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## **Sustainability assessment from development indicators of community and sustainable development guidelines for the Huay Pao highland development project using royal project system**

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**Abstract** The community sustainability was investigated by developing sustainability indicators and Sustainable Development Guidelines for the Huay Pao Highland Development Project Using Royal Project System, Thungkhaopuang sub-district, Chiang Dao district, Chiangmai province. The selection of areas by experts of Highland Research and Development Institute (Public Organization). The population of this study was 50 persons. Data were recorded between October to December 2017 by focus group discussion and the structure interview. The focus group discussion could synthesis of sustainability indicators with community. It can be divided into 4 factors, total 32 indicators including 10 indicators of economic factor, 8 indicators of social factor, 7 indicators of environment factor and 7 indicators of infrastructure factor. The results of the community sustainability assessment from the developing sustainable indicators found that a community of the Huay Pao highland development project using Royal Project system had a strong focus on 4 factors. The overall sustainability assessment of the community was a very good level. Except for the environment factor was a good sustainable of the community. However, this community of the Huay Pao highland development project using Royal Project system is accelerated by the development of the economy factor for saving, knowledge in career development, and food security. Social factor was the strengthened development of leaders and peoples in the community, and promoted the establishment of farmers' institutions. Environment factor was promoted the soil and water conservation, increasing forest area, the community forest, and protection the external threats. Infrastructure factor was development of electricity services in the area, improve the services of the District Health Promotion Hospital, and developed the remote communities that provided to access both formal and informal systems. It is suggested to develop community should concern the needs of the community into consideration. Also, in the development of the highland community, it is important to focus on working in integrated with relevant agencies.

**Keywords:** Sustainable indicators, Highland communities, Highland development project

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## **Introduction**

Thailand is characterized by high areas more than half of the country. Mostly in the northern and central regions covers an area of 67.22 million rai of land in 20 provinces including Chiang Mai, Chiang Rai, Mae Hong Son, Phayao, Lamphun, Phrae, Nan, Lampang, Tak, Phetchabun, Phitsanulok, Loei, Sukhothai, Kamphaengphet, Kanchanaburi, Uthaitani, Suphanburi, Ratchaburi, Prachuap Khiri Khan and Phetchaburi. Most of populations in the highland are 15 hill tribes. There are 851,282 people or 88.22% of hilltribes in the country (Chiangmai University, 2008). Current highland areas still have the necessary problems and need to focus on continuous improvement. The problem of highland areas may be classified as population in highland areas is generally poor, production system use of inappropriate agricultural chemicals, agricultural rotation, degradation area, intrusion problems to find new areas, conflict in the use of natural resource, majority of the population also has less education, there is a high rate of population increase, lack of knowledge of crop cultivation. The area is far away, receiving little help from various agencies.

Royal Project is a truly public organization, has a good system to make work more streamlined and efficient. The cooperation between government and private sectors has led to new research and development projects as a result, professional development, product development and product promotion from the Royal Project, social development and community on highland, as well to maintain the integrity of the environment. This leads to the sustainable development of highland watersheds in Northern Thailand (Highland Research and Development Institute (Public Organization), 2017). Currently, in 2018, the institute had 33 highland areas in the Royal Project, covering 7 provinces, 24 districts and total of 336 villages. The project area for highland area development projects is divided into 3 groups, namely the highland development project with low altitude (less than 500 meters), highland development project with moderately altitude (500-1,000 meters) and highland development project with high altitude (over 1,000 meters) (Highland Research and Development Institute (Public Organization), 2017). Over the past ten years, opium has been depleted from the Royal Project area and most areas of the country. Hill tribe turned to cold winter crops (Noppakunwong, 2007). The market is supported. The Parallel development of education, health, social, awareness, and conservation of soil and water, has made life and better living of farmers in the Royal Project area (Office of the National Economic and Social Development Board, 2010).

Highland Research and Development Institute (Public Organization)  
Highland Research and Development Institute (Public Organization) was

established on December 7, 2004. The mission is to support the research and development of the Royal Project. The development approach covers both the context of the world and the changing technology, as well as the use of the watershed area as the framework for the master plan, in order to develop a balanced economy in both dimensions. Society and natural resources and environment on decision-making database consistent with community context. Strengthen the participation and development of community organizations as a mechanism to drive future plans. The goal is to provide high quality living for the target community and good environment, food security. It has enough income to live and sustainable living with the environment. Promote and develop an environmentally friendly agricultural profession under community participation. Using the knowledge and learning process of the royal project combined with the local wisdom in the development of highland communities, to achieve a balanced and sustainable development under Sufficiency Economy philosophy and the royal way project by using the participatory process of all sectors as a Highland Development Project using the Royal Project System (Highland Research and Development Institute (Public Organization), 2017).

Highland Development Project in Huay Pao Royal Project is the one of the 17 projects in the royal project expansion area in 2005, originally called "Project to expand the upper Ping River Basin Huay Pao". The first operation was a village of Huay Pang, Moo 1, Thungkhaopuang sub-district, Chiang Dao district Chiangmai Province. Later, the project was renamed "Highland Development Project in Huay Pao Royal Project", announced by the Highland Research and Development Institute on April 25, 2016, with the mission of the Royal Project Foundation and the Institute for Highland Research and Development like a mirror. It must be implemented together with four principles: 1) Suitability 2) Product quality and safety of chemicals including do not destroy the environment 3) participatory community planning and 4) restoration of natural resources, soil, water and forestry. Huay Pao village is located in Thungkhaopuang sub-district, Chiang Dao district, Chiangmai province from 100 kilometers of Chiang Mai city, take highway 007 (Chiang Mai - Fang). Most of the terrain is upland and highland. Most of the areas are 500-600 meters high, accounting for 49.75%. Most of the people live in the foothills. It has a tropical climate with an average temperature of 23.6 degrees celsius. Rainfall was at a moderate level of 1,082 milliliters (Highland Research and Development Institute (Public Organization), 2017).

Highland operations are multi-dimensional including social, cultural, economic, and environmental under time conditions, human resource, and the budget is limited. So it is important to select only the most important and easy to understand information, presentation in terms of sustainability indicators to

prioritize appropriate factors for community development, to achieve a sustainable quality of life. Historically, the development of highland indicators has been studied as a tool to measure the quality of life in highland communities, for example sustainable assessment in land management of famers in the highland of district Mae Fah Luang, Chiang Rai Province (DLD, 1998), analysis of sustainability indicators applied to evaluate sustainability of farmers in the highland of Wat Chan sub-district, Mae Chaem district, Chiang Mai Province (Praneetvatakul *et al.*, 2001), analysis of sustainability indicators of agricultural system and Natural Resources in highland areas to assess the community's potential for sustainable living (Ekasingh *et al.*, 2001). Sustainability assessments make it possible to compare the needs and urgency of community development (Ekasingh and Promburom, 2010). The development of community sustainability indicators in highland areas is needed to improve indicators in relation to critical development, consistent and appropriate with the context of the community. It is also possible to assess the sustainability of highland communities. So that, researchers are interested in assessing the sustainability from development indicators of highland communities by developing sustainable indicators and sustainable development guidelines for the Huay Pao highland development project using royal project system, Thungkhaopuang sub-district, Chiang Dao district, Chiangmai province, for information on community development planning.

## **Materials and methods**

### ***Study area and sample size***

This research collected data by focus group discussions with leader community such as sub-district headman, village headman, leader famer institute, president of sub-district administration organization, famers in the Huay Pao highland development project using Royal Project system, Thungkhaopuang sub-district, Chiang Dao district, Chiangmai province, to set the appropriate indicators for the community. It was also to assess the sustainability of highland communities. Data was collected by questionnaire from 50 famers. There was opened end and closed end questions. The Huay Pao highland development project using Royal Project system is a moderately level development area. Farmers were specific selected by experts of the Highland Research and Development Institute (Public Organization), who work with participate in all agriculture project activities and were sample farmers of the project. Data were collected during October to December 2017 and analyzed by using values of frequency, percentage, mean and standard deviation.

### ***Data analysis***

Data were analyzed using SPSS program. The statistics used in analyzing the data were descriptive statistics which was used to find the basic static value including frequency, percentage, standard deviation and means of minimum value and maximum value. As for analysis of the Sustainability assessment of highland communities based on importance values and assessment values of indicators had scores since score 1 was the less level to score 10 was the highest level. It used weight mean scores by importance value or assessment value as follow, 1.00-2.79 was the no importance or few level, 2.80-4.59 was the less importance or little level, 4.60-6.39 was the moderately importance or the moderate level, 6.40-8.19 was very importance or good level, 8.20-10.00 was the most importance or very good level. Then, prioritize the development of indicators in each aspect. The results are analyzed. (Importance value of indicators - Assessment value of indicators = Significance in development of indicators). The greatest value was most important in the development of the indicator and the least value was a minimal importance in the development of the indicator.

### **Results**

#### ***Developing sustainable indicators under the Huay Pao highland development project using Royal Project system***

Indicators derived from analysis with highland communities under the Huay Pao highland development project using Royal Project system. The indicator was divided into 4 factors: economic, social, environment and infrastructure. There were 32 indicators. Economic factors had 10 indicators: eating area, food security, income, debt, saving, access to finance, knowledge in career development, product distribution channels, water resources for agriculture and related integrated agencies (Department of Agriculture, Department of Agricultural Extension etc.). Social factor had 8 indicators: farmer institution, strength of the community, drugs, healthy people in community, community rules, leader/board of directors, community involvement and related integrated agencies (District, Rural Development, Department of Cooperative Promotion etc.). Environment factors had 7 indicators: abundant forest area, increasing of forest area, soil and water conservation, natural water source, community forest, community regulation on forest land management and related integrated agencies (Department of National Parks, Royal Forest Department etc.). Infrastructure factors had 7

indicators: road, water for consumption, electricity, school, phone/cell phone signal, internet system and related integrated agencies (Local Administration Provincial Electricity Authority etc.).

Performing a set of indicators of highland development in the Royal Project by intensive group meetings with leaders community such as sub-district headman, village headman, leader famer institute, president of sub-district administration organization, famers in the Huay Pao highland development project using Royal Project system, Thungkhaopuang sub-district, Chiang Dao district, Chiangmai province, to set the appropriate indicators for the community. The community-based indicators were used as a tool to evaluate community sustainability. The indicator was divided into 4 factors:- economic, social, environment and infrastructure.

### ***General conditions of highland communities under the Huay Pao highland development project using Royal Project system***

The result showed that the most of farmers were male (56.0%) with the mean age of the respondents was 54 years old. Farmers graduated from primary School (52.0%). Most of the informant farmers were the leader family status. Famers (54.0%) had been settled habitation for more than 41 years. There were 3-4 children/household and 3-4 persons/household of number in house registration document. Most of farmers have their own land (88.0%). Most of the famers (84.0%) participated in the Royal Project. The average of farmers earning income before joining the Highland Research and Development Institute were 184,470.00 Baht/year and after working were 223,455.20 Baht/year. Majority of famers borrowed money (82.0%). Famers in project were integrated agriculture both cultivating and raising animals. Most of the farmers (84.2%) planted the mango, followed by rice, longan, garlic, corn and Chinese cabbage were 56.0, 50.0, 44.0, 24.0 and 12.0 %, respectively. Black bean and red beanpumpkins were also grown by 8.0%. Passion fruit and cucumber were 4.0%. In addition, red finger bean, avocado, grape and chilli were also grown by 2.0%. For animal husbandry, famers (34.0%) had the most pig pit farming, followed by chicken, chicken bones and cow were 32.0, 14.0 and 6.0%, respectively.

### ***Sustainable Assessment of Highland Community by Developing Sustainable Indicators under the Huay Pao Highland Development Project Using Royal Project System***

Sustainability assessment of highland communities under the Huay Pao

highland development project using Royal Project system from development of indicators of 4 factors such as economic, social, environment and infrastructure were recorded. When considering each indicator from total 35 indicators, it made possible to know what the community needs to develop.

#### **Economic factor**

Participating farmers were focused on eating area, food security, income, debt, saving, access to finance, knowledge in career development, product distribution channels, water resources for agriculture, and related integrated agencies such as Department of Agriculture, Department of Agricultural Extension, at the highest level ( $\bar{x} = 8.28$ ). The results of the evaluation of the indicators showed that eating area, food security, access to finance, water resources for agriculture, and related integrated agencies had scores in the very good level ( $\bar{x} = 9.22-8.36$ ). For income, debt, saving, knowledge in career development and product distribution channels had scores in the good level ( $\bar{x} = 8.08-7.52$ ) (Table 1).

#### **Social factor**

Participating farmers focused all indicators on farmer institution, strength of the community, drugs, health people in community, community rules, leader / board of directors, community involvement and related integrated agencies such as Department of National Parks, Royal Forest Department, at the highest level ( $\bar{x} = 8.82$ ). The results of the evaluation of all indicators showed that farmer institution, strength of the community, drugs, health people in community, community rules, leader / board of directors, community involvement and related integrated agencies were scores in the very good level ( $\bar{x} = 8.28-8.82$ ) (Table 1).

#### **Environment factor**

Participating farmers focused on abundant forest area, increasing of forest area, soil and water conservation, natural water source, community forest, risk of natural disasters, community regulation on forest land management and related integrated agencies such as Department of National Parks, Royal Forest Department, at the high level ( $\bar{x} = 7.98$ ). The results of the evaluation of the indicators showed that abundant forest area, the external threats and related integrated agencies were scores in the very good level ( $\bar{x} = 8.28-8.82$ ), followed by the increase of forest area, soil and water conservation, natural water source, community forest, risk of natural disasters and community regulation on forest land management ( $\bar{x} = 7.34-8.18$ ) were scores in the good level. (Table 1).

**Table 1.** Results of evaluation of Developing Sustainable Indicators of the highland development in the Huay Pao Royal Project Area

<b>Developing Sustainable Indicators</b>	<b>Assessment value</b>	<b>Meaning</b>
<b>Economic factor</b>	<b>8.28</b>	<b>Very Good</b>
1. eating area	8.70	Very Good
2. food security	8.50	Very Good
3. income	8.08	Good
4. debt	7.84	Good
5. saving	7.52	Good
6. access to finance	9.22	Very Good
7. knowledge in career development	7.96	Good
8. product distribution channels	7.76	Good
9. water resources for agriculture	8.36	Very Good
10. related integrated agencies	8.90	Very Good
<b>Social factor</b>	<b>8.82</b>	<b>Very Good</b>
1. farmer institution	8.84	Very Good
2. strength of the community	8.72	Very Good
3. drugs	8.52	Very Good
4. healthy people in community	8.62	Very Good
5. community rules	8.78	Very Good
6. leader / board of directors	9.08	Very Good
7. community involvement	8.90	Very Good
8. related integrated agencies	9.14	Very Good
<b>Environment factor</b>	<b>7.98</b>	<b>Good</b>
1. forest area is abundant	8.28	Very Good
2. increase of forest area	7.34	Good
3. soil and water conservation	7.60	Good
4. natural water source	7.56	Good
5. community forest	7.58	Good
6. risk of natural disasters	8.04	Good
7. community regulation on forest land management	8.18	Good
8. external threats	8.44	Very Good
9. related integrated agencies	8.82	Very Good
<b>Infrastructure factor</b>	<b>8.33</b>	<b>Very Good</b>
1. road	8.22	Very Good
2. water for consumption	8.46	Very Good
3. electricity	8.50	Very Good
4. school	9.08	Very Good
5. phone / cell phone signal	7.62	Good
6. internet system	7.04	Good
7. health center / hospital	8.76	Very Good
8. related integrated agencies	9.02	Very Good

#### **Infrastructure factor**

Participating farmers focused all indicators on road, water for consumption, electricity, school, phone/cell phone signal, internet system,



healthy center / hospital and related integrated agencies such as Local administration, Provincial Electricity Authority, at the high level ( $\bar{x} = 8.33$ ). The results of the evaluation of the indicators showed that the score was at a high level in indicators of road, water for consumption, electricity, school, healthy center/hospital and related integrated agencies ( $x = 8.22-9.08$ ). For phone/cell phone signal and internet system of indicators ( $\bar{x} = 7.04-7.62$ ) were scores in the good level (Table 1).

### ***The Sustainable Development of the Huay Pao highland development project using Royal Project system***

The results of community assessment of the Huay Pao highland development project using Royal Project system found that the community needs to be developed in all factors, including economic, social, environment and infrastructure, in order for the community to develop sustainment (Table 1). It can be divided into 3 phases.

#### **Economic factor**

Community development for sustainability in Phase 1: The community believes that savings needed to develop in the most urgent way. The project should promote savings using the philosophy of sufficiency economy, in order to immune to the community. The community can access various channels of agricultural production so that the community can sell agricultural products and generate income.

Community development for sustainability in Phase 2: The community should have the knowledge to work in various fields. Especially, the use of less space but the return was very such as planting in a greenhouse system, help farmers reduce problems, water consumption in agriculture was very high for growing crops outside the house, and the community did not to use a lot of occupation, reduce production costs, increase revenue and be able to solve the problem of debt as well.

Community development for sustainability in Phase 3: The community should improve food security in the village by developing about rice growing because the area was good water and plain. It also promoted protein sources in the community such as raising pig pit, chicken etc., and integrating with related agencies such as the Bank for Agriculture and Agricultural Cooperatives to provide services in the capital for occupation.

#### **Social factor**

*Community development for sustainability in Phase 1: the strength of*

people in the community was developed to work together to solve the drug problem in the community, which was the important problem that the community. In addition, there was a need to promote health by detecting residues in the blood of people in the community because people in the community are using chemicals in agriculture.

*Community development for sustainability in Phase 2:* the community leaders was developed to strong and exemplary leaders of the community. The development of community rules was up-to-date, making it acceptable to the community and the use of important traditions for promoting of participation in the community.

*Community development for sustainability in Phase 3:* the establishment of farmers' organizations was encouraged, such as cooperatives, cooperative preparation Group, in order to agriculture and bargaining power to sell agricultural products. It included the integration with related agencies for knowledge and budget support such as Department of Cooperative Promotion, Local government.

#### **Environment factor**

*Community development for sustainability in Phase 1:* the soil and water conservation were developed for increasing the forest area by reforestation in degraded forest areas within the community, in order to reduce the problem of nature. It resulted in an increased in natural water sources.

*Community development for sustainability in Phase 2:* the community forest maintenance was encouraged because the community forests are important for their livelihoods and the line between the forest and the community forest conservation, to prevent intrusion into the forest, Promote food crops, and local plants in the forest community, to make the forest fertile.

*Community development for sustainability in Phase 3:* the awareness of forest conservation is promoted to prevent external threats by setting up groups or the duty of the people in the community to check, track the forest area, together with integrated agencies such as the Forest Department, the Department of Wildlife and Plant Conservation.

#### **Infrastructure factor**

*Community development for sustainability in Phase 1:* the electricity services in the area is developed in many communities, the lack of electricity and the development of telephone signals, internet signal because of its importance in developing especially communication. Coordinated with relevant agencies such as regional electricity. Private companies providing telephone services, internet signal.

*Community development for sustainability in Phase 2:* the development of the services of the District Health Promotion Hospital is accelerated. The Huay Pao area is distributed throughout the service area. The project must be integrated with local public health agencies by making a proactive plan to serve the community. Road development in transportation is also important as a means of transport and a route to transport.

*Community development for sustainability in Phase 3:* the remote communities is developed to provide access to both formal and informal systems because education is important in sustainably developing the community. Integration with the Office of Educational Service Area or the Office of Non-Formal Education and education.

## **Discussion**

### ***Developing sustainable indicators under the Huay Pao highland development project using Royal Project system***

Community-based indicators were synthesized by using intensive group-based conferencing methodology. The indicators were divided into 4 items: economic, social, environment and infrastructure. This was consistent with Ekasingh and Promburom (2010) reported that the development of high-altitude indicators is based on 3 main areas: development of economy, social and resources and environment in the highland. Bring the data to determine the indicators in the important sub-dimensions. The dimension is 6 items including 18 indicators as physical and infrastructure, natural resources, environment, finance, livelihood, human resources, and community strength. According with Promburom *et al.* (2013) reported development of the strength of community and the community happiness indicators in the highlands. The indicators were identified into 6 categories including 31 indicators: economic, people and family, infrastructure, community and social, culture and resources/environment.

### ***General conditions of highland communities under the Huay Pao highland development project using Royal Project system***

The highland communities under the Huay Pao highland development project using Royal Project system were integrated agriculture both cultivating and raising animals. Consistent with Praneetvatakul and Sirijinda (2005) suggested that highland areas should have agricultural systems with variety of production models for promoting of sustainable agriculture in the highland. It

should also support the activities to maintain the existence of folk wisdom and traditional knowledge of highland farmers in agricultural activities that did not affect the environment. Sustainable agricultural production planning was under the conditions and context of the community is different. It should take into account the technical and economic efficiency of activities, create self-reliant food for the household. There were a variety of plant systems, both short-term and long-term, for subsistence and sales. Production activities did not destroy the environment and degrade resources (Chaiwinit, 2009; Felix and Judith, 2010).

***Sustainable Assessment of Highland Community by Developing Sustainable Indicators under the Huay Pao Highland Development Project Using Royal Project System***

Sustainable communities would be characterized by a better quality of life, a better ecosystem, more effective governance. It is required a meaningful and thorough participation from people in the community and a stable economic system. Consistent with the concept of sustainable development, the community participates in every step to be self-reliant (Thammajinda *et al.*, 2017). Sustainable communities can manage resources, finance, and responding on needs both current and future by ensuring that resources will be enough and can be shared with future generations of the community (Institute for Sustainable Communities, 2015). In addition, it can be seen that participating farmers focus all indicators of infrastructure factor. Consistent with Bhandari and Grant (2007) reported that Community sustainability must be developed in all dimensions to suit the community and area conditions in the economic, social, environment. This research also focuses on infrastructure because the highland communities also have a growing need for infrastructure.

***The Sustainable Development of the Huay Pao highland development project using Royal Project system***

The results of community Assessment of the Huay Pao highland development project using Royal Project system found that the community needs to be developed in all factors, including economic, social, environment and infrastructure, in order for the community to develop sustainment. This community of the Huay Pao highland development project using Royal Project system will be accelerated by the development of the economy factor by using the philosophy of sufficiency economy, in order to immune to the community. Social factor was the strength the development of leader, people

and farmer's institution in the community. Environment factor was accelerated the protection of the community forest and external threats. Infrastructure factor was accelerated the development of the services of public utility and healthy of people in community.

Sustainability assessment of the highland communities from the developing sustainable indicators had a strong focus on 4 factors, including 32 sustainable indicators under the Huay Pao highland development project using Royal Project system. Overall, the community was sustainable at a very good level. Except for the environment factor was a good level. The development of community in the highlands that should be considered in the planning of community development was the first as infrastructure. The second was the economic, social and environment, respectively. However, in the development process, it is very important to consider other related factors. So, it is suggested that community development should take into account the needs of the community that are essential. This will help the community to be stronger, manage itself and contribute to the sustainability of the community.

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### **References**

- Bhandari, B. S. and Grant, M. (2007). Analysis of livelihood security: A case study in the Kali-Khola watershed of Nepal. *Journal of Environmental Management*. 85:17-26.
- Chaiwinit, W. (2009). Economically and environmentally optimal highland crop production plans at farm level, Mae Suk watershed, Mae Chaem district, Chiang Mai province. (Master Thesis). Chiangmai University, Thailand.
- Chiangmai University (2008). Complete report of highly developed database and information development. Highland Research and Development Institute (Public Organization).
- DLD (1998). Framework of evaluation of sustainable land management, A case study Ban Pha Duea, Mae Fha Louang. Department of Land Development.
- Ekasingh, B. and Promburom, P. (2010). Complete report on development indicators for economic, social, resource and environmental development in highland areas. Highland Research and Development Institute (Public Organization).
- Ekasingh, B., Ekasingh, M. and Promburom, T. (2001). Indicators of sustainable land resource use in highland agricultural systems. *Journal of Agriculture*. 19:7-85.
- Felix, M. and Judith, M. (2010). A farm resource allocation problem: Case study of small scale commercial farmers in Zimbabwe. *Journal of Sustainable Development in Africa*. 12:315-320.
- Highland Research and Development Institute (Public Organization) (2017). Master plan project expansion project Royal Project 2017-2021. Chiang Mai: Wanida Printing.

- Institute for Sustainable Communities (2015). Definition of sustainable community. Retrieved from the <http://www.iscvt.org/impact/definition-sustainable-community>.
- Noppakunwong, R. (2007). The project gathers knowledge about the conditions for success and good performance of the Royal Project for the development of integrated highland areas. Highland Research and Development Institute (Public Organization).
- Office of the National Economic and Social Development Board (2010). Report on the strategic plan for the development and conservation of natural resources in the Northern highlands. Highland Research and Development Institute (Public Organization).
- Praneetvatakul, S. and Sirijinda, A. (2005). production plan for sustainability of highland agricultural systems in Northern Thailand. *Journal of NRCT*. 39:93-107.
- Praneetvatakul, S., Janekarnkij, P., Potchanasin, C. and Prayoonwong, K. (2001). Assessing the sustainability of agriculture: A case of Mae Chaem Cathchment, Northern Thailand, *Environment International*. 27:1-7.
- Promburom, P., Limmirankul, B., Thong-ngam, K. and Kaewmuangmoon, T. (2013). Full report of community development process, and community happiness indicators in the highlands. Highland Research and Development Institute (Public Organization).
- Thammajinda, R., Chingchayanurak, C., Jitaree, W., Trakarnsirinont, W. and Na Ayudhya, T. N. (2017). The development of a sustainable community enterprise model: A case study of the Puk Plod San Ban Don Satan group in Pua district, Nan province. *Journal of Community Development Research (Humanities and Social Sciences)*. 10:98-107.

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