

A GUIDELINE FOR THAILAND'S SUSTAINABLE AGRICULTURE DEVELOPMENT

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ABSTRACT

This research aims to explore causal factors affecting sustainable agriculture development in order to develop a guideline for Thailand's sustainable agriculture development. The mixed methods research was applied to collect data from agriculturalists registered with the Ministry of Agriculture and Cooperatives and provincial cooperatives. Selected by the multistage sampling method, 400 households from 77 provinces were chosen as survey respondents. Meanwhile, 5 informants were selected for in-depth interviews. The findings show that government policy, agriculturalists' potential, and sustainable agriculture ideology highly affected sustainable agriculture development. Financial management and agricultural innovation management moderately affected sustainable agriculture development. The analysis of Pearson's correlation coefficient between observed variables suggests that all pairs of the variables moved in the same direction, showing a positive relationship. At significance levels of 0.01 and 0.05, the most correlated pair contained "access to funding" and "financial adequacy" ($r = 0.612$). The least correlated pair comprised "participation of agriculturalists" and "agricultural technology transfer" ($r = 0.104$). According to the t-values in the regression model, agriculturalists' potential, financial management, agricultural innovation management, and government policy directly influenced sustainable agriculture development (Chi-square = 31.80; $df = 29$; $p\text{-value} = 0.328$; $GFI = 0.97$; $AGFI = 0.94$; $RMR = 0.028$; $RMSEA = 0.018$; $CFI = 1.00$; $CN = 461.15$).

Keywords: Sustainable Agriculture, Agriculturalists' Potential, Agricultural Innovation Management

INTRODUCTION

The Thai society has been rooting on agriculture. Rice production is a main source of incomes of a majority in Thailand, leading to the emergence of the 'rice culture' which is a foundation of Thai politics, lifestyle, moral beliefs, language, and many other aspects. Therefore, rice is the most important crop in Thailand. Thailand is a major exporter of rice in the global market. The country has a total size of 51,360,000 hectares, and agricultural land (22,080,000 hectares) makes up 43% of it. The revenues of the agricultural sector account for 10% of the national gross

domestic product (GDP) [1]. The Thai agricultural sector is predominantly composed of small-scale farmers or agricultural households, and their practices are diversified by local contexts and different expertise. At present, the agricultural sector is facing myriad concerns such as technological advancements, increases in natural disasters, and aging populations. Furthermore, the capital costs of agricultural business, including the prices of machinery, fertilizers, and pesticides, are rapidly rising. This tremendously reduces the agricultural sector's profits, making it prone to debts and become more fragile than any other economic sectors [2]. According to a survey on household socio-economic status conducted by the Bank of Thailand, there is a high level of income inequality among Thai agriculturalists. The relatively uneducated farmers earn extremely low incomes, and most of them are aging. As a result, their quality of life is low, and their economic mobility is limited [3]. As the quality of life is crucial for national stability and family prosperity, it must be developed and sustained [4].

The problems and challenges in the Thai agricultural sector reflect that traditional agriculture should not be continued. The public sector should support the agriculturalists to adapt themselves and reform the production system in order to make more profits. Traditional farmers should transform themselves into 'smart farmers' who adopt modern management and advanced technologies. Thailand's agricultural policies have been lacking and inconsistent, resulting into the persistence of farmers who 'work hard but earn little'. Efficient management can strengthen cooperatives and assist smart farmers. A new ecosystem facilitating modern agriculturalists should be developed to help them expand their networks and enhance their quality of life. Towards stable incomes, the farmers can be freed from poverty and rely on themselves. The ideology of sustainable agriculture (consisting of organic farming, 'New Theory' agriculture, integrated farming, natural farming, and agroforestry) can be applied to the agricultural production process, connecting plantations with animal husbandry and reducing environmentally harmful impacts on soil and water sources. The ideology is consistent with the 12th National Economic and Social Development Plan which emphasizes the agricultural sector reform. The purposes of the reform are agricultural product value adding, innovative and technological development, environmental protection, agricultural economic competitiveness, and sustainable development [5]. Therefore, the goal of this study is to investigate factors related to sustainable agriculture development, which is the transition from traditional agriculture to modern agriculture. The factors include government policy, agriculturalists' capacity, financial management, and agricultural innovation management.

OBJECTIVE

1. To explore causal factors affecting sustainable agriculture development
2. To scrutinize the level of influence of the causal factors
3. To propose a guideline for Thailand's sustainable agriculture development

LITERATURE REVIEW

Rice is a primary agricultural product of Thailand. Rice farms make up 46.1% of agricultural land in the country and cover 4.9 million agricultural households or 60.5% of the total agricultural households nationwide [6]. The Thai government has been paying great

attention on rice farmers. Supporting policies have been consistently implemented, for example, the rice price guarantee program, the rice pledging scheme, and other projects such as capital funding, harvesting grants, and rice quality improvements. The public sector is responsible for pushing forward sustainable development of the agricultural sector in a practical direction [7]. However, there is a huge number of challenges the contemporary agriculturalists are facing. The amount of available agricultural land is rapidly declining due to vast urbanization, infrastructure development, industrialization, and expansion of transportation systems.

The ideology of sustainable agriculture is the integration of agricultural practices which can sustainably produce agricultural products and preserve the environment in the midst of climate change. The ideology also emphasizes the reduction of pesticides, preservation of agricultural and economic capacities, sufficient production, self-reliance, and eco-friendliness [8]. Sustainable agriculture is, therefore, a systematic process which creates balance between social, economic, and environmental dimensions. A sustainable agriculture lifestyle is grounded on local contexts and capacities, including local ecosystems and local wisdom which is integrated with modern technology and innovation. As a result, the local ecosystems and the environment can be managed effectively [9], leading to improved quality of life, more diverse job opportunities, better health care and education, and legacies for future generations [10]. There are various factors affecting sustainable agriculture such as demographic factors, economic factors, social factors, financial factors, technological factors, and policy factors [11].

The innovation-based economy can enhance the country's competitiveness, allowing the local communities and small and mid-size enterprises (SMEs) to access the value chain of their target sectors more conveniently. Subsequently, natural resources are sustainably utilized in accordance with the carrying capacity of the ecosystems [12]. Government policies are vital for aiding agriculturalists to move forward from traditional agricultural to sustainable agriculture. They can provide supporting funds and suitable business environments for the farmers. [13].

Agriculturists' potential is another factor influencing sustainable agriculture development. Experienced farmers have learned to adapt themselves to changes. They are creative and ready to improve themselves in order to seize opportunities and succeed. These farmers are life-long learners who have a positive attitude towards sustainable agriculture [14].

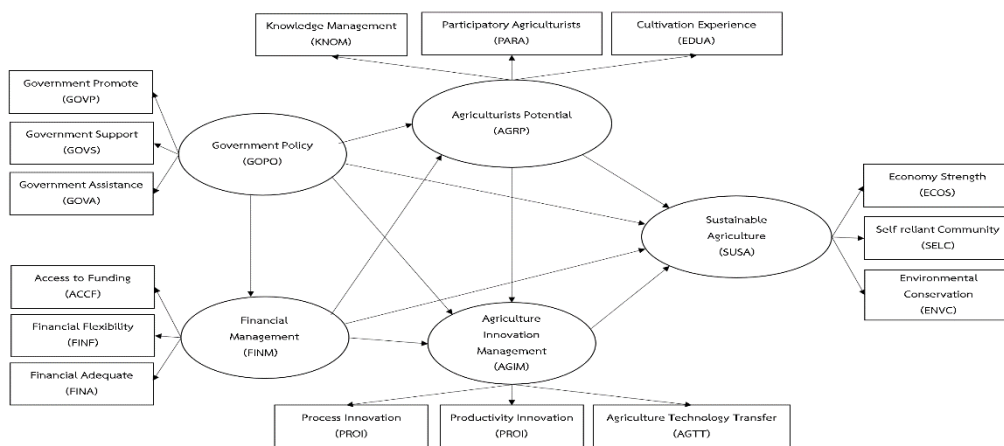
Financial management is a key factor that affects the agricultural production process. Agriculturalists must have adequate funds to produce their products and prepare for future investments. Financial capital plays a huge role in facilitating the agriculturalists and providing them more job opportunities [15]. Thus, financial management, access to public and private funds, low-interest loans, financial flexibility, and sufficiency of funds all contribute to the growth of the agricultural sector [16]. Many small-scale farmers who live in remote areas depend on loan sharks because it is difficult for them to obtain loans from public financial institutions [17].

In terms of agricultural innovation management, monoculture of cash crops has become phenomenal and dramatically transformed the agricultural production process. This new agricultural trend requires more fertilizers, chemical substances, instant animal feed, and pesticides, which results into higher capital costs and increasing environmental impacts. Therefore, it is important to apply modern innovations such as information technology,

biotechnology, and other agricultural techniques to the traditional farming. The analysis can help farmers to make better decisions on how to grow plants, manage agricultural products after harvesting, and achieve value-added products [18]. The traceability system is improved to push the Thai agricultural sector forward to Thailand 4.0. Innovative agriculturalists use innovative marketing and production management to conquer global trends and achieve sustainable development [19].

Based on the review of literature, the conceptual framework showing relationships between causal factors affecting sustainable agriculture development, including the observed and latent variables, is illustrated in Figure 1.

Figure 1
Conceptual Framework



METHODOLOGY

This study applied the mixed methods research to collect data quantitatively and qualitatively. The population for the quantitative research consisted of 4,437,527 agricultural households who were registered with the Ministry of Agriculture and Cooperatives of Thailand [20]. By applying the Taro Yamane’s sample size calculation approach [21], 400 households were selected from 77 provinces towards the multi-stage sampling method. To clarify, a province was selected from each region in Thailand, which means there were 6 six provinces selected in total. Then, 400 households, found in the list of agricultural households registered with the Ministry of Agriculture and Cooperatives of Thailand, were systematically randomized from the 6 provinces.

Developed based on Rensis Likert’s rating method [22], a 5-point rating scale questionnaire survey was used as a data collection tool. The content validity of the questions was assessed by the index of item-objective congruence. Tested with 30 samples, the survey reliability was measured by Cronbach’s Alpha Coefficient [23], and the entire survey was approved ($\alpha = 0.980$).

For the qualitative research, the samples were selected by the purposive selection method. Five outstanding agriculturalists who had applied the philosophy of Sufficiency Economy to their sustainable agriculture practice were chosen as key informants for in-depth interviews.

The creditability of interview questions was tested by the data triangulation technique. The collected data was analyzed by descriptive statistics and the path analysis in order to construct a structural equation model and test relationships between latent variables and observed variables based on certain criteria [24].

RESULTS

The analysis of demographic data shows that the majority of the survey respondents were male (63%) and aged between 51-60 years old (35%). 39% of them earned only an elementary diploma. 44% had become agriculturalists for not less than 20 years. 37% earned less than 400,000 baht per year. In terms of expenses, 37% of their money was spent on debts for agricultural processes (with the value of 250,000 baht/year on average), followed by 24% for non-agricultural purposes, 17% for labor force, maintenance, machinery, and land leasing, 16% for household spending, and 6% for original debts, respectively.

The causal factors affecting sustainable agriculture development were also statistically analyzed. According to Table 1, government policy has the highest level of influence on sustainable agriculture development, followed by agriculturalists' potential, sustainable agriculture ideology, financial management, and agricultural innovation management, respectively. From Table 1.

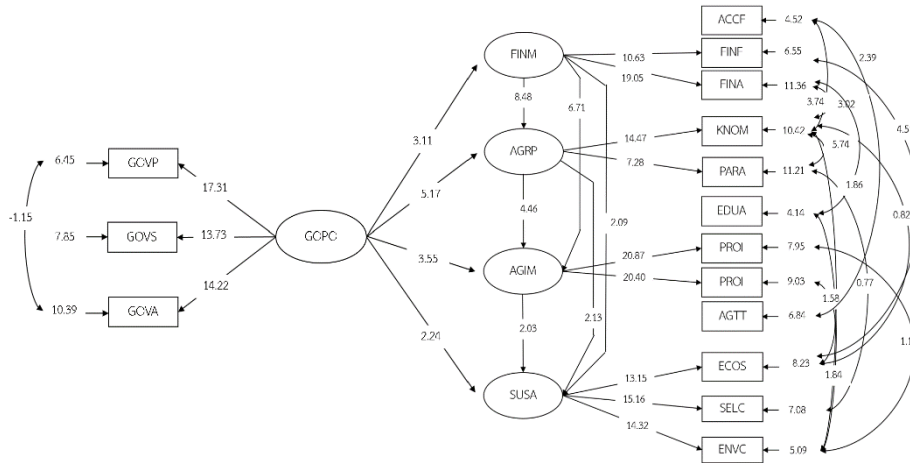
Table 1
Means, Standard Deviations, and Levels of Influence of Causal Factors Affecting Sustainable Agriculture Development

No.	Causal Factors	\bar{x}	S.D.	Level of Influence	Order
1	Sustainable Agriculture Ideology	3.65	0.73	High	3
2	Government Policy	3.97	0.78	High	1
3	Agriculturalists' Potential	3.75	0.65	High	2
4	Financial Management	3.45	0.79	Moderate	4
5	Agricultural Innovation Management	3.42	0.88	Moderate	5
	Overall	3.68	0.76	High	

As demonstrated in Figure 2, the effects of the causal factors of sustainable agriculture development were analyzed by the path analysis of the relationships between variables in a t-value regression model. The analysis of the relationships between observed variables reveals that there are 105 pairs of relationship between 15 variables, and all pairs of the variables move in the same direction. This shows positive relationships between them. The correlation coefficients range between 0.104 and 0.612 at significance levels of 0.01 and 0.05. The most correlated pair contains “access to funding (ACCF)” and “financial adequacy (FINA)” ($r = 0.612$), while the least correlated pair comprises “participation of agriculturalists (PARA)” and “agricultural technology transfer (AGTT)” ($r = 0.104$). The correlation is significant at the 0.05 level (2-tailed) (Kaiser-Meyer-Olkin Measure of Sampling Adequacy = 0.950, Bartlett's Test

of Sphericity = 5163.784, df = 151, p = 0.000). Chi-square = 31.80, df = 29, p-value = 0.328, GFI = 0.97, AGFI = 0.94, RMR = 0.028, RMSEA = 0.018, CFI = 1.00, CN = 461.15

Figure 2
T-value Path Analysis



The t-value analysis model shows that latent variables have both direct and indirect effects on sustainable agricultural development. The results of the structural equation modeling analysis, which include the direct, indirect, and total effects of the latent variables, are presented in Table 2. Combining Table 2 and 3 together, it can be concluded that agriculturalists' potential has the highest total effects on sustainable agricultural development, followed by financial management, government policy, and agricultural innovation management, respectively.

Table 2
Direct, Indirect, and Total Effects of Latent Variables in the Model

Dependent Variables	Relationships	Independent Variables				R ²
		GOPO	FINM	AGRP	AGIM	
FINM	DE	0.22**	-	-	-	0.18
	IE	0.28**	-	-	-	
	TE	0.50**	-	-	-	
AGRP	DE	0.43**	0.66**	-	-	0.62
	IE	-	-	-	-	
	TE	0.43*	0.66*	-	-	
AGIM	DE	0.32**	0.62**	0.71*	-	0.91
	IE	0.50**	0.27**	-	-	

Dependent Variables	Relationships	Independent Variables				R ²
		GOPO	FINM	AGRP	AGIM	
	TE	0.82**	0.89**	0.71*	-	
SUSA	DE	0.35*	0.54*	0.58*	0.51*	0.69
	IE	0.21*	0.15**	0.14**	-	
	TE	0.56**	0.69**	0.72**	0.51*	

Table 3
Direct, Indirect, and Total Effects of Causal Factors Affecting Sustainable Agriculture Development

Effects of Variables	Cause-Effect Relationships		
	Direct Effects	Indirect Effects	Total Effects
Government Policy	0.35*	0.21*	0.56**
Financial Management	0.54*	0.15**	0.69**
Agriculturalists' Potential	0.58*	0.14**	0.72**
Agricultural Innovation Management	0.51*	-	0.51*

*At a significance level of 0.05 ([t] >1.96), ** At a significance level of 0.01 ([t] >2.56)

CONCLUSION AND FUTURE WORK

In this study, the causal factors affecting sustainable agriculture development are investigated. The factors include government policy, agriculturalists' capacity, financial management, and agricultural innovation management. The research results show that government policy, agriculturalists' potential, and sustainable agriculture ideology influenced sustainable agriculture development at a high level. Meanwhile, financial management and agricultural innovation management affected sustainable agriculture development at a moderate level. Moreover, agriculturalists' potential (DE = 0.58), financial management (DE = 0.54), agricultural innovation management (DE = 0.51), and government policy (DE = 0.35) all have direct effects on sustainable agriculture development at significance levels of 0.01 and 0.05.

This research also proposes a guideline for Thailand's sustainable agriculture development (See Fig. 3). First of all, the public sector must prepare farmers to convert from traditional agriculture to sustainable agriculture. Explicit government policies must be implemented to support the farmers to achieve sustainable agriculture practically and effectively [25]. Second, agriculturalists must be allowed to access sufficient low-interest loans for their agricultural investments. This can increase their financial flexibility and manage their business more conveniently. Third, agriculturalists must be equipped with skills and knowledge towards regular trainings on sustainable agriculture. This can be accomplished by collaboration and knowledge transfer between the agriculturalists themselves, the public sector, the academic sector, and the business sector. Therefore, the agriculturalists must be allowed to participate in

local agricultural wisdom management. A new set of knowledge, such as agricultural chemistry, can help them approach sustainable agriculture more efficiently. Lastly, in order to enhance agriculturists' performance, innovative agricultural equipment as well as modern technologies must be provided to them. By applying new innovations to their agricultural processes, it is possible to create innovatively safe products, reduce capital costs, and increase productivity in a long run. As a result, the agriculturalists will be able to rely on themselves, protect the environment, and contribute to sustainable economic growth [25].

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