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The Role of Management Information Systems on the Performance of Agricultural Extension

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The purpose of this study is to examine the role of management information systems (MIS) such as system quality, information quality and organizational impact on the performance of agriculture extension. Agricultural extension providers of Thailand that are registered under the ministry of agriculture are the respondents of the study. Data was gathered through a questionnaire through the mail. The findings reveal that all dimensions of MIS, such as system quality, information quality and organizational impact have a positive association with the performance of agricultural extensions. These findings are useful for the policymakers of the agriculture sector of Thailand in that implementation of suggestions can improve the quality of MIS that enhances the quality of agriculture extensions and ultimately effects the production of the agriculture sector.

Key words: *Management Information System, Agricultural Extension, System Quality, Information Quality, Organizational Impact.*

Introduction

The agriculture sector of developing countries is considered the backbone of a country's economy. It makes a prominent contribution to the gross domestic product (GDP), exports and removing unemployment as a condition in a country. The agriculture sector of Thailand

demonstrates these qualities and is highly specialized, diversified and competitive (Banchuenvijit, 2016). Moreover, the exports of the agriculture sector are internationally successful. Rice is considered the most prominent crop of the agriculture sector because it represents 60 percent of the whole of agriculture production, about 13 million Thai farmers grow it and about half of the cultivated land is used for rice cultivation (Chanthawong & Dhakal, 2016). Furthermore, Thailand is the key exporter of rice in the global rice market (Jermsittiparsert, Sriyakul, & Rodoonsong, 2013). The export of rice contributes 1.3 percent of the GDP of the country, while the whole of agriculture production represents 9 to 10.5 percent of the GDP of Thailand (Suphannachart, 2017). Moreover, around 40 percent of the total population of the country work in this prominent sector and their work was valued at US$2945 according to the ministry of agriculture. Thailand also produces a significant amount of other agriculture products such as sugar, tapioca, fish, grains, rubber and fishery products, significantly the exports of canned tuna, frozen shrimp and pineapple are at peak (Laothamatas, 2019).

Table 1 below shows the importance of the agriculture sector in the economy of Thailand. According to these figures, the average cash inflow in terms of farm income is US$712.55 while the average non-cash income of the is US$521.57 and average total income of farms is US$1233.7. Moreover, the average cash farm expenses are US$359.22, while average non-cash farm expenses are US$746.67 and average total expenses are US$1105.9. Finally, average net farm income is US$353.33 while average total income is US$127.84. These figures show that farms produce a satisfactory income for the economy of Thailand. The income and expenses of all size of farms are described in Table 1 below:

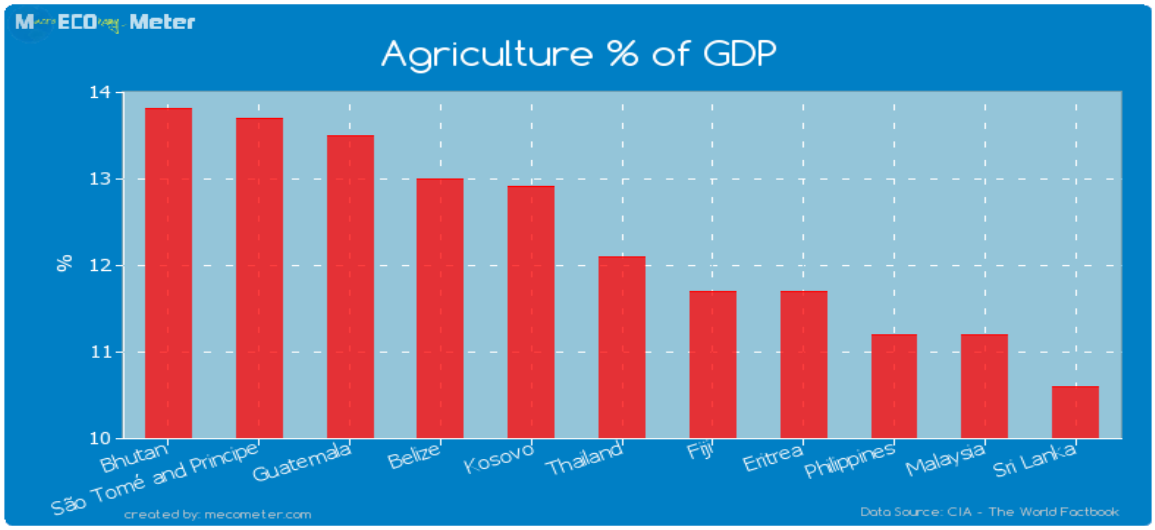
Table 1: Income from Agriculture Farming of Thailand (US$ per farm)

	Farm Size									
Item	< 0.32	0.32 - 1.60	1.60 - 3.20	3.20 - 4.80	4.80 - 6.40	6.40 - 8.00	8.00 – 9.60	9.60 – 11.20	> 11.20	Average
Cash Farm Income	522.4	605.88	656.47	702.35	812.16	837.25	887.45	1011.37	995.29	712.55
Non-cash Farm Inco.	540	486.67	544.71	535.69	459.61	511.76	542.75	581.57	618.04	521.57
Total Income	1062	1092.2	1201.2	1238.4	1271.8	1349.0	1430.6	1592.9	1613.3	1233.7
Cash Farm Expenses	361.2	304.71	328.24	342.75	356.86	520.00	497.65	438.04	390.20	359.22

Non-cash Farm Exp.	737.6	703.14	743.92	758.82	754.90	774.90	885.10	780.78	717.25	746.67
Total Expenses	1099	1007.8	1072.2	1101.6	1111.4	1294.9	1382.8	1218.8	1107.5	1105.9
Net Farm income	161.2	301.18	328.24	359.61	355.69	317.65	389.80	573.33	605.10	353.33
Total Income	-36.47	84.31	129.02	136.08	160.39	54.12	47.84	373.73	505.88	127.84

In addition, the quite handsome contribution of the agriculture sector in the GDP of Thailand was observed during the past decades. Figure 1 below shows the contribution of the agriculture sector of different countries to GDP. According to Figure 1, the Sri Lankan agriculture sector contributes about 5 percent in the GDP of the country while Malaysian and Philippian's agriculture sectors contribute around 11 percent to their GDP, and in Fiji the agriculture sector contributes around 11.5 percent to their GDP. The agriculture sector of Thailand contributes more than 12 percent to the country GDP. Although some other countries' agriculture sector makes more contribution to their GDP than in the Thai sector, for example Kosovo and Belize have 13 percent while Guatemala has 13.5 percent and Sao Tome and Principe have 13.8 percent while Bhutan has 14 percent contribution to GDP ry, Thailand also has a prominent contribution in this respect. Figure 1 below shows the contribution of the agriculture sector of different countries to GDP:

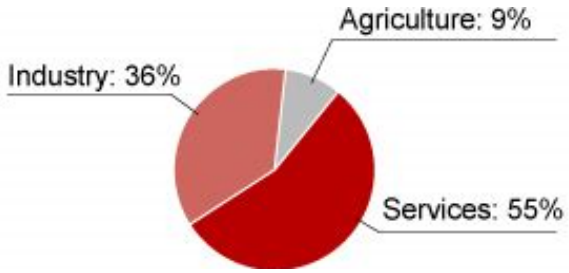
Figure 1. Contribution in GDP by Agriculture Sector



The relative importance of the agriculture sector in the economy of a country necessitates informed and appropriate intension of its policymakers and regulators particularly as

currently the contribution of the agriculture sector in Thailand is decreasing and is at only 9 percent contribution to GDP (Chambon, Ruf, Kongmanee, & Angthong, 2016) which other sectors have quite a prominent contribution, such as the industry sector which contributes 36 percent while the services sector contributes 55 percent to Thai GDP as represented in Figure 2 below:

Figure 2. Different Sector Contribution in GDP



There is a need to develop different policies to improve the contribution of the agriculture sector of Thailand to the country GDP and its overall production and performance. Thus, agriculture extensions are a possible way to increase production and performance. Agriculture extensions can improve the process of the agriculture sector and result in increased performance of the overall agriculture sector. The importance of agriculture extensions in the agriculture sector highlights the need to explore this emerging topic. Thus, this study aims to investigate the role of MIS in terms of system quality, information quality and organizational impact on the performance of agricultural extensions that ultimately increase the performance of the agriculture sector of the country.

Literature Review

The operational definitions of variables used in the study are mentioned in this section of the study. Moreover, this section also provides the literature about all the variables as well as literature about the relationship among the variables under study.

Performance of Agricultural Extensions

The performance of agricultural extensions is relevant to their improvement of the performance of the whole agriculture system. Agriculture extensions should impact the performance, production and employment condition of the agriculture sector of the country. Moreover, "there is no universally-accepted framework for how to measure the performance of agricultural extension and advisory services. The best-fit framework suggests an impact chain approach, which investigates how components of the system (e.g., governance and management structures, organizational and individual capacities and methods and approaches) affect the performance of the system" (Ragasa, Ulimwengu,

Randriamamonjy, & Badibanga, 2016). Furthermore, a study by Ainembabazi et al. (2017) conducted on the performance of agriculture extension explains it as the increase in the overall system of the agriculture sector such as agriculture process, methods, production, exports and employment condition of the country.

Additionally, "agricultural extension is the application of scientific research and knowledge to agricultural practices through farmer education. Generally, an agricultural extension can be defined as the delivery of information inputs to farmers. The role and performance of extension services can be measured by its function of improving agricultural productivity" (Hounkonnou et al., 2018). Similarly, the performance of agriculture extensions can be measured by the improvement in the process, production and employment of the agriculture sector of the country (Faure, Davis, Ragasa, Franzel, & Babu, 2016). Thus, based on all of the above mentioned information, agriculture extensions performance was chosen as a main variable of the study.

System Quality

System quality refers to the quality of the system that produces quality products with the help of quality-oriented process for valued customers of the company. Moreover, "system quality, also known as a quality management system (QMS), ensures a business provides a standard of products or services that reflects the business' values and integrity. When customers feel that they are receiving good quality and value for their dollar, they are more likely to become repeat customers, helping grow business bottom line and increase market share" (McKnight, Lankton, Nicolaou, & Price, 2017). Furthermore, the quality of the system is defined as the quality of the whole process of the company that ensures the quality of the products that attract the valued customer towards the products of the company (Kumar, Zare, & Ghosh, 2017). Likewise, "system quality is also defined as the aggregate of the organizational activities, incentives, plans, policies, procedures, processes, resources, responsibilities, and the infrastructure required in formulating and implementing a total quality management (TQM) approach" (Mohammed et al., 2016). Similarly, system quality means the quality of the entire production department of the company that facilitates high quality production (Filippiadis et al., 2017). Thus, on this basis, this study used the quality system as an independent variable of the study.

Information Quality

Information quality is defined as content quality in regard to the information system and the use of information at the right place is also considered information quality. Moreover, "Information quality (IQ) is the quality of the content of information systems. It is often pragmatically defined as the fitness for use of the information provided". (Savazzi et al.,

2016). Likewise, the information is considered as quality information if it contains relevant content and is delivered in a timely manner and used meaningful for the improvement of the processes of the company (Kwag, González-Lorenzo, Banzi, Bonovas, & Moja, 2016). Moreover, "information quality is an integral part of a pre-dissemination review of information. Furthermore, it is also integral to information collection and is incorporated into the clearance process" (Barata & Cunha, 2017). Similarly, quality information is the information that enhances the quality of the entire system (Rodríguez et al., 2016). Thus, on the basis of the above, quality information is an independent variable of the study.

Organizational Impact

This term is used to describe the impact of the organization from different changes in the process of business activities. It also refers to the impact of the organization from the adoption of technology, changes in the major processes and adoption of new methods for the production of the company. Moreover, "the term organizational impact has a different meaning in each context where it is used. For instance, in any organization, you can examine the impact of any major change coming from inside or outside the firm. One way to better understand this phenomenon would be to examine the organizational impact of technology and its associated characteristics" (Newman, Miao, Hofman, & Zhu, 2016). Furthermore, it is defined as the impact of the organization in terms of different decisions about the enhancement of the business process of the company.

Similarly, in the case of the agriculture sector, decisions are made dependent upon organizational approval (Jaiswal & Dhar, 2016). Likewise, "you can also trace the organizational impact of technology on how the organization's work is performed. Employees must learn to continuously use newly introduced technologies effectively to perform their jobs well. A new software application or configuration could create new job tasks to be assigned by managers, thus creating another substantial organizational impact" (Jiang & Men, 2017). Furthermore, organizational impact refers to the involvement of the organization toward decision making in every process of the business entity (Nikpour, 2017). It also refers to the impact of the organization regarding the adoption of technology, changes in the major processes and adoption of new methods for company production. Thus, this study used organizational impact as an independent variable.

System Quality and Performance of Agricultural Extensions

The performance of the agriculture extensions depends upon the quality of the system existing in the organization. If system quality is high in the organization, quality of performance of agriculture extensions in the agriculture sector of the country is enhanced but if system quality is not good, quality is reduced (Turner, Klerkx, Rijswijk, Williams, &

Barnard, 2016). Further, a positive association has been observed between system quality and the performance of agricultural extensions. Similarly, the performance of agricultural extension is enhanced if a quality system is instilled in the agriculture sector of the country (Ragasa & Mazunda, 2018). Likewise, poor a quality-oriented agricultural sector loses performance of agriculture extensions that are provided to the farmers for improvement. Further, the high quality-oriented agricultural sector has achieved high performance of agriculture extensions that are provided to the farmers for improvement (Lameck, 2017). Additionally, system quality has a positive influence on the performance of agriculture extensions of the country. The performance of agriculture extensions can be increased through the quality system of the agriculture sector of the country (Sewell et al., 2017) as quality oriented performance of agriculture extensions also increases. Thus, to investigate the perceived positive association between system quality and performance of agriculture extensions, the following hypothesis has been developed:

H1: There is a positive association between system quality and performance of agriculture extensions in the agriculture sector of Thailand.

Information Quality and Performance of Agricultural Extensions

The performance of the agriculture extensions depends upon the quality of information that exists in the organization. If information quality is high and delivery timely it should enhance the quality of the performance of agriculture extensions in the agriculture sector of the country but if information quality is not good or delivered at the wrong time it will reduce the quality of the performance of agriculture extensions (Steiner & Hanks, 2016). Moreover, a positive association has been observed between information quality and performance of agricultural extensions of the country. Similarly, the performance of agricultural extension is enhanced if quality information is delivered on time in the organization (Tarandung, 2016). Likewise, poor information a quality-oriented agricultural sector has lost the performance of agriculture extensions that are provided to the farmers for improvement (Mushore et al., 2017).

Further, high information quality-oriented agricultural sectors achieve high performance of agriculture extensions that are provided to the farmers for improvement (Padilla, García, & Molina, 2018). Additionally, information quality has a positive influence on the performance of agriculture extensions of the country and the performance of agriculture extensions can be increase through quality information of the agriculture sector of the country (Auma, Christopher, Adrian, & Joshua, 2018). Moreover, quality-oriented and timely delivery enhance performance of agriculture extensions. Thus, regarding the perceived positive association between information quality and performance of agriculture extensions, this study also develops the following hypothesis.

H2: There is a positive association between information quality and performance of agriculture extensions in the agriculture sector of Thailand.

Organizational Impact and Performance of Agricultural Extensions

The performance of the agriculture extensions depends upon the positive organizational impact of the organization. If the impact of the organization is positive it should enhance the quality of the performance of agriculture extensions in the agriculture sector of the country but if the impact of organization is negative it will reduce the quality of the performance of agriculture extensions in the agriculture sector of the country (Elahi, Abid, Zhang, ul Haq, & Sahito, 2018). Moreover, a positive association has been observed between organization impact and performance of agricultural extensions of the country. Similarly, the performance of agricultural extension is enhanced if the organization has a positive impact on the decision making (Audretsch, 2018).

Further, negative organizational impact results in loss the performance of agriculture extensions that are provided to the farmers for improvement. The positive organizational impact achieves high performance of agriculture extensions that are provided to the farmers for improvement (Zougmoré et al., 2016). Additionally, the positive organizational impact has a positive influence on the performance of agriculture extensions of the country. Further, the performance of agriculture extensions can increase through positive organization impact of the agriculture sector of the country (Matthew & Mordecai, 2016).Elias, Nohmi, & Yasunobu, 2016). Thus, regarding the perceived positive association between organization impact and performance of agriculture extensions, this study also developed the following hypothesis.

H3: There is a positive association between organization impact and performance of agriculture extensions in the agriculture sector of Thailand.

Research Methods

The target population of the study is agriculture extension providers of Thailand. According to the Thailand Ministry of agriculture, 16 996 registered agriculture extension providers are working in the agriculture sector. Every 50th respondent was selected by applying systematic random sampling. A survey questionnaire was used to collect data from the respondents of the study. PLS-SEM was used for the analysis of the data. Every question in the questionnaire consists of a five-point Likert scale.

Measures

This study used the performance of agriculture extensions (PAE) as a dependent variable that has twelve items. Moreover, the current study also used the MIS with dimensions such as system quality (SQ), information quality (IQ) and organizational impact (OI) as an independent variable that have six, six and eleven items respectively (Rezaei, Asadi, Rezvanfar, & Hassanshahi, 2009).

Data Collection Procedure

Every 50th respondent of the target population of 16 996 registered agriculture extension was selected by applying systematic random sampling. A survey questionnaire was sent by mail to 400 selected respondents to collect the data. After twenty days, only 315 responses were received from the potential respondents. Fifteen of them were not up to standand and were eliminated from the study while the remaining 300 valid responses were used for analysis that is approximately, this is a 75 percent response rate.

Theoretical Framework

Findings

The findings consist of two models; the first model is about the validity and reliability of the data and the second model is about hypotheses testing. The measurement assessment model is for the validity and reliability of the data while the structural model assessment is for hypotheses testing. Firstly, this study deals with the measurement model that deals with two types of validity, convergent and discriminant. In terms of the convergent validity, the items were highly correlated with each other and can be verified by four criteria. First is the factor

loading that must be greater than 0.50, second is Cronbach's Alpha that must be greater than 0.70, third is composite reliability (CR) that must be greater than 0.70, and the final criteria are AVE that must be greater than 0.50. Table 2 below shows that all criteria are fulfilled and there is no problem with convergent validity.

Table 2: Convergent Validity

Constructs	Items	Loadings	Alpha	CR	AVE
Information Quality	IQ1	0.824	0.862	0.896	0.592
	IQ2	0.671			
	IQ3	0.710			
	IQ4	0.862			
	IQ5	0.876			
	IQ6	0.642			
Organizational Impact	OI1	0.812	0.905	0.921	0.515
	OI10	0.719			
	OI11	0.637			
	OI2	0.688			
	OI3	0.651			
	OI4	0.768			
	OI5	0.720			
	OI6	0.679			
	OI7	0.775			
	OI8	0.684			
	OI9	0.739			
Performance of Agricultural Extensions	PAE1	0.840	0.826	0.872	0.505
	PAE10	0.664			
	PAE11	0.853			
	PAE12	0.856			
	PAE3	0.475			
	PAE5	0.518			
	PAE8	0.657			
System Quality	SQ1	0.273	0.759	0.849	0.553
	SQ2	0.870			
	SQ3	0.764			
	SQ5	0.772			
	SQ6	0.867			

The second validity is discriminant, which means identifying constructs that are not highly correlated with each other. It can be checked by two criteria, first using Fornel Lacker and secondly, HTMT ratio. According to Fornel Lacker, the construct first value is greater than the rest of the values and Table 3 and 4 below reflect this.

Table 3: Fornel Lacker

	IQ	**OI**	**PAE**	**SQ**
IQ	0.770			
OI	0.749	0.718		
PAE	0.688	0.701	0.710	
SQ	0.400	0.450	0.481	0.743

Table 4: Cross Loadings

	IQ	**OI**	**PAE**	**SQ**
IQ1	0.824	0.699	0.606	0.296
IQ2	0.671	0.459	0.418	0.362
IQ3	0.710	0.524	0.477	0.357
IQ4	0.862	0.622	0.619	0.294
IQ5	0.876	0.669	0.615	0.279
IQ6	0.642	0.423	0.376	0.315
OI1	0.690	0.812	0.568	0.301
OI10	0.583	0.719	0.533	0.247
OI11	0.390	0.637	0.453	0.505
OI2	0.441	0.688	0.489	0.478
OI3	0.405	0.651	0.546	0.428
OI4	0.650	0.768	0.518	0.292
OI5	0.501	0.720	0.427	0.248
OI6	0.476	0.679	0.462	0.319
OI7	0.651	0.775	0.590	0.284
OI8	0.473	0.684	0.387	0.217
OI9	0.585	0.739	0.493	0.235
PAE1	0.548	0.555	0.840	0.392
PAE10	0.477	0.461	0.664	0.374
PAE11	0.602	0.599	0.853	0.434
PAE12	0.570	0.606	0.856	0.383
PAE3	0.257	0.307	0.475	0.162
PAE5	0.252	0.317	0.518	0.171
PAE8	0.557	0.528	0.657	0.359
SQ1	0.198	0.218	0.222	0.273

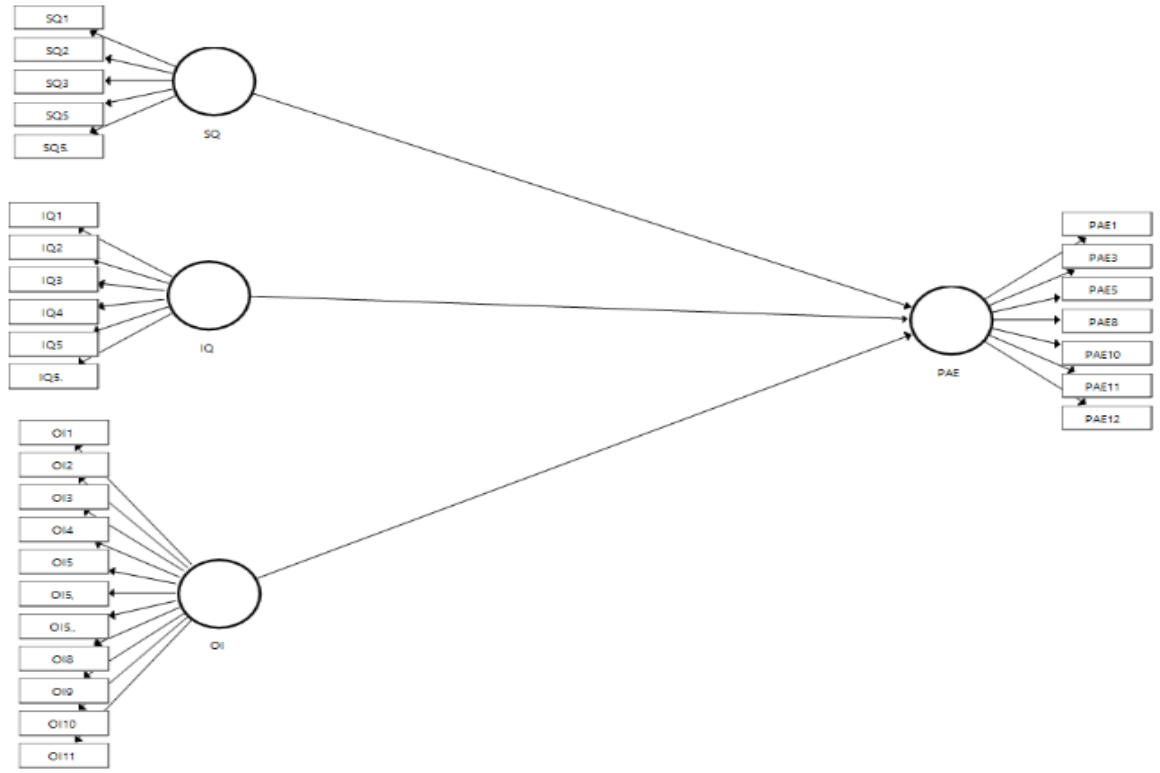
Table 4 Continue				
	IQ	**OI**	**PAE**	**SQ**
SQ2	0.309	0.370	0.404	0.870
SQ3	0.307	0.364	0.406	0.764
SQ5	0.291	0.305	0.344	0.772
SQ6	0.352	0.376	0.360	0.867

The Fornel Lacker criteria are old and most researchers discourage its use. The newer criteria for determining discriminant validity is HTMT ratio. According to these criteria, the values must be less than 0.85 and Table 5 below shows that discriminant validity is valid.

Table 5: HTMT Ratio

	IQ	**OI**	**PAE**	**SQ**
IQ				
OI	0.825			
PAE	0.775	0.789		
SQ	0.520	0.552	0.595	

Figure 3. Measurement Assessment Model

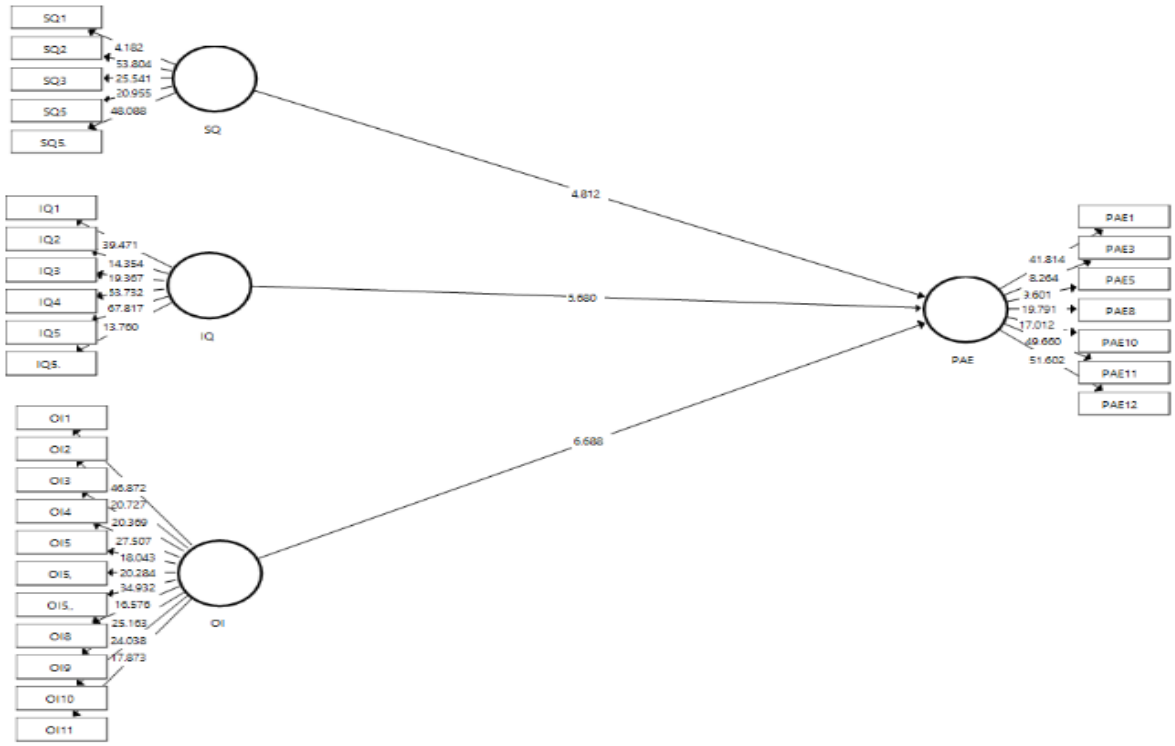


The second model is a structural assessment model that is used to test the hypotheses. The findings of the model show that information quality has a positive association with performance of agricultural extensions because p<0.05, T statistics are greater than 1.64, no zero exist between confidence intervals and positive sign with the beta value. Moreover, the organizational impact has a positive association with performance of agricultural extensions because p<0.05, T statistics are greater than 1.64, no zero exist between confidence intervals and positive sign with the beta value. Similarly, system quality also has a positive association with performance of agricultural extensions because p<0.05, T statistics are greater than 1.64, no zero exist between confidence intervals and positive sign with the beta value.

Table 6: Path Analysis

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values	Confidence Interval 5 %	95%
IQ -> PAE	0.346	0.351	0.052	6.680	0.000	0.267	0.432
OI -> PAE	0.361	0.357	0.054	6.688	0.000	0.271	0.443
SQ -> PAE	0.180	0.182	0.038	4.812	0.000	0.123	0.244

Figure 4. Structural Assessment Model



Discussion

The agriculture sector is the backbone in the economy of developing countries and it is necessary to improve its processes, performance and production. Thus, it is currently an emerging area for researchers and the current study aimed to investigate the MIS for system quality, information quality and organizational impact on the performance of agricultural extensions. The findings exposed that the system quality dimension of MIS has a positive link with the performance of agricultural extensions which means that if systems are quality-oriented then agriculture performance will increase. Moreover, the results showed that the information quality dimension of MIS has a positive link with the performance of agricultural extensions, which means that if the information is quality-oriented and delivered in a timely manner, then agriculture performance will increase. In addition, the findings exposed that the organizational impact dimension of MIS has a positive link with the performance of agricultural extensions which means that if the organization has a positive impact on the decisions of its management, especially the management of the agriculture sector, then agricultural performance will increase. These results are similar with the findings of Rezaei et al. (2009), Faure et al. (2016) and Filippiadis et al. (2017) who also found the positive link between MIS and performance of the agriculture sector.

Conclusion and Suggestions

Finally, the present study concludes that if the systems of the agriculture sector are quality-oriented and delivered in a timely manner and the organization has a positive impact on the decisions of the management then the performance of the agriculture extensions will increase. Thus, it is the duty of policymakers to focus on these points and enhance the processes, performance and production of the agriculture sector of the country. They should develop policies that enhance the information and system quality of businesses to increase the agricultural extensions and production.

Limitations and Future Directions

The present study has some limitations that would be the starting point for future prospective researchers. Firstly, this study takes only the Thai agriculture sector into consideration and ignores the other sectors and future research can check the MIS impact on the other national sectors. Secondly, the scope of the study is only Thailand and cross country analysis could be an interesting field for future research. The present study also uses only three dimensions of MIS: system quality, information quality and organizational impact and MIS has many other dimensions that future researchers could study. This study investigates only the agricultural extensions providers and future research could add other relevant MIS respondents.

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