and Discriminant validity

Convergent validity is the validation of items for constructs and proves the internal consistency of data. On the other hand, discriminant validity shows the discriminant of a variable from others. Statistical tools were used to identify convergent and discriminant data validity.

Findings are presented in Table 2 below:

Table 2: Convergent and Discriminant validity

	CR	AVE	MSV	AES	SN	BC	EMA	AT
AES	0.915	0.724	0.389	0.851				
SN	0.897	0.745	0.402	0.576	0.863			
BC	0.733	0.478	0.013	-0.029	-0.023	0.691		
EMA	0.935	0.749	0.402	0.573	0.634	-0.113	0.866	
AT	0.919	0.792	0.389	0.624	0.621	0.045	0.624	0.890

With respect to Table 2, composite reliability and average variance values confirm a case of convergent validity. The remaining columns show the discriminate validity of data. If composite reliability for each construct has a value more than .70 and value of MSV is less than AVE, convergent validity is proven. Other columns show that each construct has a greater AVE compared to other values. In this respect, the discriminant validity of data is established.

Confirmatory Factor Analysis

A Confirmatory Factor Analysis test is used to identify whether the model of this study is suitably rigorous or not. To achieve model rigour and threshold, at least five indicators are present. The observed values are provided in Table 3:

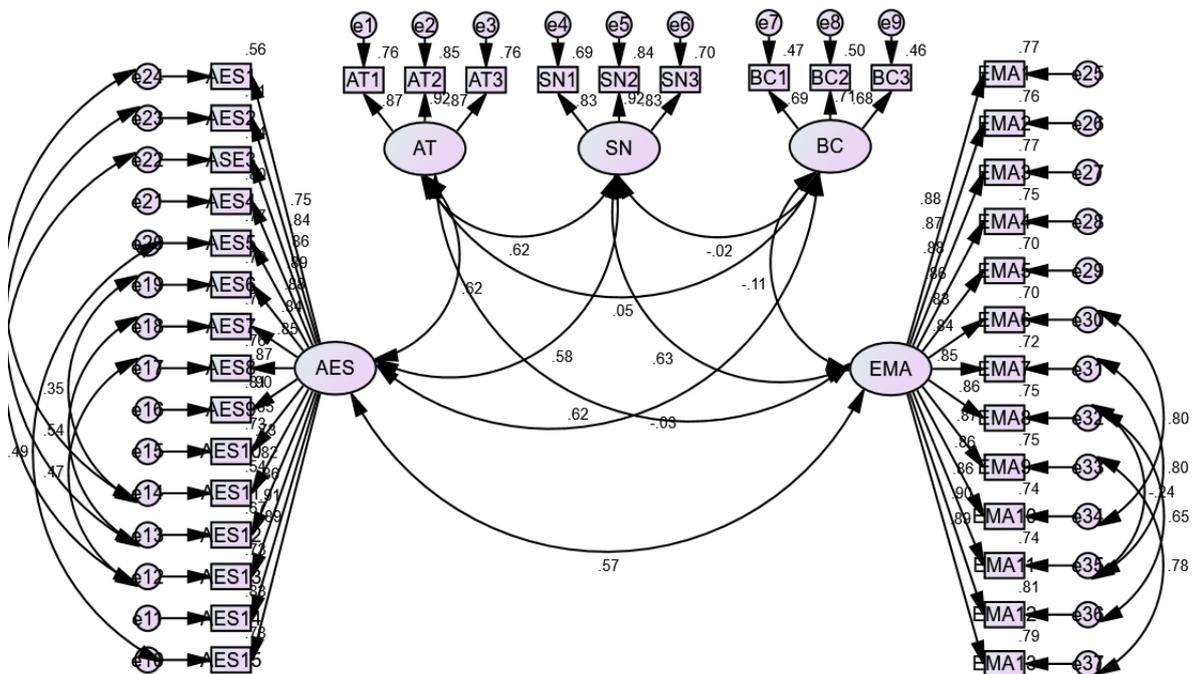
Table 3: CFA

Indicators	CMIN/DF	GFI	IFI	CFI	RMESA
Threshold range	<3	>.80	>.90	>.90	<.08
Observed values	2.556	.803	.928	.928	.075

The results presented in Table 3 verify that all values fall under the threshold range because the value of CMIN/DF for the current data is 2.556, which is less than 3.0. The value of GFI equals .80 while the IFI and CFI are .928 and are greater than .928. Lastly, RMESA is .07 and less than .08. This clearly means that the model of the study is suitably rigorous.

The following figure of CFA, Figure 2, taken in AMOS, shows the loading of each item and the correlation between variables:

Figure 2. CFA



Structural Equation Modeling

In order to test the hypotheses, Structural Equation Modelling was performed by using AMOS. This was necessary because SEM features multiple regression and simultaneously tests the entirety of the model.

Table 4 below presents the regression weights of each variable and predicts the hypotheses outcomes:

Table 4: Structural Model Results

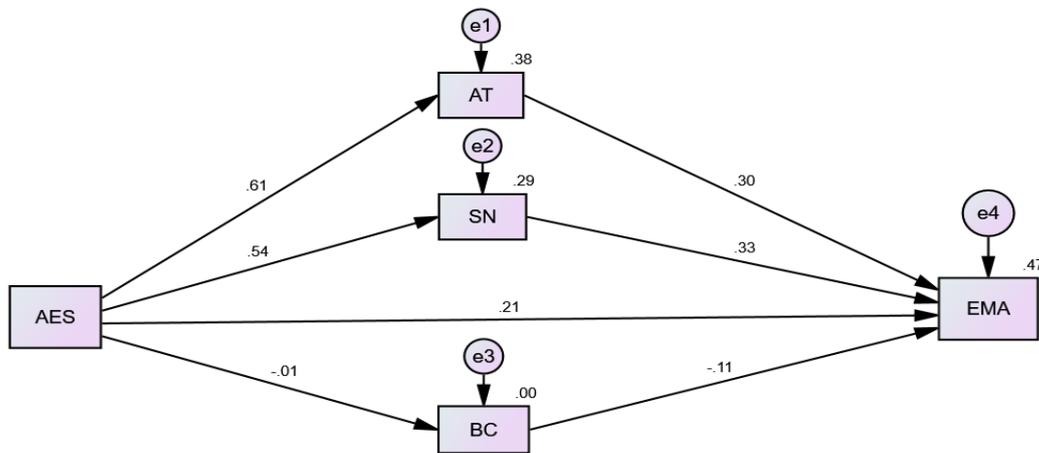
Total	AES	BC	AT	SN
BC	-.009	.000	.000	.000
AT	.614***	.000	.000	.000
SN	.543***	.000	.000	.000
EMA	.572***	-.112	.301**	.326**
Direct	AES	BC	AT	SN
BC	-.009	.000	.000	.000
AT	.614***	.000	.000	.000
SN	.543***	.000	.000	.000
EMA	.209**	-.112	.301**	.326**
Indirect	AES	BC	AT	SN
BC	.000	.000	.000	.000
AT	.000	.000	.000	.000
SN	.000	.000	.000	.000
EMA	.363***	.000	.000	.000

Table 4s results of structural equation modeling indicate that knowledge of Agricultural Extension Services has a direct and positive and significant impact on environmental management accounting practices. The effect size stands at 21%. This figure demonstrates that by increasing one unit of knowledge of Agriculture Extension Services will result in a 21% positive impact on environmental management and accounting practices. The results also indicate that of three mediators identified in the current study, two are significant mediators between knowledge of Agricultural Extension Service and environmental management accounting practices. This means that one mediator has plays an insignificant role.

The direct impact of agricultural Extension Services on attitude is 61%, whereas its direct impact on subjective norms sits at 54%. However, perceived behavioural control has an impact effect size of 1% - quite insignificant. The direct impact of attitude on environmental management accounting is 30%; and the direct impact of subjective norms on environmental management accounting practices 33%. This likewise shows that the direct impact of behavioural control on EMA is insignificant.

The following screenshot of Structural Equation Modeling – Figure 3 – is taken from AMOS for the purposes of hypotheses testing:

Figure 3. SEM



Discussion and conclusion

Discussion

The aim of this study was to investigate the impact of knowledge of agriculture extension services (KAES) on environmental management accounting (EMA). It also aimed to investigate the mediating role of farmer's attitudes (FA) between KAES and EMA. Inquiring into the mediating role of Farmers' subjective norms (FSN) between KAES and EMA and the mediating role of Perceived behavioural control (PBC) between KAES and EMA was also considered (Tandi Lwoga, Stilwell, & Ngulube, 2011).

The first hypothesis is proven and upheld by the research work of Shamim Tashakor, Ranjith Appuhami and Rahat Munir. The Department of Accounting and Corporate Governance, Macquarie University, Sydney, Australia (2019) further verifies that effective KAES involves applying the basic scientific knowledge and techniques to the agricultural sector. This is achieved by educating farmers about modern farming techniques and, in turn, employing these techniques to impact EMA (Abebe, Bijman, Pascucci, & Omta, 2013).

The second hypothesis is proven and is upheld by the research of Petrzela Peggy. The investigation demonstrates that KAES and EMA both increase if a farmer has a positive attitude and behaviour towards agricultural and environmental sustainability. Developing KAES will advance a positive FA towards modern agricultural needs and impact EMA significantly (Klerkx, Schut, Leeuwis, & Kilelu, 2012).

The third hypothesis is proven and upheld as Arnett concluded that subjective norms put pressure on a subject to do or not to do something according to the norms of their surroundings. KAES puts pressure on farmers to implement modern farming techniques and scientifically approved agricultural methods. This brings betterment and sustainability and increases EMA from an internal and monetary aspect (Kilelu, Klerkx, Leeuwis, & Hall, 2011).

The fourth hypothesis is unproven and therefore rejected. Current findings did not support the significant mediation of this variable. Icek Ajzen states that KAES instils into farmers modern and scientific agricultural techniques. PBC is enhanced as it is the perception of an individual about performing or not being able to perform a certain task that plays a significant role (Aker, 2011). PBC clearly enhances farmers' abilities to implement agricultural techniques and, subsequently, EMA increases. Accordingly, KAES has a significant impact on PBC and, in turn, significantly impacting EMA.

Conclusion

This study was conducted in Thailand with the aim to investigate the impact of knowledge of agriculture extension services on environmental management accounting. The mediating role of farmers' attitude' between KAES and EMA was also considered. Additionally this study sought to understand the mediating role of farmers' subjective norms between KAES and EMA. Also examined was the mediating role of Perceived behavioural control between KAES and EMA. Data was collected from a sample size of three hundred Thai farmers via a questionnaire. Ensuing data analysis concluded that there exists a significant relationship between KAES and EMA while FA and FSN significantly mediate between KAES and EMA.

Implications of the study

This study has increased the knowledge and research base concerning the importance and presence of PBC, FCN, and FA as a mediator between KAES and EMA. The KAES process can be embedded in farmers' agricultural processes for the betterment and sustainability of the Thai agricultural sector. KAES should be made a critical component of farmer education so that better outputs can be obtained.

Limitations and future research indications

Future research can be conducted using a larger sample size than the present research. Moreover, as it is a global problem, future research can be conducted out of Thailand. Farmers can be interviewed individually for their feedback using the same processes with and without basic education and knowledge.

REFERENCES

- Abdollahzadeh, G., Sharifzadeh, M. S., & Damalas, C. A. (2015). Perceptions of the beneficial and harmful effects of pesticides among Iranian rice farmers influence the adoption of biological control. *Crop Protection*, 75, 124-131.
- Abdollahzadeh, G., Sharifzadeh, M. S., & Damalas, C. A. (2016). Motivations for adopting biological control among Iranian rice farmers. *Crop Protection*, 80, 42-50.
- Abebe, G. K., Bijman, J., Pascucci, S., & Omta, O. (2013). Adoption of improved potato varieties in Ethiopia: The role of agricultural knowledge and innovation system and smallholder farmers' quality assessment. *Agricultural Systems*, 122, 22-32.
- Aker, J. C. (2011). Dial "A" for agriculture: a review of information and communication technologies for agricultural extension in developing countries. *Agricultural Economics*, 42(6), 631-647.
- Benin, S., Nkonya, E., Okecho, G., Randriamamonjy, J., Kato, E., Lubade, G., & Kyotalimye, M. (2011). Returns to spending on agricultural extension: the case of the National Agricultural Advisory Services (NAADS) program of Uganda. *Agricultural Economics*, 42(2), 249-267.
- Bennett, M., & James, P. (2017). *The Green bottom line: environmental accounting for management: current practice and future trends*: Routledge.
- Burritt, R. L., Schaltegger, S., Ferreira, A., Moulang, C., & Hendro, B. (2010). Environmental management accounting and innovation: an exploratory analysis. *Accounting, Auditing & Accountability Journal*.
- Clark, W. C., Tomich, T. P., Van Noordwijk, M., Guston, D., Catacutan, D., Dickson, N. M., & McNie, E. (2016). Boundary work for sustainable development: Natural resource management at the Consultative Group on International Agricultural Research (CGIAR). *Proceedings of the National Academy of Sciences*, 113(17), 4615-4622.
- Dlodlo, N., & Kalezhi, J. (2015). *The internet of things in agriculture for sustainable rural development*. Paper presented at the 2015 international conference on emerging trends in networks and computer communications (ETNCC).



- Fu, X., & Akter, S. (2016). The impact of mobile phone technology on agricultural extension services delivery: Evidence from India. *The Journal of Development Studies*, 52(11), 1561-1576.
- Greaves, M., Zibarras, L. D., & Stride, C. (2013). Using the theory of planned behaviour to explore environmental behavioural intentions in the workplace. *Journal of Environmental Psychology*, 34, 109-120.
- Jamil, C. Z. M., Mohamed, R., Muhammad, F., & Ali, A. (2015). Environmental management accounting practices in small medium manufacturing firms. *Procedia-Social and Behavioural Sciences*, 172, 619-626.
- Jermisittiparsert, K., Sutduean, J., & Sutduean, C. (2019a). Sustainable Procurement & Sustainable Distribution Influence the Organizational Performance (Economic, Social and Environmental): Moderating Role of Governance and Collaboration at Thai Food Industry. *International Journal of Supply Chain Management*, 8(3), 83-94.
- Jermisittiparsert, K., Sutduean, J., & Sutduean, C. (2019b). The Mediating Role of Innovation Performance between the Relationship of Green Supply Chain Management Skills and Environmental Performance. *International Journal of Supply Chain Management*, 8(3), 107-119.
- Ju, X.-T., Xing, G.-X., Chen, X.-P., Zhang, S.-L., Zhang, L.-J., Liu, X.-J., . . . Zhu, Z.-L. (2009). Reducing environmental risk by improving N management in intensive Chinese agricultural systems. *Proceedings of the National Academy of Sciences*, 106(9), 3041-3046.
- Kapardis, M. K., & Setthasakko, W. (2010). Barriers to the development of environmental management accounting. *EuroMed Journal of Business*.
- Kasayanond, A., Umam, R., & Jermisittiparsert, K. (2019). Environmental Sustainability and its Growth in Malaysia by Elaborating the Green Economy and Environmental Efficiency. *International Journal of Energy Economics and Policy*, 9(5), 465-473.
- Kilelu, C. W., Klerkx, L., Leeuwis, C., & Hall, A. (2011). Beyond knowledge brokering: an exploratory study on innovation intermediaries in an evolving smallholder agricultural system in Kenya. *Knowledge Management for Development Journal*, 7(1), 84-108.
- Klerkx, L., & Proctor, A. (2013). Beyond fragmentation and disconnect: Networks for knowledge exchange in the English land management advisory system. *Land use policy*, 30(1), 13-24.
- Klerkx, L., Schut, M., Leeuwis, C., & Kilelu, C. (2012). Advances in knowledge brokering in the agricultural sector: towards innovation system facilitation. *ids Bulletin*, 43(5), 53-60.

- Labarthe, P., & Laurent, C. (2013). Privatization of agricultural extension services in the EU: Towards a lack of adequate knowledge for small-scale farms? *Food policy*, 38, 240-252.
- Lagerkvist, C. J., Shikuku, K., Okello, J., Karanja, N., & Ackello-Ogotu, C. (2015). A conceptual approach for measuring farmers' attitudes to integrated soil fertility management in Kenya. *NJAS-Wageningen Journal of Life Sciences*, 74, 17-26.
- Liu, T., Bruins, R., & Heberling, M. (2018). Factors influencing farmers' adoption of best management practices: A review and synthesis. *Sustainability*, 10(2), 432.
- McCullough, E. B., & Matson, P. A. (2016). Evolution of the knowledge system for agricultural development in the Yaqui Valley, Sonora, Mexico. *Proceedings of the National Academy of Sciences*, 113(17), 4609-4614.
- Negatu, B., Kromhout, H., Mekonnen, Y., & Vermeulen, R. (2016). Use of Chemical Pesticides in Ethiopia: a cross-sectional comparative study on Knowledge, Attitude and Practice of farmers and farm workers in three farming systems. *The Annals of occupational hygiene*, 60(5), 551-566.
- Papagiannakis, G., & Lioukas, S. (2012). Values, attitudes and perceptions of managers as predictors of corporate environmental responsiveness. *Journal of environmental management*, 100, 41-51.
- Saeidi, S. P., Othman, M. S. H., Saeidi, P., & Saeidi, S. P. (2018). The moderating role of environmental management accounting between environmental innovation and firm financial performance. *International Journal of Business Performance Management*, 19(3), 326-348.
- Sands, J., Lee, K.-H., & Gunarathne, N. (2015). Environmental Management Accounting (EMA) for environmental management and organizational change. *Journal of Accounting & Organizational Change*.
- Senger, I., Borges, J. A. R., & Machado, J. A. D. (2017). Using the theory of planned behaviour to understand the intention of small farmers in diversifying their agricultural production. *Journal of rural studies*, 49, 32-40.
- Smith, L. E., & Siciliano, G. (2015). A comprehensive review of constraints to improved management of fertilizers in China and mitigation of diffuse water pollution from agriculture. *Agriculture, Ecosystems & Environment*, 209, 15-25.
- Somjai, S. & Jermstittiparsert, K. (2019). The Trade-off between Cost and Environmental Performance in the Presence of Sustainable Supply Chain. *International Journal of Supply Chain Management*, 8(4), 237-247.



- Sriyakul, T., Umam, R., & Jermsittiparsert, K. (2019). Supplier Relationship Management, TQM Implementation, Leadership and Environmental Performance: Does Institutional Pressure Matter. *International Journal of Innovation, Creativity and Change*, 5(2), 211-227.
- Tandi Lwoga, E., Stilwell, C., & Ngulube, P. (2011). Access and use of agricultural information and knowledge in Tanzania. *Library review*, 60(5), 383-395.
- Tashakor, S. (2019). Environmental management accounting practices in Australian cotton farming. *Accounting, Auditing & Accountability Journal*, 32(4), 1175-1202. doi: 10.1108/AAAJ-04-2018-3465
- Utami, C. W. (2017). Attitude, Subjective Norm, Perceived Behaviour, Entrepreneurship Education and Self Efficacy Toward Entrepreneurial Intention University Student In Indonesia.
- Vasile, E., & Man, M. (2012). Current dimension of environmental management accounting. *Procedia-Social and Behavioural Sciences*, 62, 566-570.
- Verma, P., & Sinha, N. (2018). Integrating perceived economic wellbeing to technology acceptance model: The case of mobile based agricultural extension service. *Technological Forecasting and Social Change*, 126, 207-216.
- Zeweld, W., Van Huylbroeck, G., Tesfay, G., & Speelman, S. (2017). Smallholder farmers' behavioural intentions towards sustainable agricultural practices. *Journal of environmental management*, 187, 71-81.