SEP strategy for survival of the rice farming careers of small farming households in the upper Northern region of Thailand

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Abstract Recognizing on the sustainability of farmers' livelihoods requires a proper livelihood asset management strategy. Sufficiency Economy Philosophy (SEP) can serve as an effective strategy for ensuring the sustainability of the rice farming career. The findings indicated that two Sufficiency Economy Philosophy (SEP)-based strategies which one involved immunization and the middle path principle, especially increased the likelihood of a farming household to remain in the rice farming career. Furthermore, the non-strategic factors were significantly and positive affected on career continuation which were presented an heir to inherit the family farming occupation, good social surroundings, strong community organization, culture of mutual help, and sharing which provided incentives for farming households to maintain their rice farming careers. However, the increased in age of the head of household had a slightly negative effect of the rice farming occupation.

Keywords: Sufficiency economy philosophy, Sustainability of household's rice farming career, Middle path, Sustainable livelihood approach, Livelihood strategy

Introduction

Rice has long been considered as the essence of life, permeating all aspects of the lives of people from all walks of life. Rice cultivation and practices and related cultural heritage have been handed down to present day farmers from the first rice cultivators to have ever settled on this land. Rice farmers in Thailand are still regarded as the backbone of the country, where currently 46.5% of the total land is used for agriculture with 5.9 million total farm households, more than 60% of which or 3.9 million households cultivate rice (OAE, 2018).

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Despite being characterized as an agricultural society, Thailand has undergone some structural changes. In particular, the mean age of the heads of farm households has increased from 56 years old in the 2013/2014 crop year to 58 years old in the 2017/2018 crop year, and there has been a drop in farming laborers (15- 64 years old) per household from 2.81 persons to 2.59 persons in the corresponding crop years (OAE, 2019a) partly due to the fact that the younger generation has no interest to enter the farming career (S-Curve Hub, 2017; Saisakul, 2019). Furthermore, the Thai rice sector has been hard hit by the rising trend in production cost, the declining productivity trend, and a farm gate price that is more volatile than for other grain crops (TDRI, 2016; 2019). The low and uncertain income from farming has caused farmers to incur growing household debts, which became as high as 221,490 baht per household in 2019, a 47% increase from the previous year's level (OAE, 2020). It cannot be denied that the survival of many Thai farming households has been possible because part of the household income comes from the off-farm work of the working-age farmer and other family members (OAE, 2019b) as off-farm earning has been found to account for up to 70% of the total household income (OAE, 2020).

Generally, it is difficult for the household heads, who are often older with a low level of education, to find or do off-farm work for supplementary income or to apply or develop any technology or innovative technique to enhance farming efficiency, save production cost, and increase agricultural income. Nevertheless, a large number of the small-scale farmers has been observed to be able to maintain a healthy farming career and live a better life because these farmers have adhered to the guiding principles in the Sufficiency Economy Philosophy, both in the way they lead their lives and in the management of their production resources (Wiboonpongse and Sriboonchitta, 2009; Mongsawad, 2010; Office of the Royal Development Projects Board, 2011; Utsahajit, 2014; Janmaimool and Denpaiboon, 2016). These farmers have allocated their resources for farming in the ways prescribed by New Theory Agriculture, which is one of the most concrete forms of the practical application of the SEP. As a result, they have been successful in paying off all household debts and have been able to improve their farming capacity from the level of sufficiency farming to meet family needs to that of generating secure family income. The accomplishment is not only personal but also regards networking, as demonstrated by the case of Mr. Boontaen Laosup in Lei Province. Boontaen used to experience financial loss from mono-cropping which involved high production costs and which constantly incurred more debt. His participation in training sessions organized by local government agencies on integrated farming within the framework of New Theory Agriculture brought him tremendous

knowledge and a new perspective. He then re-oriented his land use and farming practices in 2001. Out of his 25 rai of land, he allocated one rai for homestead and four rai for rice cultivation (growing one rice crop per year using one particular variety for two years before adopting a different variety to break the pest's life cycle). After the rice crop, other crops would be planted in the paddy field without assistance of any chemicals but using local wisdom and insect repellent plants for pest control and management. All production activities were done by family labor (without hiring any farmhands). Boontaen allocated 16 rai for intercropping of more than 20 kinds of field crops, fruit trees, vegetables, and herbal plants. He constructed 4 farm ponds in various locations of his land with a combined size of roughly three rai for raising fish and irrigating the farm. He processed food waste, crop residues, and unsellable produce into compost and biological substances for pest control. His implementation of New Theory Agriculture helped restore the productiveness and biological diversity of the ecosystem and enabled Boontaen's family to attain household food sufficiency while producing good quality output for market sales year-round and eventually becoming free from debt (Office of the Royal Development Projects Board, 2011). To alleviate poverty and foster sustainable development of the rural sector in the less developed countries, FAO and other humanitarian aid organizations as well as development scholars have made use of the Sustainable Livelihood Approach (SLA) (Slater, 2002; Niehof, 2004; FAO, 2005; Masae, 2015; Wan, *et al*., 2016; Hua *et al*., 2017; Bjornlund *et al*., 2019). The Sustainable Livelihoods Approach (SLA) helps researchers understand the adaptive capabilities of the studied subjects (farmers / villagers) and the ways they reduce poverty (Ashley, 2000). The approach is defined in relation to the livelihood context (uplands or lowlands, remote rural or semi urban, etc.) and the livelihood assets (natural, physical, human, financial, and social capital) (Scoones, 1998) as these assets not only offer a base upon which a farming household can build its livelihood strategies, but they also enable the household to cope with various risks and shocks (Liu *et al*., 2018). These assets (the number, diversity, and balance of these assets in a portfolio) have implications for a household's livelihood strategies (DFID, 2000), the strategies a household employs to achieve its intended livelihood outcomes (Alinovi *et al*., 2010).

Sufficiency Economy Philosophy (SEP)which the late King Rama IX granted to the Thai people on December 4, 1997 (Mongsawad, 2010), is a philosophy that is not only a concept, but also a set of principles and guidelines that are appropriate according to the middle path. The principles can be applied and used at every level, from the household level to the community level to the national level (Piboolsravut, 2004; Thongpakdee, 2011). The principle of national development in the National Economic and Social Development Plan

has been in place since the 9th (Issue 12: 2017-2021), and was included in the Vision of Thailand 2037, which is in the national strategy 2018-2037 (NESDB, 2018). In addition, the UN incorporated the principles in the Sufficiency Economy Philosophy in its Sustainable Development Goals (SDGs) to spread this philosophy to a wider international audience in order to realize the Goals by 2030 (MFA, 2017).

Many thinkers in Thailand have provided definitions for sufficiency economy, all of which include the application of various principles of sufficiency economy for the management of livelihood assets with priority placed on human capital (NESDB, 2004), so as to reach the ultimate goal of sustainable livelihood (SL) outcomes according to the definition of SL. An example is the case of the production theory in Buddhist Economics (Puntasen, 2001) in which importance is given to the real cost. In Buddhist Economics, the real cost does not include only money and raw materials used for production because it comprises three essential constituents: the first is the human resources in terms of intelligence and experience; the second is the man-made resources, which includes physical capital and social capital including technology; the third involves various types of natural and energy resources. It is perceivable that the production inputs defined above by Puntasen correspond to the five Livelihood Capitals addressed in the sustainable livelihoods approach as the primary inputs for realizing the livelihood outcome but on the basis of moderation. Moreover, an article written by Sumet Tantivejkul (cited in Puntasen, 2006) pointed out that self-reliance from optimizing the use of livelihood capitals within the framework of sufficiency economy philosophy, which provides knowledge and morality considerations, will lead to sustainable livelihood. Similarly, Wasi (1999) stated that sufficiency economy includes a non-extreme or middle-path economy in which the family, community, cultural, and environmental elements are interrelated. He further noted that once everything is sufficient, there emerges a state of balance or equilibrium which is synonymous with sustainability.

The above writings demonstrate the core concept of sufficiency economy, using the "middle path" to reflect "moderation" in the management of livelihood assets from individual to household, community, and macroeconomic levels in order to reach the same ultimate goal of sustainability, as in the SL approach.

Apart from enabling those Thai farmers who adopt its principles in their everyday lives to concretely and successfully attain sustainable livelihood as exemplified in a multitude of studies, the SEP has also been praised in many countries and has been applied to practices in such countries as Bhutan, Lesotho, Lao PDR, Timor-Leste, Tonga, Cambodia, and Myanmar (United

Nations Office for South-South Cooperation, 2017). Consequently, the objective of this study is to find the factors and sufficiency economy strategies that contribute to a sustainable rice farming career. This study incorporates the concept of sustainable livelihood (SL) which places the importance on possession of or access to livelihood assets, which in turn forms the basis for devising various livelihood strategies to attain the desired goals or livelihood outcomes of the rice farming household. It is the belief of the present researchers that the application of sufficiency economy principles in the management of livelihood assets is tantamount to devising a well-grounded and suitable livelihood strategy.

Previous SLA research has attempted to gain insight into asset management strategies through observation and analysis of activities or conduct of individuals or communities with the interpretation and conclusions made by the researchers. For example, diverse production activities undertaken by a household will be interpreted as risk diversification (Walker *et al*., 2001; Meert *et al*., 2005; Soltani *et al*., 2012; Hua *et al.,* 2017; Bjornlund *et al*., 2019). Within the agricultural research community, the most common conclusion has been that crop or activity diversification indicates a farming strategy to lower risk and obtain food security (Liu *et al*., 2018; Manlosa *et al*., 2019).

However, this study was to take a different stance to apply the Sufficiency Economy Philosophy as theoretical reference. As the SEP provides concept and practical guidelines, those who adopt the concept gain an "SEP mindset" and will make plans and decisions on the basis of mindset which is manifested in terms of his conduct in different matters.

The research addressed "mindset" as the governing factor in the building of a "livelihood strategy", while considering activities as the tangible output of strategy to reduce poverty and sustainable production of livelihood as the livelihood outcome according to the concept in the Sustainable Livelihood Approach.

This study was conducted to premise the middle path principle in the Sufficiency Economy Philosophy (SEP) to serve as an effective strategy for ensuring the sustainability of the rice farming career.

Materials and methods

Design and sample

Chiang Mai Province was selected to be the study site as it features many types of land. As such, rice farming systems in Chiang Mai are highly diversed. The 447 rice farming household samples from 28 Sub-districts of 11 Districts

in Chiang Mai Province comprise cultivators in Upper Northern Thailand engaged in lowland, upland and highland rice farming systems under either irrigated, non-irrigated, or rain-fed conditions. These sample households can be further divided into those farming in the lowland area using agrochemical inputs like the majority of rice farmers in Thailand, those farming in organic or chemical-safe systems, and those farming in the upland or highland areas, including some local Thai or hill tribe people.

Data were collected as the socio-economic background of the sample farming households, the characteristics and elements of SEP principles through a questionnaire and in-depth interviews the farmers. The obtained SEP-related information was selectively extracted for the development of a SEP practice self-assessment form which was used for data and information collection.

Variables and measurement

Dependent variable

During the survey, each farmer was asked to indicate and consider his/her domestic context, how much longer the household was expected to continue rice farming. Half (51.7%) of the samples indicated that they would continue no more than 15 years, with 25% responding 10-15 years and the rest, a comparable proportion, expecting to continue fewer than 10 years. Of the total sample, 14.1% expected to be in the rice farming career for 16-20 years, and one-third or 34.2 % expected to continue for more than 20 years.

Based on the range of years the farmers expected to be in the rice farming career (Y) as shown above, three definitions of Y were experimented to explore which definition of Y is the best predictor of the Logit models, namely M1, M2, and M3. The variable Y is defined as follows:

Model 1 (M1): rice farming expectancy is divided into 2 groups
$\quad\quad\quad\quad\quad$ $Y_0 = 1 – 20$ years $\quad$ leads to 65.77 % observations
$\quad\quad\quad\quad\quad$ $Y_1 = > 20$ years $\quad\quad$ leads to 34.23 % observations
Model 2 (M2): $Y_0 = 1 – 15$ years $\quad$ leads to 51.67 % observations
$\quad\quad\quad\quad\quad$ $Y_1 = > 20$ years $\quad\quad$ leads to 34.23 % observations
Model 3 (M3): $Y_0 = 1 – 15$ years $\quad$ leads to 51.67 % observations
$\quad\quad\quad\quad\quad$ $Y_1 = > 15$ years $\quad\quad$ leads to 48.33 % observations

The logit model analysis was performed on two experiments. The first was the comparison between M1 and M2 in which the same objective is shared, that is to maintain the rice farming career for at least 20 years. Thus, both have $Y = 1$. However, $Y = 0$ is given in M2 as the observations indicating the intention to continue rice farming for another 16-20 years were excluded

(14.10% of the samples). This was done to observe the results of the prediction from the responses of farmers in the two extreme groups and to understand the factors determining the two different expectations, namely continuation of the rice farming career for less than 15 years or for more than 20 years. This is based on the hypothesis (assumption) that M2, which provides a prediction based on the extreme values, will give a more clear-cut result compared to M1, which considers all 447 observations with a more continuous set of data regarding the number of years in the rice farming career.

The second experiment was the comparison between M1 and M3 to observe the differing results derived from setting the threshold of being in the rice farming career at 20 years or 15 years, respectively. In M3, grouping the farming households using 15 years as a benchmark led to approximately equal numbers of households expecting to continue rice farming for more than 15 years as continuing for no more than 15 years (52% and 48%, respectively).

Independent variables

Apart from the livelihood strategy, henceforth called the SEP strategy, which is the primary explanatory variable, other internal and external independent variables commonly found in the literature review are also considered in this study. Consequently, a total of 29 explanatory variables are shown in Table 1. They can be distinguished into 4 groups namely: 1) internal factors, 2) SEP strategies, 3) farmer's attitude toward and satisfaction with livelihood assets and environment, and 4) external factors.

Age of household head, number of household laborers, and the existence of someone to inherit the rice farming occupation are the three main household characteristics hypothesized to have a direct effect on the sustainability of the rice farming career. Other factors like educational attainment are also considered to have influence (Soltani *et al.*, 2012; Bhandari, 2013; Nindam *et al.*, 2018).

Land utilization and land tenure are the two internal factors that are considered not only because land right security is supportive of on-farm investment, which will in turn enhance land productivity and benefit the landowner (IFAD, 2007), but also because it affects the sustainability of a farmer's persistence to continue farming as well as the farmer's decision to farm for commercial purposes or for subsistence (IFAD, 2012). Furthermore, attitudes toward the rice farming occupation, life satisfaction, and farmers' social and environmental surroundings are also hypothesized to be explanatory variables of the sustainability of a rice farming career (Table 1).

As the livelihood strategy in this study corresponds to the SEP's principles in conducting one's everyday life, we used Principal Component

Analysis (PCA) to identify livelihood strategy, which henceforth will be referred to as the SEP strategy (Prabripu, 2020). Six SEP strategies were identified using PCA.

Table 1. Descriptive statistics of independent variables and hypothetical effect on years

Variable	Description	General		Expected effect
		Mean	**SD**	
Independent variables				
Internal factors				
AGE	Age of household head, a rice farmer (years)	58.74	9.61	-
HIHR	Having someone to inherit rice farming (Dummy) =1	0.34	0.48	+
EDU>12	Having at least one working-age family member with education higher than senior high school/ vocational school certificate (Dummy) =1	0.36	0.48	-
ATTD	Good attitudes toward rice farming occupation (1-5)	3.65	0.45	+
NAC	Number of activities generating direct and indirect income.	3.66	1.30	+
NPA	Number of organizations that household members participate in	2.02	2.14	+
IPH	Average income per head (baht/year)	58,897	57,496	+
IOFF	% share of off-farm income in total household income	46.62	33.23	-
SAVING	Current household savings (baht)	18,836	57,331	+
DEBT	Current household debs (baht)	83,051	142,617	-
NAGR	Number of household member(s) doing farming	1.88	0.84	+
LOWL	Lowland rice cultivation (Dummy) =1	0.82	0.38	+
LUSE	Farming land area (rai)	10.94	7.74	+
LOWNE	Land ownership (% of land with ownership in total land available for household utilization)	34.06	41.25	+
SWAT	Sufficient water for farm irrigation (Dummy) =1	0.78	0.41	+
SFARM	Subsistence farming (Dummy) =1	0.15	0.35	-
AFARM	Alternative farming (Dummy) =1	0.08	0.27	+

Table 1. (Con.)

Variable	Description	General		Expected effect
		Mean	**SD**	
SEP strategies [1]				
STRA1 (Technical knowledge concentration: TKC)	SEP based strategy under the conventional technical knowledge principle	4.5E-08	0.99	+
STRA2 (Self-Immunization concentration: SIC)	SEP based strategy similar to New Theory Agriculture.	-2.68E-07	0.99	+
STRA3 (Industriousness – self-reliance concentration: IRC)	SEP based strategy under the industriousness and not making use of hired labor.	2.2E-08	0.99	+
STRA4 (Self-reliance concentration: SRC)	Strategy under the self-reliance on family labor.	1.34E-07	1.00	+
STRA5 (Market economy concentration: MEC)	Strategy under the principle of using proper level and correct procedure when applying agrochemicals; and having diverse income sources.	-2.24E-07	1.00	+
STRA6 (Middle Path concentration: MPC)	SEP based strategy under the morality principles and moderation.	2.01E-07	1.00	+
Farmer's attitude toward and satisfaction with livelihood assets and environment				
ASSET	Satisfaction with assets and livelihood (1-5)	4.05	0.55	+
LSAT	Satisfaction with security in life (1-5)	4.31	0.51	+
External factors				
GOODST	Satisfaction with social surroundings (1-5)	4.32	0.43	+
FIN	Access to financial sources (1-5)	3.87	0.95	+
GOODENV	Satisfaction with the richness of the environment (1-5)	4.29	0.49	+
GOODINFR	Satisfaction with the public infrastructure (1-5)	4.07	0.59	+

Source: Survey, 2017

[1] Prabripu (2020)

Data analysis

The effects of the independent variables were analyzed on the dependent variable, expected number of years to continue rice farming (Y), which taken the dichotomous value of 1 if it exceeds the threshold and 0 if it is less than the threshold, the appropriate regression would be either the logit or probit models. Because the cumulative normal distribution and the logistic distribution are very closed to each other, except for the tails, the estimates are unlikely to be very different (Maddala, 1983). More importantly, the partial effects are implied by the probit and logit models suggest the difference largely disappears (Greene and Hensher, 2009:33). In empirical research, however, the logit model is commonly used in the binary choice model and it is expressed as in equation (1).

$$P(Y_i = 1) = \frac{e^{a+bX_i}}{1 + e^{a+bX_i}} \tag{1}$$

and $P(Y_i = 0) = 1 - P(Y_i = 1),$ where $i = 1.......n$ observation

To estimate the coefficient a and vector b, the maximum likelihood method is applied (Maddala, 1983; Verbeek, 2004). The marginal effect of a factor is measured by equation (2) to predict change in the probability of $Y_i = 1$ i.e. rice farming career expectancy >20 years.

$$\frac{\partial P(Y_i = 1)}{\partial X_k} = \frac{e^{a+bX_i}}{\left(1 + e^{a+bX_i}\right)^2} b_k \tag{2}$$

Because the derivative is calculated with respect to a small change, it is appropriated to apply equation (2) to a dummy variable, but it can be calculated for the difference of probability where the dummy variable takes the value 1 and 0, evaluated at the means of all other variables. It is also commonly reported the elasticity of probability calculated directly from the marginal effect shown as ε_{ik} in equation (3):

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$$\varepsilon_{ik} = \frac{\partial P(Y_i = 1 | X_i)}{\partial X_k} \cdot \frac{X_{i,k}}{P(Y_i = 1 | X_i)} \qquad (3)$$

Results

The estimates of equation (1) revealed that all three logit models, regardless of definition of the dependent variable were statistically significant (Table 2). However, the AIC values and the prediction accuracy of M1 and M2 were quite comparable to each other but differed from those of M3. Thus, it concluded that 1) the setting of the career threshold at 20 years was more suitable than 15 years because planning to continue rice farming for more than 20 years beyond the year the survey was taken in 2017 that was statistically differed from planning to continue rice farming for no more than 20 years due to contributing factors at the first choice; 2) the comparability between M1 and M2 in terms of prediction accuracy were 78.5% and 77.3%, respectively, and their better performance than M3 which confirmed the robustness of the first two models. Since M1 utilized all 447 observations, while M2 was 86% of total observations.

Influences of internal and external factors

Based on the literature, 17 internal variables, 4 external variables, and 2 attitudinal variables as shown in Table 1 were hypothesized as attributes affecting the probability of career expectancy. However, our findings revealed that only 3 internal and 2 external variables (and no attitudinal variables) were statistic significantly differed in coefficients as seen in Table 2.

The age of the household head was found slightly negative effect in marginal effect as -0.006 or -0.028% in the form of elasticity on the probability of maintaining the rice farming career for a long time. On the contrary, having some family members to inherit the rice farming career is linked to a higher probability of the farming household continuing to farm rice (marginal effect = 0.315 or elasticity = 1.711%). Existence of an heir to the rice farming occupation was the most influential factor for the sustainability of family rice farming; otherwise, the family occupation would be disappeared in the next generation.

Living in a good society (GOODST) was the only external factor that increased the probability of expectation to continue a family rice farming career for more than 20 years at a statistically significant level (0.01) with marginal effect = 0.011 and elasticity = 0.046%. It was a result of living in a good community where people come together to help and shared with one another.

Table 2. The logit models of rice farming expectancy

Variable	(M1) (0-20, >20)		(M2) (0-15, >20)		(M3) (0-15, >15)	
	Coefficients	**Marginal effect**	**Coefficients**	**Marginal effect**	**Coefficients**	**Marginal effect**
Internal factors						
AGE	-.0437***	-.00683***	-.0599***	-0.0091***	-.0612***	-.01064***
	(0.0146)		(0.0163)		(0.0140)	
HIHR	1.7805***	.31513***	2.2686***	0.3438***	2.1372***	.38579***
	(0.3090)		(0.3601)		(0.3162)	
EDU>12	-0.0883	-0.0138	-0.1436	-0.0218	0.0781	0.01359
	(0.3222)		(0.3525)		(0.3065)	
ATTD	-0.0211	-0.0033	-0.0273	-0.0041	-0.0102	-0.00178
	(0.0166)		(0.0189)		(0.0163)	
NAC	-0.0286	-0.0045	-0.0208	-0.0032	-0.0531	-0.00924
	(0.0998)		(0.1116)		(0.0963)	
NPA	0.0378	0.0059	-0.0028	-0.0004	-0.0049	-0.00085
	(0.0611)		(0.0670)		(0.0598)	
IPH	0.0209	0.0033	0.0213	0.0032	0.0071	0.00123
	(0.0192)		(0.0206)		(0.0190)	
IOFF	0.0038	0.0006	0.0052	0.0008	0.0066	0.00114
	(0.0049)		(0.0053)		(0.0047)	
SAVING	-0.0202	-0.0032	-0.0331	-0.0050	-.0406**	-.00706**
	(0.0210)		(0.0219)		(0.0200)	
DEBT	-0.0079	-0.0012	-0.0051	-0.0008	-0.0035	-0.00061
	(0.0099)		(0.0105)		(0.0093)	
NAGR	-0.2377	-0.0372	-0.2146	-0.0325	-.2949*	-.05127*
	(0.1760)		(0.1928)		(0.1682)	
LOWL	-0.4394	-0.0706	-0.5153	-0.0781	-0.4097	-0.07144
	(0.3127)		(0.3513)		(0.3040)	
LUSE	-0.0065	-0.0010	-0.0152	-0.0023	-0.0097	-0.00169
	(0.0189)		(0.0218)		(0.0185)	
LOWNE	-0.0009	-0.0001	0.0014	0.0002	-0.0010	-0.00018
	(0.0033)		(0.0036)		(0.0031)	
SWAT	-.5021	-.08149*	-0.4365	-0.0661	-0.2930	-0.05125
	(0.2976)		(0.3267)		(0.2927)	
SFARM	0.6672	0.1094	0.5320	0.0806	0.2300	0.04019
	(0.4212)		(0.4763)		(0.4128)	
AFARM	0.0602	0.0095	-0.2762	-0.0418	0.1014	0.01765
	(0.5078)		(0.5942)		(0.4912)	

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Table 2. (Con.)

Variable	(M1) (0-20, >20)		(M2) (0-15, >20)		(M3) (0-15, >15)	
	Coefficients	Marginal effect	Coefficients	Marginal effect	Coefficients	Marginal effect
SEP strategies						
STRA1	-0.0454	-0.0071	0.0288	0.0044	0.0802	0.01395
	(0.1640)		(0.1781)		(0.1608)	
STRA2	.2807**	.04390**	.4178***	0.0633***	.4099***	.07130***
	(0.1397)		(0.1606)		(0.1338)	
STRA3	-0.2161	-0.0338	-0.2363	-0.0358	-0.1131	-0.01967
	(0.1355)		(0.1448)		(0.1295)	
STRA4	-.4553***	-.07119***	-.4623***	-0.0700***	-.3453***	-.06005***
	(0.1353)		(0.1487)		(0.1315)	
STRA5	-0.0539	-0.0084	-0.0039	-0.0006	0.1046	0.01818
	(0.1354)		(0.1516)		(0.1319)	
STRA6	.6077***	.09502***	.7943***	0.1204***	.7289***	.12674***
	(0.1510)		(0.1688)		(0.1473)	
Farmer's attitude toward and satisfaction						
with livelihood assets and environment						
ASSET	-0.0132	-0.0021	-0.0039	-0.0006	0.0026	0.00044
	(0.0157)		(0.0173)		(0.0152)	
LSAT	-0.0088	-0.0014	-0.0067	-0.0010	-0.0078	-0.00135
	(0.0153)		(0.0178)		(0.0148)	
External factors						
GOODST	.0695***	.01087***	.0681***	0.0103***	.0389*	.00676*
	(0.0216)		(0.0239)		(0.0208)	
FIN	-.0156	-.00244*	-0.0134	-0.0020	-0.0095	-0.00165
	(0.0083)		(0.0091)		(0.0082)	
GOODENV	0.0009	0.0001	-0.0084	-0.0013	-0.0177	-0.00308
	(0.0174)		(0.0197)		(0.0168)	
GOODINFR	-0.0040	-0.0006	-0.0024	-0.0004	-0.0046	-0.0008
	(0.0140)		(0.0156)		(0.0139)	
Statistical report						
Pseudo R^2	0.2543		0.3088		0.2491	
AIC	488.3		416.9		524.9	
Prediction accuracy	78.5		77.3		72.9	
No. of observations	447		384		447	

Remark: *,**,*** indicate the level of significance at .1, .5 and .01 respectively.

The standard error is in parenthesis. Semi-elasticity is used instead of normal elasticity.

Semi-Elasticity: AGE= -0.0287***, HIHR= 1.1711***, SWAT= -0.3302*,

STRA2= 0.1846**, STRA4= -0.2994***, STRA6= 0.3997***,

GOODST= 0.0457***, FIN= -0.0103*

Semi-elasticity of a dummy variable (d) is

$$e_{i,k} = \frac{\text{Prob}(y_i = j \mid x_i d_i = 1) - \text{Prob}(y_i = j \mid x_i d_i = 0)}{\frac{1}{2}\left[\text{Prob}(y_i = j \mid x_i d_i = 1) + \text{Prob}(y_i = j \mid x_i d_i = 0)\right]}$$

(Greene and Hensher, 2009: 36)

Two factors, SWAT and FIN, whose marginal effects were -0.081 and - 0.002 or elasticity = - 0.330 and - 0.010, respectively. It needed to explain their negative effects. The results indicated that a 1% increased in the sufficiency or supply of water for farm irrigation decreased the probability to maintain the family rice farming career for more than 20 years by 0.33%. While a one unit increased in access to a financial resource decreased such probability by 0.01%. Moreover, when positive change was taken place by one unit simultaneously in both of these factors. The combined effect reduced the probability of continuing the family rice farming career for more than 20 years by 0.34%, which was contradictory to the hypothesis of this study. However, the survey disclosed that irrigation water sufficiency opened the opportunity for the rice farmer to grow higher-value crops in which the farmer may greater incentive to invest. With experience with water shortage, rice farmers become more aware of the value and the scarcity of water.

Furthermore, farmers who had sufficient water supply for farm irrigation who have land in the irrigated zone close to a city or town, and earned more knowledgeable than their counterparts in the rain-fed areas. Therefore, those farmers with relatively more access to land and water resources and to relevant knowledge become more likely to take out loans that transformed their rice farming into other agricultural pursuits. Nevertheless, these two factors, which were statistically significant at the 0.10 level and further monitored to confirm their negative effects in the future.

The findings were contradictory from previous studies. We found that other internal and external factors including household income, off-farm income, indebtedness, production system, and attitude which were not statistically significant affected on a farmer's decision to maintain the family rice farming career for more than 20 years from the time of the study.

Influence of livelihood strategy

This study deviated from previous investigations by using livelihood strategy which determined by the theory governing farmers' mindsets rather than their conduct or activities to analyze the effects of independent variables on sustainability of the farming career. The present livelihood strategy is based on the concept of sustainability corresponding to various principles in the Sufficiency Economy Philosophy. Prabripu (2020) found the same rice farmers to employ six livelihood strategies. Each strategy carried a different weight of the SEP components, and the difference was meaningful for reflecting the level of SEP practice. The SEP strategies for managing livelihood assets that enhanced the likelihood of the household to maintain the family rice farming

career for more than 20 years for strategy 2 and strategy 6, while strategy 4 was a negative effect.

Strategy 2 emphasized building immunity to minimize risk through the practice of mixed-farming, construction of farm ponds, integration of local knowledge in agricultural production, and distribution of farm output via marketing network. The marginal effect of strategy 2 showed the value of 0.044, which is used to calculate an elasticity value of 0.185. It showed 1% increased in intensity for strategy 2 which increased the probability of career expectancy exceeding 20 years by 0.185%. In general, those rice farmers who implemented New Theory Agriculture grew rice as the main crop to meet household consumption that needed and sell only in the marketable surplus, which become the reason why they were likely to continue their rice farming career for a longer time.

Strategy 6 was stressed the middle path by relying primarily on one's own capital and borrowing loans only when necessary, spending money logically, reducing spending on unnecessary goods, services (e.g., alcohol, cigarettes), and was reduced harm of others environment by refraining from the use of agrochemicals. Farmers pursuing this strategy placed importance in safety food suitable for household consumption. This strategy was more influential than strategy 2. The marginal effect was 0.095 and the elasticity was 0.399, which 1% increased in a farming household's intensity of following the middle path principle that increased the probability of maintaining the family rice farming career 20 years by 0.399%.

Strategy 4 emphasized dependence on family labor without hired labor due to limited land resources. Since the economy of scale was not possible, farming households would use only their own resources without renting additional land for farming. They would take other secondary occupations to earn income. The strategy reduced the probability of maintaining the rice farming career for more than 20 years by 0.299%.

Evidently, those farmers who used strategy 1 (conventional technical technology), strategy 5 (market economy oriented), and strategy 3 (industriousness) to manage their livelihood assets which were unlikely to continue their rice farming careers for long time.

Discussion

Sustainable livelihood is a widely known research and community development approach. Comprehension of livelihood asset management strategies, or livelihood strategies in short, is useful for the development of the target community or the development issues of interest of various

organizations. Regarding the farming community, previous research has attempted to identify livelihood strategies by drawing conclusions from behavior and activities of the target group (Prabripu, 2020). However, the present research used farmers' practice of SEP principles as the representation or indicator of livelihood strategies because the SEP principles were recognized as an approach to sustainability, which is considered to be synonymous with sustainability of the rice farming career or, specifically, the continuation of the family rice farming career for more than 20 years from the time of the present investigation.

The binary logit regression analysis revealed that two strategies had a positive impact on the sustainability of the rice farming career, named strategy 2 regarding building immunity via construction of farm ponds, participation in marketing networks, and management of livelihood assets for farming in accordance with New Theory Agriculture; and Strategy 6, which stresses the middle path in production and consumption and which is the principle that most clearly reflects a state of sufficiency economy and which is regarded as the core principle of the SE theory.

Prabripu (2020) stated that other strategies, regarding knowledge and technical know-how of mainstream agricultural production or involving diversification of income risk through off-farm work, did not appear to determine factors of sufficiency economy.

Even though the SEP recommended self-reliance and used of adequate labor and production material to support production quality and efficiency (the reasonable use principle). It found that the Logit model analysis indicated that strategy 4 was emphasized a self-reliance by depending largely on household labor and associated with the smaller farms and lower investments that reflected a lack of perseverance and was not conducive to sufficiency economy.

The present empirical research confirmed the possibility to increase the probability to stay in the family rice farming career for more than 20 years. At the same time, It was able to indicate the level of farming household's employment of SEP principles which Puntasen (2017) who proposed either not qualified, qualified, understand or access. It can be explained that only strategy 6 and strategy 2 are considered to be SEP strategies but not strategy 4 which was a negative effect on sufficiency economy.

Apart from the strategies used to make a career, the most important internal factor was existed an heir to inherit the family rice farming career, and followed by living in a good community. The present finding is consistent with the study of Nindam *et al*. (2018) which indicates that the availability of family labor is the most significant indicator of the sustainability of a family farm due to the growing scarcity of the waged-labor in the agricultural sector. Living in a

good society also refers to a community where people cooperate in career support and agricultural problem solving by creating activity groups such as vocational and savings groups. This finding is consistent with Leerattanakorn and Wiboonpongse (2017) who point out that living in the good social surrounding can bring about happiness from one's exposure to the social-economic strength and religiousness of the community. Moreover, a farmer can be happy partly because he/she is attentive to relative income rather than absolute income (Leerattanakorn and Wiboonpongse, 2015). For these reasons, those farmers who earn not so attractive financial return from their rice farming career at the moment (other things being equal) but are living in a community having no social class will be likely to have a more lengthy rice farming career expectancy.

These two factors, both with highly statistically significant explanatory power, are thus crucial in policy implications. A sustainable rice farming career can be realized if a good community can be developed through SEP-based community planning which has been proven to correlate highly with the well-being of community members.

At present, Thai government is aware of the problem of the Thai youth's lack of interest in the farming career, and has launched a policy to encourage Thai youth to interest in agriculture and register as young smart farmers. This policy is enhanced by including aggressive measures to draw the attention of younger people who still have not interested in agriculture to enter the farming career, and used their technical knowledge in combination with the middle path principle of the SEP, while taking into account their available livelihood capitals. This suggestion is not limited only to the rice farming career because the application of New Theory Agriculture in any farming ventures that can lead to future advancement, and security for young farmers. Furthermore, SEP-based community planning at the village or sub-district level can contribute to provide good communities for farmers to live and continue their family rice farming careers. For this reason, it is necessary to help farmers to understand the SEP and apply the principles suitably.

Acknowledgements

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