Variables Affecting Economic Plant Cultivation Behavior for Environmental Conservation

Watagran Lapsan[1]
Narueset Prasertsri[2]
Chatchai Thiengkamol[3]

Abstract

The purpose of this research was to develop a model of factors affecting economic plant cultivation behavior for environmental conservation in Maha Sarakham Province by using survey research and a questionnaire as tools for data collection. The population was a total of 678 households from Kaeng-Kae Sub-district, Kosumpisai District, Maha Sarakham Province, in 2014. The simple random sampling technique was employed to collect a sample of 400 agriculturists. The Structural Equation Model (SEM) was used for model verification. Results revealed that the structural model of confirmatory factors of Economic Plant Cultivation Knowledge (Kno) and Environmental Education (EE) were able to explain the variation of endogenous factors of Inspiration of Public Mind (IPM) to cause Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with 89.00%. The EE had the most effect on BEH with 0.37, IPM with 0.25, and Kno with 0.16, respectively.

Keywords: Model, economic plant cultivation knowledge, environmental education, inspiration of public mind, economic plant cultivation on environmental conservation behavior

[1]Ph.D. Candidate, Ph.D. Program in Environmental Education Mahasarakham University
Mahasarakham University
E-mail: dr.wattakan@gmail.com
[2]Advisor, Mahasarakham University
Mahasarakham University
E-mail: dr.wattakan@gmail.com
[3]Co-Advisor, Director of Research In Motion Co., Ltd.
Mahasarakham University
E-mail: dr.wattakan@gmail.com

Introduction

The agriculture sector is an essential part of Thailand (Siripanich, et al., 2011), particularly because it also plays an important role with regard to world food security, since Thailand is a major rice exporter of the world (Thiengkamol, 2009). Additionally, other agricultural products of Thailand are in world demand, such as different kinds of fruit, and are very successful internationally. Therefore, if Thailand is faced with the threat of disasters, such as global warming, floods, landslides, mudslides, summer storms, and earthquakes, agricultural products will, inevitable, be threatened (Thiengkamol, 2011e).

By Tracing Thai agriculture through historical, scientific, and social aspects, one can see how modern Thailand's exclusive approach to agriculture has evolved. About 1,000 years ago, the Tai's soaked glutinous rice culture determined administrative structures in a practical society that commonly produced a surplus for selling. They especially used the organic cultivation method without any chemical use. At present, these systems fuse the importance of rice agriculture with national security and economic well-being. Chinese and European persuasion later benefited agribusiness and initiated the demand that would increase agriculture as population increased until available land was exhausted (Kenneth & Purugganan, 2002).

Current developments in agriculture have been destined since unemployment fell from over 60% in the 1960s to under 10% in the early 2000s. During the same period, food prices halved; hunger was reduced (from 2.55 million households in 1988 to 418,000 households in 2007); and child malnutrition was significantly reduced—from 17% in 1987 to 7% in 2006 (Siripanich, et al., 2011). This occurred due to the combination of a strong and positive state role in guaranteeing investment in infrastructure, education, and access to credit, and successful private initiatives in the agribusiness sector. This has maintained Thailand's conversion to an industrialized economy (Leturque & Wiggins, 2010).

Thailand has made manifold adaptations with regard to this matter. Since the rise of temperature began, many policies and innovative groups have been created to support Thailand's farmers, such as the National Strategy for Climate Change Management and the Climate Change Alleviation Plan for Agriculture (Supnithadnaporn, et al., 2012). These groups and policies have created knowledge concerning climate change information and water resource management in the agricultural sector, with projects dealing with water consumption, and they have issued useful regulations and natural disaster management (UNDP, 2012).

There was a declaration from the Ministry of Agriculture and Cooperatives on February 5, 2013, which identified the suitable areas for significant economic plant cultivation by analyzing soil appropriateness with regard to the required factors of each type of plant, along with plant cultivation situations and other associated factors, such as legal forest boundaries and irrigation project areas. It was discovered that Maha Sarakham Province had appropriated an area for rice cultivation of only 700,000 rai (2.5 rai = 1 acre) for an area of rice cultivation of 1,337,732 rai. It also has appropriated an area for sugarcane of 330,000 rai, but sugarcane is cultivated on only 5,625 rai. In addition, it has appropriated an area for cassava of 310,000 rai, but cassava is cultivated on only 13,464 rai (the Office of Agriculture and Cooperatives of Maha Sarakham Province, 2014). This data pointed out that the plant cultivation in this province was not proper for the area. Consequently, the cultivation will affect systems and conditions, namely environmental and ecological systems, along with bio-physical,

economic, and social conditions. Subsequently, it was unavoidable that it resulted in high costs.

In order to accomplish high production and reach sustainable agriculture for economic plant cultivation by the agriculturists of Kosumpisai District, Maha Sarakham Province, it requires the achievement of more knowledge and the understanding of economic plant cultivation in the following aspects: economic plant cultivation, area appropriateness, bio-physical conditions, social conditions, technology and pattern of cultivation, and local wisdom concerning environmental management.

The majority of agriculturists in Thailand is lacking in the knowledge of bio-physical conditions, and technology and pattern of cultivation, when compared to other aspects of knowledge (Mesinthree, 2013). It is observed that during preceding times, they have not developed in the other aspects necessary for terminating the crisis concerning ecological security and dealing with the intimidating nature of economic globalization in terms of issues related to trade barriers (Pongpit, 2009). Therefore, if they still adhere to the previous knowledge concerning chemical use, having been in practice since the mono-culture revolution period, production will be of low quality, and the soil fertility will be diminished as well. The production will not be upheld and ecological security will be devastated (Mesinthree, 2013). A lack of awareness is the origin of unconsciousness concerning suitable guidelines or directions of improvement related to natural or organic agriculture that will affect the quality of life for present and future generations (Thiengkamol, 2009c). Thus, they should establish their future by thinking, choosing, and making proper decisions by themselves and learning the value before added value, including realizing the essence of natural resources and the environment. This will enable them to achieve self-reliance, and it will support them to live on their own potential.

Area appropriate knowledge of economic plant cultivation assists agriculturists to lessen the risk and reduce the susceptibility, but it also increases ecological security by allocation of the requirements of future generations (Gold, 2014). Therefore, the agriculturists will give emphasis to the cultivation of economic plants in the appropriate areas because the Ministry of Agriculture and Cooperatives has approved the area of economic plant cultivation along with the area possibility by examining the soil appropriateness for each type of economic plant over the entire country by the consideration of other factors, such as legal forest areas and irrigation areas (the Office of National Economic and Social Development Plan, 2010). It aimed to help agriculturists to cultivate economic plants by following the diverse measurements (such as economic plants in dry areas), together with a plan for agricultural product distribution in the market at suitable times, with surveillance, in order to elevate the income to create a balance between supply and demand. In addition, this can serve the environmental conservation by incorporating organic agriculture, which is an ecological production management system that supports and enhances biodiversity, biological cycles, and biological soil activity. With regard to minimal use of off-farm inputs and management practices, they can restore, sustain, and develop ecological harmony (Leturque & Wiggins, 2010) through their knowledge of local wisdom on environmental management based on traditional agricultural practices used for a long period of time (Thiengkamol, 2009c).

The philosophy of environmental education has the basic concept that people share a narrow band of land, air, and water on the surface of the third planet from the sun (UNESCO, 1978). Included in that space are all of the

resources people will ever have (Thiengkamol, 2011e). It is a closed system run by the radiant energy from the sun. The whole population of living species on Earth lives, consumes resources, and dies. However, humans are unlike any other species. We have developed an economic system using technology which has consumed vast amounts of resources, brought rapid environmental changes, and overloaded the environment with waste. Humans have developed the potential to destroy themselves. By their decisions and actions, they have determined the quality of the environment. Global peoples have an obligation to our generation and future generations to preserve a quality of life that people perceive to be necessary for a healthful and productive existence for all people (Thiengkamol, 2009c). Therefore, there needs to be an essential policy and plan to reach the goals of environmental education that are firstly to foster clear awareness of and concern about economic, social, political, and ecological interdependence in urban and rural areas; secondly, to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment, and skills needed to protect and improve the environment; and thirdly, to create new patterns of behavior of individuals, groups, and society as a whole toward the environment with a public mind and responsibility (Thiengkamol, 2011i; Thiengkamol, 2011j).

Thiengkamol described public consciousness or public mind based on inspiration from insight, inspiration that is different from motivation since inspiration requires no rewards or money (Thiengkamol, 2009a). Regarding inspiration of public consciousness or public mind, particularly for natural resources and environmental conservation, one does not receive any rewards, admiration, or compliments for one's actions (Thiengkamol, 2009b). Inspiration might occur due to appreciation of a person as a role model or an idol, events, situations, environment, or media perceived, such as movies, books, magazines, or the Internet (Thiengkamol, 2011f). Moreover, an extensive amount of research has been conducted by Thiengkamol (Tiengkamon, 2012a; Thiengkamol, 2012b; Thiengkamol, 2012c). Her colleagues have also confirmed that inspiration of public consciousness or public mind is essential for environmental conservation in different environmental management with integration of environmental education principles, such as public mind for traveling behavior (Waewthaisong, et al., 2012a), public mind for energy conservation behavior (Pimdee, et al., 2012a), public mind for environmental conservation behavior (Morrasri, et al., 2012b), public mind for flood disaster response (Mongkonsin, et al., 2013b), public mind for dengue fever control and prevention behavior (Artwanichakul, et al., 2012a), public mind for food consumption behavior (Tumpracha, et al., 2012b), and public mind for water consumption behavior (Udonboon, 2012b).

Therefore, the study of a causal relationship model of economic plant cultivation knowledge and environmental principles affecting economic plant cultivation on environmental conservation behavior in terms of the cultivation of behaviors for conservation of the ecosystem, security creation and maintenance behavior, environmental conservation behavior, and ecosystem balance maintenance behavior through inspiration of public mind, including persons as role models, impressive environments, and impressive events was conducted .

Objective

The objective of this research was to develop a model of factors affecting economic plant cultivation behavior for environmental conservation in Maha Sarakham Province.

Methodology

The research design was implemented in a step by step fashion as follows:

1) The population was a total of 678 households from Kraenk-Kra-Arm Sub-district, Kosumpisai District, Maha Sarakham Province, in 2014. The simple random sampling technique was employed to collect a sample from 400 agriculturists. A questionnaire was used as a tool for data collection.

2) The research instrument was a questionnaire consisting of 90 questions. It was used for data collection. The content and structural validity were determined with Item Objective Congruence (IOC) by five experts in the aspects of environmental education, psychology, social science, and social research methodology. The reliability was tested by collecting a sample group from 50 agriculturists from Kosumpisai District, Maha Sarakham Province, in Northeastern region of Thailand. The reliability was determined by Cronbach's Alpha. The reliability results of the Economic Plant Cultivation Knowledge, Environmental Education, Inspiration of Public Mind, and Economic Plant Cultivation on Environmental Conservation Behavior and the entire questionnaire were 0.810, 0.887, 0.954, 0.947, and 0.980, respectively.

3) The descriptive statistics used were frequency, percentage, mean, and standard deviation. The inferential statistics used were from the Structural Equation Model (SEM) and were analyzed with LISREL version 8.30, by considering a Chi-Square value that differs from zero with no statistical significance at a 0.05 level or a Chi-Square/df value of less than or equal to 5, a RMSEA (Root Mean Square Error Approximation) value and RMR (Root Mean Square Residual) value of less than 0.05 including an index level of model congruence value, GFI (Goodness of Fit Index), and AGFI (Adjust Goodness of Fit Index) between 0.90-1.00, and a critical number of more than 200.

Results

Results of the Effects among Variables in the Model in Terms of Direct Effect

1) Confirmatory factors of Economic Plant Cultivation Knowledge (Kno) had a direct effect on Inspiration of Public Mind (IPM) and Economic Plant Cultivation on Environmental Conservation Behavior (BEH) and was statistically significant at a level of 0.01 with effects of 0.31 and 0.16. Moreover, confirmatory factors in the aspect of Economic Plant Cultivation Knowledge (Kno) had an indirect effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.05 with an effect of 0.08. Kno had a total effect on BEH with 0.24.

2) Confirmatory factors of Environmental Education (EE) had a direct effect on Inspiration of Public Mind (IPM) and Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with effects of 0.77 and 0.37. Moreover, confirmatory factors in the aspect of Environmental Education (EE) had an indirect effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with an effect of 0.19. The EE had a total effect on BEH with 0.56.

3) Confirmatory factors of Inspiration of Public Mind (IPM) had a direct effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with an effect of 0.25.

4) By considering the structural model, the confirmatory factors of Economic Plant Cultivation Knowledge (Kno) and Environmental Education (EE) were able to explain the variation of endogenous factors of Inspiration of Public Mind (IPM) to cause Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with

89.00% as follows in Equation (1): BEH = 0.25*IPM + 0.16*Kno + 0.37*EE ..... (1) R2 = 0.89.

Equation (1) factors that had the most effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) included Environmental Education (EE) with an effect of 0.37, and subsequently included the Inspiration of Public Mind (IPM) and Economic Plant Cultivation Knowledge (Kno) with effects of 0.25 and 0.16. These results explained the variation of Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with 89.00%.

Moreover, confirmatory factors of Economic Plant Cultivation Knowledge (Kno) and Environmental Education (EE) explained the variation of confirmatory factors of Inspiration of Public Mind (IPM) with 84.00%. Therefore, the equation can be written as follows in Equation (2): IPM = 0.31*Kno + 0.77*EE ..... (2) R2 = 0.84.

Equation (2) factors that had the most effect on Inspiration of Public Mind (IPM) included Environmental Education (EE) with an effect of 0.77, and subsequently included Economic Plant Cultivation Knowledge (Kno) with an effect of 0.31. These results explained the variation of Inspiration of Environmental Conservation with 84.00%.

Considering that the Chi-Square value/df was 1.731, which was less than 5, it was accepted that the hypothetical model of research was congruent with the empirical data. Moreover, it was considered based on other statistical values in order to verify the congruence, using the Goodness of Fit Index (GFI) and Adjust Goodness of Fit Index (AGFI), which were 0.94 and 0.92, respectively (GFI > 0.90 and AGFI > 0.90), RMSEA <0.05 (0.048), and RMR <0.05 (0.021), and the critical number equals 236.73, which was more than 200. It indicated that the model was congruent with the empirical data. The results of analysis of the causal relationship model and analysis of the path effect are presented in Figure 1 and Table 1.

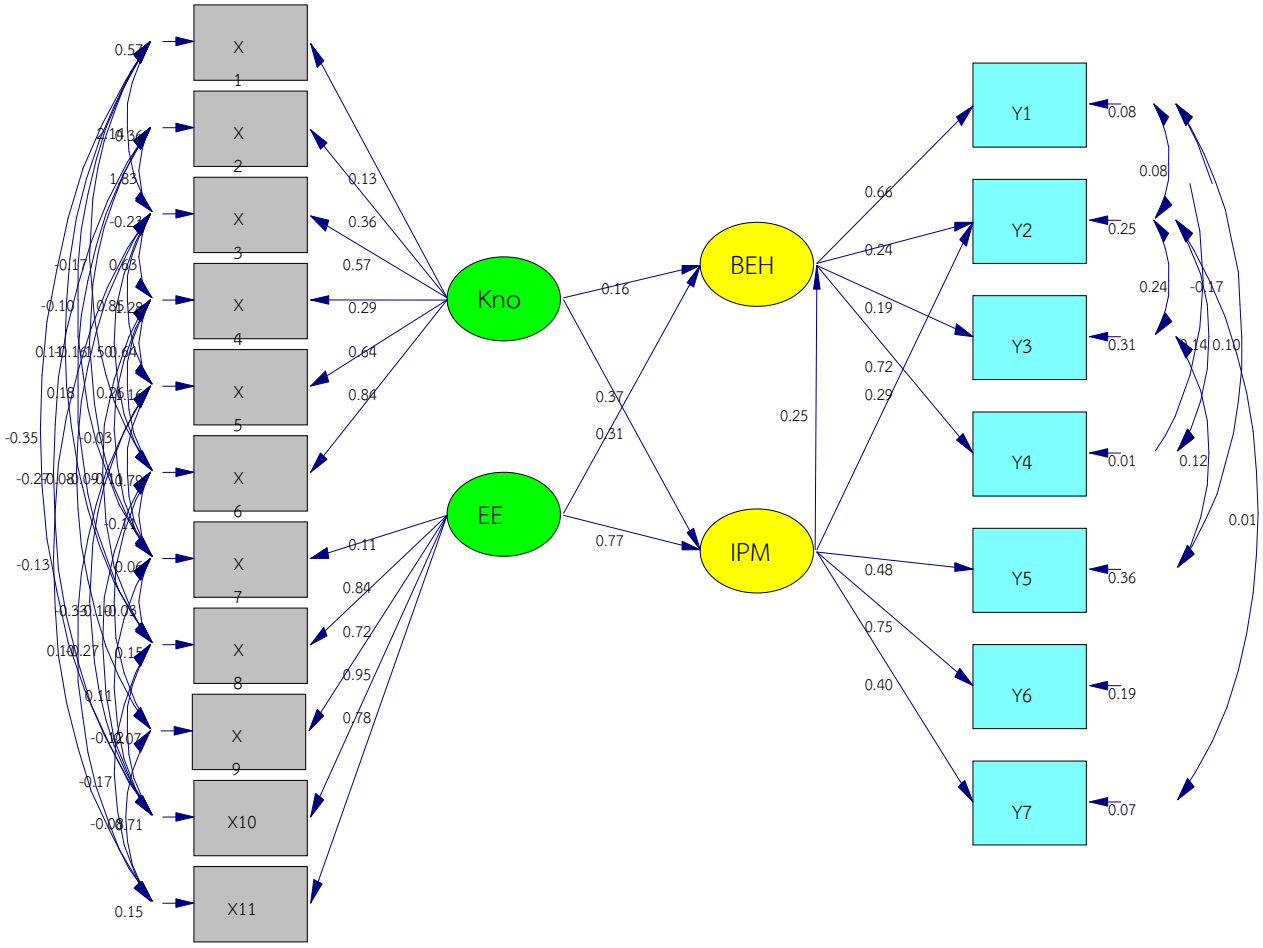

Figure 1. Causal Relationship Model of Economic Plant Cultivation Integrated with Environmental Education

Table 1 Direct, Indirect, and Total Effects of Kno and EE Affecting BEH through IPM

Causal variables	Result variables					
	IPM			BEH		
	TE	IE	DE	TE	IE	DE
Kno	0.31** (0.054)	-	0.31** (0.054)	0.24** (0.061)	0.08* (0.040)	0.16** (0.041)
EE	0.77** (0.045)	-	0.77** (0.045)	0.56** (0.064)	0.19** (0.058)	0.37** (0.042)
IPM	-	-	-	0.25** (0.050)	-	0.25** (0.050)
χ^2 = 159.28; df = 92			CN = 236.73		χ^2/df = 1.731	
RMSEA=0.048, RMR=0.002			GFI=0.94		AGFI=0.92	

TE: Total Effect, IE: Indirect Effect, DE: Direct Effect

Discussion

The findings indicated that Economic Plant Cultivation Knowledge (Kno) had a direct effect on Inspiration of Public Mind (IPM) and Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with effects of 0.31 and 0.16. Moreover, confirmatory factors in the aspect of Economic Plant Cultivation Knowledge (Kno) had an indirect effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.05 with an effect of 0.08. However, Environmental Education (EE) had a direct effect on Inspiration of Public Mind (IPM) and Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with effects of 0.77 and 0.37. Moreover, confirmatory factors in the aspect of Environmental Education (EE) had an indirect effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with an effect of 0.15. It can be elucidated that the sample groups of agriculturists have proper knowledge of economic plant cultivation in terms of environmental cultivation behavior for conservation of the ecosystem, security creation and maintenance behavior, environmental conservation behavior, and ecosystem balance maintenance behavior. Simultaneously, the exogenous latency of Environmental Education can be confirmed from the five observed variables of Environmental Knowledge, Environmental Awareness, Environmental Attitude, Environmental Skill, and Environmental Participation with effects of 0.34, 0.73, 0.91, 0.50, and 0.45.

Additionally, the exogenous variable of Economic Plant Cultivation Knowledge (Kno) can be confirmed from the six observed variables of General Knowledge of Economic Plant Cultivation, Area Appropriateness Knowledge, Bio-physical Condition Knowledge, Social Condition Knowledge, Technology and Pattern of Cultivation Knowledge, and Knowledge of Local Wisdom on Environment Management with effects of 0.63, 0.91, 0.27, 0.21, 27, and 0.36.

However, the results also indicated that the endogenous latent variable of Inspiration of Public Mind can be confirmed from the three observed variables of a Person as a Role Model, Impressive Environment, and Impressive Event with effects of 0.63, 0.50, and 0.74. These results were pertinent to Thiengkamol's research concept (Thiengkamol, 2009a; Thiengkamol, 2009b; Thiengkamol, 2011e; Thiengkamol, 2011f), and her different studies, such as Inspiration of Public Mind, particularly for natural resources and environmental conservation (Thiengkamol, 2009b), Inspiration of Public Mind in a person as a role model or an idol, events, situations, environment, or media perceived, such as movies, books, magazines, or the internet (Thiengkamol, 2011f), and the research of her colleagues, such as public mind for traveling behavior (Waewthaisong, et al., 2012a), public mind for energy conservation behavior (Pimdee, et al., 2012a), public mind for environmental conservation behavior (Morrasri, et al., 2012b), public mind for flood disaster response (Mongkonsin, et al., 2013b), public mind for dengue fever control and prevention

behavior (Artwanichakul, et al., 2012a), public mind for food consumption behavior (Tumpracha, et al., 2012b), and public mind for water consumption behavior (Udonboon, 2012b).

The results led to the conclusion that Economic Plant Cultivation Knowledge (Kno) and Environmental Education (EE) had a direct effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with effects of 0.16 and 0.37. Additionally, Inspiration of Public Mind (IPM) had a direct effect on Economic Plant Cultivation on Environmental Conservation Behavior (BEH) with a statistically significant level of 0.01 with an effect of 0.25. These were congruent with Thiengkamol's concept of the importance of General Knowledge (Thiengkamol, 2009a), Area Appropriateness Knowledge (Thiengkamol, 2009c), Social Condition Knowledge (Thiengkamol, 2009b), Knowledge of Local Wisdom on Environment Management (Thiengkamol, 2011e), and Technology and Pattern of Cultivation Knowledge (Thiengkamol, 2011f), and her colleagues' research, such as bio-physical condition knowledge (Waewthaisong et al., 2012a), energy conservation knowledge (Pimdee, et al., 2012b), saving energy of traveling knowledge (Waewthaisong, et al., 2012a), dengue fever control and prevention knowledge (Artwanichakul, et al., 2012a), food security knowledge (Tumpracha, et al., 2012b), and appropriate water consumption knowledge (Udonboon, 2012b). The results illustrated that Economic Plant Cultivation Knowledge (Kno) and Environmental Education (EE) influenced through inspiration of Public Mind to perform better environmental behaviors whether they be environmental cultivation behavior for conservation of the ecosystem, security creation and maintenance behavior, environmental conservation behavior, or ecosystem balance maintenance behavior when they had direct experience concerning economic plant cultivation based on the concepts of environmental conservation with inspiration of public mind with integration of the environmental education principle because the environmental education principle is pertinent to the sustainable development concept.

Therefore, the research results should be used to train all agriculturists in the Maha Sarakham Province and other provinces in the Northeastern region to gain knowledge and understanding regarding the importance of cultivating the appropriate plants in suitable areas and to encourage them to change the existing cultivation pattern of not paying attention to matching between the soil property and the type of plant, particularly since most of the soils in this region are salted. Therefore, the governmental sector must promote and support the information concerning the appropriateness of economic plant cultivation in order for them to meet food security (Tumpracha, et al., 2012b), energy security (Pimdee, et al., 2012b), and sustainable development (Thiengkamol, 2011e), and especially promote the observed variable general knowledge of economic plant cultivation, area appropriateness knowledge (Thiengkamol, 2009a), bio-physical condition knowledge (Waewthaisong et al., 2012a), social condition knowledge (Thiengkamol, 2009b), technology and pattern of cultivation

knowledge (Thiengkamol, 2011f), knowledge of local wisdom on environmental management (Thiengkamol, 2011e), environmental knowledge, environmental awareness, environmental attitude, environmental skill, and environmental participation (Thiengkamol, 2011i and Thiengkamol, 2011j).

However, it might be concluded that whether Kno, the EE, IPM, and BEH latent variables play significant roles in causing environmental cultivation behavior for conservation of the ecosystem, security creation and maintenance behavior, environmental conservation behavior, and ecosystem balance maintenance behavior through IPM. Therefore, the model of Kno and EE influencing through IPM to BEH was verified, and the proposed model was fitted with all observed variables according to the criteria of a Chi-Square value that differs from zero with no statistical significance at 0.01 level or a Chi-Square/df value of less than or equal to 5, RMR (Root Mean Square of Residual), RMSEA (Root Mean Square Error Approximation) values of less than 0.05 including an index level of model congruence value, GFI (Goodness of Fit Index), and index level of model congruence value, AGFI (Adjust Goodness of Fit Index) between 0.90-1.00 and a critical number of more than 200.

References

Artwanichakul, K., Thiengkamol, N., & Thiengkamol, T. (2012a). Structural Model of Dengue Fever Control and Prevention Behavior. **European Journal of Social Sciences**, 32 (4): 485-497.

Chapin, F.T, Matson, P.A, Mooney, H.A. (2002). **Principles of Terrestrial Ecosystem Ecology**. New York: Springer.

Gold, M. (2014). **"National Agricultural Library"**. USDA. Retrieved from: 1 March 2014.

Kenneth, M. Olsen and Michael D. Purugganan. (2002). "Molecular evidence on the origin and evolution of glutinous rice". **Genetics**. 162 (2): 941–950.

Leturque, H. & Wiggins, S. (2010). **Thailand's progress in agriculture: Transition and sustained productivity growth**. London: Overseas Development Institute.

Mesinthree, S. (2013). **World Changes, Thai Adapt**. Bangkok: Krungthep Business Media.

Morrasri, P., Thiengkamol, N., & Thiengkamol, T. (2012b). Causal Relationship Model of Little Green Child with Environmental Behavior. **European Journal of Social Sciences**, 34 (2): 177-189

Mongkonsin, Thiengkamol, N., & Thiengkamol, T. (2013b). Causal Relationship Model of Flood Response

Behavior. **Mediterranean Journal of Social Sciences**, 4 (1):587-598.

Office of Agriculture and Cooperatives of Maha Sarakham Province. (2014). **Area appropriateness for economic cultivation**. Retrieved from http://www.moac-info.net/MahaSarakham/index.php?option=com.

Pimdee, P., Thiengkamol, N., & Thiengkamol, T. (2012a). Causal Relationship Model of Electrical Energy Conservation. **European Journal of Social Sciences**, 32 (3): 306-315.

Pongpit, S. (2009). **Reform Thai Society**. Bangkok: Powerwisdom Publishing.

Siripanich, S., Sayompurujinant, S, & Muanepueng, P. (2011). **Surveillance System of Disease from Occupation and Environment with Passive type**. Weekly Report of Epidemiology Division of Epidemiology, Department of Disease Control, Ministry of Public Health.

Supnithadnaporn, A., Inthisang, J., Prasertsak, P., Meerod, W. (2012). **Adaptation to Climate Change and Agricultural Sector in Thailand**. Retrieved from http://www.adbi.org/files/2011.12.15.cpp.day3.sess3.18.country.presentation.thailand.pdf.

Thiengkamol, N. (2009a). **The Great Philosopher: the Scientist only know but Intuitioner is Lord Buddha**. Bangkok: Prachya Publication.

Thiengkamol, N. (2009b). **The Happiness and the Genius Can be Created before Born**. Bangkok: Prachya Publication.

Thiengkamol, N. (2009c). **Environment and Development Book 2 (Food Security).** Bangkok: Chulalongkorn University Press.

Thiengkamol, N. (2011e). **Environment and Development Book 1**. (4th ed.). Bangkok: Chulalongkorn University Press.

Thiengkamol, N. (2012a). Development of a Prototype of Environmental Education Volunteer. **Journal of the Social Sciences**, 7(1): 77-81.

Thiengkamol, N. (2012b). Model of Psychological Factors Affecting to Global Warming Alleviation. **International Proceedings of Economic Development and Research**, 44, 6-12.

Thiengkamol, N. (2012c). Model of Environmental Education and Psychological Factors Based on Inspiration of Public Consciousness Affecting to Global Warming Alleviation. **Mediterranean Journal of Social Sciences**, 3(11): 435-444.

Tumpracha, K., Thiengkamol, N., & Thiengkamol, C. (2012b). Causal Relationship Model of Food Security Management. **Mediterranean Journal of Social Sciences**, 3(11): 639-650.

UNDP. (2012). **Thailand's climate change master plan nears completion**. Retrieved from http://www.th.undp.org/content/thailand/en/home/presscenter/articles/2012/08/10/thailand-s-climate-change-master-plan-nears-completion/.

Udonboon, C., Thiengkamol, N., & Thiengkamol, C. (2012b). Causal Relationship Model of Water Conservation Behavior. **Mediterranean Journal of Social Sciences**, 3(11): 599-611.

UNESCO. (1978). **Intergovernmental Conference on Environmental Education Organized by UNESCO in Cooperation with UNEP Tbilisi (USSR) 14-16 October 1977**. Final Reports. Paris: UNESCO. U.S.

Waewthaisong, S. Thiengkamol, N., & Thiengkamol, C. (2012a). Causal Relation Model of Environmental Traveling Behavior**. European Journal of Social Sciences**, 33(2): 184-195.