Songklanakarin J. Sci. Technol.
44 (1), 72-78, Jan. - Feb. 2022

http://www.sjst.psu.ac.th

Original Article

Alternative farming on the highland and livelihood assets of small scale farmers in Na Noi District, Nan Province, Thailand♣

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Received: 26 April 2021; Accepted: 29 July 2021

Abstract

The livelihood assets of small-scale farmers described problems and situations of alternative farms on the highland of Na Noi district. The research methods involved key informant's interviews, focus group discussions, and questionnaires with 222 samples who have alternative farming on the highland of Na Noi district. Data analysis used a sustainable livelihood assets framework, which included both quantitative and qualitative analysis. According to data collection, alternative farming systems were: 56 households of maize and rubber tree farming, 153 households of maize, rubber tree, and integrated farming, and 13 households of integrated farming. Analysis between farm types and their livelihood assets found that farmers have different accessibility of natural assets, human assets, social assets, financial assets, and physical assets. It was the ability to reduce their vulnerabilities. Alternative farm types have contributed by the accessibility of their livelihood assets. Thus, to promote the alternative farming systems should consider their livelihood assets.

Keywords: livelihood assets, alternative farming, integrated farming

1. Introduction

The majority of land in Nan province is upland and highland areas. Farmers more than 60% practice monoculture. According to the area under rainfed conditions, maize is a dominant crop contributing to more than 50% (Kitchaicharoen *et al.*, 2015) of the upland area due to suitable upland and highland conditions in Nan province. Maize farming in Nan province increased to 679,196 rai (Office of Agricultural Economics [OAE], 2017). The maize planted area of Na Noi district was 90,529 rai that was the second-largest of Nan province (OAE, 2017). Farmers also had relied on maize farming from an ancestor. Commercial farming increased farm income and satisfaction profits (Thongngam *et al.*, 2014). However, increasing maize farming on the highland effects, especially the soil erosion and soil infertility (Ekasingh *et al.*, 2014). Farmers have direct health affection from using insecticides, and pesticides. Moreover, a post-harvest procession is slash and burn in farms affected by smog or air pollution (Tanwatthana *et al.*, 2016). The government agencies have been promoting alternative crops to reduce environmental affections (Thai Environment Institute, 2012). Na Noi district was one of the districts which have an outstanding way of promoting sustainable agriculture on the highland. Small scale farmers of Na Noi district, Nan province have been attempting continuously to stop growing maize farming on the highland. The topography is upland and highland, which covered approximately 84 % of all agricultural areas approximately 757,332 rai (Kitchaicharoen *et al.*, 2015). Farmers adopted alternative cropping on the upper and slope land area. However, the accessibility of

♣Peer-reviewed paper selected from The 1st International Conference on Sustainable Agriculture and Aquaculture (ICSAA-2021)

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livelihood assets reaches to achieve livelihood strategies. The government and private sectors also have continuously developed sustainable agricultural practices. But, farmers still rely on maize farming and some of them try to stop growing maize. Farmers have different human assets such as knowledge, experience, and leadership. These were the important factors to access other livelihood assets Thus, the government and private sector found out and supported role models, folk wisdom, and learning centers. While the government and private sectors have developed social assets. Contributing relationship between them through agricultural extension services. Physical assets focused on a reservoir of agriculture, road, and agricultural technology. Natural assets have community forests and soil fertility that provide ecosystem services. It reduces the risks of food insecurity. However, financial assets are farm income, saving money, and financial institutions that influence achieving livelihood outcomes.

2. Materials and Methods

Study area and sample: Farms located on the highland and sloping land. The agricultural area is rainfed agriculture. According to the population data in January 2010, there were 32,889 people in seven sub-district of the Na Noi district. There are two municipal districts and six sub-district administration organizations of Na Noi district. Samples were divided into two groups. First, 64 purposive samples from 7 sub-districts. Second, Taro (Yamane, 1973) defines the amount of sample, which is 93% of the confidence interval. The purposive sampling covered 222 householders who do alternative farming on the highland of Na Noi district during 1-3 years.

Data collection: A participatory rapid appraisal technique (PRA) has been used for the collection of sets of data. The participating farmers and key informants were given information and answered the questionnaire. Firstly, key informant interviews involve the Organic Agriculture farmer association, Nan province, and farmer models. This process collected the general information, farm management, risks, and extension services. Secondly, focus group discussions with representative farmers from seven sub-districts. Thirdly, structured individual questionnaires covered 222 samples.

Data analysis: Firstly, farm types are categorized by household goals (Dillon & McConnell, 1997) and the kind of reducing maize planted area to intercrops. Secondly, descriptive statistical analysis was used to explain the characteristics of the small-scale farmer and production systems. Thirdly, the sustainable livelihood assets framework (SLF) was used to analyze the livelihoods of smallholders (DFID, 1999). SLF consists of vulnerability context, livelihood assets, transformation structure and process, livelihood strategies, and livelihood outcome. The analysis described the accessibility of five assets; natural assets, social assets, physical assets, financial assets, and human assets. Qualitative and quantitative analyses were used to describe. Comparison of livelihood assets used to average and standard deviation to describe and interpret by 5-point Likert scale (Rensis, 1961).

3. Results and Discussion

Alternative farming system on the highland of Na Noi district, Nan province: Commercial farming whose household goal is mainly profit. The part-commercial farm provides food (more than 50%) and profit.

Cropping system: Commercial farming (T1) included maize and rubber tree. Part-commercial farms included maize, rubber tree, and integrated farming. Hence, T2 is Maize, rubber tree farming integrated farming such as the Royal Project crops, fruit tree, rice paddy on the upland, small plot of pesticide-free vegetables at home. Next, T3 is integrated farming, which involves pesticide-free vegetables and organic vegetables.

The household character: Farmers of Na Noi district are small-scale farmers. The overall average of household members was 4 people and the average age was over 47 years old. They have an average education in primary school. The average of agricultural plots was three plots and the agricultural area was 24.61 rai. The average household members were approximately 3-4 people. Farmers of all farm types have approximate age, but farmers of T1 are older than others. They have a similar average of education, which was a primary school. Although farmers have approximate agricultural plots, T1 has the most average agricultural area, which covered 32.14 rai. Farmers have maize farming on larger scales. Thus, the integrated farming (T3) covered the lowest agricultural area, which was 12.3 rai as Table 1.

Farm's vulnerability: (T1) maize and rubber tree farming always faces drought because it depends on the rainy season. (T2) maize, rubber tree, and integrated farming, and (T3) integrated farming also got affection from water shortage to vegetables. A flood happens every year. Deforestation area causes flash flooding and soil erosion directly affects maize farming on the sloping land. Furthermore, the economic problems affected all farm systems. For example, cost of illness treatment, damage from the disaster, and fluctuated price.

Table 1. Comparison of different farm characteristics

Household character (Average)	T1 (Maize and rubber tree) (N=56)	T2 (Maize, rubber tree, and integrated farming) (N=153)	T3 (Integrated farming) (N=13)
Household member	3	4	4
Age of household labors (year)	49 years	47 years	48 years
Education of household labors (level)	Primary school	Primary school	Primary school
Agricultural plots (plot/ household)	3 plots	4 plots	3 plots
Agricultural area (rai)	32.14 rai	29.39 rai	12.30 rai

Source: Survey, 2018

Organization and policy implication: Alternative farming system on the highland of Na Noi district, Nan province comprised seven organizations as follows, Department of Agricultural Extension in Na Noi district, Sub-district Administration Organization, Bank for Agriculture and Agricultural cooperatives, Pidthong Foundation, Educational institution, and farmer associations.

Livelihood strategy: Maize is planted on the highland once a year by household labor in the rainy season between May and June. Chemical stuff and insecticides are highly required every year. Maize will be sold to local merchants, while farmers who have loaned must sell their productions to those they have loaned from private sectors. The rubber product is sold through a middleman. Integrated farming also has sufficient household labor. They integrate pest and disease management and mainly use groundcover and organic fertilizer. The rotational livestock feed manure on vegetable farming. The major market distribution of pesticide-free vegetables is a local market within Nan province. Meanwhile, organic vegetables are sold through niche markets.

3.1 The livelihood assets

1) Natural assets involve soil, water resources, climate, and biodiversity. It also includes ecosystem services. Farmers have good accessibility to natural assets. T1 (Maize and rubber tree farming) and T2 (maize, rubber tree, and integrated farming) are located in the forest area and access natural water resources more than T3 (Integrated farming). Integrated farming is located in the community area. Cropping systems and livestock farming of three farm types found that most crops rely on precipitation and naturally growing up. Thus, soil fertility was appropriated to alternative farming on the highland. T1, T2, and T3 accessed the local irrigation system, but T3 needed more insufficient water to increase seasonal vegetable farming and livestock. The climate also appropriated their farm system. Although T1 and T2 rely on maize farming which risks food insecurity, the Na Noi district has ecosystem services. Farmers of T1 and T2 always access non-timber forest products. Meanwhile, farmers of T3 have diversified food from the integrated farming system and seek non-timber forest products in the rainy season as Table 2.

2) Human assets involve skill, knowledge, experience, labor, and leadership. The level of human assets depended on personal ability and accessibility of agricultural extension services. T1 (Maize and rubber tree farming), T2 (maize, rubber tree, and integrated farming), and T3 (integrated farming) have good knowledge and skill in agriculture. Because of different cropping systems, T2 has a rotational farm because farmers grow various types of cropping systems and second crops. While T3 was starting with only seasonal vegetables, some farmers were not integrated with animals. Moreover, T2 accessed more local folk wisdom and new technology. Farmers who relied on only maize and rubber trees which they have less experience than T2 and T3. However, the results about agricultural extension services seem to have a problem because farmers have low access to agricultural information, visit and training, and applying knowledge. Farmers need more accessibility to agricultural extension service programs that they have an interest in and preparedness to apply new technologies to their farms. The alternative farming systems on the highland of Na Noi district have sufficient labor, and their family laborers also are healthier because they have been reducing pesticides, especially T2 and T3. Moreover, farmers of three farm types have good leadership and the ability to make a decision about farm management in their household as Table 3.

3) Social assets involve group collaborations. Farmers of T1 (maize and rubber tree farming), T2 (maize, rubber tree, and integrated farming), and T3 (integrated farming) accessed the agricultural extension services and have successful farmer groups. Group management usually has problems that discontinue operations. Moreover, long-distance was an obstacle to joining activities. Thus, the results showed that many farmers have low accessibility to agricultural groups. Some of them did not have access to agricultural groups in the community and the lowest provincial associations. The technology sponsorship from organizations was not accessible to farmers. However, if those activities were culture and tradition, they always have collaboration. They have some sharing labor in the rice-growing season. They also have rarely exchanged their product from land rent as Table 4.

4) Financial assets indicated the potential of financial capital to begin alternative farming. T1 (maize and rubber tree farming), T2 (maize, rubber tree, and integrated farming), and T3 (Integrated farming) have poor accessibility of financial assets. They lost money from maize farming. Thus, farmers of T1, T2, and T3 have scanty savings. Low access to financial institutions and sources of investment funds influenced farmers to have high debt. T1 also has

Table 2. Comparison of different farm types on natural assets

Natural assets	T1 (Maize and rubber tree) N=56			T2 (Maize, rubber tree, and integrated farming.) N=153			T3 (Integrated farming) N=13		
	Mean	SD	Accession	Mean	SD	Accession	Mean	SD	Accession
1. Soil fertility	4.02	0.70	High	3.48	1.11	High	3.23	1.59	Moderate
2. Local irrigation system	3.37	1.13	Moderate	3.33	1.29	Moderate	2.31	1.65	Low
3. Climate change (suitable)	3.64	0.77	High	3.80	0.95	High	3.23	1.59	Moderate
4. Biodiversity	3.91	0.72	High	3.46	1.12	High	3.23	1.74	Moderate
Average	4.02	0.83	High	3.52	1.12	High	3.00	1.64	Moderate

Source: Survey, 2018

Table 3. Comparison of different farm types on human assets

Human assets	T1 (Maize and rubber tree) N=56			T2 (Maize and rubber tree integrated farming.) N=153			T3 (Integrated farming) N=13		
	Mean	SD	Accession	Mean	SD	Accession	Mean	SD	Accession
1. Knowledge and skill in agriculture production	2.86	0.99	Moderate	3.14	0.96	Moderate	2.85	1.28	Moderate
2. Ability to use local inputs to farm	2.62	1.12	Moderate	2.92	1.06	Moderate	2.77	1.36	Moderate
3. Ability of farm rotation	2.25	1.24	Low	2.78	1.12	Moderate	2.38	1.66	Low
4. Applying folk wisdom and new technology	2.41	1.25	Low	2.71	1.16	Moderate	2.23	1.42	Low
5. Experience in agriculture	2.5	1.11	Low	3.12	1.11	Moderate	2.69	1.44	Moderate
6. Access new agriculture information	1.71	1.17	Lowest	2.50	1.45	Low	2.08	1.71	Low
7. Access agricultural extension services	1.57	1.23	Lowest	1.90	1.61	Low	1.92	1.55	Low
8. Knowledge from agriculture visits and training	1.66	1.46	Lowest	1.79	1.66	Lowest	1.92	1.55	Low
9. Using knowledge from visiting and training in farm	1.54	1.40	Lowest	1.83	1.75	Low	1.85	1.46	Low
10. Household labor sufficiency	3.27	0.82	Moderate	3.48	1.06	High	3.15	1.35	Moderate
11. Farmer and their labor healthy	3.11	1.06	Moderate	3.75	0.94	High	3.46	1.51	High
12. Leadership and making decision	2.66	1.21	Moderate	3.26	1.24	Moderate	2.92	1.55	Moderate
Average	2.35	1.17	Low	2.76	1.26	Moderate	2.52	1.49	Low

Source: Survey, 2018

Table 4. Comparison of different farm types on social asset

Social assets	T1 (Maize and rubber tree) N=56			T2 (Maize, rubber tree, and integrated farming.) N=153			T3 (Integrated farming) N=13		
	Mean	SD	Accession	Mean	SD	Accession	Mean	SD	Accession
1. Social group in a community	2.23	1.40	Low	2.11	1.63	Low	1.85	1.68	Low
2. Access new technology	1.27	1.31	Lowest	1.79	1.45	Lowest	2.08	1.66	Low
3. Village/sub-district associations	1.32	1.52	Lowest	1.53	1.71	Low	1.77	1.79	Low
4. Other sub-district associations	1.48	1.49	Lowest	1.48	1.55	Lowest	1.46	1.66	Lowest
5. Culture and traditional collaboration	3.02	1.41	Moderate	4.13	1.12	High	3.85	1.46	High
6. Labor sharing	2.21	1.86	Low	3.54	1.63	High	3.77	1.64	High
7. Exchange product and offer planted area for rice	1.91	1.78	Low	2.13	1.88	Low	1.77	2.01	Lowest
Average	1.92	1.54	Low	2.39	1.57	Low	2.36	1.7	Low

Source: Survey, 2018

insufficient farm income because of the price risk of maize farming. Farmers spent their only free time to generate off-farm income. They have low off-farm income. But, T2 and T3 have sufficient farm income, which is higher than T1 because integrated crops and livestock provide food and good income dispersion. It also reduced the risk of food insecurity. Maize and rubber trees are sold to a few middlemen within the sub-district. While organic and pesticide-free vegetables get ordered from Tops and Big C supermarkets, farmers have problems with low quality and grading products. Those low-quality products are distributed to the local market at a low price. Thus, alternative farming relied on local market distribution more than alternative markets or niche markets. The Highland area was also the condition to access alternative markets. An affection from low accessibility of social assets also influenced poor accessibility of an agricultural inputs substitution. For example, accessibility of agricultural inputs substitution, and offer channels of distribution as Table 5.

5) Physical assets involve the accessibility of infrastructure, transportation, and information channels. Farmers need equality of that accessibility to have better self-organization and increase other assets, especially the market distributions. The highland area affected by overall physical assets was low. Although an electrical system was available for households, it was not accessible to provide using on-farm. Road and distance from farm to market also were the

Table 5. Comparison of different farm types on financial assets

Financial assets	T1 (Maize and rubber tree) N=56			T2 (Maize, rubber tree, and integrated farming.) N=153			T3 (Integrated farming) N=13		
	Mean	SD	Accession	Mean	SD	Accession	Mean	SD	Accession
1. Saving money	1.00	1.51	Lowest	1.84	1.75	Low	1.46	1.81	Lowest
2. Financial institution	1.89	1.51	Low	2.13	1.52	Low	2.08	1.66	Low
3. Source of investment funds in their community	2.02	1.17	Low	1.83	1.7	Low	2.08	1.88	Low
4. Off-farm income sufficiency in household	1.03	1.48	Lowest	1.18	1.66	Lowest	1.46	1.76	Lowest
5. Farm income sufficiency	1.00	1.46	Lowest	3.34	1.18	Moderate	3.00	1.68	Moderate
6. Alternative market/niche market	1.00	0.59	Lowest	1.00	1.01	Lowest	1.00	1.61	Lowest
7. Agriculture inputs substitution	1.00	0.94	Lowest	1.00	1.04	Lowest	1.54	1.85	Lowest
Average	1.28	1.24	Lowest	1.59	1.40	Lowest	1.79	1.75	Lowest

Source: Survey, 2018

obstacles. The local market of T1 was located within the community, but the price was negotiable. T2 also faces the same situation as T1, but they are able to sell their fruit and vegetables in the district market. T3 solved the problem of the long distance to the market by the organic vegetable group. Farmers negotiated prices and built a small store to keep pumpkin, red bean, and other seasonal vegetables. However, farmers have a high investment at the beginning of alternative farming that farmers ignored telecommunication and internet access. In the past, they used to communicate face to face and were not as important to marketing online as Table 6.

Analysis between alternative farming and their livelihood assets of small-scale farmers of Na Noi district, Nan province illustrated that accessibility of livelihood assets related to types of alternative farm. The livelihood assets were basic preparedness to begin alternative farming and decrease their vulnerabilities to achieve sustainable agriculture on the highland. T1 has good natural assets, but other assets were low access. T2 has high accessibility of natural assets and has better human assets than T1 and T2. T3 also has only good accessibility to natural assets. The samples were farmers who used to rely on maize farming in the highland. Maize requires high external farm inputs. The price of maize fluctuated, and farmers were not able to access sources of funds. These situations affected increasing debt in the household. Thus, they have low financial assets. Farmers need to access the sources of funds that provide low interest. Moreover, financial assets are important to decide on alternative crops investment. Furthermore, farmers have their household labors and do not place importance on farmers' associations. Although the government and private sector have been pushing farmers to collaborate in agricultural activities, a small number of farmers accessed it. However, various infrastructures (physical assets) require support from the local government of the Na Noi district. Low accessibility of the physical assets was the significant condition to select alternative crops. Especially long distances from farm to market that damaged yield and high cost as following Figure 1.

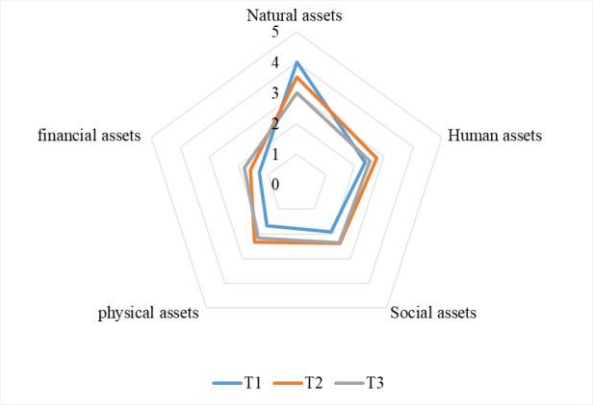

Figure 1. Livelihood assets of alternative farming systems

3.2 Farm's achievement (livelihood outcome)

The economic performance of alternative farming on the highland of the Na Noi district showed that T2 (maize, rubber tree, and integrated farming) has the highest farm income of 221,000 baht/year. It indicated that T2 generated more income than T1 (maize and rubber tree). Because reducing maize farming to T2 which got income from several economic crops and food crops. T2 has more income security by good income dispersion. Farmers reduce maize farming to rubber tree farming for generating long-term income, but rubber trees did not provide income in 3-4 years. However, they have high debt, thus T1 and T2 still rely on maize farming to maintain an income while other crops do not have productivity to sell and consume. While T3 has the lowest income because they get income daily and monthly from seasonal vegetables. Integrated farming provides sufficient food, though they have approximate food expenditure. T3 has the highest saving money, thus farmers of T3 have self-organization as Table 7.

Table 6. Comparison of different farm types on physical assets

Physical assets	T1 (Maize and rubber tree) N=56			T2 (Maize, rubber tree, and integrated farming.) N=153			T3 (Integrated farming) N=13		
	Mean	SD	Accession	Mean	SD	Accession	Mean	SD	Accession
1. Household electrical system availability	1.64	1.45	Lowest	2.56	1.46	Low	2.23	1.64	Low
2. Road and distance from farm to market	2.27	1.42	Low	2.35	1.65	Low	2.38	2.02	Low
3. Access Telecommunications	1.75	1.34	Lowest	2.46	1.74	Low	2.38	1.94	Low
4. Internet accessing	1.00	1.12	Lowest	2.00	1.84	Low	1.62	1.85	Lowest
Average	1.67	1.33	Low	2.34	1.67	Low	2.15	1.86	Low

Source: Survey, 2018

Table 7. Comparison of different livelihood outcomes

Livelihood outcome (average Baht/year)	T1 (Maize and rubber tree) N=56	T2 (Maize and rubber tree integrated farming.) N=153	T3 (Integrated farming) N=13
Farm income	107,573.93	221,000	51,931
Saving money	2,616.79	4,615.78	13,284.62
Food expenditure	38,243.29	38,731.10	43,885.38
Debt	323,267.86	195,718.95	210,000.00

Source: Survey, 2018

3.3 Discussion

Livelihood assets have important roles to adopt an alternative farming system on the highland. Farmers need better accessibility of livelihood assets to contribute sustainable farming system on the highland. Low accessibility was a problem, which needs to consider before adoption. Five livelihood assets are also influenced by each other to reduce vulnerabilities. Although low accessibility of social assets, financial assets, and physical assets were the obstacles, good human assets and natural assets can determine the appropriated livelihood strategies to achieve sustainability. Thus, farmers who have good livelihood assets will achieve their livelihood strategies and lead to having sustainability. Somboonsuke *et al.* (2003) also said that these five assets lead to developing other livelihood assets. Good human assets lead to an increase in other livelihood assets. While alternative farming systems also provided better livelihood assets. Diversified farming reduces many risks such as food insecurity, insufficient income, and environmental affections. Data conform to five assets analyses by Jantasuwan (2019) in the Na Noi district. Moreover, Farmers develop livelihood strategies to achieve more efficiency and productivity. The government policies also should be active in pushing them to sustainable agriculture (Jiumpanyarach, 2018).

4. Conclusions and Recommendations

Na Noi district has three alternative farm types. There were 1) Maize and rubber tree farming, 2) Maize, rubber tree, and integrated farming, and 3) Integrated farming. Farmers have been trying to adapt themselves by reducing maize planted areas. They have been adopting alternative farming systems. Household laborers have the potential to develop their farming system. Farmers have adjusted agricultural activities by increasing five livelihood assets. Thus, using the sustainable livelihood approach conducted to explaining about the existing livelihood assets contribution to alternative farming systems in this study. Meanwhile, associated organizations should provide suitable solutions to solve those problems through developing plans and policies.

The sustainability of an alternative farming system on the highland of Na Noi district depended on many factors and conditions. Especially, water systems and land title to increase integrated vegetables and livestock farming. They need access to substitution support. Integrated management has the opportunity of sustainable agriculture on the highland of Na Noi district. But, it needs to design cropping systems, which able to provide both short and long-term income. Farmers expect the income from integrated farming, that enough to reduce debt and invest new growing season. Moreover, it has an opportunity to increase social capital by promoting sustainable agriculture.

Acknowledgements

My sincere thanks also go to The Thailand Research Fund and Thai Health Promotion Foundation, which gave me a scholarship for the program “Agricultural System Management” and supported monetary matters for whole researching activities. Thank you also to give to Participatory and Integrative Support for Agricultural Initiative or (PISAI) for financial supply to this workshop.

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