

The Role of Agricultural Extension Education in the Entrepreneurial Competencies of University Students in Thailand

Aernporn Sirirat^a, Rutchanok Hempolchom^b, Kittisak Jernsittiparsert^{c,d*}, ^{a,b}Graduate School, Suan Sunandha Rajabhat University, Bangkok, Thailand, ^cDepartment for Management of Science and Technology Development, Ton Duc Thang University, Ho Chi Minh City, Vietnam, ^dFaculty of Social Sciences and Humanities, Ton Duc Thang University, Ho Chi Minh City, Vietnam,
***Corresponding Author Email:** ^{c,d*}kittisak.jernsittiparsert@tdtu.edu.vn,
^aaernporn.si@ssru.ac.th

This study centres on the role of agricultural extension education on entrepreneurial competencies of public sector universities situated in Bangkok, Thailand. The study aims to ensure the role of education in selecting entrepreneurial activities, especially in the field of agriculture. Data from the study was collected from students of public sector universities who have selected the agriculture as specialisation. Simple random sampling was used for the selection of respondents, and PLS-SEM used for data analysis. The findings demonstrated that educating about agricultural extension has a positive role in the development of competences and selection of agriculture as a profession. This study suggests that policymakers should improve agriculture education in institutions as improvements would increase entrepreneurialism in the field of agriculture.

Key words: *Entrepreneurial Competencies, Agricultural Education, Agricultural Extension.*

Introduction

The need for agricultural products is growing globally due to the increasing level of population of the world. It is an enormous challenge for countries that are agriculturally dependent, especially developing countries. Most developing countries are known as 'agriculture countries' and include India, Bangladesh, Pakistan, and Thailand (Stewart &

Dudash, 2017). Moreover, the agricultural sector is considered the economic backbone in in these and other developing countries. Similarly, the Thai economy is dependent on the agricultural sector because it contributes highly to employment, exports, and GDP (Pongpiachan, Hattayanone, & Cao, 2017). The agricultural sector plays a pivotal role in the development of Thailand (Jernsittiparsert, Sriyakul, & Rodoonsong, 2013) as approximately 70 million people (or one-third of the total population) are attached to this sector. Moreover, the contribution of Thailand's agricultural sector to total exports is 25% and where approximately 30% of its total land area is used for agricultural purposes. Likewise, the agricultural sector contributes more than 10% to national GDP (Chuchird, Sasaki, & Abe, 2017). Crop production represents roughly 60% of total agriculture production, those being rice and rubber. Another prominent agricultural sector concerns fishing and represents nearly 14% of total agricultural production. Animal products represent 9% of total agricultural production while the agro-processing industry 11% (Riwthong, Schreinemachers, Grovermann, & Berger, 2017).

Table 1 below shows the exportation of Thai fruit crops:

Table 1: Exports of Fruit Crops of Thailand (Million US\$)

Fruit Crops	2009	2010	2011	2012	2013	2014
Mango	46.2	49.9	48.2	64.7	77.6	85.2
Longan	86.9	117.9	113.3	200.3	272.7	274.3
Durian	123.4	159.7	149.2	180.3	231.2	275.2
Mangosteen	24.0	60.6	63.1	66.8	94.2	138.6
Rambutan	4.1	4.6	5.7	7.5	19.9	20.2
Tangerine	8.7	3.9	1.6	3.0	1.3	1.2
Pomelo	3.5	3.7	4.2	4.4	4.4	7.3
Lychee	19.1	26.6	17.1	12.2	18.4	11.8
Banana	3.7	4.8	3.1	2.6	1.8	1.5
Baby Banana	2.4	2.4	3.3	5.2	4.5	4.8

Source: Ministry of Agriculture and Corporative

According to the figures in Table 1, durian fruit tops the export list. Its export value was US\$123.40 in 2009 and, with continued increases, reached US\$275.20. Longan is the second highest export with US\$86.90 in 2009 and subsequently reaching US\$274.30 in 2014. Mangosteen exports were US\$24.00 in 2009 and US\$138.60 in 2014. Furthermore, mango is in the fourth position in terms of exports. Its exports were US\$46.2 in 2009 and with continues increase its exports reached US\$85.2.

In addition, rambutan is at fifth position in terms of exports. Its exports were US\$4.1 in 2009 and with continues increase its exports reached US\$20.2. Additionally, lychee is at the sixth

position in terms of exports. Its exports were US\$19.1 in 2009 and with continues increase its exports reached US\$11.8. Moreover, pomelo is in the seventh position in terms of exports. Its exports were US\$3.5 in 2009 and with continues increase its exports reached US\$7.3. Similarly, baby banana and banana is at the eighth and ninth position respectively in terms of exports. Their exports were US\$2.4 and US\$3.7 in 2009 and with continues increase its exports reached US\$1.5 and US\$4.8 respectively. However, tangerine is in the last position in terms of exports. Its exports were US\$8.7 in 2009, and instead of increasing, its exports decreased and reached US\$1.2.

Table 2 presents the exports of agricultural goods and foods of six ASEAN countries such as Indonesia, Thailand, Philippines, Viet Nam, Malaysia, and Singapore.

Table 2: Agricultural Goods and Foods Exports ASEAN Countries (Billion US\$)

Countries	Agricultural Goods			Agri. Foods Exports, % of Total Agri. Exp.	Agricultural Area ('000Ha)
	Exports	Imports	Trade Balance		
Indonesia	42.6	21.5	21.1	0.75	56500
Malaysia	30.1	20.0	10.1	0.84	7749.5
Philippines	6.4	7.2	-0.7	0.91	12395
Singapore	10.9	14.3	-3.4	0.89	0.73
Thailand	40.4	16.6	23.7	0.73	21860
Viet Nam	28.5	15.8	12.7	0.82	10842

According to the figures in Table 2, the exports of agriculture products of Indonesia are US\$42.6 billion, while imports are US\$21.5 billion and the balance of trade favourable with US\$21.1 billion by using 56,500,000 acres agricultural area.

The exports of Malaysian agricultural products is US\$30.1 billion, while imports are US\$20.0 billion and the balance of trade is favourable with US\$10.1 billion by using 17,495,00 acres agricultural area.

In addition, the exports of Filipino agricultural products is US\$6.4 billion, while imports are US\$7.2 billion and the balance of trade is unfavourable with US\$-0.7 billion by using 12,395,000 acres agricultural area.

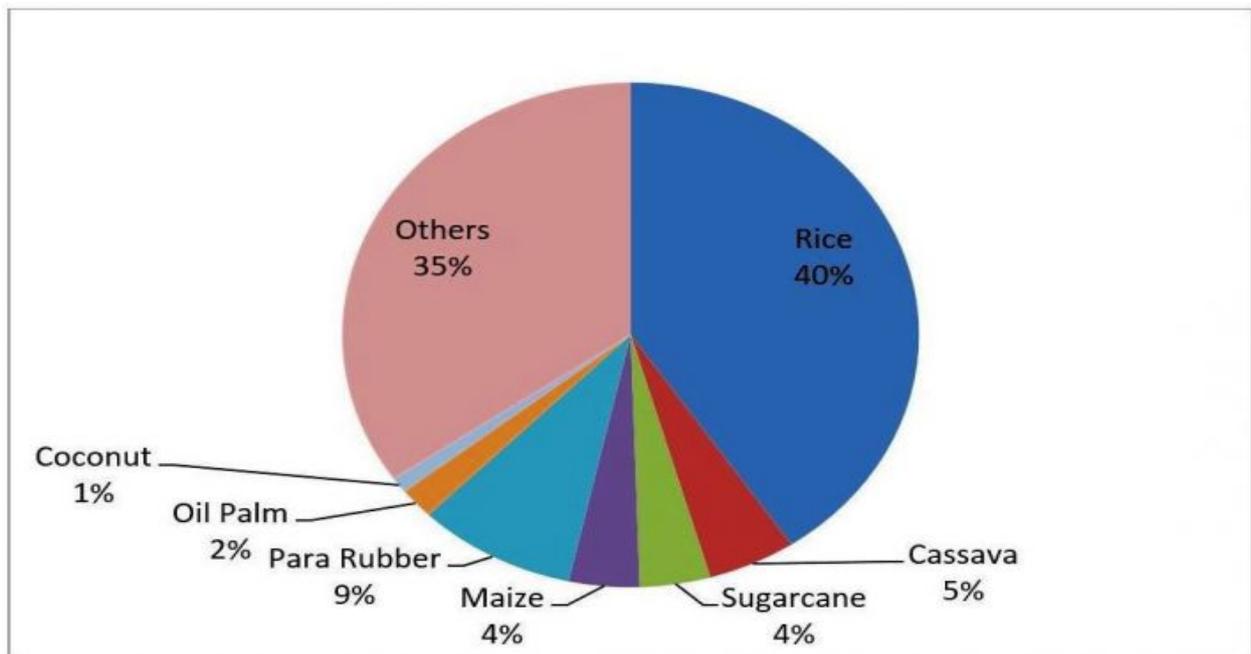
Furthermore, the exports of agriculture products of Singapore are US\$10.9 billion, while imports are US\$14.3 billion and the balance of trade is unfavourable with US\$-3.4 billion by using 73,000 acres agricultural area.

Additionally, the exports of agriculture products of Viet Nam are US\$28.5 billion, while imports are US\$15.8 billion and the balance of trade is favourable with US\$12.7 billion by using 10,842,000 acres agricultural area.

Likewise, the exports of agriculture products of Thailand are US\$40.4 billion, while imports are US\$16.6 billion and the balance of trade is favourable with US\$23.7 billion by using 21,860,000 acres agricultural area. These figures show that the balance of trade in Thailand is better than other ASEAN countries by using less agricultural area.

Figure 1 below depicts the percentage of agricultural production by food type in Thailand. According to the figures, rice produced by Thailand is 40% of the country's total agricultural production. Para rubber produced by Thailand is 9% while cassava stands at 5% of the country's total agricultural production. In addition, sugarcane and maize sit at 4% while palm oil at 2% and coconut at oil 1% of the country's total agricultural production.

Figure 1. Percentage Production of Agricultural Crops of Thailand



Notwithstanding the importance of Thailand's agricultural sector, as presented in Figure 1, the agriculture industry is in crisis owing to a 0.67 percent drop in growth to 3.10 percent. Thus, there is a need to improve this vital sector by providing facilities and skilled trainers and educators.

Therefore, the aim of this study is to investigate the role of education and entrepreneurial activities to promote growth, especially in the field of agriculture.

Literature Review

The operational definitions of constructs used in this study and recent literature is provided below. Additionally, previous literature on the relationships of variables used in this study is provided.

Entrepreneurial Competencies

Entrepreneurial competencies are the skills and ability of an entrepreneur to manage, organize, and establish the enterprise according to available resources and knowledge. ‘Entrepreneurial competencies are the skills necessary for an entrepreneur to venture into an enterprise; organise and manage an enterprise ably and competently; and to realise the goal for which the enterprise is established. These competencies help and entrepreneur to successfully venture into an enterprise’ (RezaeiZadeh, Hogan, O’Reilly, Cunningham, & Murphy, 2017). It is clear that entrepreneurial competencies refer to the knowledge, ability, and skills of owners to develop, manage, and organize the business entity (Mamun, 2016). In the same way, ‘entrepreneurial competencies refer to the key characteristics that should be possessed by successful entrepreneurs to perform entrepreneurial functions effectively. Competencies are defined as the combination of knowledge, abilities, and attitudes needed to accomplish a role efficiently’ (Hashim, Raza, & Minai, 2018).

Entrepreneurial competencies define the characteristics and skills of the entrepreneur that should positively influence owners in performing the development and management of the business. ‘Entrepreneurial competencies are defined as characteristics such as generic and special knowledge, motives, traits, self-images, social roles and skills which result in the birth of venture, its survival and/or growth’ (Mohsin, Halim, & Farhana, 2017). Evidently, entrepreneurial competencies are necessary for the development of new business entities or selecting the field of entrepreneurship. This relationship is also considered by the current study as a construct and main variable.

Academic Knowledge of Agricultural Extensions

Academic Knowledge of Agricultural Extension refers to the knowledge provided by institutions and transferred to students via that learning institutions and its materials (Drape, Lopez, & Radford, 2016).

‘Agricultural extension-related academic knowledge is learned in school; it is usually theory-based since one spends most their time learning concepts and theories. Professional knowledge is knowledge which is gained through the application of theory into



practice while on-the-job. A student's experience would primarily be academically based, given a choice between academic and professional' (Hyland, 2016).

The knowledge of agricultural extension refers to the type of knowledge provided by the institution (McKim, Sorenson, & Velez, 2016). Furthermore, the agricultural extension knowledge is provided by teachers, along with contributions from parents and the community and in partnership with institutions.

'Agricultural extension related academic knowledge is one of the ways in which almost all academics try to verify their knowledge about agriculture extension and set high-quality standards for academic peer review, whereby they are permitted to publish their knowledge if it is found credible by their peers' (McCullough & Matson, 2016).

Without a doubt, academic knowledge of agricultural extensions is necessary for the development of new business entities or the selection of agriculture entrepreneurship. This relationship is used as a construct and independent variable of the study.

Foundation Knowledge of Agricultural Extensions

This is knowledge already held by a person or knowledge they have acquired from their surroundings. This knowledge has greater impact than academic knowledge in the mind of the entrepreneur (Ginige et al., 2016). 'It also refers to knowledge that is getting from a group of parts working together as a whole, for example: understanding the policies influence the work within a company or industry as a whole, and further into the larger community or environment' (Medema et al., 2017).

This is knowledge that comes from the experience. Individuals interacting and learning from others acquire knowledge by watching and doing in their own surroundings (Stone, 2016). 'Foundation knowledge refers to observation and application. That is the base from which we all build. Each person is exposed to some subset of all possible experiences and data. What you have seen, felt, tasted, heard, read, smelled, and otherwise sensed forms the basis from which you formulate everything else' (Bardy, Rubens, & Pelzmann, 2016).

Thus, foundation knowledge of agricultural extension is necessary for the development of new business entities or selection of agriculture entrepreneurs. These two represent a construct and independent variable of the study.

Teaching Strategy Knowledge of Agricultural Extensions

This is knowledge transferred from a teaching strategy a teacher uses in teaching about agricultural extension (Rice & Kitchel, 2016b). This knowledge is important because teachers develop the necessary entrepreneurial skills and competencies in students. Teachers are the leaders and providers and should possess the knowledge and skills needed to instruct their students (Rice & Kitchel, 2016a). Peralta, Dudley, and Cotton (2016) refer to the strategies that teachers adopt to transfer knowledge about the field of specialisation to their students.

Academic Knowledge of Agricultural Extensions and Entrepreneurial Competencies

The academic knowledge of agricultural extension is necessary for the improvement of skills, knowledge and abilities concerning agricultural entrepreneurship. A positive association has been observed in academic knowledge of agricultural extension and entrepreneurial competencies (Sinyolo, Mudhara, & Wale, 2017). Entrepreneurial competencies depend on academic knowledge about agricultural extension. If an entrepreneur gains strong academic knowledge, then they have a comprehensive range of entrepreneurial competencies.

Academic knowledge about agricultural extensions plays a positive role in the teaching of entrepreneurial competencies and skills (Yusoff, Ahmad, & Halim, 2016). If an entrepreneur wants to acquire additional skills, abilities, and knowledge, then the entrepreneur must access high quality academic knowledge available in reputable institutions. Additionally, academic knowledge about agricultural extensions is necessary for gaining the skills, abilities, and knowledge of agriculture entrepreneurship.

Academic knowledge about agricultural extension is needed to improve the sector as well as agricultural entrepreneurial competencies.

In light of the above, this study presents the following hypothesis:

H1: That there is a positive association between academic knowledge and agricultural entrepreneurial competencies.

Foundation Knowledge of Agricultural Extensions and Entrepreneurial Competencies

Foundation knowledge about agricultural extension is necessary for the improvement of agricultural entrepreneurship skills, knowledge, and abilities. A positive association has been observed in foundation knowledge about agricultural extension and entrepreneurial competencies (Armoogum, Ramasawmy, & Driver, 2016). These competencies are dependent on foundation knowledge. If an entrepreneur gains strong foundation knowledge,

then an entrepreneur has a comprehensive range competencies. Likewise, foundation knowledge about agricultural extensions plays a positive role in the transfer of agricultural entrepreneurial competencies and skills (Diise, Zakaria, & Mohammed). Similarly, an entrepreneur aspiring to acquire skills, abilities, and knowledge about agriculture entrepreneurship, must have access to high quality knowledge of that area. Thus, foundation knowledge about agricultural extensions is needed to improve the agriculture sector and agricultural entrepreneurial competencies.

This study develops the following hypothesis:

H2: That there is a positive association between foundation knowledge about agricultural extension and agricultural entrepreneurial competencies.

Teaching Strategies Knowledge of Agricultural Extensions and Entrepreneurial Competencies

Teaching agricultural extension is necessary for the improvement of skills, knowledge, and abilities about agricultural entrepreneurship. A positive association has been observed in teaching strategies about agricultural extension and agricultural entrepreneurial competencies (Karimi, Biemans, Lans, Chizari, & Mulder, 2016). In addition, agricultural entrepreneurial competencies depend on the quality of teaching strategies. If an entrepreneur gains strong teaching strategies about agricultural extension, then they have a comprehensive range of agricultural entrepreneurial competencies. These strategies play a positive role in the use of agricultural entrepreneurial competencies and skills (Lans, Blok, & Wesselink, 2014). Similarly, if an entrepreneur seeks additional skills, abilities, and knowledge they must have access to high quality teaching in reputable institutions.

Teaching and modelling strategies agricultural extension knowledge is needed to improve the agriculture sector and agricultural entrepreneurial competencies as shown above.

This study provides the following hypothesis:

H3: That there is a positive association between teaching knowledge strategies about agricultural extension and agricultural entrepreneurial competencies.

Research Methods

The investigation considers students who have a specialisation in agriculture and who have studied in one of fifteen public sector universities situated in Bangkok, Thailand. Near to

9000 students undertake an agricultural specialisation. A survey questionnaire was used to collect data from respondents through personal visits. PLS-SEM was used to analyse the data.

Measures

Entrepreneurial Competencies (EC) are used as a dependent variable and comprises eight items. Academic knowledge of agricultural extensions (ANAE), foundation knowledge of agricultural extensions (FNAE) and teaching strategies knowledge of agricultural extensions (TSNAE) are used as independent variables and comprise six, eight and twelve items respectively (Lindner & Dooley, 2002).

Data Collection Procedure

There are fifteen public sector universities situated in Bangkok. Thirty students were selected through simple random sampling from each public university. Thus, a total of 450 questionnaires were distributed but with only 380 returned by respondents; 30 of these questionnaires were deemed invalid and eliminated from the study. The remaining 350 valid responses were used for analysis purposes and represents a 77.78% response rate.

Figure 2: Theoretical Framework

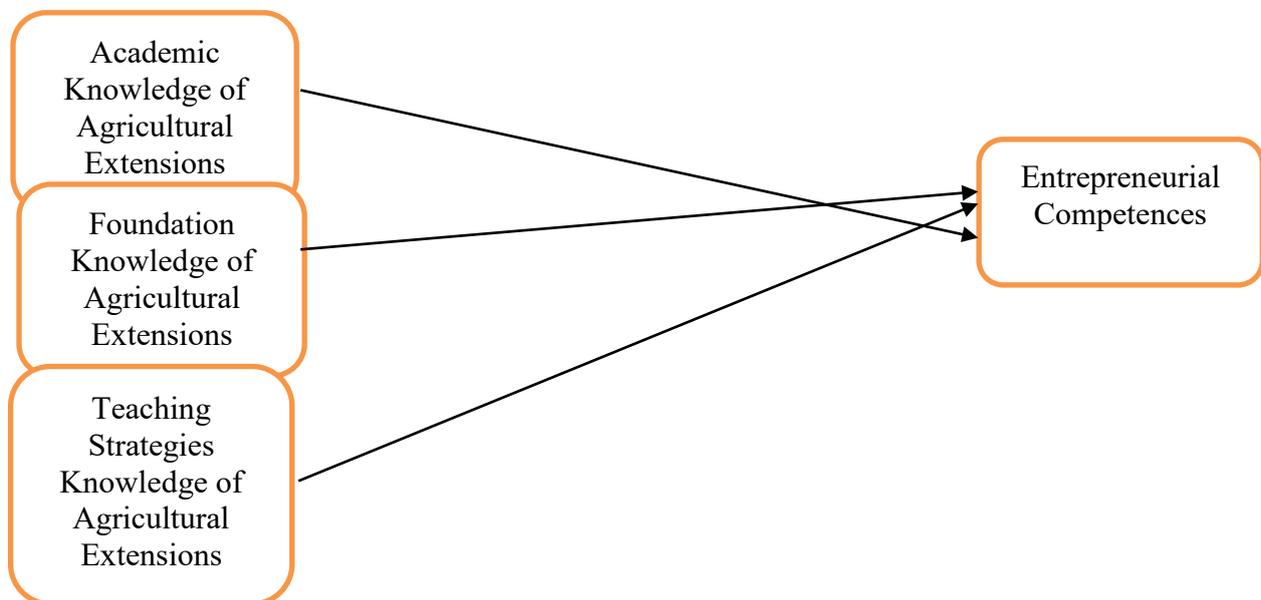


Figure 2 Results

Two types of modelling are used in this study: the Measurement Assessment Model (MAM) and the Structural Assessment Model (SAM). MAM is used to check the reliability and

validity of the data, items, and constructs of the study; while SAM is used to test the hypotheses developed in the previous section of the study.

There are two kinds of validity checked in MAM and they are discriminant and convergent validity. Convergent validity can be verified by the help of four criteria:

- i. Item factor loadings should be greater than 0.50,
- ii. Cronbach's Alpha of the constructs should be greater than 0.70 composite reliability,
- iii. (CR) of the constructs should be greater than 0.70, and
- iv. AVE of the constructs should be greater than 0.50.

Table 3 below shows that all criteria are satisfied and that convergent validity is achieved.

Table 3: Convergent Validity

Constructs	Items	Loadings	Alpha	CR	AVE
Academic Knowledge of Agricultural Extensions	ANAE1	0.273	0.759	0.849	0.553
	ANAE2	0.870			
	ANAE3	0.764			
	ANAE4	0.772			
	ANAE5	0.867			
Entrepreneurial Competencies	EC1	0.840	0.826	0.872	0.505
	EC2	0.475			
	EC3	0.518			
	EC4	0.657			
	EC5	0.664			
	EC6	0.853			
	EC8	0.856			
	Foundation Knowledge of Agricultural Extensions	FNAE1			
FNAE2		0.671			
FNAE3		0.710			
FNAE4		0.862			
FNAE5		0.876			
FNAE8		0.642			
Table 3 Continue					
Constructs	Items	Loadings	Alpha	CR	AVE

Teaching Strategies Knowledge of Agricultural Extensions	TSNAE1	0.812	0.905	0.921	0.515
	TSNAE10	0.739			
	TSNAE11	0.719			
	TSNAE12	0.637			
	TSNAE2	0.688			
	TSNAE3	0.651			
	TSNAE4	0.768			
	TSNAE5	0.720			
	TSNAE6	0.679			
	TSNAE8	0.775			
	TSNAE9	0.684			

The second validity can be checked in two ways: the first via the Fornel Lacker Method and, the second, the HTMT ratio. Using the Fornel Lacker Method, the first value of the construct is evidently greater than the remaining values.

Table 4 below shows that this criterion is satisfied and discriminant validity achieved.

Table 4: Fornel Lacker Model

	ANAE	EC	FNAE	TSNAE
ANAE	0.743			
EC	0.481	0.710		
FNAE	0.400	0.688	0.770	
TSNAE	0.450	0.701	0.749	0.718

Table 5: Cross Loadings

	ANAE	EC	FNAE	TSNAE
ANAE1	0.273	0.222	0.198	0.218
ANAE2	0.870	0.404	0.309	0.370
ANAE3	0.764	0.406	0.307	0.364
ANAE4	0.772	0.344	0.291	0.305
ANAE5	0.867	0.360	0.352	0.376
EC1	0.392	0.840	0.548	0.555
EC2	0.162	0.475	0.257	0.307
EC3	0.171	0.518	0.252	0.317
EC4	0.359	0.657	0.557	0.528
EC5	0.374	0.664	0.477	0.461
EC6	0.434	0.853	0.602	0.599

EC8	0.383	0.856	0.570	0.606
FNAE1	0.296	0.606	0.824	0.699
FNAE2	0.362	0.418	0.671	0.459
FNAE3	0.357	0.477	0.710	0.524
FNAE4	0.294	0.619	0.862	0.622
FNAE5	0.279	0.615	0.876	0.669
FNAE8	0.315	0.376	0.642	0.423
TSNAE1	0.301	0.568	0.690	0.812
TSNAE10	0.235	0.493	0.585	0.739
TSNAE11	0.247	0.533	0.583	0.719
TSNAE12	0.505	0.453	0.390	0.637
TSNAE2	0.478	0.489	0.441	0.688
TSNAE3	0.428	0.546	0.405	0.651
TSNAE4	0.292	0.518	0.650	0.768
TSNAE5	0.248	0.427	0.501	0.720
TSNAE6	0.319	0.462	0.476	0.679
TSNAE8	0.284	0.590	0.651	0.775
TSNAE9	0.217	0.387	0.473	0.684

The second way of checking the discriminant validity is via the HTMT ratio where the values should be less than 0.85.

Table 6 below shows that the above criteria are fulfilled and discriminant validity achieved.

Table 6: HTMT Ratio

	ANAE	EC	FNAE	TSNAE
ANAE				
EC	0.595			
FNAE	0.520	0.775		
TSNAE	0.552	0.789	0.825	

Figure 2. Measurement Assessment Model

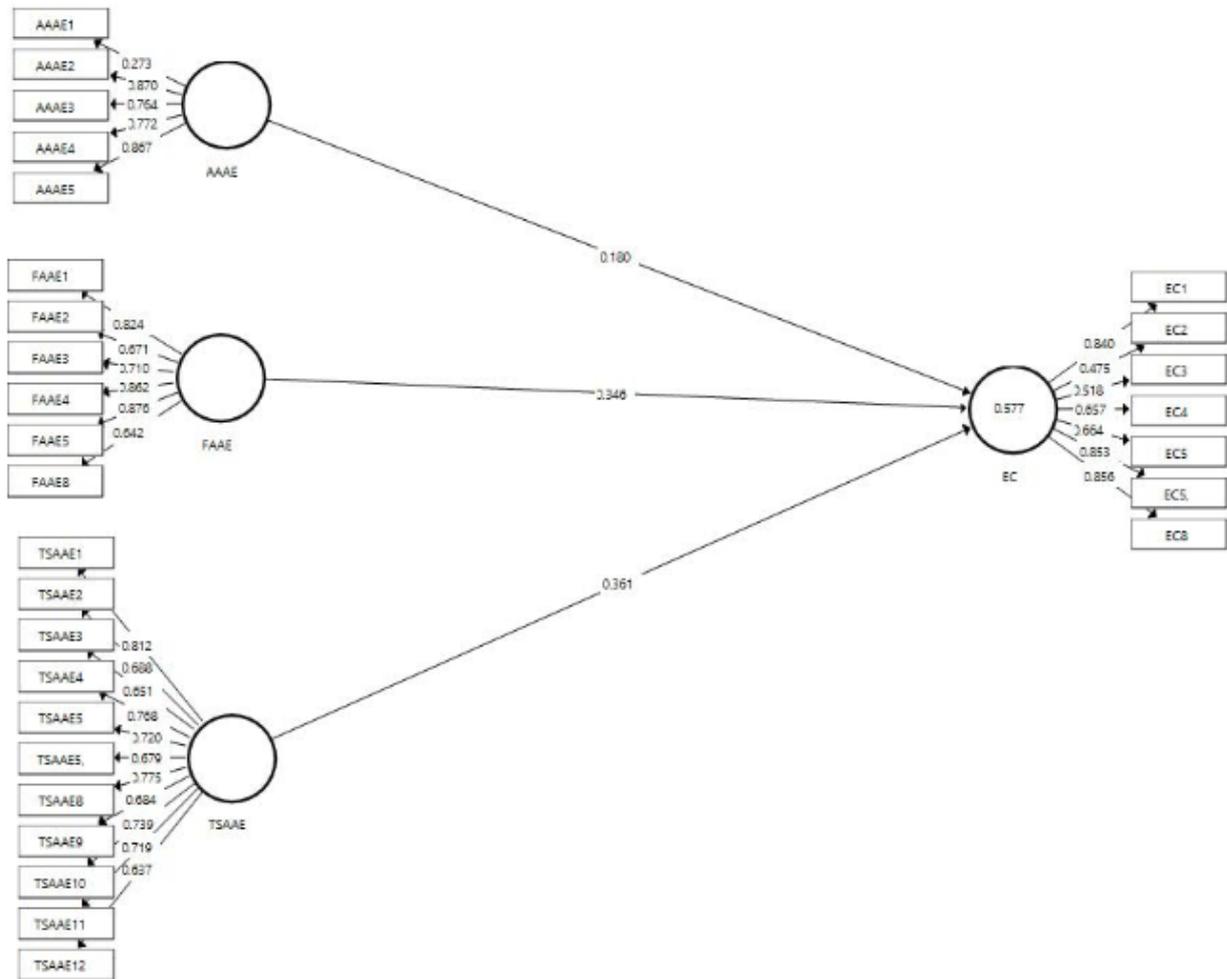


Table 7 below demonstrates the regression analysis and depicts the relationship between the variables used in the study. The results revealed a positive and significant association between academic knowledge of agricultural extension and entrepreneurial competencies because the $p < 0.05$, $t > 1.64$, demonstrates a zero relationship between confidence intervals and positive signs with a beta value of ($b = 0.180$).

The results also revealed a positive and significant association between foundation knowledge of agricultural extension and entrepreneurial competencies because the $p < 0.05$, $t > 1.64$, demonstrates a zero relationship between confidence intervals and positive sign with a beta value of ($b = 0.346$).

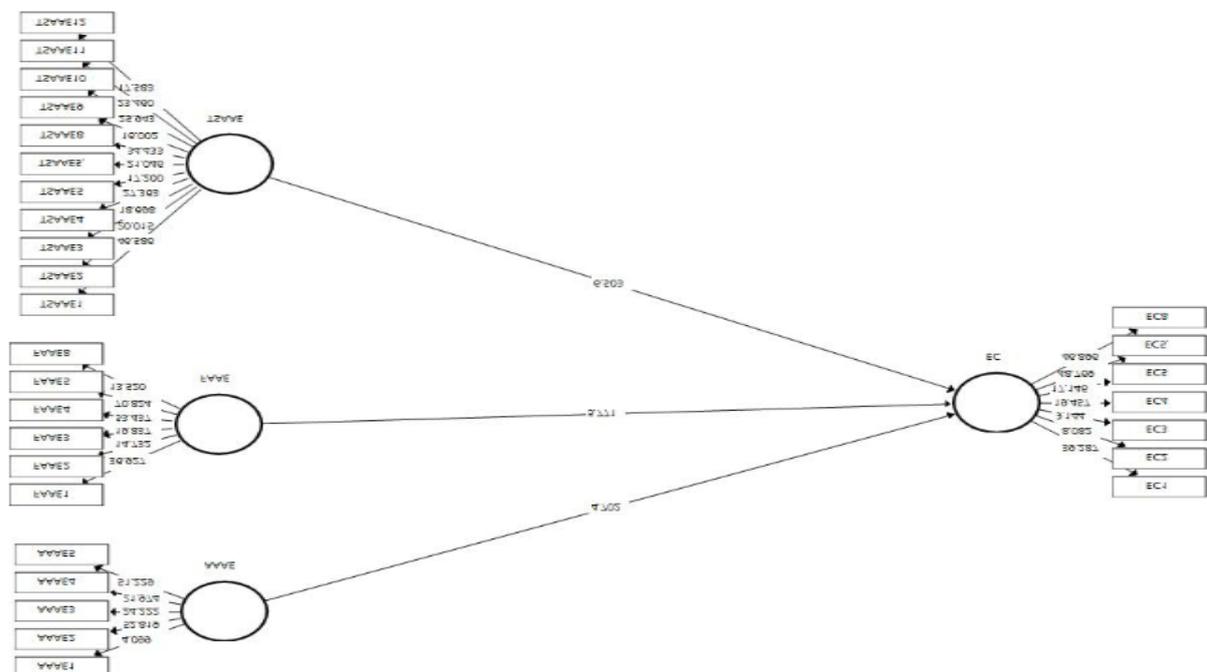
Additionally revealed was a positive and significant association between teaching strategies knowledge of agricultural extension and entrepreneurial competencies because the $p < 0.05$, t

> 1.64, demonstrates a nil relationship between confidence intervals and positive sign with a beta value of (b = 0.361).

Table 7: Path Analysis

	Original Sample	Sample Mean	Standard Deviation	T Statistics	P Values	Confidence Interval	
						5%	95%
ANAE -> EC	0.180	0.180	0.038	4.702	0.000	0.119	0.241
FNAE -> EC	0.346	0.349	0.051	6.771	0.000	0.266	0.432
TSNAE -> EC	0.361	0.360	0.055	6.503	0.000	0.269	0.451

Figure 3. Structural Assessment Model



Discussions

The agriculture sector is considered the economic backbone of developing countries. Accordingly, there is a strong need to improve performance in this sector so that a stable economy can be achieved.

This study investigated the contribution of academic institutions to improving Thailand's agricultural sector. The results revealed that academic knowledge of agricultural extensions does increase agricultural entrepreneurial competencies. These results parallel those of Spais (2010) who also revealed a positive association between academic knowledge of agricultural extensions and agricultural entrepreneurial competencies. The results further showed that



foundation knowledge of agricultural extension has the ability to increase entrepreneurial competencies. These results are verified by those of Mehlhorn, Bonney, Fraser, and Miles (2015) who also discovered a positive association between foundation knowledge and agricultural entrepreneurial competencies.

Teaching strategies about knowledge of agricultural extension have the ability to increase the agricultural entrepreneurial competencies. These results reflect those of Heinert (2016) who proved a positive association between teaching strategies knowledge and agricultural entrepreneurial competencies.

This study concluded that if entrepreneurs acquire academic knowledge from high-quality institutions and exemplary teachers, then entrepreneurs' agricultural skills and competencies will be of a very high standard. Clearly, academic institutions must improve the standard and teaching of agricultural education so that leading agricultural entrepreneurs exist and contribute to economic productivity.

Limitations exist in this study and should be addressed by future researchers. This study centred on only three aspects of education. This study does not address the mediation and moderation impact of the model. While the current study investigates students of public universities, subsequent research should include private universities. Finally, a cross-sectoral approach would further enrich research results and provide for a deeper understanding of how the agricultural sector can be supported.

REFERENCES

- Alia, S. N. (2017). *The influence of trust, information technology and communication skill on knowledge transfer in MADA (Muda Agricultural Development Authority)*. Universiti Utara Malaysia.
- Armoogum, N. Y., Ramasawmy, B., & Driver, B. M. F. (2016). The need to enhance the employability competences (knowledge, skills, autonomy, and attitudes) of undergraduates in Agriculture. Evidence from students' perceptions and employers' expectations. *Tuning Journal for Higher Education*, 4(1), 169-219.
- Bardy, R., Rubens, A., & Pelzmann, G. (2016). Using an Intellectual Capital Statement to Deploy Knowledge Management: The Example of an Austrian Chamber of Agriculture. *Electronic Journal of Knowledge Management*, 14(1).
- Chienwattanasook, K. & Jernsittiparsert, K. (2019). Impact of Entrepreneur Education on Entrepreneurial Self-Employment: A Case Study from Thailand. *Polish Journal of Management Studies*, 19(1), 106-116.
- Chowdhury, A. H., Hambly Odame, H., & Leeuwis, C. (2014). Transforming the roles of a public extension agency to strengthen innovation: lessons from the National Agricultural Extension Project in Bangladesh. *The Journal of Agricultural Education and Extension*, 20(1), 7-25.
- Chuchird, R., Sasaki, N., & Abe, I. (2017). Influencing factors of the adoption of agricultural irrigation technologies and the economic returns: A case study in Chaiyaphum Province, Thailand. *Sustainability*, 9(9), 1524.
- Davis, K., Ekboir, J., Mekasha, W., Ochieng, C. M., Spielman, D. J., & Zerfu, E. (2007). *Strengthening agricultural education and training in Sub-Saharan Africa from an innovation systems perspective: Case studies of Ethiopia and Mozambique*: Intl Food Policy Res Inst.
- Diise, A. I., Zakaria, H., & Mohammed, A. A. Effectiveness of Project Method of Teaching on Agricultural Knowledge and Skills Acquisition among Agricultural Science Students of Awe Senior High School in the Upper East Region, Ghana.
- Drape, T. A., Lopez, M., & Radford, D. (2016). Teacher efficacy and professional development needs of mid-career agriculture educators integrating the Next Generation Science Standards and other content areas. *Career and Technical Education Research*, 41(1), 33-48.
- Ghina, A., Simatupang, T. M., & Gustomo, A. (2017). The relevancy of graduates' competencies to the effectiveness of entrepreneurship education: A case study at SBM ITB-Indonesia. *Journal of Entrepreneurship Education*.



- Ginige, A., Walisadeera, A. I., Ginige, T., De Silva, L., Di Giovanni, P., Mathai, M., . . . Sebillo, M. (2016). *Digital knowledge ecosystem for achieving sustainable agriculture production: a case study from Sri Lanka*. Paper presented at the 2016 IEEE International Conference on Data Science and Advanced Analytics (DSAA).
- Hashim, N. A. B., Raza, S., & Minai, M. S. (2018). Relationship between entrepreneurial competencies and small firm performance: are dynamic capabilities the missing link? *Academy of Strategic Management Journal*.
- Heinert, S. B. (2016). *Describing characteristics of and best practices in entrepreneurship education for exemplary school-based agricultural education programs: A multiple case mixed methods study*. University of Florida.
- Hyland, K. (2016). *Academic Publishing: Issues and Challenges in the Construction of Knowledge-Oxford Applied Linguistics*: Oxford University Press.
- Jermisittiparsert, K. & Sommanawat, K. (2019). TQM, Human Oriented Elements and Organizational Performance: A Business Excellence Model for Higher Education Institutes of Thailand. *International Journal of Innovation, Creativity and Change*, 5(2), 514-532.
- Jermisittiparsert, K, Sriyakul, T., & Rodoonsong, S. (2013). Power(lessness) of the State in the Globalization Era: Empirical Proposals on Determination of Domestic Paddy Price in Thailand. *Asian Social Science*, 9(17), 218-225.
- Karimi, S., Biemans, H. J., Lans, T., Chizari, M., & Mulder, M. (2016). The impact of entrepreneurship education: A study of Iranian students' entrepreneurial intentions and opportunity identification. *Journal of small business management*, 54(1), 187-209.
- Lans, T., Blok, V., & Wesselink, R. (2014). Learning apart and together: towards an integrated competence framework for sustainable entrepreneurship in higher education. *Journal of cleaner production*, 62, 37-47.
- Lindner, J. R., & Dooley, K. E. (2002). Agricultural education competencies and progress toward a doctoral degree. *Journal of Agricultural Education*, 43(1), 57-68.
- Mamun, A. A. (2016). Access to credit, education and entrepreneurial competencies: a study among women micro-entrepreneurs in Malaysia. *Vision*, 20(3), 159-168.
- 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.
- McKim, A. J., Sorenson, T. J., & Velez, J. J. (2016). Exploring the Role of Agriculture Teachers in Core Academic Integration. *Journal of Agricultural Education*, 57(4), 1-15.

- Medema, W., Adamowski, J., Orr, C., Furber, A., Wals, A., & Milot, N. (2017). Building a foundation for knowledge co-creation in collaborative water governance: Dimensions of stakeholder networks facilitated through bridging organizations. *Water*, 9(1), 60.
- Mehlhorn, J. E., Bonney, L., Fraser, N., & Miles, M. P. (2015). Benchmarking entrepreneurship education in US, Australian, and New Zealand university agriculture programs. *Journal of Developmental Entrepreneurship*, 20(03), 1550017.
- Mohsin, A. M. B. A., Halim, H. A., & Farhana, N. (2017). Assessing the role of entrepreneurial competencies on innovation performance: A partial least squares (PLS) approach. *The Journal of Business Inquiry*, 16(1 Spec), 88-101.
- Odongo, W., Kalule, S. W., Kule, E. K., Ndyomugenyi, E., & Ongeng, D. (2017). Responsiveness of agricultural training curricula in African universities to labour market needs: the case of Gulu University in Uganda. *African Journal of Rural Development*, 2(1), 67-76.
- Peralta, L. R., Dudley, D. A., & Cotton, W. G. (2016). Teaching healthy eating to elementary school students: a scoping review of nutrition education resources. *Journal of School Health*, 86(5), 334-345.
- Pongpiachan, S., Hattayanone, M., & Cao, J. (2017). Effect of agricultural waste burning season on PM_{2.5}-bound polycyclic aromatic hydrocarbon (PAH) levels in Northern Thailand. *Atmospheric pollution research*, 8(6), 1069-1080.
- RezaeiZadeh, M., Hogan, M., O'Reilly, J., Cunningham, J., & Murphy, E. (2017). Core entrepreneurial competencies and their interdependencies: insights from a study of Irish and Iranian entrepreneurs, university students and academics. *International Entrepreneurship and Management Journal*, 13(1), 35-73.
- Rice, A. H., & Kitchel, T. (2016a). Deconstructing Content Knowledge: Coping Strategies and Their Underlying Influencers for Beginning Agriculture Teachers. *Journal of Agricultural Education*, 57(3), 208-222.
- Rice, A. H., & Kitchel, T. (2016b). Influence of Knowledge of Content and Students on Beginning Agriculture Teachers' Approaches to Teaching Content. *Journal of Agricultural Education*, 57(4), 86-100.
- Rice, A. H., & Kitchel, T. (2018). Agriculture Teachers' Integrated Belief Systems and its Influence on their Pedagogical Content Knowledge. *Journal of Agricultural Education*, 59(1).
- Riwthong, S., Schreinemachers, P., Grovermann, C., & Berger, T. (2017). Agricultural commercialization: Risk perceptions, risk management and the role of pesticides in Thailand. *Kasetsart Journal of Social Sciences*, 38(3), 264-272.



- Sinyolo, S., Mudhara, M., & Wale, E. (2017). The impact of social grant-dependency on agricultural entrepreneurship among rural households in Kwazulu-Natal, South Africa. *The Journal of Developing Areas*, 51(3), 63-76.
- Spais, G. S. (2010). Building adult educational programs in entrepreneurship based on Mezirow: the case of agricultural entrepreneurship *Global perspectives on educational leadership reform: The development and preparation of leaders of learning and learners of leadership* (pp. 323-356): Emerald Group Publishing Limited.
- Stewart, A. B., & Dudash, M. R. (2017). Flower-visiting bat species contribute unequally toward agricultural pollination ecosystem services in southern Thailand. *Biotropica*, 49(2), 239-248.
- Stone, G. D. (2016). Towards a general theory of agricultural knowledge production: environmental, social, and didactic learning. *Culture, Agriculture, Food and Environment*, 38(1), 5-17.
- Yaghoubi Farani, A., Karimi, S., & Motaghd, M. (2017). The role of entrepreneurial knowledge as a competence in shaping Iranian students' career intentions to start a new digital business. *European Journal of Training and Development*, 41(1), 83-100.
- Yusoff, A., Ahmad, N. H., & Halim, H. A. (2016). Entrepreneurial orientation and agropreneurial intention among malaysian agricultural students: the impact of agropreneurship education. *Advances in Business-Related Scientific Research Journal*, 7(1), 77-92.