

## **Triple Helix System : The Heart of Innovation and Development for Rural Community in Thailand**

Wissara Chaisalee<sup>1</sup>, Anan Jongkaewwattana<sup>2</sup>, Morakot Tanticharoen<sup>3</sup>, Sakarindr Bhumiratana<sup>4</sup>

<sup>1</sup>Rural Development Technology Service Unit (TS), National Center for Genetic Engineering and Biotechnology (BIOTEC), 113 Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani, 12120, Thailand.

<sup>2</sup>Virology and Cell Technology Laboratory, BIOTEC Central Research Unit, National Center for Genetic Engineering and Biotechnology (BIOTEC), 113 Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani, 12120, Thailand.

<sup>3,4</sup>National Science and Technology Development Agency (NSTDA), 111 Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani, 12120, Thailand.

### **ABSTRACT**

Farmers have been playing a crucial role in Thai society for centuries. Despite their highly important responsibility as food suppliers for the entire country, the majority of them (>80%), often poorly educated, still live in rural, less developed areas, thus lacking sufficient knowledge for supporting their well being. It is thus essential that science and technology be implemented to enable them not only to sustain their career, but also to improve their life quality. This paper discussed the Triple Helix model for rural community development by focusing on the agricultural village using Ban Pakub, Bo Kluea district, Nan province in Thailand as a case study. The strategic intervention affected by the collaboration of government, university and industry have resulted in prosperity, and improved standard of living and stronger community. The Triple Helix system applied in this case explained the integration of interaction, knowledge transfer and different roles of each player in the system from knowledge production, implementation and commercialization. In order to determine their actual needs, the procedure was divided into three steps. First, the surrounding areas such as types of annual crops, natural resources and their activities were surveyed. Subsequently, one-on-one interviews with village members were conducted to assess overall situations as well as to identify causes of problems. Finally, based on the collected information, focused group discussions were conducted with villagers in form of various activities. The findings of this study indicate that triple helix system, collaboration through networking among government, university and industry, are essential for rural technology transfer. It is clear that the success of the program depends largely on the use of technology transfer to increase productivity, income, and the source of food for farmers, which, in turn enables them to improve standard of living, strengthen the community, and, most importantly, sustain development in a long run

**Keywords :** Innovation, Triple Helix, Technology transfer, Rural Community, Agricultural, Thailand

-----  
Copyright of the paper resides with the author(s). Submission of a paper grants permission to the 8th Triple Helix International Scientific and Organizing Committees to include it in the conference material and to place it on relevant websites. The Scientific Committee may invite papers accepted for the conference to be considered for publication in Special Issues of selected journals

## **Triple Helix System : The Heart of Innovation and Development for Rural Community in Thailand**

### **1. INTRODUCTION**

Farmers, figuratively regarded as the backbone of the nation, have been playing a crucial role in Thai society for centuries. Despite their highly important responsibility as food suppliers for the entire country, more than 80 percent of them still live in rural, less developed areas and often are poorly educated, thus lacking knowledge sufficient for supporting their well being. Although most Thai people consume rice as their main food, and rice is one of the country's most lucrative export products, Thai farmers have long been threatened by various difficulties, such as water shortage, lower productivity and lose of field fertility. As a result, the new generation tends to abandon this century-old career to work in factories in cities for better income. It is thus essential that science and technology be implemented to enable them to not only sustain their career, but also improve their life quality.



*Photo Printed for Permission*

The Triple Helix is a spiral model of innovation that captures multiples reciprocal relationships at different points in the process of knowledge capitalization. A Triple Helix-based approach to regional development originated in Boston, Massachusetts, during the Great Depression of the 1930s (Etzkowitz, 2002), and has since spread across the US and further afield to Europe, Asia and Latin America providing a dynamic framework for the interaction of a variety of institutions and stakeholders, broadly encompassed by University, Industry and Government. The phenomenon of the Triple Helix System has been widely recognized in several developed countries (Leydersdoff, 1997). The model engages the university as the centre of excellent with its academic-based research and development activities, industry as the provider of the customer demand based on its commercial activities as well as research and development, and the government as a policy maker.

This paper applied and discussed the Triple Helix model for rural community development by using the agricultural village at Ban Pakub, Bo Kluea district, Nan province in Thailand as a case study. The strategic intervention affected by the collaboration of government, universities and industries have resulted in prosperity, improved standard of living and stronger community. The Triple Helix system applied in this case explained the integration of interaction, knowledge transfer and different roles of each player in the system from knowledge production, implementation and commercialization. By using local resources, the Triple Helix model for agricultural development has created a significant impact on local and regional economic development, especially in remotely rural areas.

### **2. STAKEHOLDERS AND PARTICIPANTS**

Agriculture, including crop cultivation, livestock, fisheries, and forestry, is the largest and most important sector of the Thai economy. Not only is rice the main food that most Thai people consume daily, but it is also one of the main export products. Undoubtedly, farmers can be considered the most important driving force of Thai economy. Unfortunately, this occupation has been threatened by various predicaments, for example, lack of water, lower yield and lost of field fertility. Worse, the new generation tends to abandon this career and choose to work in the city, hoping to earn more incomes. If these problems still persist, it is likely that Thai farmers may not be able to confront these challenges. Science and technology is one of the tools that can be employed to lift up their quality of lives.

## 2.1 Background

As part of the project under the patronage of H.R.H. Princess Maha Chakri Sirindhorn named, this study has been held at Ban Pakub, the village with a century-long history, located at Bo Kluea District, Nan Province. It is 3.5 kilometers far from Bo Kluea District and 113 kilometers far from the downtown of Nan province. Forty-seven families with 183 people have been attracted to live in this fertile plain landscape. Agriculture is the major career of these residents. Each family owns an average of 3 rai (1.2 acres) of land. In addition, they also do wild-products searching, wild-life hunting and some other general hiring jobs. Most areas of the landscape are paddy fields where the Mang River is flowing through from the west. The high latitude location of 600 meters above sea level, the surrounding forests and the steep valleys landscape are all the factors making this area cool all year long, especially during nighttime. Despite an ideal location for agriculture and tourism, most of young residents have tendency to abandon their land, moving out to find jobs after harvesting. That has been the most serious problem for rural technology transfer. Thus, the project, driven by not only the National Science and Technology Development Agency (NSTDA) by rural development technology service unit (TS) under the National Center for Genetic Engineering and Biotechnology (BIOTEC) but also alliance agencies, had been launched aiming to introduce science and technology to the village. It serves as a means to open the windows of opportunities for all of them to lift up and strengthen community, to help them access more work channels after harvesting and , most importantly, to encourage new developments to come from villagers' local wisdom by stimulating the farmers to realize the importance of land after harvesting periods.

We have followed the guidance for the country's economic and social development popularly known as Philosophy of sufficiency Economy created by His Majesty King Bhumibol Adulyadej, who has been regarded by most Thais as the soul of Thai people and the nation. This philosophy is applied in the agricultural system to make farmers more self-reliant through a holistic management of their land, while living harmoniously with nature and within society. This philosophy is living in moderation and being self-reliant in order to protect against changes that could destabilize the country (UNDP, 2007). The Sufficiency Economy is believed to adapt well within existing social and cultural structures in a given community, if the following factors are met:

- subsistence production with equitable linkage between production/consumption
- the community has the potential to manage its own resources following aspects to achieve the principle of self-reliance:
- State of Mind: One should be strong, self-reliant, compassionate and flexible. Besides, one should possess a good conscience and place public interests as a higher priority than one's own.
- Social Affairs: People should help one another, strengthen the community, maintain unity and develop a learning process that stems from a stable foundation.
- Natural Resource and Environmental Management: The country's resources need to be used efficiently and carefully to create sustainable benefits and to develop the nation's stability progressively.
- Technology: Technological development should be used appropriately while encouraging new developments to come from the villagers' local wisdom.
- Economic Affairs: One needs to increase earnings, reduce expenses, and pursue a decent life.

## 2.2 The Triple Helix System for Technology Transfer

As a party of the Triple Helix System, NSTDA by Rural Development Technology Service Unit (TS), the government agency, has been a leading provider and contributor of new knowledge and technology transfer such as seed production, some commercial vegetables such as sweet corn, Snack slim tomatoes, new breed of tomato suitable for fresh consuming and naturalistic hens farming. Moreover, such a strategy provided opportunities for training and collaborating with the community, academics and the company by transferring technology based on the guidance of the country's economic and social development, known as sufficiency economy, the economic philosophy created by His Majesty King Bhumibol Adulyadej. This philosophy can be applied in various agricultural systems to help farmers become more self-reliant through a holistic management of their land, and live harmoniously with nature and society through various types of technology to encourage their wisdom. Rajamangala University of Technology Lanna (RMUTL) plays an active role as a technologist, providing training of new process such as wheat and wheat tea production and being the help of various other technology developments on product and process and value-added products from wheat for the community. Besides the linkage to technical resources, NSTDA by TS also collaborated with the private sector. In this case, the Lemon Farm company linked the market of the developed organic and macrobiotics products with the consumers, providing the consultation on new ideas to produce quality products and designed attractive packaging. The synergy, therefore, played a pivotal rule in collaboratively developing these people's community as depicted in Figure 1.

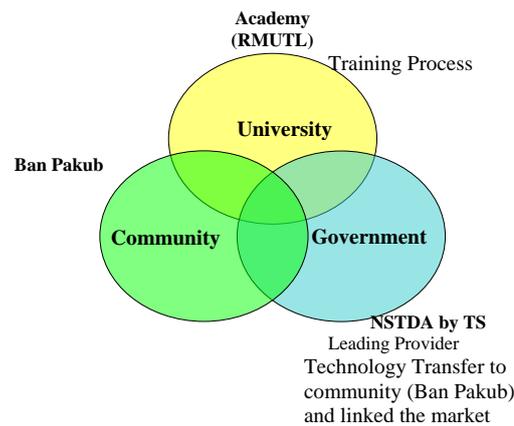


Figure 1. The Triple Helix System

### 2.3 Procedure

Farming systems in developing countries require skilled transfer agents to communicate the complex needs of farmers to researchers (Thomas, 1993). There is often a shortage of such skilled workers, but training and subject-matter specialists can help improve skills. A receptive and open attitude on the part of researchers contributes to improving channels of communication. Communication and direct collaboration may be difficult because either one or both groups are incapable of dealing with the other. The following factors are essential for good services to small farmers and require strong linkages (Kaimowitz, 1992):

- Research must focus on real problems and constraints faced by farmers.
- Agroecological and socioeconomic aspects of farming systems should be taken into account in technology development and consolidation.
- Technology transfer groups should be aware of technologies available to farmers.
- Feedback regarding transferred technologies should be provided to research so that necessary adjustments can be made to future technologies.

A goal of the project was to establish economic self-reliance for rural disabled people as entrepreneurs. NSTDA by TS assisted in strengthening the capacity of the local institution to train and prepare rural disabled people for equal participation in social and economic development at the family and community levels. Training methods were developed to address specific needs and to assure replication and sustainability following training. Alternative ways of accomplishing certain tasks were developed to accommodate specific disabilities. Appropriate construction designs were introduced for trainees to set up their activities, using readily available materials, lowering set-up costs substantially. Motivational sessions as part of the training contributed to personal development. In order to determine their actual needs, the procedure was divided into three steps. First, the surrounding areas such as types of annual crops, natural resources and their activities were surveyed, as shown in Table 1. Subsequently, one-on-one interviews with village members were conducted to assess overall situations as well as to identify causes of problems. Finally, based on the collected information, focus group discussion was carried out with villagers through various activities. Figure 2 shows an example of the activity done during the discussion group. The list of crop data generated during the discussion group is shown in Figure 3. Moreover, the annual activity set up is listed in Table 1.



Figure 2. Focused group discussion with the villagers

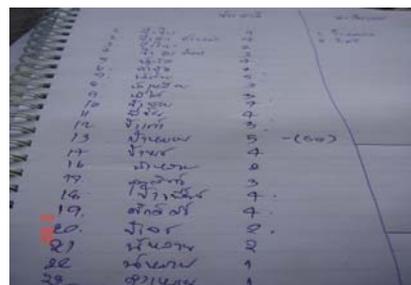


Figure 3. List of crop data

Table 1.

The Annual Activities set up from focus group discussion

Activity	Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice												
Wheat												
Wheat Tea												
Onion												
Garlic												
Sweet Corn	Paddy Field				High Field					Paddy Field		
Tomato												
Soybean												
Garden Pea												
Mustard Green												
Wild-Products												
Mushroom												
Fish/Fogs												
Handmade Products												
Chicken												
Temporary jobs												

#### 2.4 The Management of Agricultural Technology Transfer

Thailand has a great potential for food production and now one of the world's major producers and world's largest exporter of rice and tapioca. Moreover, Thai food plays an important part in contributing to the Thai economy and the business of Thai food outlets has a market value of 100 billion baht annually (Tourism Authority of Thailand, 2010). However, most farmers who produce food live in rural areas. They still face with problems such food price, production cost, malnutrition and health problem. The high food price directly affects their livelihood status. Agriculture development provided assistance to the crop producers with the help of various agricultural resources. Therefore, improvements in agricultural productivity aimed at small-scale farmers will benefit the rural poor first to increase agricultural output and reduce production costs. Scaling up research and development will ensure continued productivity. Moreover, the country set technology transfer to improve soil and crop varieties and further develop water sources. Agriculture is necessary for Ban Pakub community because after rice harvesting most of the farmers left the land to find the jobs in the city. Therefore, project aiming at improvement in agricultural productivity helping the grassroots to increase their agricultural output and reduce production cost in their paddy fields.

The project driven by NSTDA and alliance agencies stimulated, the farmers to become concerned with and realize about the importance of land utilization after harvesting periods. In addition, the project has provided the opportunity for farmers to improve several issues regarding the use of their resources, especially on the ground of the production costs, the land's quality improvement, as well as supports additionally high-quality protein source to the community members. The successful results of this project could be summarized as shown below.

#### 2.4.1 More productivity of wheat:

Wheat is a grass, originally from the Fertile Crescent region of the Near East. By 4,000 B.C. wheat farming spread to Asia, Europe and North Africa. Soon, wheat has been cultivated worldwide. Wheat is well adapted to harsh environments and is mostly grown on wind-swept areas that usually are too dry and too cold for rice and corn. Moreover, wheat holds an important food-security role in a growing world population. During 2006 until the present, the farmers planted wheat after rice harvesting. They hope to get some money for their children and expense in their household. A total of 20 farmers participated in this project. In the 30-rai (12 acres) land, the average productivity was 300 kilograms per rai. This means each rai yielded 1,500 baht. The establishment of wheat tea producer for value adding was also introduced. The number of members expanded from 6 to 15 with the circulating money, of 50,000 baht per present. The money circulated in the community to support the member. This group is one strengthen and successful in Nan province.

#### 2.4.2 Seed production and selective planting after farming period

Seeds have been an important development in the reproduction and spread of flowering plants. The starter group, comprising 8 members, planted for local vegetables, e.g. typical lettuce, typical parsley and some commercial vegetables, e.g. sweet corn, Sida-tomato and Snack slim tomatoes, which is a new species of tomatoes suitable for fresh consumption without any remained insecticides. As a result, this project gave the farmers approximately 2,000 baht per family.

#### 2.4.3 Naturalistic project by chicken farming

Chickens are the most accessible livestock for rural community due to their short reproductive cycle which speed up the productivity. In addition, they are important source of protein for human nutrition. Farmers in rural area are not familiar with chicken farming system. Normally, chickens are left at backyard. Leftover food and insect are sources of feed. Farmers do not arrange any vaccine program. The lack of management system results in low productivity, inadequate nutrition and low income. The system is simple and easy to be operated. This is to give farmers knowledge in operating farm management system. The system offers alternative to farmers. It can help reducing production costs while increasing quality of nutrition, i.e. protein. The system can be of benefit to farmers as it can help increasing farmers' income and make the best use of their farms after harvesting season. Chicken meat is an important source of high quality proteins, minerals and vitamins to balance the human diet. Specially developed breeds of chicken meat (broiler) are now available with the ability of quick growth and high feed conversion efficiency. Depending on the farm size, broiler farming can be a main source of family income or can provide subsidiary income and gainful employment to farmers throughout the year. Moreover, chicken manure has high fertilizer value and can be used for increasing yield of all crops.

The project started with 10 farmers at Bo Kluea District, Nan Province, Thailand. Each farm held 50 hens. At this time, the productivity was 30 eggs per day. Delivery rate is 60 percent of the flock. As a result, the income was 75 baht per day with approximately 10-15 baht per day profit. Management system is the most important factor in profitable hen farming. The system can have effect on annual egg production, egg size, feed cost and production cost. Proper management system, i.e. good housing, balanced feeding, good hygiene and good production can result in high income. During the course of the project, farmers start to learn management skill. The project assists farmers to gain more benefit and educate them to accumulate management skill. It helps them to gain access to cheap inputs and improve their marketing efficiency. It is expected that the system will help them increase their income. The study finds that the small farmers have potential to operate naturalistic hen farming system, which encourages free-range or organic production. They are able to accumulate skill in production, management and earn more income. Although farmers have problem in high feed costs and competitive market, the project can benefit farmers financially and nutritionally in a long-run. The project also attempts to help them accumulate more skill in feed management, access to cheap inputs and improving marketing efficiency. Based on the income earned by people in Pakub as mentioned above, each family could earn 10,000 baht per year. Most incomes were earned after regular paddy farming. This helps farmers use their land more properly and profitably and obtain more high-quality protein sources. This protein source is also useful for other communities. This strategy will allow farmers to rely on their own capability with less or no required daily expenses.

### 3. RESULTS

Since the year 1980 the agricultural and Rural development efforts among the government, non government organizations and the farmer's associations in Thailand were seeking solutions to solve the problems about the crisis of Ecological and Environment which many impacts to the people, of course most of farmers in Thailand who increased their productions with the high – technology and also high in – put in Chemical Fertilizers. This is the big problems nowadays in 2000 that make the farmer's are poor and debted it is called modernization but not civilizations. Agriculture is a major source of incomes of these people in Ban Pakub with approximately 3-rai land (1.2 acres) per family. In addition, they earn their livings through wild-product searching and some other temporary jobs. Most areas of the landscape are paddy fields with the Mang River as the main source for nourishment. The high latitude location of 600 meters above the sea level, surrounding forests and steep valleys landscape are all the factors contributing to invariably cold climate, especially at night. Despite such a pleasant setting, most of them unfortunately leave the land to find other jobs after crop harvesting. Part of the problem is likely due to a lack of rural technology transfer. Because of this, National Science and Technology Development Agency (NSTDA) by Rural Development Technology Service Unit (TS) under the National Center for Genetic Engineering and Biotechnology (BIOTEC) viewed that introducing science and technology to the village could open the windows of opportunities for them to lift up their community by helping them access more work channels after harvesting and, most importantly, encouraging new developments based on their own local wisdom. The collaborative system among this synergy was found very essential for rural technology transfer. It was a key success for technology management.

As a result, the farmers, after having harvested, had more activities to increase the productivities in their own land (Figure 4), earned more incomes, received more sources of food and gained more opportunities to produce quality goods with their resources for the consumers (Figure 5), leading to the reduction of their payment compared to that during 2007 to 2009, as presented in Figure 6.

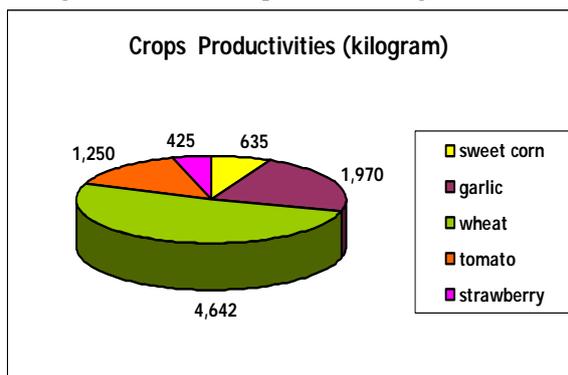


Figure 4. Products after harvesting

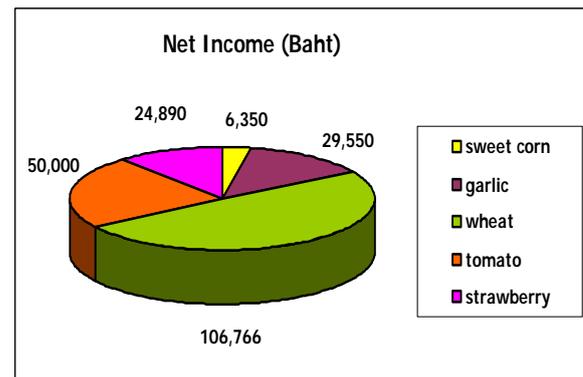


Figure 5. Net Income from crop production

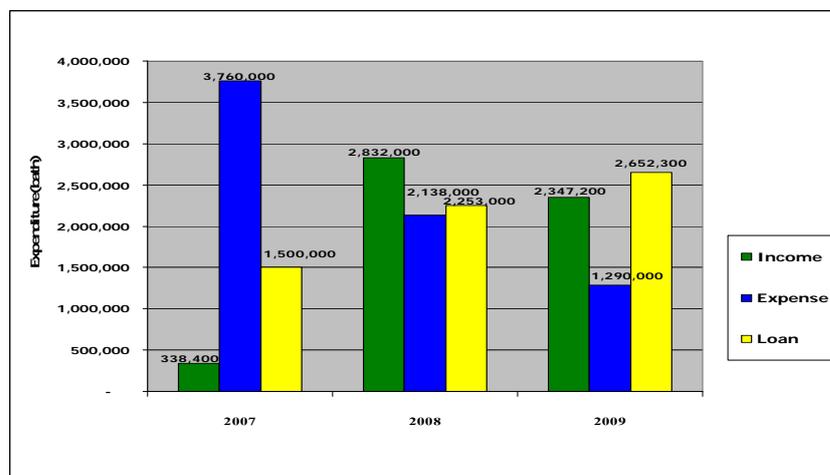


Figure 6. The total expenditure from 2007 to 2009

#### **4. DISCUSSION AND SUMMARY**

This study used the Triple Helix model to analyze linkage between science and society. The findings of this study indicate that Triple Helix system, the collaboration through networking among government, university and industry, is the tool and essential for rural community technology transfer. It was a key success to give good knowledge, to increase the productivity, to increase income and to increase source of food for farmers, necessary for improving standard of living, stronger community, providing the opportunity for farmers to improve and realize about the importance of land utilization after harvesting periods and sustainable development of technology transfer. Although it seems impossible to enrich all of the farmers or to convince them not to leave their village, we, to a greater extent, have been successful in assisting them to learn how to gain more agricultural productivity after harvesting, improve the productivity, make the best use of their resources, including applying new knowledge with their own local wisdom to improve agricultural productivity. The integration of these different actors lies at the heart of the triple helix system that combines the innovation and development to strengthen the rural community. As a consequence, more activities are created in the community besides regular paddy farming, consequently resulting in more income. Moreover, productivities have been significantly improved, giving more high-quality protein sources for themselves and those in other communities. Most importantly, they are able to practice self-sufficient lifestyle by relying on their own capability with less superfluous expenses and live happily with their families.

#### **5. ACKNOWLEDGEMENTS**

The work reported here was financially supported by the National Center for Genetic Engineering and Biotechnology (BIOTEC) and the Cluster Program Management Office (CPMO), granting agencies, under the National Science and Technology Development Agency (NSTDA). We are grateful to Asst.Prof.Dr. Saneh Thongrin, Thammasat University, for her assistance in the preparation of this paper. Also, we gratefully acknowledge the farmers at Ban Pakub, Bo Kluea District, Nan Province for their good collaboration helped and make sense of the study data in this project. Finally, a brief note of thanks goes to the VIII Triple Helix Conference that will be held in Madrid on October 20<sup>th</sup> – 22<sup>nd</sup>, 2010 for granting us an opportunity to participate in the event and exchange good experience with others.

#### **6. REFERENCES**

- Annual Report 2009, National Center for Genetic Engineering and Biotechnology (BIOTEC), 113 Thailand Science Park, Paholyothin Rd., Klong Luang, Pathumthani, 12120, Thailand.
- Eponou, Thomas. 1993. Partners in agricultural technology: Linking research and technology transfer to serve farmers. ISNAR Research Report No. 1. The Hague: International Service for National Agricultural Research.
- Etzkowitz, H. 2002. MIT and the Rise of Entrepreneurial Science. London : Routledge.
- Kaimowitz, D. 1992. Motive Forces: External Pressure and the Dynamics of Technology Systems. Linkages Discussion Paper No. 11. The Hague: ISNAR.
- Leydersdoff, L., Van den Basselaar, P. (1997). Technological development and factors substitution in a complex dynamic system, Journal of Social and Evolutionary System.
- Tourism Authority of Thailand (2010), retrieved 1 August 2010 from <http://www.sawadee.com/thailand/food>
- UNDP. 2007 Thailand Human Development Report 2007: Sufficiency Economy and Human Development, UNDP: Bangkok.
- Wissara Chaisalee, Vanida Kamnerdpeth, Prateep Insaeng and Nan-Mongkol Induong. 2008. The Potential of small farms in naturalistic hen farming : Case Study of Bo Kluea District, Nan Province, Thailand. Proceeding of The 13th Animal Science congress of the Asian-Australasian Association of Animal Production Societiesb21-29 September, 2008, Hanoi, Vietnam.