Income diversification strategies of rubber farmers in Southern Thailand: an empirical study

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Abstract

In Thailand, rubber is a very important cash crop of which nearly 95% is produced by smallholders. This study aims to investigate the income diversification strategies adopted by rubber farmers in Southern Thailand. Primary data was collected through a cross-sectional survey conducted in 12 sub-districts under six districts of three provinces (namely, Songkhla, Surat Thani and Trang) in Southern Thailand. A standardized questionnaire was used to receive responses from a total of 398 rubber smallholders selected randomly in the chosen areas (i.e. 12 sub-districts) for this study. The findings revealed that three income strategies, namely, rubber farm income only (R), rubber farm and non-farm income (RN), and combination of rubber farm, other farm, and non-farm income (RAN) were the dominant income strategies adopted by rubber farmers in Thailand. The study identified seven factors namely, age and education of household head, family size, land size holding, access to credit, land right and access to cooperative that had significant influence on income diversification strategies of the households. It was also revealed that rubber farmers with large household size are more likely to pursue all choices of income diversification strategies to increase their income. This might be due to the relation between larger family size and household labor or corresponding higher expenditure in the household. The study findings might be useful for policymakers to design and implement more effective policies to provide more income-generating ventures for rubber farmers in Thailand.

Keywords: Income diversification, strategy, rubber farmers, Thailand.
Abbreviations: FAO_Food and Agriculture Organization; ha_hectare; OAE_Office of Agricultural Economics; ANOVA_Analysis of Variance; R_Rubber farm income only; RA_Rubber farm and other farm income; RO_Rubber farm and off-farm income; RN_Rubber farm and non-farm income; RON_Rubber farm, off-farm and non-farm income; RAN_Rubber farm, other farm and non-farm income

Introduction

In Thailand, 53% of the population is living in rural areas and 40% of the labor force is working in the agricultural sector (World Bank, 2012). Most of the agricultural products come from small family farms (FAO, 2015). Like other developing countries, rural households in Thailand have diversified income portfolios. Income diversification is a strategy whereby households allocate their assets among different income-generating activities (Abdulai and Rees, 2001). In other words, they earn income not only from farming activities but also off-farm activities (at least one) (Barrett et al., 2001; Davis et al., 2007; Babatunde and Qaim, 2009; Senadza, 2014). It is important to note that income diversification is not seen as an indication of deficient (ineffective) agriculture or as an emergency solution, but rather as a long-term strategy of farm households and a contribution to the sustainable development of rural areas (Pieniadz et al.,2009). The literature also explains income diversification as a risk reduction approach i.e. responding to household income shocks and asset accumulation strategies. Several previous studies attempted to identify the determinants of income diversification among households in

rural areas (Bernard et al., 2008; Longpichai, 2012; Senadza, 2014; Asfaw et al., 2017; Nguyen and Nguyen, 2019; Akrasi et al., 2020). The determinants include household asset endowments (human, physical, social, and financial), access to infrastructure, locational advantages, agro-climate, relative prices, and risk.

The forms and patterns of income diversification have changed with the passage of time. One of the income diversification strategies adopted by smallholders is to expand existing activities or explore new activities aimed at improving the standard of their living. An example of an important strategy for improving the livelihoods of smallholders is to conduct non-agricultural activities. Diversity in crop types is often used as an alternative to maintaining the livelihoods of a community, in addition to agricultural and plantation integration activities and involvement in non-agricultural activities (Legesse et al., 2013). However, the strategies adopted depend on their accessibility to living assets as well as economic, social, and environmental factors (Dorward et al., 2009). Alternative strategies are the second-best option to ensure that the

smallholders have a better life and get out of the poverty line. They not only diversify their strategies for survival but also strengthen their financial and wealth assets. The level of wealth and ownership of living assets are among the important factors in the selection of alternative strategies (Zulhaid et al., 2021).

Rubber is a very important crop fueling the Thai economy. Nearly 95% of the total production of natural rubber in the country is produced by small family farms that own less than 8 ha of land (Siriaraya, 2009). Natural rubber contributes to the national GDP of the country and provides livelihoods to thousands of rural families. A greater portion of agricultural labor in Thailand is engaged in the rubber sector. It is important to note that Thailand has emerged as the largest producer and exporter of natural rubber around the world during the last few decades. The volume of production has regularly increased mainly because of the extension of land for rubber production and the increase in yields ((IRSG, 2015). In addition, the support from the Government for replantation and new plantation of the rubber tree and favorable economic conditions contributed to making planted area double and increase in production by 13 times during the past few decades (Chambon and Dao, 2014). It was reported that in 2020, Thailand was able to export rubber of 181,934 million baht around the world (OAE, 2020). The total rubber plantation area in the country covered 22.3 million rai of land in the year 2020. Out of this, the largest area was in the South of Thailand covering 13.3 million rai of rubber plantation, followed by the Northeast with 5.3 million rai, 2.4 million rai in Central Thailand and 1.3 million rai in the North (OAE, 2020). The findings indicate that most of the rubber plantations are in the south of Thailand as compared to other parts of the country, because of the suitability of its geography and meteorology for rubber production (OAE, 2020). Therefore, natural rubber plays a key role in the development of the regional economy of the country (Siriaraya, 2009).

Since 1960 the Thai Government has promoted monoculture of cash crops that are export oriented. Chemical fertilizer, herbicides, machineries and technology-based equipment, and insecticides had been intensively the used in agriculture sector to the promote monoculture of cash crops. However, in the 1980s, a number of problems such as lowered productivity, degraded soil conditions, high amounts of farmers' debt and damaged health of farmers started to arise due to the increased usage of chemical inputs and mechanical equipment. Rubber smallholders in Thailand also faced many of these problems and constraints. It is important to note that all these persistent problems and constraints influence the farmers to adapt and implement new plans and strategies and lead to diversify sources of their income. Previously, a few studies focused on diversification in rubber farming systems in Thailand. Somboonsuke et al., (2001) revealed that rubber smallholders in Thailand adopted various farming systems and adjustment strategy to cope up the adverse effects of the 1997 economic crisis. In line with the previous study, Longpichai (2013) attempted to classify rubber farming systems as well as identify the internal and external drivers behind such diversification in rubber farming in Thailand. However, the previous studies focused only on diversification of rubber farming systems in the country. To the best knowledge of the researchers, there is no empirical evidence on income diversification strategies of rubber smallholders in the country. Therefore, this study aims to investigate the determinants of income diversification of rubber farmers in Southern Thailand. From the viewpoint of designing and implementing policies for rubber farmers, it is also equally important and needful to understand the income diversification of the rubber farmers and factors influencing such diversification in the country.

Results and Discussion

Comparison of income diversification strategies

As stated earlier, the income diversification strategies of the rubber farmers have been classified into six groups. The study conducted analysis of variance (ANOVA) and chi-square test to examine the difference of some variables of household in all income strategies. In this case, the mean values of continuous variables in all income categories were compared using ANOVA. Table 1 shows the summary statistics for continuous variables by the choice of income diversification. The study found a significant mean difference between households falling in all six income strategies in terms of the following factors: age of household head, education level of household head in years, family size of the household in terms of adult, and size of land holding by the household. The study results showed that the farmers who adopted the combination of rubber farm, other farm and non-farm activities (RAN) as their income diversification strategy, monthly income of the households were higher than that of the others. Their monthly cash income was found to be, on average 34,453.57 Baht, followed by the rubber farmers who have rubber farm and non-farm activity (RN) with the average monthly income of 28,224.28 Baht. The study also found the average land size of 24.15, 35.91, 11.63, 18.88, 11.38 and 33.06 rai for the households who adopted R, RA, RO, RN, RON and RAN respectively. The findings indicate that the greater the land size the higher the on-farm activities. In other words, the households owning more land area seem to adopt more on-farm activities. It was also found that the household heads who were engaged in rubber farm only had the lowest level of education while the household heads who were engaged in rubber farm and non-farm activities had the highest level of education. This indicates that education is an important factor in the pursuit of non-farm activities (RN, RON, RAN). On the other hand, less educated household heads pursue farm activities both on farm and off farm (R, RA, RO) (Table 1).

Table 2 provides summary statistics for dummy variables by the choice of income diversification. The value of chi-square test indicated the existence of statistically significant difference among the six strategies in terms of six discrete variables. More specifically, the test revealed that there was a significant difference among the groups in terms of access to credit service and access to formal cooperatives at 1% and 5% probability level respectively (Table 2).

Factors influencing the choice of income diversification Strategy by Rubber Farmers

Table 3 shows the summary findings of the multinomial logistic model. Out of ten hypothesized variables in the model, seven variables (i.e. age of the household head, education level of the household head, family size, land size holding, access to credit service, land right and access to formal cooperative) were found to have significant influence on household's choice of alternative income diversification

Table 1. Summary statistics for continuous variables by the choice of income diversification.

Variable	R	RA	RO	RN	RON	RAN	Total	F-value
	Mean							
Age	62.49	59.78	54.90	54.66	50.24	55.81	57.03	7.001**
Education	7.79	8.10	8.10	9.97	9.14	9.69	9.06	5.551**
Family size	2.12	2.58	3.20	2.98	3.29	3.04	2.78	7.114**
Land size (in rai)	24.15	35.91	11.63	18.88	11.38	33.06	23.82	5.387**
Household Income (Baht per month)	16,046.85	23,869.72	19,218.00	28,224.28	22,653.14	34,453.57	25,256.25	11.127**

** Stand for 1% significance level 1 rai = 0.16 hectare; 1 US$ = 0.032 Bath (April, 2021)

Table 2. Summary statistics for dummy variables by the choice of income diversification.

Variable	Response	R	RA	RO	RN	RON	RAN	Total	χ^2 value
	Percent (%)								
Sex	Male	14.1	10.1	3.3	27.4	3.8	12.1	70.6	5.184
	Female	8.3	2.5	1.8	10.6	1.5	4.8	29.4	
Credit	Yes	12.3	8.8	4.0	27.6	4.8	12.8	70.4	16.475**
	No	10.1	3.8	1.0	10.3	0.5	4.0	29.6	
Extension	Yes	3.5	2.8	0.5	5.8	0.8	5.0	18.3	8.912
	No	18.8	9.8	4.5	32.2	4.5	11.8	81.7	
Land right	Yes	15.6	8.3	2.3	28.6	3.8	10.6	69.1	9.915
	No	6.8	4.3	2.8	9.3	1.5	6.3	30.9	
Coopmem	Yes	14.6	7.8	4.5	25.1	2.3	12.6	66.8	12.788*
	No	7.8	4.8	0.5	12.8	3.0	4.3	33.2	
Roat	Yes	14.6	7.8	3.8	26.6	3.0	10.3	66.1	3.719
	No	7.8	4.8	1.3	11.3	2.3	6.5	33.9	

**Significance at 1% probability level, *Significance at 5% probability level. R_Rubber farm income only; RA_Rubber farm and other farm income; RO_Rubber farm and off-farm income; RN_Rubber farm and non-farm income; RON_Rubber farm, off-farm and non-farm income; RAN_Rubber farm, other farm and non-farm income

Table 3. Result of multinomial logistic model.

Income Diversification										
Variable	rubber farm + other farms		rubber farm + off-farm		rubber farm + non-farm		rubber farm + off-farm + non-farm		rubber farm + other farms + non-farm	
	Coeff.	RRR	Coeff.	RRR	Coeff.	RRR	Coeff.	RRR	Coeff.	RRR
Cons	-1.635197	0.1949139	-2.002743	0.1349646	-1.665444	0.1891066	-1.755956	0.1727421	-2.662361	0.0697833
SEX	0.6597967	1.934399	0.5406519	1.717126	0.450616	1.569279	0.6698856	0.1954014	0.0560037	1.057602
AGE	-0.007641	0.9923881	-0.027388	0.9729836	-0.0150987	0.9850147	-0.0495985	0.9516114*	-0.011465	0.9886004
EDUCATION	-0.0144016	0.9257016	0.002024	1.002026	0.1481933	1.159737***	0.0648923	1.067044	0.1026397	1.108092*
FAMSIZE	0.280823	1.324219*	0.6232932	1.86506***	0.5453232	1.725166***	0.821427	2.273742***	0.5599925	1.750659***
LANDSIZE	0.009431	1.009476	-0.0942497	0.9100555***	-0.0259443	0.9743894***	-0.0949666	0.9094033***	0.0098154	1.009864
CREDIT	0.546943	1.727962	0.5767641	1.780268	0.4881782	1.629345	2.151022	0.8593637**	0.5853343	1.795591
EXTENSION	0.3157898	1.371342	-5947707	0.5516891	-0.1892431	0.8275853	0.1637232	1.177888	0.5841239	1.793419
LANDRIGHT	0.0458123	1.046878	-1.009088	0.3645513*	0.3493027	1.418078	0.2217249	1.248228	-0.1868023	0.8296078
COOPMEM	-0.2830899	0.7534521	1.421882	0.4144915*	-0.2160952	0.8056586	-1.39295	0.2483417**	0.1125191	1.119094
RAOT	-0.0369976	0.9636785	0.920456	2.665671	0.3056756	1.351542	0.2154991	1.240481	-0.1373222	0.8716893
Number of observation	398									
LR chi^2 (50)	169.38									
Prob > chi^2	0.0000									
Pseudo R^2	0.1356									
Log likelihood	-539.65702									

***, **, * stand for 1%, 5% and 10% significance level respectively

Table 4. Choice of income diversification adopted by sample households.

Choice of income diversification	Frequency (N = 398)	Percent (%)
rubber farm income only (R)	89	22.4
combination of rubber farm + other farm income (RA)	50	12.6
combination of rubber farm + off-farm income (RO)	20	5.0
combination of rubber farm + non-farm income (RN)	151	37.9
combination of rubber farm + off-farm + non-farm income (RON)	21	5.3
combination of rubber farm + other farm + non-farm income (RAN)	67	16.8

Table 5. Description of variables used in the multinomial logistic and regression model.

Variables	Description and unit of measurement	Expected sign
Sex	Dummy, 1 if the head is male and 0 if female	+
Age	Continuous, age of household head in years	-
education	Continuous, education level of household head in years	+
family size	Continuous, family size of the household in adult equivalent	+
land size	Continuous, land size holding of the household	+
Credit	Dummy, 1 if head has access to credit and 0 otherwise	+
extension	Dummy, 1 if head has access to extension services and 0 otherwise	+
land right	Dummy, 1 if head has land right and 0 otherwise	+
Coopmem	Dummy, 1 if head has access to formal cooperatives and 0 otherwise	+
Roat	Dummy, 1 if head has access to economics support and 0 otherwise	+

strategies' at 1%, 5% and 10% significance level. It is worthwhile to mention that the household group who adopted rubber farm activity only (i.e. no diversification) was selected as the base category for the multinomial logit to determine the factors influencing income diversification of rubber farmers so that all other choices of diversification strategies could be compared with this group (Table 3).

Age of household head was found to have significant and negative influence on households' choice of RON (rubber farm, off farm, and non-farm) livelihood strategies at 10% significance level. Given all other variables in the model held constant, a one-year increase in age of the household head will decrease his/her choice of RON livelihood strategies by 5% as compared to the household head who adopted the base rubber farm only (R). This implies that the younger farmers could be pushed to engage more in off-farm and non-farm activities than the farming activities solely. It was found that younger generation in the study area are more attracted towards the other industry and service sector than the agricultural sector. One of the possible reasons is that younger households do not own enough land to support their livelihoods based on farming activities as compared to the older farm households. In other words, younger households get less quantity of land from their parents because of distribution of land among their siblings and relatives. This argument is supported by previous study (Gagabo, 2014). It was also found that the households with greater land size are less likely to participate in other income activities (i.e. RO, RN and RON strategies). This finding supports the argument of Man (2009) and Akrasi et al., (2020) that larger farm size is an indicator of good asset holding and higher social status. Hence, persons with larger farm size are less likely to engage in non-farm income diversification. The study by Teshome and Edriss, (2013) and Akrasi et al. (2020) also reported similar results in Ethiopia where participation in income diversification was comparatively lower among the households with larger farm size.

The educational attainment of the household head was also found to be significant in the adoption of income diversification strategies. The study revealed that the household heads who adopted only the rubber farm activities (R) have the lowest level of education (Table 1). On the other hand, the household heads adopting RN (rubber farm and non-farm activities) and RAN (rubber farm, other farm and non-farm activities) were found to have higher educational attainment. The fact that the household heads with high level of education are more interested in diversifying their incomes. In other words, better educated households have a much higher likelihood of adopting

strategies involving non-farm employment (Akrasi et al, 2020).

The study findings revealed that large household size is more likely to pursue all possible choices of income diversification strategies. This might be due to the relation between larger family size and household labor or corresponding higher expenditure in the household. It implies that the rubber farmer households with larger family size participate in more income-generating ventures to increase their household income. This confirms the argument by Asfaw et al., (2015) in rural Malawi that larger household is associated with income diversification. Moreover, large household size results in labor availability that allows some household members to engage in off-farm and non-farm activities. Micevska and Rahut (2008) found almost similar result in India.

Access to credit plays no role in the adoption of income diversification strategies except RON (rubber farm, off farm and non-farm activities). The study found that households who had access to credit were more likely to pursue the RON strategy as compared to the households who had rubber farm activities only (R). Households practicing RON strategy have the lowest size of land. In other words, households who have limited land size can diversify their income sources if they have easy access to credit service for self-employment through the development of small and micro enterprises. The findings of the current study are congruent with Anshiso and Shiferaw (2016). It was also found that households having the land right were less likely to pursue the RO strategy (rubber-farm and off-farm activities). In other words, receiving land tenure or land tenure arrangements inhibit RO strategy, because security of tenure, including security in the hereditary transmission of tenure across generations considerably motivate them to work in rubber farm rather than off-farm activities. Land tenure regimes may cause multiple difficulties for diverse livelihood strategies. In customary tenure systems, ownership security may be contingent and unclear and risky, making it difficult to enter or exit from farming (Ellis and Allison, 2004).

Finally, the study revealed that membership in cooperatives increases the probability of the rubber farmers to adopt income diversification strategies, particularly the RO (rubber-farm and off-farm activities). Becoming a member of cooperatives minimizes financial constraint of the households so that they will have the opportunity to participate in off-farm income generating activities. Moreover, being the member of cooperatives could increase the bargaining power of farm households in selling and buying their products as well as other related collective

actions and decisions. Farmers can get better rubber price because of the bargaining power as well as achieve profit sharing among members. However, membership in cooperatives may have an inverse effect on the choice of RON income diversification strategy. Households having membership in cooperatives are less likely to pursue this strategy as compared to R (rubber-farm only). Households adopting RON strategy may not have enough time to participate in cooperative because they have many activities regarding on-farm, off-farm and non-farm. In addition, some of the rubber farmers usually are not interested and motivated enough to participate in the system of group working. Particularly, farmers lack confidence to participate in groups since they believe that group system cannot much solve their problems. They are also not much sure about what benefit they can get because of the lack of effective management and good leadership. Leaders seem not to have enough capability to manage the groups which causes conflicts.

Materials and methods

Survey design and data collection
This study conducted a cross-sectional survey to collect primary data to fulfill its objectives. The survey was conducted in three provinces, namely, Songkhla, Surat Thani and Trang of Southern Thailand. These three provinces play a vital role in producing and marketing rubber products around the country. In addition, these provinces have a vast rubber plantation area and a developed rubber industry. Rubber plantation in these provinces shows varying topographic, land use, biodiversity, and socio-economic characteristics. The study followed a multistage sampling approach to select the samples. Initially, two districts from each of the three provinces were purposively selected based on the criteria that each district has large number of rubber farmers. Subsequently, two sub-districts under each of the six districts were purposively selected based on the previous criteria. A simple random sampling technique was employed to select the respondents in the chosen areas (i.e. 12 sub-districts) for this study. A total of 398 farmers were selected randomly without any previous knowledge of socio-economic status of the respondents. A standardized questionnaire was used to collect the data from the respondents. In addition, the study arranged group discussions with the selected respondents to extract data related to the study. The data was collected from October 2019 to December 2019.

Data analysis
For this study, income diversification is the process of combining income from rubber farming with income from other sources (i.e. other farm or non-farm) to enhance living standard. To get a better understanding about income diversification strategies of the rubber farmers, the respondents were grouped into six categories based on their choice of income strategy (Table 4). It was found that combination of rubber farm and non-farm income (RN), being adopted by around 38% of the farm households, was the dominant type of income strategy in the study areas. Besides involving with rubber farming, this group of respondents engage themselves in non-farm activities to generate income. Non-farm activities include non-agricultural wage employment, non-agricultural self-

employment of any kind, owning a shop, engaging in trade, and earnings from artisans among others.

Rubber farm income only (R) was found to be the second important income strategy, with around 22% of the farm households adopting it. This group comprises farming households that rely solely on rubber farming for income and neither grow other crops nor engage in other livelihood activities. In other words, farmers who chose this income strategy did not diversify their incomes. On the other hand, nearly 17% of the farm households adopted the combination of rubber farm, other farm and non-farm income (RAN). Other farming activities adopted by this group of rubber farmers include raising livestock and aquaculture while non-farm activities consist of non-agricultural wage employment, non-agricultural self- employment of any kind, owning a shop, engaging in trade, and earnings from artisans.

Combination of rubber farm and other farm income (RA) was practiced by 12.6% of the farm households. This category is made up of rubber farmers who simultaneously earn incomes from rubber farming and other agricultural activities. Combination of rubber farm, off-farm and non-farm income (RON) and combination of rubber farm and off-farm income (RO) are the next two types of income strategies adopted by 5.6% and 5% of the farm households respectively. RON category is made up of rubber farmers who simultaneously earn incomes from rubber, off-farm wage employment as well as the non-agricultural sector. In contrast, RO category consists of rubber farmers who generate income from rubber farming as well as off- farm activities.

The above-mentioned income strategies have no natural ordering. Therefore, this study employed the (unordered) multinomial logit model to estimate the probabilities associated with choosing each income strategy (Warren, 2010). The maximize utility of households from different income strategies can be determined from the following model:

$$U_{ij} = X_{ij} \beta_j + \epsilon_{ij} \qquad (1)$$

Where,
U_{ij} = the utility that household gets from choosing alternative activity j
β_j = coefficient which varies across alternatives,
X_{ij} = covariates which remains constant alternatives; and
ϵ_{ij} = random disturbance term, and unobserved of alternatives

For an outcome variable with J categories, let the jth income strategy that the ith household chooses to maximize its utility could take the value 1 if the ith household chooses j^{th} income strategy and 0 otherwise. Therefore, the probability that a household with characteristics x chooses income strategy j, can be modeled as below:

$$P_{ij} = \frac{\exp(x_i\beta_j)}{\sum_{j=0}^{j}\exp(x_i\beta_j)}, \, j = 0 \qquad (2)$$

With the requirement of $\sum_{j=0}^{j} P_{ij} = 1$ for any i

Where,
P_{ij} = probability representing the ith respondent's chance of falling into category j,
X = Predictors of response probabilities,

$ß_j$ = Covariate effects specific to j^{th} response category with the first category as the reference.

Then, the appropriate normalization that removes indeterminacy in the model is to assume that $ß_j = 0$ (this arises because probabilities sum to 1, so only J parameter vectors are needed to determine the $J + 1$ probability). So $\exp(x_i\beta_j) = 1$, implying that the generalized equation (2) above is equivalent to:

$$P_{ij} = \exp \frac{x_i\beta_j}{1+\sum_{j=1}^{5}}, \text{ for } j = (1,2,3,4,5) \text{ and}$$

$$P_i 1 = \frac{1}{1+\sum_{j=1}^{5} \exp(x_i\beta_j)} \tag{3}$$

Which can be estimated using the maximum likelihood method (Greene, 2003).

Table 5 explains the variables, code, and the expected signs for each of the estimated coefficients and describe the independent variables.

Policy Recommendation

The findings of the current study have several policy implications. Therefore, this study suggests some recommendations for policy and decision-making regarding income strategies adopted by rubber farmers in southern Thailand. The specific recommendations that can be suggested from this study for policy implications are stated below:

Firstly, given their relative importance, it is necessary to promote other agricultural, off- farm and non-farm opportunities to enhance access of the rubber farmers to these sources of income. Households that have additional farming manpower should try to diversify to other income sources. Thai Government has been promoting farming diversification strategies in the country. However, most of the effort focused on production rather than marketing. In other words, inefficient local market system is an important constraint facing by the farmers; the local market system with full of intermediaries always take benefit from the small holders, consequently the small holders normally get an unfair price in the existing market system. In this circumstance, farmers can form farmers groups and increase their bargaining power by selling their products together through farmers groups. Thus, farmer organization, local professional support and networking should be implemented and promoted, with the supply and use of up-to-date information and technology related to specific agricultural activities especially about marketing. In addition, the Government should be more committed towards efficient fund allocation and management for farmer groups through well-trained individuals for self-running of the groups in future. This can be achieved through setting up and effective implementation of monitoring and supporting system for groups' operation and performance.

Secondly, education is a key determinant of income diversification, particularly, non-farm income. In other words, knowledge gained from educational institutions can influence and enable farmers to enhance their capability for income diversification strategy. For instance, for a purely non-farm income strategy, the households should have a certain level of educational attainment. In other words, for non-farm employment, the minimum level of education for households should exceed the primary level. Therefore, the Government should provide support to and encourage farmers to participate in various training programs to improve their skills that are necessary for non-farming activities. In addition, government should separately arrange training for farmers who have a small piece of land because they have the limitation to diversify to other agricultural activities.

Finally, access to credit was found have a significant influence on only combination of rubber farm, off-farm and non-farm income (RON) activities. The reason is that formal credit schemes for farmers in Thailand are currently being handled by many government organizations as well as formal organizations of the farmers. Among these organizations, Bank for Agriculture and Agricultural Cooperative (BAAC) plays a major role in providing agricultural credits. Agricultural Cooperatives and Community Saving Groups also play a very important role as major sources of rural credit. Moreover, the government has introduced a scheme called "Village Revolving Funds" to provide funding for people living in rural areas so that they can invest money in productive activities. This program is specifically aimed at stimulating rural economies by enabling farmers to increase productivity and get engaged in value-added activities. However, most of the farmers do not follow the purposes of the program. Therefore, credit monitoring policies are urgently needed to monitor the credit utilization of rubber farmers in the country.

Conclusion

This study provided efforts to examine the income diversification strategies adopted by rubber farmers in southern Thailand and investigate the determinants of households' choice of income diversification. The analyses revealed that three income strategies, namely, rubber farm and non-farm income (RN), rubber farm income only (R), and combination of rubber farm, other farm and non-farm income (RAN) are the dominant income strategies adopted by households (77% of surveyed households). It was also found that several factors play a significant role in the adoption of income diversification strategies by the rubber farmers. The key determinants of pursuing other farm activities (apart from rubber, off- farm and non-farm income strategies) are age, education, family size, land size, access to credit, land right and membership in cooperative. The empirical evidence of the study provides an insight and understanding about various issues related to income diversification strategies that might be useful for policy makers to design and implement more effective policies to provide more income-generating ventures for rubber farmers in Thailand.

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