THE SIGNIFICANCE OF NATIVE WEIRS IN SUSTAINABLE DEVELOPMENT OF VANG VIENG DISTRICT, VIENTIANE PROVINCE, LAO PDR

Miss Lamngeune Souliyavong

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ความสำคัญของฝายต่อการพัฒนาอย่างยั่งยืนของอำเภอวังเวียง
แขวงเวียงจันทน์ สปป.ลาว

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By	Miss Lamngeune Souliyavong
Field of Study	Southeast Asian Studies
Thesis Advisor	Associate Professor Withaya Sucharithanarugse, Ph.D.

Accepted by the Graduate School, Chulalongkorn University in Partial Fulfillment of the Requirements for the Master's Degree

.....Dean of the Graduate School
(Associate Professor Sunait Chutintaranond, Ph.D.)

THESIS COMMITTEE

.....Chairman
(Assistant Professor Theera Nuchpiam, Ph.D.)

.....Thesis Advisor
(Associate Professor Withaya Sucharithanarugse, Ph.D.)

.....External Examiner
(Chuwit Mitrchob, Ph.D.)

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การศึกษาที่ให้ความสนใจในความรู้ของท้องถิ่นในการจัดการฝายในเขตลุ่มน้ำชอง อำเภอวังเวียง เป็นการศึกษาพื้นฐานของตำบล ชีวิติความเป็นอยู่ ของชาวบ้านในฤดูฝน และฤดูร้อนที่ใช้อยู่กับการใช้น้ำ เป็นการรักษาฝายพื้นเมือง ได้แก่ฝายไม้ ฝายหิน และฝายคอรกรีต การจัดการฝายโดยทางราชการ และชาวบ้าน ยังได้ศึกษาการใช้น้ำจากระบบฝายในการเกษรตกรรม ในฤดูร้อน และฤดูฝน การใช้น้ำเพื่ออุสาหกรรม กสิกรรม การท่องเที่ยว การอุปโภคบริโภค การรักษาสภาพนิเวศวิทยา และกิจกรรมเกี่ยวกับสิ่งแวดล้อม ได้มีตัวแบบในการใช้ระบบฝายเพื่อประยุคต์ใชในเขตชนนบท

สาขาวิชา เอเชียตะวันออกเฉียงใต้ศึกษา ลายมือชื่อนิสิต .....

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This study focuses on local knowledge of management of weirs in the Basin of Nam Xong River in Vang Vieng district. It looks into background of villages, livelihood of villagers in rainy season and dry season based on water usage. It studies native weir system and kind of weir such as wood weir, gabion weir, concrete weir, and management of native weirs by officials and villagers. Furthermore, it studies using water from weirs system for agriculture in dry season and rainy season; and water usage for industry, agriculture, tourism, consumption and ecological conservation and environmental activities. The model for using weirs system is developed for replication in rural areas.

Field of Study: Southeast Asian Studies Student's Signature .....

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Sustainable development: dating back to the Brundtland Report of the United Nation in 1987, one basic definition of sustainable development is a “development which meets the needs of the present without compromising the ability of future generations to meet their own needs". Since then, a number of useful and internationally recognized definitions have come up for different purposes. For the purpose of defining the long term vision of the Lao Agricultural Development Strategy (AND), sustainable development is seen as a holistic concept, based on three pillars. Long-term sustainability is then to include all three dimensions; economic, social and ecological/ environment. The objective of the sub sector plan for irrigated agriculture is therefore to create a more conducive environment for irrigated agriculture development. The long term strategy covers the period of 2011-2020. Its direction will be towards re-modelling and re-orienting the mechanisms of the various areas of public management that relate to the irrigated agriculture sub sector. The new model for public management will need to be shaped around a holistic perception of irrigation, namely as “irrigate agriculture", a business activity undertaken by farming households and the private sector, and governed by economic incentive.(Forestry, 2010)

Michael P.Todaro’s book on economic development, mentions three important core values of development: sustenance, self-esteem and freedom. Development was viewed as a process of a series of successive stages of economic growth through which all countries must pass in the 1950s and1960s. Nobel Laureate

W. Arthur Lewis said that the development theories put their focus on structural transformation and were mainly so formulated. More recent has been the neoclassical approach to development, which became popular in the 1980s, especially with the World Bank and the International Monetary Fund (IMF). This approach insisted on free markets, the privatization of public enterprises and on certain government regulation of economic activities. (Luther, 2002)

Lao People's Democratic Republic (Lao PDR) is a country abundant in natural resources such as: land, water, biodiversity and a mainly untapped mineral resource. In addition, Lao PDR possesses a number of beautiful historical, archaeological and natural sites. These resources have been in the past, and will be in the future, a great potential for national socio-economic development, providing for the livelihood of its multi-ethnic people. Despite the good social and environmental condition of major cities in Lao PDR, the government have to take into account the fact that population growth rate is still fairly high. Industry and tourism sectors are growing fast. A flux of rural population into cities has become a factor, stimulating rapid urbanization. However, urban utilities still remain primitive. About 40% of urban populations have no access to clean water. Storm water drainage systems are poor. There is no municipal waste water treatment system. Waste and toxic waste disposal sites are located at inappropriate positions and do not comply with technical requirements. Cities still lack public parks and green zones. Apart from that, currently there are no proper measures to prevent and mitigate air and noise pollution and to prevent and minimize nuisances such as odors among many others. This has caused some social impacts, such as waste and waste water from households and servicing premises discharged directly into publicly accessible water courses.

The new millennium is in which significant and technological knowledge will continue to be rapidly and constantly developed. This gives great impetus to the

socio-economic development. However, many human activities have resulted in environmental degradation namely: biodiversity loss, air and water contamination, forest destruction, decline of water resources, land degradation and the increase of waste, the increase of toxic chemical substances, climate change and many others that are posing threats to human life and property. At the same time, the environment and natural resources provide for basic need and continue to play a important role in socio-economic development of all nations, including developing countries that are heavily reliant up on natural resources for their development.

Lao PDR still heavily relies on natural resources and this clearly demonstrates that long-term economic growth will have to be closely linked with natural resource use, the management and protection of the environment. So, there are many issues that are essential for the future of sustainable development in the Lao PDR. While talking about agriculture and forestry development at the level of high productivity and quality for provision of goods to the market, first of all we have to deeply understand the potential natural resource, environmental conditions at each location, especially the land because land is the fundamental factor for agriculture and forestry production. As a result, to undertake survey to identify strength and restriction of the land, climate and environmental conditions of each location. For this reason, Lao PDR has conducted soil survey and land classification and developed land maps nationwide to serve as reference for the formulation of agriculture development strategy. (NationalEnvironmentCommitee, 2005)

According to the significance of water resources management is important issue for development Vang Vieng District in Lao PDR, mention above the researcher would like to find out and appropriate model to be come for using native weir system development for replication in rural areas.

Water resources are essential for socio-economic development, enabling, for hydropower, irrigation and weir. Water resources management and development are expected to become more complex and challenging and to involve new uncertainties as water development increases and accelerates in different water use sectors and is couple with increasing population, urbanization, and climate change. hence, water resources need to be managed in more integrated and sustainable way, both in Lao PDR and in the whole Mekong Basin area (JUSI, 2013).

Water use irrigation sector Strategies of the boundaries in the Vang Vieng district area is of important to development for the Vang Vieng example villagers, irrigated agriculture, industry, tourism and fishery. There is little community engagement and participation in resource management in the Nam Xong basin. Generally there is a one way communication between districts, provinces and national authorities and villages. water resource development and use for irrigation purposes.

Lao PDR is on an increasingly sustainable development path. Reforms underway have helped reduce poverty and stimulate broad-based growth. The economy has expanded on average by 7.1 percent per year from 2001 to 2010, and is expected to grow by 7.6 percent per year in 2011-2015. In 2011, Lao PDR reached a gross national income per capita of US$1,010, and, as such, moved up from its lower income status to become classified as a lower-middle income economy. At this pace, Lao PDR is on track to achieve its long term vision: to graduate from the Least Developed Country status by 2020. Natural resources - forestry, agricultural land, hydropower, and minerals - comprise more than half of the total wealth of Lao PDR. The hydropower and mining sectors combined accounted for about one third of the country's economic growth between 2005 and 2010. The growth in these sectors has resulted in significant increases in revenue which has translated into poverty

reduction. It has also spurred progressive changes in environmental legislation. Lao PDR is increasing its integration into the regional and global economy. It is located in one of the fastest growing regions of the world economy which has strategic importance in terms of potential for growth in cross-border investment and exports (including hydropower and mineral products) to rapidly industrializing neighboring countries. Lao PDR is a member of the Association of Southeast Asian Nations (ASEAN) and the ASEAN Free Trade Area. On February 2, 2013, Lao PDR has officially become a full member of the World Trade Organization. (WorldBank, April 2014)

1.2 Literature review

The review represents a synthesis of study on livelihood and sustainable development, such as sustainable agriculture, crop, and water management for agriculture.

Nowadays, there are a lot of countries that focus on sustainable development, sustainable environment, and sustainable agriculture. The main purpose of this paper is to explore weir in sustainable development. The weir system is a mean that process water from natural sources to areas that require water for planting. It modifies natural resource by adding new construction to control water and schedule that complies with the geography of the area.

Suesuwan mention that livelihood in Lanna kingdom involved using weir or small irrigation drain for agriculture, crop, and growing. Water supply system from weir or small irrigation is significant for agriculture since ancient period and irrigated rice cultivation system and farm crops. Besides that, there are two types of management of water for conservation, such as group, division and using water management in rainy season and dry season. However, there are studies mentioning that irrigation system in Lan Na kingdom whereby the control is by head of village

and head of district. There are 4 kinds of native weirs in Lan Na: stone weir , wood weir, mix of stone and wood weir, and concrete weir. Nowadays, persons who live in a village still preserve weir system as irrigation system which is significant for livelihood of village and their relationship. Utilization of weir makes livelihood of villagers better as well as boosting family economy (Suesuwan, 1986)

Lao PDR socio-economic development plan in 2012-2013 has the goal to induce rural development and poverty reduction, create conditions to achieve the millennium development and help country emerging from the least developed countries in 2015, ensure sustainable economic - social transformation to industry and moderning linked to protect environment, reducing natural risk, ensure political stability, governance, and open access to the international cooperation. (Misnistry of Planning and Investment MPI, 2012). Lao government sets a goal period that Laos would be leaving from least developed country in 2020. This is the most important goal for Lao PDR which economic development is a key to achieve this goal. Sustainable development is an act of balancing economic, social, and environmental benefits through implementation of development policies, programs, and projects that will not enhance one kind of benefit at the cost of others. Sustainable development also requires a major overhaul in the mindset, attitude, and behavior of the local people as well as of the international community. (District, 2009-2014)

Development means different to people. When asked about “development”, economists would say economic growth is the most important kind of development, educationalists point to the better education, medical doctors would stress the importance of the public health system, and political scientists would give priority to efficient institutions as a basic condition for development. Certainly, all these people are right in their professional way, but what we need for practical purposes is a working definition of “development”.

Sustainable development may also include local participation, empowerment, an equitable sharing of society's resource, limits on consumption and energy use, and a new ethical relationship with the environment. However, sustainable development mentions a kind of economic growth that is not environmentally destructive. Such a process would mean that the present generation would pass onto the succeeding generation a natural resource base equivalent to what it had inherited. (Leinbach & Ulack, 2000)

Another definition which is more explicit argues that "sustainable development" is the process of improving the quality of all human life. Moreover, it includes a dimension of consistency and sustainability, while also involving structural change in economic, social and environmental, attitudes, politics, administration, education and appropriate social values. (Chareonwongsak & Paul, 2004)

For this reason, sustainable development is not only measured by GDP as generally understood, but it should also include social satisfaction, public policy and sufficient nutrition-preservation of the environment to support healthy life. The most recent report on sustainable development attempts to argue that ensuring sustainable development requires attention not just to economic growth but also to environmental and social issue. (WorldBank, 2003)

Sustainable livelihood Development, livelihood is simply the way people make a living. The concept of sustainable livelihood arose from the struggle to reconcile conflicting paradigms of the 1980s. (UNDP 2001:71). The concept of a livelihood is widely used in contemporary writing on poverty and rural development, but its meaning can often appear elusive, either due to vagueness or to different definitions being encountered in difference sources. The dictionary definition of "livelihood" is a "means to a living", which makes it more than merely synonymous with income because it directs attention to the way in which a living is obtained.

There are several researchers who have adopted a rural livelihood approach. (Carswell, 1997; Hussein and Nelseon, 1998; Scoones, 1998). However, a popular definition is that provided by Chamber and Conway which was accepted by the World Bank and used as a standard of livelihood sustainable development. (Santavasy, 2005)

1.3 Rationale

Vang Vieng District is an agriculture-based area fed by Namxong and its tributaries. Source of water from Namxong tributaries affords villagers to grow rice and crops all the year round. Most agricultural production depends on supply of water from tributaries. The ability to grow rice and crops continuously helps to rid villagers from poverty through harvest of rice and crops not only to consumption but sell some product to earn more income. In this manner, livelihood of the people of Vang Vieng depends on water usage for their agriculture. Villager live to weir making in order to obtain water from tributaries. They cooperate to build a system of weir and help maintaining them. They found local groups to take care of their weir. Through this method, water can be harnessed and distributed which allows people to grow rice and crops, the production of which maintains people's livelihood. It is argued here that utilization of weir helps sustain people well-being as well as development of Vang Vieng.

1.4 Objectives

- To find out how native weirs can contribute to the sustainable development of water resources in Vang Vieng District, Vientiane Province in Lao PDR.

- To study the significance of native weirs to sustainable development of Vang Vieng in term of how they provide sustainable support for the livelihood of villagers in this district.

1.5 Scope of the study

This study is aimed at understanding of the role of native weirs to livelihood of villager in Vang Vieng district. However, function of weir depends on irrigation system as a whole, with irrigation system is place, weir can provide enough water for farmer in dry season as well as is rainy seasons so that paddy, other crops can be grown. Irrigation and weir system also provide enough water for some industry, tourism and environment conservation

1.6 Methodology

The study used both qualitative and quantitative methods. To deal with primary data of qualitative approach, in- depth interview was used with officials of the Ministry of Agriculture and Forestry of Laos, Natural and Water Resource Department, agriculture office in district, head of water users groups. It will also include information gathered in the field trip on the use of weir. Information on theoretical approach and background which were secondary data were gathered from textbook, journal, concerned report, internet, newspaper. During my field research, I attempted to find answers to my research questions using in-depth interviews, participant observation, and focus group interviews with chiefs of weir group and members of each weir groups. The study compared up-stream and downstream weirs survey.

1.7 Significance/usefulness of research

- This thesis provides better understanding of the livelihood of villagers who use native weir in agricultural activities.

- The findings from this research can be used to help villagers to find suitable strategy to overcome the problem of water shortage

1.8 Structure of thesis

This thesis composed of 5 chapters.

CHAPTER 1: This chapter is an introduction which mentions about the background of the study including objectives, scope of study, hypothesis, methodology, significance and literature review.

CHAPTER 2: This chapter introduces the background of Vientiane province, Vang Vieng district, and important role of weir in the livelihoods of people locally.

CHAPTER 3: This chapter show the information of the field work by data collection

CHAPTER 4: This chapter Discussion and analysis of data gained through field works

CHAPTER 5: This chapter Conclusion and recommendations

CHAPTER 2

BACKGROUND OF VIENTIANE PROVINCE

2.1 Location

Vientiane Province (also known as rural Vientiane) (Lao ວຽງຈັນ) is a province of Laos, located in the northwest of the country. In 2012 there was 506,881 people in Vientiane Province, Vientiane Province is a large province, covering an area of 22 554 square kilometres; 2/3 of the land is mountainous and 1/3 is land field with 13 districts (Misnistry of Planning and Invesment MPI, 2012). The province borders Luang Pabang province to the north, Xieng Khuang to the northeast, Borikhamxay province to the east, Vientiane and Thailand to the south, and Xaignabouli Province to the west. The principal towns are Vang Vieng and Muang Phôn-Hông. Several kilometres to the south of Vang Vieng is one of Laos's largest lakes, Nam Ngum. Much of this area, particularly the forests of the southern part, are under the Phou Khao Khouay National Bio-Diversity Conservation Area. The principal rivers flowing through the province are the Song River, Nam Ngum River and the Nam Lik River (Wikipedia, 2014)

2.2 Social-economic condition

The government of Laos, one of the few remaining one-party communist states, began decentralizing control and encouraging private enterprise in 1986. The results, starting from an extremely low base, were striking - growth averaged 6% per year from 1988-2008 except during the short-lived drop caused by the Asian financial crisis that began in 1997. Laos' growth exceeded 7% per year during 2008-12. Despite

this high growth rate, Laos remains a country with an underdeveloped infrastructure, particularly in rural areas. It has a basic, but improving, road system, and limited external and internal land-line telecommunications. Electricity is available 75% of the country. Laos' economy is heavily dependent on capital-intensive natural resource exports. The labor force, however, still relies on agriculture, dominated by rice cultivation in lowland areas, which accounts for about 30% of GDP and 75% of total employment. Economic growth has reduced official poverty rates from 46% in 1992 to 26% in 2010. The economy also has benefited from high-profile foreign direct investment in hydropower, copper and gold mining, logging, and construction though some projects in these industries have drawn criticism for their environmental impacts. Laos gained Normal Trade Relations status with the US in 2004. On the fiscal side, Laos initiated a VAT tax system in 2010. Simplified investment procedures and expanded bank credits for small farmers and small entrepreneurs will improve Laos" economic prospects. The government appears committed to raising the country's profile among investors, opening the country's first stock exchange in 2011 and participating in regional economic cooperation initiatives. Laos was admitted to the WTO in 2012. The World Bank has declared that Laos" goal of graduating from the UN Development Program's list of least-developed countries by 2020 is achievable. (CIAWorldFactbook, 2013)

2.3 Background of Vang Vieng District

Nam Xong, the main river of this district has its own legend. According to the tales of Khounboulom Rajathirath, King Fa Ngum defeated and governed Phai Naam the capital city of Lane Xang Vientiane. Phra Nha Phao, king of Phai Naam was captured on the Xong (bed) and was to be taken to Luang Prabang for sentencing. Along the way from Pai Naam to Luang Prabang, the troops had pass through Bane Thine Heng and Pha Tang. When Pha Nha Phao was taken to Pha Tang, he became ill

and died. His corpse was then sent to drift along the Houai Sida river, as the villagers saw the corpse, they then named the river Xong of Pha Nha Phao or Nam Xong ever since 1356. And even before given the name Muong Xong, Vang Vieng was also called Bane Thine Heng where the middle land and Khom people liveed their lives for many generations. Then as time passed, Thai Phouane, the Xieng Khouang people settled here and most of the people in Vang Vieng today are from Xieng Khouang. When the black warriors and Siamese troops invaded Lane Xang Kingdom in 1874, Thao Tengtai or Pha Nha Isane Outaitesa Saysanaxongkham was born in 1850 in Houaphan Thangha and Thanghok. He was the fourth child of Pha Nha Gnom family and nephew of Pha Nha Soulintha. Thao Tengtai was advised by his father to look for a peaceful place for his people to live.Thao Tengtai spent 22 years looking for a permanent place to live before arriving in Bane Phone Nhang located in the Thoulakhom area. They stayed there for 9 years because Thao Tengtai had to attend an administration training course in Luang Prabang managed by the Siamese administration. The chief of Thoulakhom was requested by Thao Tengtai to look after his people within that time. After completing the training course, he returned to his people in Thoulakhom and said goodbye to the chief of Thoulakhom. They then moved upward passing through Bane Phone Nhang and upstream through Nam Lik and Nam Xong river. When Thao Tengtai and his people arrived at Bane Hine Khanmak, the present cement factory, they spent a year building their town. But they realized that the location of Muong Xong was much better since it was located along Nam Xong River. So they decided to construct their homes and Thao Tengtai was nominated to be the chief of the town. From 1893 to 1899, when the kingdom of Laos was under French administration, Muong Xong was recognized as the town. Pierre Moring, a representative of the French government and his assistant in Vientiane, officially recognized the town in May 16, 1899 and nominated Thao

Tengtai or otherwise known as Pha Nha Isane to be the chief of the town and changed the name of Muong Xong to be called Vang Vieng. Vang Vieng is on the way to Luang Prabang from Vientiane, so the king of Lane Xang Luang Prabang and Lane Xang Vientiane often stopped here to relax. Vang Vieng is now a tourist site for travelers from Vientiane heading to Luang Prabang along road No.13 north. When visiting Vang Vieng one has to stop and see the lovely nature of Pha Xang, Tham Jang, Tham None, Phadeng, Pha Tang and much more. (Phouangsava, 2014)

2.4 Population

There are 63 villages in Vang Vieng district, 6 zones of villages. A total of 58,926 people, there are 4 officially recognized ethnic groups that live in the Vang Vieng district. 38.601 people of the villagers are Phuan (Lao Lum), 18.221 are Hmong and 1.338 are Lao Therng. Over 98% of the population of the Nam Xong River lives in Vang Vieng district. Like population around the world the majority of the villages are distributed along the waterways. With the tourism industry offering jobs and opportunities Vang Vieng has seen a significant population increase in the next 5 years. In 2014 there were 58,926 people; in 2019 there were 61,984 people in Vang Vieng district, many villages have been moved to one village in Vang Vieng district from what is estimated to be over 100 household from Xaysomboun province and 3 villages from Luang Prabang province. There is expected to be little more relocation in the future (Resources, 2009). Figure 1 shows the distribution and population in the Vang Vieng. It can be seen that the majority live in the valley of the Nam Xong river. This requires close monitoring and management to ensure sustainable water and natural resource management in Vang Vieng.

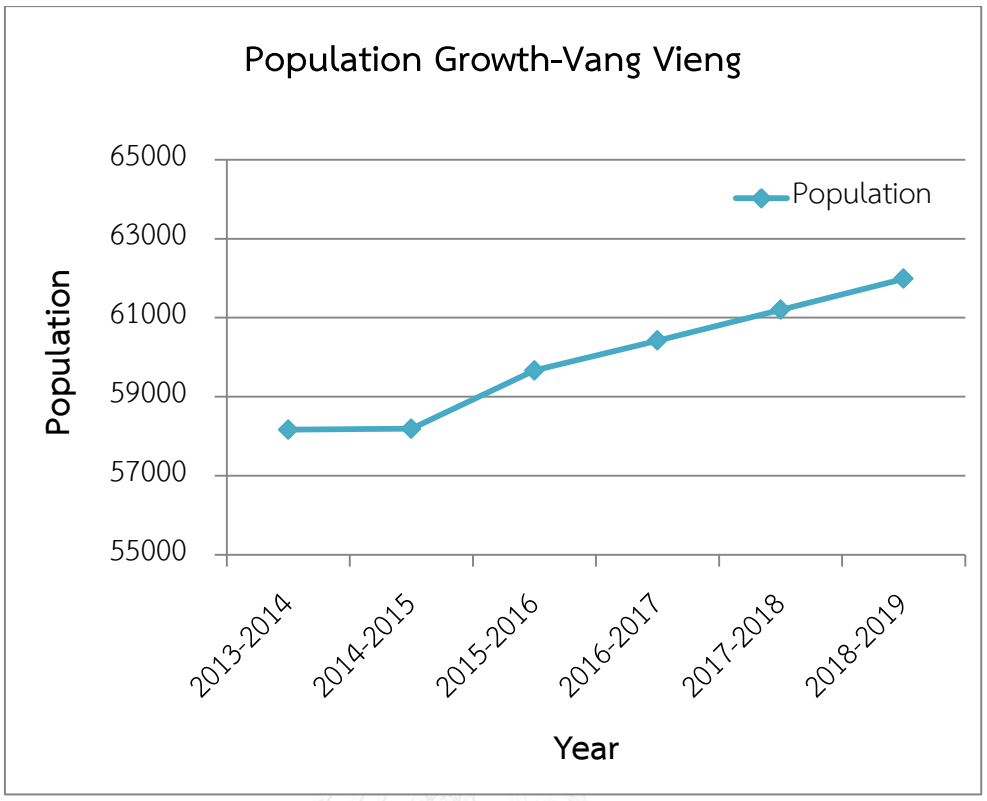

Figure 2.1 Estimated population increase in 2013 to 2019

2.5 Education

There are 15 elementary schools, 47 primary schools, 6 Secondary schools, 4 high schools and one monastery school. 17 villages did not have access to any level of school. Many children do not attend school. There are barriers that prevent children from attending school. This leads to many children and adults having limited quality of life. Barriers include: lack of schools in villages, domestic duties and work. Most children have commercial activities during and outside school hour. Some leave the village to live in the city and work within the local industries and their business, textiles, manufacturing, restaurants and hospitality sector. There are limited funds for building a new schools and lack of teachers; teachers do not want to teach in remote areas. Furthermore, most students who finish high school are not able to continue their study at the university.(VangVieng workshop,2008)

2.6 Economy

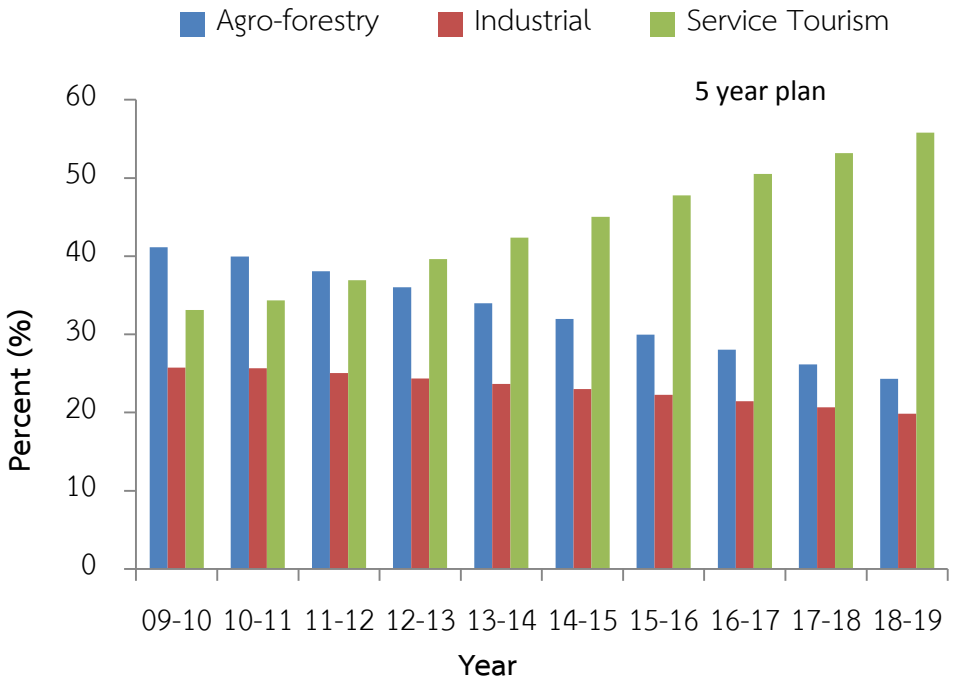

Figure 2.2 Five year plan of Administration Office of Vang Vieng District

Source: Five year plan of Administration Office in Vang Vieng District, 2014.

The bar chart illustrates the gross domestic product generated from the agro-forestry, industrial and service tourism sectors in VangVieng district from 2009-2019 which is measured in percentages. It is evident from the chart that the service tourism sector has highly increased from time to time by 42.36% in 2013-2014. According to the second five-year social economic development plan of Vang Vieng district from 2014-2019, it is apparently to see that the growth of the service tourism sector tend to be increased. In contrast the other two of economic sectors including agro-forestry and industrial slightly decrease by 36.02% and 24.36% in 2013-2014. Furthermore, over the following five years, the patterns of the two components would be quite dramatically decreased to 24.33% and 19.86%. At the end of the period, the percentage of GDP from service has tremendous impact on livelihood of villagers in Vang Vieng district.

So, in the future livelihood will change from agriculture to service tourism. But agriculture is still significant for family.

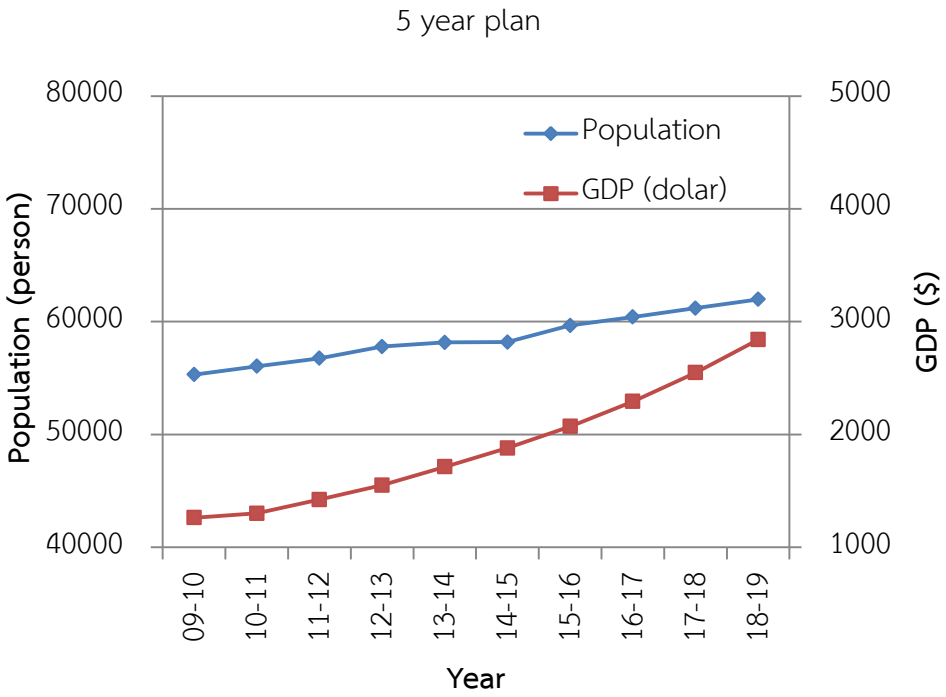

Figure 2.3 GDP growth of five year plan of Administration Office, Vang Vieng District 2014

Source: Administration Office in Vang Vieng District, 2014

According to interview and conversation with Mr.Bouathong Souvong, who is chief of Plan and Investment office for five year plan of Administration Office in Vang Vieng District on 13th June 2014, he said that in the last five years, the economic development of the district has maintained firmly the rate of growth. The average increase of total income of the district is about 9.4% which is higher than the five years plan by 1.1%. For the average increases of income of agro-forestry sector is about 4.4% which is 1.4% more than the plan. For the average increase of income of industrial sector is about 7.9% which is 0.5% more than the plan. For the average

increase of income of service sector is about 18.6% which is 1.2% more than the plan.

Average gross income per capita has risen steadily, from $ 1,203/ person / year in 2010 to $1,714 / person / year in 2014.

- Gross revenue reached 22.24 billion kips, compared to 2009-2010; this is an increase of 45.3%.
- Total operating expenses were 34.6 billion kips.
- Clean water consuming reached 84% of all families; compared to 5 years plan this is an increase by 12%; the rate of toilet usage was about 80.7%, compared to 5 year plan which is an increase by 16%; the rate of electricity consumption reached 98% of the all families.

2.7 Road

Road No.13 cuts through the Nam Xong river from the north of the south. It provides an important connection north to Luang Pabang and the rest of the country south of Vientiane. Within the NXRB Road No.13 connects 34 villages. There are about 13 other smaller roads connecting to other villages. One village has no road access.

2.8 Village water supply

The majority of drinking water in remote rural villages comes from groundwater wells and streams and is boiled before drinking. Villages along road No.13 can buy drinking water produced in several factories and delivered by trucks. Villages have reported to be suspicious about this water as it is not natural, made with chemical and stored in plastic and they prefer the taste of ground or stream water. The decision to buy drinking water came down to access to firewood, wealth

and workforce. Some families prefer to collect firewood, boil the groundwater and save 2500kip, while others preferred to save time and effort and buy the drinking water (Miaillier, 2007)

Domestic water use, other than drinking water, comes from groundwater and streams. Wells of around 10m, either private or communal, provide the majority of domestic water. During the dry season many of the wells dry up. Few people collect rainwater during the wet season. This is because it is difficult and expensive to find an appropriate container. Rainfall collection has the potential to provide a high quality water source, however limited to the wet season

Vang vieng domestic water is supplied through a water supply network that has been functioning since 1996. The water diverted from Nam Lao is stored and treated with chlorination and filtration. The water, however, is not treated to a level that makes it safe for drinking. The water is then gravity feed to eight villages, Vang Vieng, Naduang, Phonpeng, houaysangao, Sisavang, Sengsavan, Viengkeo and Muangxong. The water supply network has been expanded in 2010 to include Phoudindeng, Pakpor, Viengxaynaluang and Houayngam villages.

2.9 Community Engagement

There is little community engagement and participation in resource management in the Nam Xong basin. Generally, there is a one way communication between districts, provinces and national authorities and villages. Villages often feel that communication with authorities is effective (Miaillier, 2007). In addition, there is an issue with contesting districts attitudes or decisions due to fear of reprisal from the authorities.

Government authorities have a key role in river basin planning community consultation and engagement. This however is seldom done due to lack of funding

and resources. Government authorities are often limited to transmitting instruction and collecting data.

2.10 Water Resource in Laos overview

Lao PDR has rich water resources, mainly good quality fresh water. Water is an essential part of the life and culture of Lao people, and also contributes to the socio-economic development goals of the country. Ultimately the welfare of Lao PDR is bound up with water and all development plans will depend on water resources in some way. The contribution of the water sector has been examined through water sub-sectors: irrigation, hydro-power, navigation, fisheries, urban water supply, and rural water supply which are major user and the amount of water uses by these sub-sectors are being significantly increased. The total of annual water flow in Lao PDR is estimated at 270 billion cubic meters, equivalent to 35% of the average annual flow of the whole Mekong Basin. The monthly distribution of the flow of the rivers in Lao PDR closely follows the pattern of rainfall: about 80% during the rainy season (May-October) and 20% in the dry season, from November to April. For some rivers in the central and southern parts of the country (particularly Se Bang Fai, Se Bang Hieng and Se Done) the flow in the dry season is less: around 10 to 15% of the annual flow. The rivers outside the Mekong Basin flow through Viet Nam into the South China Sea. These rivers are Nam Ma, Nam Sam, and Nam Neune. The limited information on these rivers restricts assessment of their potential. Average annual rainfall ranges from 1,300 mm per year in the northern valleys; 3,700mm per year at higher elevations in the South. This corresponds to an annual rainfall of 434 billion m^3, of which less than half is estimated to be runoff. The Mekong tributaries in Lao PDR contribute some 35% of the whole lower Mekong Basin; annual national supply

of renewable fresh water is 270 billion m^3, or about 600,000 m^3 per person, while current demand is only 259m^3/person. Water usage is predominantly agricultural 82%, followed by industrial 10%, and domestic 8%. Usages of other sectors are negligible. There is available water of 270 billion cubic meters and 5.7 billion has been used and the remaining amount of 264.3 billion cubic meters flows in the natural rivers.

Currently most of the water use occurs in the agricultural sector such as irrigation, fisheries, plantations and livestock watering. In addition the water is used for hydro-power; the country has the potential to produce 23,000 megawatts of electricity. Currently only 5% of that capacity has been exploited. The plenteous supply of water in Lao PDR, especially in the rainy season, provides good condition for water transport, industrial development and water supply. Sixty percent of urban population and 51 % of rural population has access to clean water.

Currently there are some problems related to waste and polluted water in major urban areas from varied community use (residential, hotels, hospitals and entertainment centers). In addition there is water pollution from agricultural and industrial sectors, including mineral exploitation. This is not a major problem now, but the problem could escalate. The degradation of natural water and water catchments from sedimentation, land erosion and drying out continue. (WEPA, 2013)

2.11 Nam Xong sub-basin overview

The Nam Xong basin covers an area of 180,434 ha and is the third largest sub-basin out of the 18 sub-basins that make up the Nam Ngum watershed. Located in the central part of northern Lao PDR, the Nam Xong basin is 83km north of Vantiane and 14km south of Kasy. Vientiane province makes up 97.3% of the area and 100%

of the population. The central and largest city in the basin is Vangvieng, which is well khnown for its tourist attractions.

The Nam Xong basin abuts the Nam Lik watershed to the west and southern boundary, the Nam Ting to the North, the Nam Meuy and Nam Pat watersheds are to the east. The basin altitude ranges from 2,889m (at Phou Khoun District) to 185m (at the Nam Xong and Nam Lik confluence).

The Nam Xong basin is broken up both geologically and by the Nam Xong Diversion Dam. Above the dam there are three major tributaries, made up to three main valleys. These run north, west and east. The Northern valley comprises of the Nam Xong, Nam Noy, Nam Sanaen, Nam Panom, and Nam Lai. The west valley comprises of Nam Kouang and Nam Ka and makes up 33% of the flow of the Nam Xong in the dry season and 44% in the wet season (Miaillier, 2007) the Eastern valley comprises Nam Mon Nagat. The three valleys meet below Vang Vieng and the Nam Xong flows on to the diversion dam were – depending on the year – much of the flow can be diverted to the Nam Ngum reservoir via Nam Phat. South of the dam the Nam Xong continues for 27km to the confluence on the Nam Xong and Nam Lik, 3km upstream from Hin Hurp. Major tributaries in this section of the river flow from the east and include-Nam Ken and Nam Phouset. Geologically, the watershed consists of a mixture of limestone and sandstone. In the Northern mountains are dominated by limestone. To the south and east of Vang Vieng the geology comprises mostly of alluvial plains and sandstone. The Northern region of the basin is defined by slops exceeding more than 30% in some areas. While the southern alluvial plains at Vang Vieng and toward the Nam Lik are flat alluvia flood plains which support agriculture.

The Nam Xong and its tributaries are vital for income generation, particularly tourism and agriculture. The limestone geology is used to supply a growing cement production industry and mining. The North is limited to rice crops to the narrow valley floors, nevertheless, shifting cultivation on the mountainsides is opening the region to greater levels of agriculture. Southern alluvial plains are fertile and used dominantly for rain-fed and irrigated rice cultivation

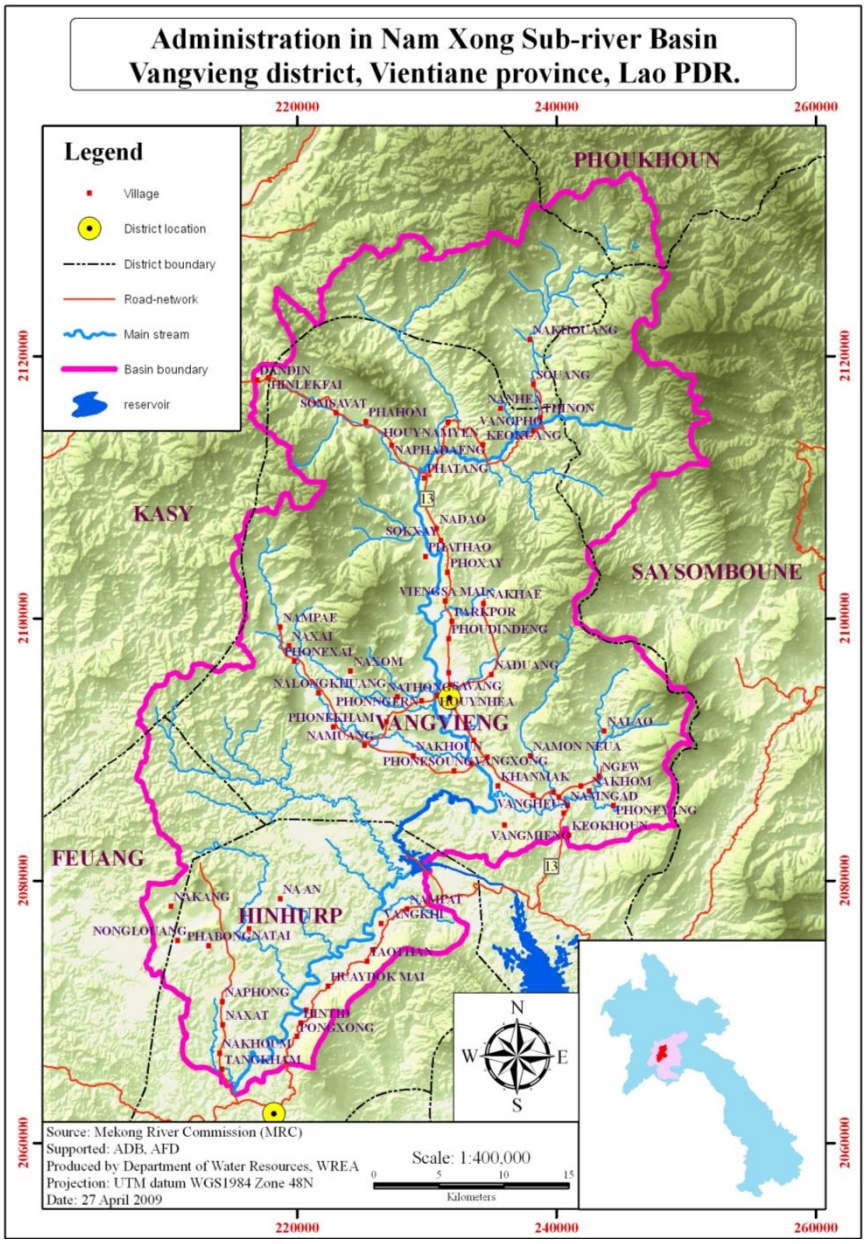

Figure 2.4 Map of Nam Xong Sub-River Basin in Lao PDR.

Source: Department of Water Resources, Water Resource and Environment Administration, Prime Minister's Office, Lao PDR. 2009.

2.11.1 Water demand

Surface and groundwater is essential to the survival of communities and environment of the Nam Xong River Basin. There is a long history of subsistence agricultural livelihoods that is still in existence today. Vang Vieng is a site of rapid population and tourism growth. Furthermore, other natural resource such as limestone and ores are also being developed in the basin to support Lao PDR growing infrastructure demand. All these activities rely on the sustainable management of water demand in basin.

2.11.2 Weir overview

Lao PDR is rich of natural resource in Southeast Asia, water resource of which is an important part of natural biodiversity, and is vital for agriculture and industry. The officially called Lao People's Democratic Republic is a landlocked country in Southeast Asia, bordered by Myanmar and China to the northwest, Cambodia to the south, Vietnam to the east, and Thailand to the west. There are 17 provinces. Its population was estimated to be around 6.6 million in 2012.

There are a lot of rivers for agriculture and industry in Vang Vieng district which is situated in Vientiane province in the center of Laos. There are a lot of mountains in Vang Vieng as well as rivers. Especially important is Num Xong Valley (Xong River) with towering Limestone Mountains. Nam Xong or Xong River is 60 km long and passes through Vang Vieng District. There are 70 branches of the river, and 153 small branch rivers. Vang Vieng district has been selected as a case study because it is a place with a lot of branch rivers, and a lot of weirs: 29 concrete weirs, 30 gabion weirs and 164 wood weirs in 2014 (AFO, 2014) with total 223 weirs. There are 4 ethnics groups example Tai ethnic, Kue Mu ethnic, Mong ethnic and Iew Mien

ethnic, they live along the Num Xong and its tributaries. Vang Vieng as an agricultural region depends on water for agriculture. Famers make native weir to save water and for planting in that area. This is a good way to conserve natural resource. Climate change causes floods in some areas, drought or shortage of water supplies in others. It significantly affects water resources at high altitudes and the survival of wetlands in the region. It is expected that climate change impacts will further exacerbate current environmental stress factors in Laos. It will increasingly affect water and agriculture sectors in Vang Vieng district. Climate change motivates people to use water sustainably, such as Vang Vieng where villagers use native weirs for saving water or slowing down water since previously. Use of native weir has changed a little compared to previously. So, I would like to research its role in agriculture, the livelihood of villagers using native weir, and it relation to sustainable water resource conservation.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Selection of research area

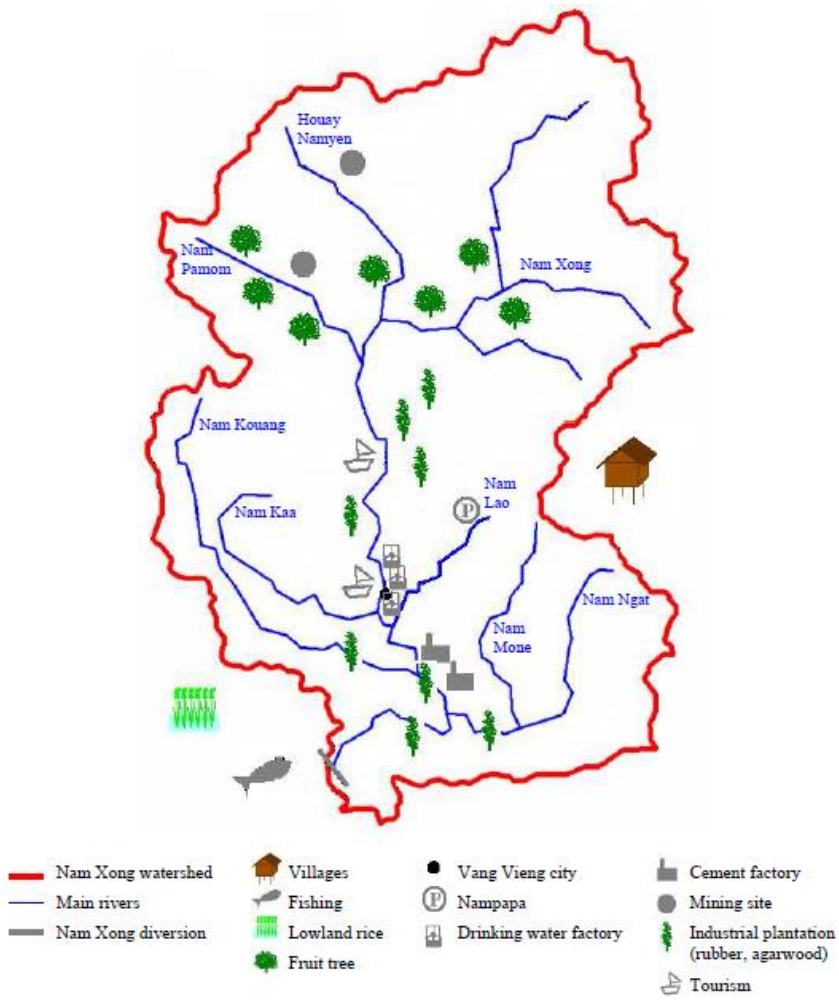

Figure 3.1 Symbols which are positioned outside the watershed indicate uses/users that can be found in the whole watershed area, close to rivers in the case of lowland rice and fishing

Source: (Miaillier, 2007)

Figure 3.2 Location Map of Vang Vieng District

Source: Google Earth (Accessed 2014, August 24)

Vang Vieng is selected as the research area from among the 13 districts of Vientiane province in Laos because this is where weirs are practiced. There are 63 villages in Vang Vieng district, a total 58.165 people and include 4 ethnic groups that live on Nam Xong river bank in Vang Vieng. The population growth rate has risen to 1.28% in 2009-2014. The population of around 80% is famers or agriculturist and 20% are worker. The area is fed by the Nam Xong River and its tributaries which are vital for income generation, particularly agriculture while tourism and shifting cultivation on the mountain sides are opening the region to greater levels of agriculture. It is obvious that to study significance of weir to livelihood of villager on sustainable development has to be carried out at Vang Vieng district. There are some differences this district in terms of historical, background, natural and physical advantages; size of population; pattern of livelihood development, socio-economic development and environmental conservation. This study selects villages related to sub- river, where

they use water for agriculture and consumption (DAFO, 2013). Three villages are selected: Pha Tang, Na Moung, and Na Mone.

3.2 Sample size

This research selects these three villages because of Pha tang village is upstream, Na Moung village is midstream and Na Mone village is downstream. The villagers use weir for crop and agriculture more than other villages. To collect data researcher interviews 4 officials from District Administration Office, Natural and Water Resource Department of Vang Vieng, and District Agriculture and Forest Office (DAFO). Then interview 7 headmen of three villages, 8 head of water groups or head of farmer group of three villages, and 38 farmers from three villages. To sum up 58 people. 2 women and 56 men. 4 officials and 54 farmers. The age between 39-54 years old.

3.3 Method of research

The procedures of data collection pertain to documentation, archival records, and interviews – especially in-depth interviews with key informants and focused interviews – direct observation, participant observation and physical artifacts (Yin, 2009) The procedure of research methodology consists of the following:

Preparation: Firstly, author requests for a field research authorized letter from the Dean of National University of Laos then go to Vang Vieng district, looking for relevant information from the District Agriculture and Forest Office, and Ministry of Agriculture and Forestry of Laos, and the Natural and Water Resource Department. After that, researcher gathers more information from heads of district agriculture and forest office, chiefs of villages, heads of water groups, and heads of famer group. Primary data collection is through:

In-depth Interviews: An in-depth interview was a face-to-face interaction between human subjects, and was one of the most popular tools used for gathering information. The interviews I carried out focus on people who were knowledgeable of the issue which were practitioners (including head of office, chief of villages, head of water groups, and head of famer groups). The intention was to investigate the importance of aquatic weir to the local community, the adaptation methods used plus to uncover the knowledge held on the use of weir system or irrigation system. I used key informant and semi-structured interviews that contained open-ended questions.

Participant Observation: Participant observation was important for my data collection activities in order to gather the information needed from individuals with regard to community practices, based on local knowledge, that were related to the utilization of weir system, the conventions surrounding, the use of weir, the gathering and cultural/ritual activities carried out, both during raining season and dry season and processing that takes place. Moreover, in order to gather data on the adaptation methods used by individuals and the community, I spend time within the community to observe their practices, while taking notes, recording comments and taking photographs.

Focus Group Interview: Focus group interview was useful for capturing people's responses, feelings and experiences; therefore, I used these to investigate the history of aquatic resource utilization. For this, I selected people who were known to be knowledgeable on this topic and divide them into two groups: the chief of weir and members who used the water system in agriculture, in order to gather their experiences in these issues.

3.4 Data collection

To provide context to the analyses and assessment in this study, both primary and secondary data were commonly collected and compiled for examining and analyzing. The potential sources are the following:

3.4.1 Primary Data Collection

The primary data were mainly collected through personal observations, discussions and interviews with key informants who were using weir in Vang Vieng district. The field research on primary data collection takes place from May to June 2014. It was collected through interview questionnaires with officials of district, village authorities, head of irrigation group, and farmer.

The main discussions are about the weirs, water management system. Head of irrigation group or head of weir were important because they know well about water management system and weir management system. Head of irrigation group was established from farmer group who used weir in crop and agriculture between dry season and rainy season.

3.4.2 Secondary Data Collection

This study also relies on secondary data from related government agencies, information types gained were official report, it also includes information gathered in the field trip on the use of weir and information on theoretical approach and background gathered from textbook, journal, concerned report, internet, newspaper, and collected mainly from different sources such as the District Agriculture and Forest Office, and Ministry of Agriculture and Forestry of Laos, Natural and Water Resource Department. Faculty of Environmental Sciences of National University of Laos.

3.4.3 Data analysis

Table 3-1 Data analysis

Step	Description	Methods	Source of data
1	Literature review	Collecting of Secondary data	DAFO, MAFL, NWRD, NUOL.
2	Field Research	Collecting of primary data: In depth interview, focus group, observation	- Administration of district office. - DAFO - Department of water resource - Pha Tang Village - Namuamg Village - Na Mone Village
3	Data analysis	Qualitative data	-Administration of district office. -DAFA -Department of water resource -Pha Tang Village -Namuamg Village -Na Mone Village

3.5 Limitation of the research

There were some challenges faced during conducting this research. Firstly, I got document from Faculty of Environmental Sciences of National University of Laos sent to Administration of Vang Vieng district in one week. After that, I went there, but

they are uncomfortable about interview and give only some information to me. Secondly, I went back there again from May to June. Working with Miss Oulay Phoupasong, she is a lecturer in Faculty of Environmental Sciences of National University of Laos. We took motorcycle to villages. This research confronts the fact that farmers are sensitive to interviews. There exist a hidden fear, and the respondents would refuse to reply, and discuss with a researcher. The solution for this, the first plan, the researcher has to set up a small team, including finding the person who knows well about district and the sampling areas, who is called district coordinator, and village coordinators. The other practical issues are related to respondent's lack of confidence to express what they feel about some opened questions especially among illiterate respondents.

3.5.1 Timing

The period of field work on May to June, is the end of the dry season and the beginning of the rainy season, which is not comfortable, and it is difficult to access some places because the road is rough due to the rain and torrent. There are some villages far from center of district, which is difficult to go there to interview. Majority of the interviewees had to be conducted either in early morning or in the evening because it is also a cultivation season. Therefore only approximately three or four interviews were conducted each day. Furthermore, many respondents come home in late evening time with tiring mood, for this reason the interview had to be quick gaining less information than expected.

CHAPTER 4

NATIVE WEIR AND LIVELIHOOD OF VILLAGER IN VANG VIENG DISTRICT

4.1 Background of weir or irrigation development in the Lao PDR

According to Agriculture Master Plan 2011-2015 of Lao PDR, there are four specific goals intended for long-term development including the improvement of livelihood through agriculture and livestock activities, increased and modernized production of agricultural commodities, sustainable production patterns and sustainable forest management. Generally it could be seen that improving of food security is the basis of country economy regarding to livelihood improvement. Since the establishment of the Lao PDR in 1975, the government has been selected agriculture development as the first priority in the development plan. Beside the agriculture development, irrigation has played tremendous important role in this pattern.

Yet priorities for irrigation development have changed during the intervening fourteen years, particularly as the National Irrigation Department has matured. During the first five year after the revolution, irrigation development emphasized relatively large schemes which turned out to be beyond the engineering and construction capacity of the government. With the promulgation of the first Five-Year Plan in 1980 officially policy was modified to emphasize small-scale projects in all sectors. In irrigation, the response was to begin a mix of projects ranging up to about area of 1,500 hectares at maximum. Since 1985, foreign assistance to the National Irrigation Department from a few non-government organizations for village-scale irrigation projects has led to the incorporation of such small schemes into ongoing plans for irrigation development. To date; there have been no systematic efforts to

incorporate community-organizing principles into irrigation systems in Laos which may provide models for government-sponsored community-managed irrigation development. In 1985, the American Friends Service Committee began a program of assistance to small-scale irrigation development in the more mountainous regions of Laos. Development emphasized the replacement of seasonal weirs with small permanent-diversion weirs which would supply water to existing canal systems. Labor for most of the American Friends Service Committee projects was provided by the villagers involved with technical supervision by provincial irrigation technicians. This program gave no specific consideration to the need to organize farmers for irrigation management. In villages where farmers have been caring for a traditional irrigation system, the new resource was incorporated into the existing system with minimal difficulty. However, where the new weir required several villages to cooperate in a larger irrigation network or involved the introduction of irrigated rice farming to groups which had previously grown crops, significant difficulties in operation and maintenance were encountered (Ireson, 1988). The National Irrigation Department and several provincial irrigation developments include farmer involvement in design, construction, and operation and management of head works and canals. However, few changes have as yet been implemented.

4.2 Background of weir or irrigation development in Vang Vieng

Nam Xong River originates from North-East from Thinon village area, Vang Vieng District. It flows through the long drawn out of Vang Vieng District and flow into Nam Lik (Lik river), the length of 60 km. Nam Xong were not a clear call name in the past because there were many branches of original river. Some people call it " Houay Sa Naen" Houay Sa Naen was changed to become "Nam Xong" in 18th century which was the name of Xong District during Tang Tai king who ruled Vang Vieng at that time.

There are 70 branches of Nam Xong river in Vang Vieng area and there are 58 branches with weirs for agriculture. The main branches of Nam Xong river are Kuang river, Ka river, Ngard river, Lao river, Pok river, Xang river, PaMom river, Huay Nam Yen river, Sa Naen river, and Pao Thao river.

Most of Nam Xong rivers' branches do not have weir. People live on the Nam Xong river bank and Nam Xong river basin with a rich natural resource and biodiversity. During the last 200 year people have moved to live in Nam Xong river area and livelihood of villagers changed from dry field farming to planting rice. With it, occurred the native weir at that time and weirs grew with increasing population until Laos was French colony and later under American influence. During this period, there appeared concrete weir and concrete weir built by the French and American. Such a situation affected forest resources and water resources as well as change in activities of livelihood especially downstream and river bank.[1]

The level of Nam Xong River in Vang Vieng currently is reduced compared to the past. (See the Figure below) according to collecting data from interviews[2] . Almost hundred percent answers that the amount of water is reduced while there are increase in population and increase of weir.

[1] From interview District authorities, Vang Vieng district, Vientiane province. 09 June 2014

[2] Interview deputy chief of District Agricultural and Forest Office on 10th June 2014

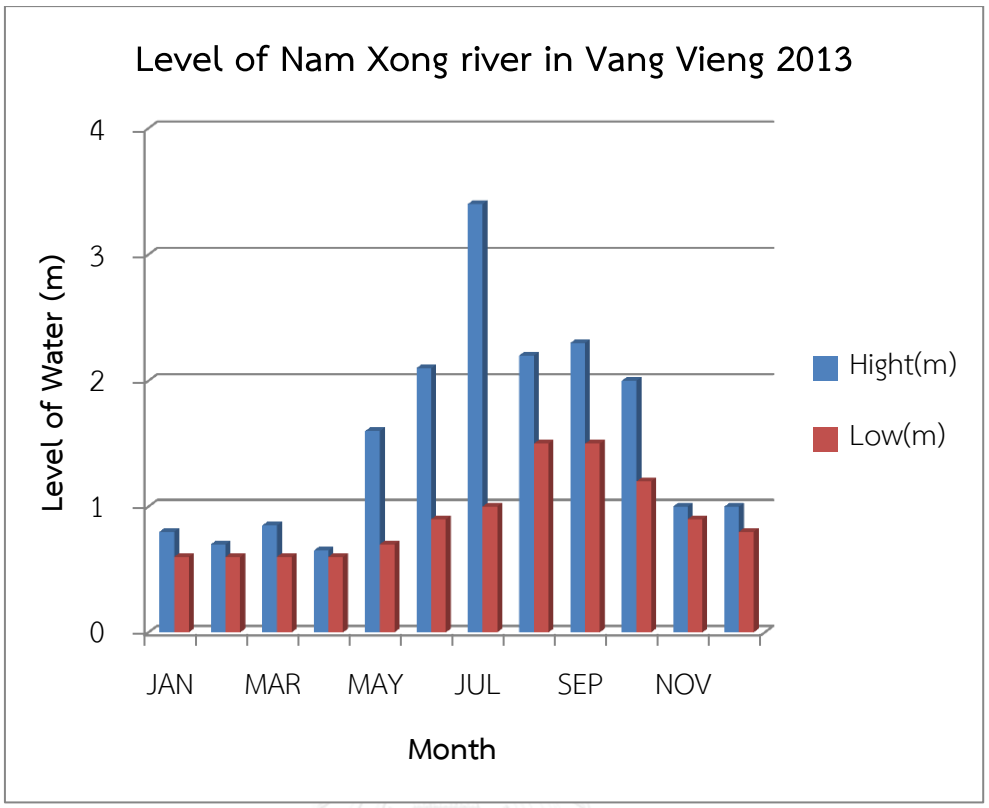

Figure 4.1 Level of Nam Xong river in Vang Vieng District

Source: Meteorological Station in Vang Vieng District, Vientiane Province, 2013

When villagers expand areas for agriculture, it certainly increases demand for water for agricultural. Another effect is decrease of forest because people cut down tree, leading to change in the natural environment.

Table 4-1 Agriculture and Forest land in Vang Vieng District

No.	Land	Area (Hectare)
1	high Mixed density forests	2130 ha.
2	Mixed forest	13383 ha.
3	low density forests	21910 ha.
4	Grasslands	1107 ha.
5	fields	3314 ha
6	Paddy fields	4751 ha.
7	wild bush forests	74553 ha.
8	agriculture land	5549 ha.
9	limestone mountain	755 ha.
10	Town	316 ha.
11	fallow forest	3592 ha
12	Weirs or irrigated	1326, 74 ha.

Source: District Agriculture and Forest Office, Vang Vieng district 2013

4.3 Weir system

There are 223 weirs in Vang Vieng and there are three kinds of weirs which are 29 concrete weirs, 30 gabion weirs and 164 wooden weirs. The concrete weir was created since French colonial time. More of concrete weirs were built after independence through government projects as well as through foreign-supported projects.

According to the government policy to stop clearing upland, people from several areas were moved down to earn living in Nam Xong river basin during 1980's. Irrigation weirs were built; also the Nam Xong dams were built in 1996. Vang Vieng developed further when it was opened to tourists in 2000 both foreign and local

tourists. Vang Vieng was also opened for rubber plantation, Agarwood plantation, mining, sand sucking and others.

The management of the weir involves of families supplied by it, and is often a contentious issue. The families that use weirs or the smaller irrigation dams can generally reach a consensus between themselves, however for the larger weirs, nai fai (head of the weir) is appointed according to a number of specified criteria. This applies to the most downstream users. Water is generally allocated proportionally by paddy size and the cost of repairing and building the weir are split among villager who use the water(Miaillier, 2007).

Furthermore, irrigation systems are underdeveloped and out of date. They are insufficient to support food production (MAF, 2006) These villages are commonly found in confined valleys with no space for extensive rice or agriculture production. Food insecurity is a huge issue throughout Lao. People are typically unskilled labourers or farmers with limited fishing and hunting. Often, they do not possess a kitchen garden and practice subsistence, upland farming on a small plot of land in highly sloping areas. They are poorly educated and illiterate. They live in villages with little or no infrastructure, including poor, seasonal road access and sanitary conditions(WFP, May 2008). Industries such as the cement factories offer little opportunities for employment as the factories are looking for skilled persons not found in the basin. (Miaillier, 2007)

The information from District Agriculture and Forest Office in Vang Vieng district, says that the Nam Xong watershed in Vang Vieng is expected to assist household production from sharing of water in the irrigated areas, in term of rice farming and agriculture between dry season and rainy season. Vientiane province mentions that Vang Vieng district is the place where there finds highest household

using weir or native weir for crop and agriculture in Laos. Furthermore, the limestone geology is used to supply a growing cement production industry.

4.3.1 Wood weir

The total number of wooden weir or traditional irrigation dam is 164. Constructing wood weir requires innovation and labor of villagers. Structure of weir is designed by villagers. As such, they have skill and experience of weirs development for generations. Constructing wood weir, villagers have to cut down trees in the forest a lot each year. Advantage in construct wood weir is that skill and labour are provided by villagers. There is no sedimentation of sand on weir and canal, and availability of fertilizer from natural flows from forest and upland after rainfall in rainy season. Weirs downstream and upstream maintain quite enough water during each season, as well as maintaining water level in the river because the water can flow through the weir which is different from gabion weir and concrete weir. Furthermore, wood weir or traditional irrigation creation is in keeping the tradition of solidarity among villagers who contribute in the building weir. But there is negative point, first, deforestation due to trees cutting and mobilization of workers and labours. Wood weir is not strong against current in rainy season and sometime it is destroyed.

Figure 4.2 Wood weir in Vang Vieng District as of 6th June 2014

4.3.2 Gabion weir

There are 30 gabion weirs (see figure4) built of steel net and stone making it strong and long-lived. Gabion weir is either a public project work or work of farmers who pay the cost by collecting money among them. Some villages get loans from the bank to construct the kind of weir because gabion weir costs are high. After harvest yields they return money to bank. Gabion weir allows water to overflow rather than blocks water downstream. Though gabion weir lasts longer than wood weir, it can also be damaged. So, it also needs repair. However, those lives downstream lack water for dry season crops [3] .

[3] Interview Water user group in Na Moung on 7th June 2014

Figure 4.3 Traditional weir or Native weir (gabion weir) in Na Moung village 2014

4.3.3 Concrete weir

There are 29 concrete weirs (see figure 5) and concrete weir is permanent weir constructed with cement, stone, sand, and steel. Before construction, it requires technical design. Concrete weir provides two water channels either earthen or concrete. Concrete weirs were wood weir in the past. Nowadays, concrete weir replaces wood weir due to increased population, extended farmland and difficulty to build wood weir. There are several good points of concrete weirs such as no need to rebuild, it helps eradicate forest destroying, and it can supply water for larger area and save water in dry season. In contrast, it needs large fund to build, the water channel is not of standard, it has sedimentation each year, it does not provide enough water for downstream areas, and it is difficult to manage because several villages are involved.

Figure 4.4 Concrete weir in Pha Tang Village, Vang Vieng district as of 6th June 2014

4.4 Area of research

4.4.1 Pha Tang Village group

According to interview of head of water user group on 29 of May in Pha Tang, he reports that there are 7 villages of water user group. There are three kinds of weir in use that is wood weir, concrete weir and gabion weir. They use a lot of wood weir because they do not want to spend more money and they do not have enough budget to support them; they only use labour for building the wood weir, but wood weir does not supply enough water for villager as it is not strong enough against the natural rain storm causing villagers to repair weirs around 13-15 time per year. They prefer to build gabion weir by collecting money from water user group. However, villagers demand concrete weir because it is strong, permanent and save water. The district agriculture and forest official have a plan to build in the future.

This village group differs from other villages because it is a fruit tree growing area. Villages in this group use water for planting rice in rainy season and planting cabbages, pumpkins, peanuts and corns in dry season and these products are for sale in the district market or Vientiane Capital market. Furthermore, some people use water from weir for seeding and watering such as lemon seeding, orange seeding which is the main income of villager.

4.4.2 Na Mon village groups

Villages made wood weir and gabion weir by collecting money from water user group while the concrete weir would be built by the District Agriculture and Forest office. There are 4 villages of Na Mon water user group and 184 families of water user group. Farmers use water from weir for agriculture as planting rice in rainy season and villagers use water a grow green bean, peanut, cucumber vegetable and animal feed in dry season. Agricultural products go to Vang Vieng market and Vientiane Capital market[4].

4.4.3 Na Moung Village groups

There are 80 families of water user group. There are two kinds of weir; gabion weir and wood weir.

According to the head of water user group of Na Moung village most villages grow rice in rainy season and plant green bean, chili, animal feed, cattle and buffalo raising in dry season. Some families' plant crops for sell and some families plant them for consumption. This area does not have enough water for people's demand

[4] Interview the Head of Water User Group, Na Mon village, Vang Vieng district, 2 June, 2014.

4.5 Livelihood of village in Vang Vieng district in dry season and rainy season

4.5.1 Livelihood of villager in rainy season in Vang Vieng district

Most villagers are farmers and before they start to farm, they have to repair each weir and canal with labour raised from villagers. Farming depends on water from weirs in rainy season because paddy field cannot keep water. They start farming at the end of May and plant the seeding when they are 35-45 days old. There are 40% of families that have tractor, other families do not have tractor. So, they have to rent tractor at 600.000 kip per hectare. Some families borrow tractor form cousins but they must buy gasoline themself. Villagers use tractor to plough, some families use buffalos to plough. Their secondary occupation is husbandry and the husbandries are cattle, buffaloes, pigs, chickens, ducks, and other animals. Some villagers grow upland rice while some villages plant orange tree, lemon tree, and corn.

Rice farming needs labour hiring. Those who finish farming earlier will help their relatives use. Both practices are dictated by limited water from weirs. If they couldn't finish in time, seedling will be too old to plant. Most villagers' do not use chemical fertilizer. Their rice gets natural fertilizer from water flowing through forest and upland. Some families use cow manure. After they finish planting they also have part time jobs such as being hired for planting, catching fish, looking for bamboos, mushrooms, and vegetables from jungle to earn a living or to sell in the market. At harvest times, villagers help each other. This shows Laotian heritable solidarity.

4.5.2 Livelihood of villager on dry season in Vang Vieng District

Their main activity is planting on the Sub-Nam Xong river bank and some villages go for off-season paddy, growing vegetable, raising cattle, buffalo, chicken,

duck, and fishing in dry season. Raising fish in pond that uses water from weirs. In the Nam Kuang area at least few families pursue these activities. The kind of plants grown is rice, cucumber, bean, peanut, watermelon, pumpkin, cabbage, onion, garlic, and corn. The planting is for consumption in their families but some crops are sold in the market which fetches income around 300.000kip/family/year. However, their planting meet the problem of water shortage in this season. They use water from weirs for watering the plant in the morning and evening. In Na Mone area with total 8 villages of Na Lao, Ngiew Tai, Phon Yang, Vang Heua, Nam Ngard, Na Mone Neua, Vang Mieng and Khan Mak, there are 504 families out of 1023 families that grow crops for sell in Phon Yang, Na Mon Neua and Nam Ngad villages with income around 1.000.000kip-5.000.000kip/family/year. The popular crops are cucumber, watermelon, bean, cabbage, chili and sweet potato. However, villagers face problem of watering their plants; with enough water they might harvest product more. There are a lot of cultivation in Pha Tang area, such as Pak Pok village and Vieng Sa Mai village with on area of 8000-48,000 m^2. The kinds of crop grown are cucumber, lemon, long bean fetching income of 1.000.000-3.000.000 kip/family/year. Their problem is not enough water in dry season. Pha Tang village grows is only cabbages and corns. Their products are for sell in the Vientiane Capital market with income around 2.000.000 - 3.000.000kip/family/year. They face problem of price of product such as the price of cabbages is 3000kip per 12kg this year while last year it was 25.000-35.000kip per 12kg.

Table 4-2 Cropping pattern of main crops in Vang Vieng District

Land type	Pattern	Dry season		Rainy season								Dry season	
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Slash & burn	1					Rice							
	2	Cassava											
	3				Rice								
Paddy filed	1						Rice						
	2								Rice				
	3	Groundnut					Rice						
	4	Vegetable					Rice						
Upland	1						Groundnut						
	2	Vegetable											
	3	Fruit tree											

Source: Laure MIAILLIER, River basin management in Lao PDR: case study of Nam Xong watershed, Vientiane Province 2007

The calendar of activities includes production activities. Planting patterns of the major crops for Vang Vieng area are presented in the table above. A general correspondence during the cultivation timeframe and the rainy season are clear. Furthermore, the majority of crops are grown in the second half of the rainy season, when river flows have been significantly increased by rainfall.

4.6 Water User Group

Water is used for agriculture, industry, tourism, consumption or household daily and ecological conservation and source of livelihood of villager. For this research there are main 2 water use groups for agriculture and Tourism.

4.6.1 Agriculture

Agriculture is still very much a subsistence way of living in Nam Xong river of Vang Vieng district. Communities rely on it not only as a source of income but also for food. The following highlights the major crops cycles in the Vang Vieng district,

grown in the different land types. In 2013-2014, there are 28591 ha of planting rice and total production of 27,547 Tons. A total of product 26,406 tons on 28,246 hectares in dry season, decrease of product in dry season of between 1,419 and 782 Tons. 345.42 hectares of upland rice produce 359 Tons production. However, there are 12,360 hectares of cash crops planted. This includes groundnut, cabbage, corn, watermelon, melon, long bean, squash, pumpkin, chilly, eggplant, taro, and potato. Out of these cash crops corn is the most popularly grown in Vang Vieng District. The district offers good soil and further cropping potential and there is continuing market demand of cash crops in Vang Vieng market and outside market. Fruit trees are continuing to be planted within the Vang Vieng district and there is potential for expansion. The total harvest areas in 2013-2014 were 3,038 ha. With total production of 3553 Tons.

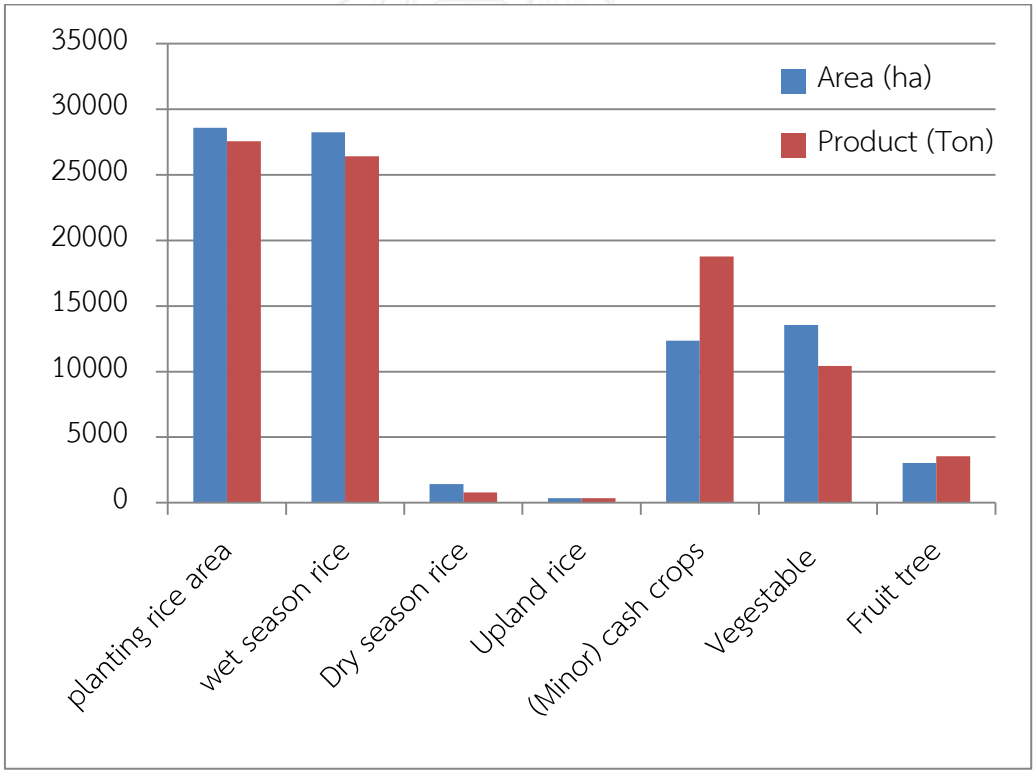

Figure 4.5 Total area and product of agriculture in Vang Vieng district 2013-2014

Source: District Office of Agriculture and Forest, Vang Vieng District, Vientiane Province 2013-2014.

4.6.2 Industry

According to research observation[5] there are big industry and small industry. There are 2 factories: Cement factory 1st and Cement factory 2nd. These factories use water for make cooling system form Nam Xong River in Vang Vieng. Likewise they use water in the office, staff and worker dormitory. The factories use water for cooling system around 1850m^3 /day and 24 hours/day. However, these factories build rain water basin in mountain for collecting water in dry season. So, they have enough supply for each year.

There are 3 small water factories; these factories use ground water with the depth around 40m from surface since 1994 in Vang Vieng District.

4.6.3 Tourism

Vang Vieng is attractive place of tourism and water is a factor in tourism. Furthermore, weir provides water for tourism. So, weir is important to tourism service offering rafting, kayaking and boat riding on Nam Xong River. Water in this area is also for consumption. Vang Vieng's natural beauty has become a major drawing card for tourism in Lao PDR for both oversees and local tourists. Tourism now plays a large part to the local economy and has created jobs in Vang Vieng with the number of tour operators, guest houses, hotels, resorts, bungalows and restaurants increasing.[6]

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[5] Observation on 2nd March 2014

[6] Interview with administrator of Vang Vieng district on 8th June, 2014

4.6.4 Households use

Increasing population and density around Vang Vieng make water availability a limiting factor of livelihoods. In the dry season Vang Vieng is already facing these issues. Nam Papa or water supply has the capacity of 1200m3/day of water production, which is close to maximum river flow in the dry season. Further planning is required to ensure a sustainable water source available for these growing populations (Miaillier, 2007).

As rice production and irrigation systems continue to grow and technological advanced systems expand, pressure continues to mount on the amount of water available. An example of this is to upgrade of wood weirs to gabion weir and concrete weirs. This allows for greater efficiency and diversion of water all year round. Water resource are not licensed or regulated and therefore impossible to understand the full extent of these irrigation systems.

4.6.5 Ecological conservation

There are activities for forest conservation and ecological conservation which start around 15 year until now. It is forbid to cut trees and deforestation between downstream and along river side. In order to preserve the kingdom's natural resource, wildlife and forest that are the most valued treasure and heritage from our ancestors, various measures for forest preservation were implemented by the government such as establishment of a scheme for national forest preservation, natural parks, sanctuaries, cancellation of logging concession and the encouragement to private participation in the preservation of forest and natural resource. Moreover, reforestation streamside and created the forest reserve areas for example at Pha Tang village. There are activities to release fish or propagation of fish in these areas due to conservation of endangered fish, 3 times per year like on 31st July of each

year, Buddhist lent day and end of Buddhist lent day of each year. Government, private sector and villagers' participate in these activities.

4.6.6 Source of livelihood of villager

People can gather food from the Nam Xong river, sub-Nam Xong river, and downstream and upstream water. There finds at least 88 species of the aquatic food within the nam Xong river and rice field ecosystem. These species include six types, namely, fish, frog, mollusk, crab, shrimp and insect (PHOMMALINH, 2013). Likewise, fern, water vegetable and water seaweeds also souse as food source.

In addition, after harvest, villagers catch fish for livelihood in Nam Xong River except in conservation area. Todays, fishery is difficult because population of fish declines. They catch fish for only morning meal, and they will not waste time catch fish from natural source. However, they can catch fish in Nam Ngum reservoir and Nam Xong Basin for sale in the local market.

Nowadays, fishery is important for villagers. Most villagers raise fish in the pond and ponds are located along the canal because villagers get water from the canal to fish ponds, but some villagers have to quit due to lack of the water. At the same time, some villagers change fishery in pond to fishery in field, which it is a good idea to solve the problem for these who don't have the fish pond. The kind of fish is Tilapia, Portal, carp and catfish to be sold in the local market. In addition, some villagers raise fish in cement ponds in the town area.

4.7 Villager participation in weir construction

4.7.1 Construction of community-managed weir system

4.7.1.1 Pre-construction of weir

First, villagers must agree on selected area and community members must show interest in participation. It is of significance to gradually identify leaders, build

local commitment and share responsibility of the weir system. It also needs to consider construction labour and materials to build weir, water management and repair of weir system after construction. Next, it is to conduct technical survey with local farmers as to the nature of the river banks, level of water outlet and maximum water level. With villagers' agreement to construct weir in the area, there forms an interim working group of competent person for cement and wood construction work and coordination among technicians, skill workers and labourers. Detail of final technical design should be discussed and approved by farmer, other project beneficiaries and people living both upland and downstream. There must be open dialogue with these groups in order to seek final agreement on design before construction. It is important that the facilitator listens to all comments and responds appropriately. When full agreement is reached, a convenient construction date which does not interfere with other annual work must be agreed upon. At this point, right of way for canal lines must be sought and delivery dates for local and imported construction materials agreed on.

4.7.1.2 Construction phase

Attention is focused on the construction of the weir, but in fact, many problems slowly come from construction of the canal. Digging and securing the canal can be quite a burden, particularly if it is left to the few families who will actually use them. Therefore, it is often better to construct the canal first. Mobilization of labour might be difficult in some schemes, especially where the number of households is not large. So, they mobilize labour from surrounding villages to help each other to get the job done. This also enables other household, even from other villages, to gain benefits from the activity. Based on the plan, farmers are then able to mobilize labour at relevant times. District and provincial staff should supervise construction to ensure that all technical features are strictly respected.

4.7.1.3 Post-construction phase

Water user group formation:

One of the main aims of the water user group formation (WUG) is to establish rules which enable participants to manage the weir effectively and avoid any unintended conflicts over distribution. Therefore, the water user group is built on community needs rather than on pre-determined policies. Water conflict usually occurs in densely populated areas where many communities share the same river. If weirs are too close together and relationships and communication are weak between up and downstream users, disagreements over the resource are likely.

Next step of the water user group formation is to look for supportive policy and legal status from district or provincial authorities and then circulate this to all parties concerned around the surrounding villages. This is extremely important for the success and sustainability of the water user groups.

Responsibilities of water user group:

Water user group often with project assistance, is responsible for managing a number of technical and social issues such as:

- Managing interactions among those involved in the project.
- Defining the boundaries of the river system and organizing it in accordance to zone or crop which will receive water from the same canal.
- Assessing the water needs of different crop varieties and delivering water accordingly.
- Maintaining the weir to ensure the system functions properly and efficiently. This includes the guarding, improving or repairing of the system if needed.

- Ensuring that a water course is not over dammed and that weirs are not placed too close together, to reduce conflict between users.
- Maintaining good relationships with up and downstream water users in order to limit potential conflict, for example one party blocking a water course upstream without consultation with those downstream.

4.8 Management of weir

Using water from weir is more in rainy season than in dry season. Water from weir is used both in agriculture area in other area. However for requirement of the weir, there must be at least 6-7 families' members to from a management group to take cause of weirs; that are permanent weir and interim weir.

4.8.1 Permanent weir

There are 2 permanent weirs that is concrete weir and gabion weir. As far as management is concerned, there are three types of management. Firstly, the district manages weir itself; secondly, the district allows village to manage the weir, and thirdly, village-own constructed weir is managed by the village. The district will not let village to manage gabion weir that is by official project. Gabion weir is small weir so it is not difficult to manage and there is no cost. For gabion weir village is allowed to manage, if the weir is damaged, money has to be collected from water user for repair. Villagers pay nothing for gabion weir that is managed by the district.

4.8.2 Interim weir

Interim weir is made of wood and the management is the same with permanent weir that the district allows village to manage. In order to manage the interim weir a chief will be chosen from water users and there is only one chief. Villages will help each other to get enough water to grow plants. Thus, sharing water

of upstream and downstream poses no problem but villages have to repair the weir up to 13-15 times per year especially at Na Mone village.

4.8.3 Leadership of weir organization

The weir group is called water association; each of which is led by a head. The head of water groups are selected by villagers in different weirs. A head can be selected from among families within the village. A head can also be selected among those who live upstream and downstream. Vice head is selected too for each weir, and they can be rotated. To become a head, one must be from the village, age between 25-55 years old; they must own paddy field, have knowledge, skills and respect from villagers. After selection the head of weir will manage and control weirs. Even in the case that district transfers control to villagers, the structure of management of weir group is the same as shown in the organization chart below

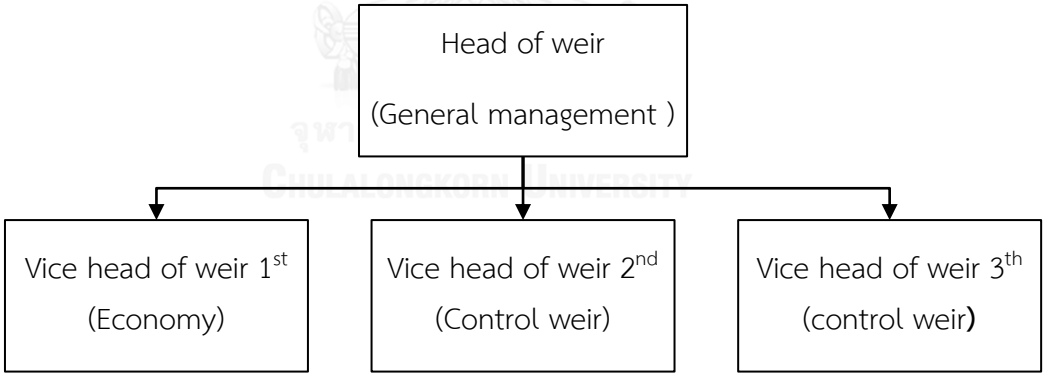

Figure 4.6 Structure of management weir of group of Na Mone Village

Source: Na Mone Village Authority 2013

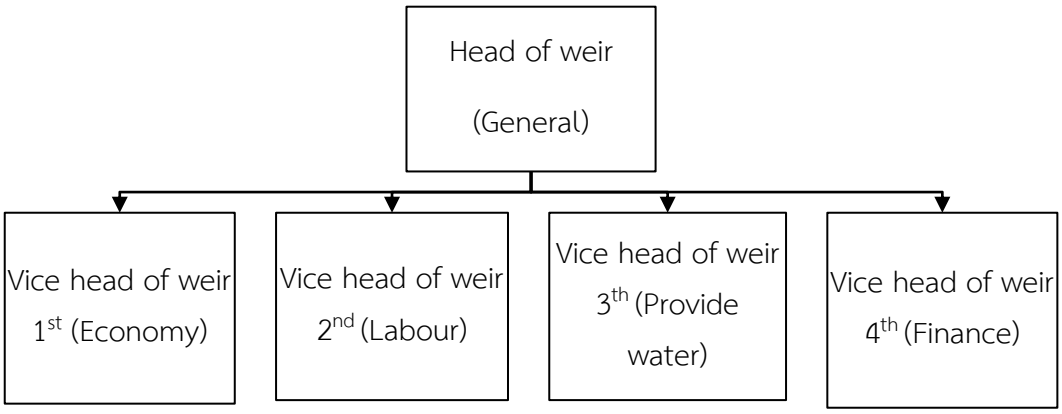

Figure 4.7 Structure of management weir group of Pha Tang Village

Source: Pha Tang Village Authority 2013

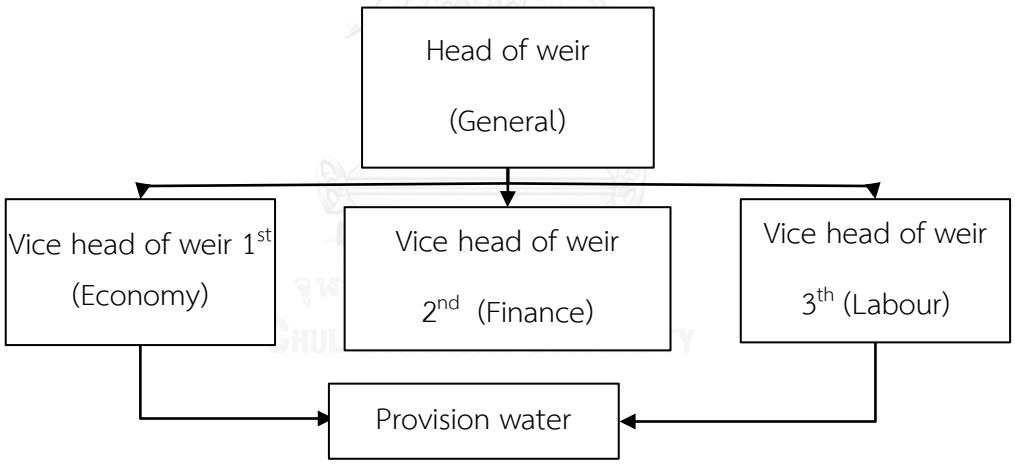

Figure 4.8 Structure's manage weir of Na Mouang Village

Source: Na Muang Village Authority 2013

General management: the head supervises management of group and makes decision when needed, coordinates with officials, help organize the dissemination of some skill, technical matters.

Economic responsibility is to give counsel about planting in dry season; collection of statistics of planting and harvest production and disseminate marketing information.

Labour responsibility is to take care of mobilization of worker in the case of repairing weir. He reports water usage to the head and cautions villagers of their use of water. He can make adjustment of water level so that each family can use water equally.

Finance responsibility is to look after some aspects of spending as in case of weir repairmen and collect money contribution from farmers after harvest. The money will be deposited with the bank and about 20% of the collection will be earmarked for the district. Money collection, contribution differs from village to village.

4.8.4 Social considerations

Social considerations

It is important to bring villagers from up and downstream to a meeting to discuss the project activities and inform them about potential positive and negative impacts during and after the construction, flooding of the upstream site and lack of water in the downstream site. The determination of, or the adjustment to an appropriate weir height by concerned parties can be a satisfactory way of seeking a common solution.

Water conflict often occurs in densely populated areas where many communities share the same stream or river. Conflict can be avoided, however, if measures are taken to guard against it: a community in the upstream areas blocking the stream without consulting to downstream communities, and too many weirs built close together in the same stream.

District and provincial authorities can help by being supportive and enforcing legal measures issued to protect against possible community conflict.

4.8.5 Environmental considerations

Rules and regulations should be established within the water user groups to identify up and downstream fish species migration throughout the year. This is important for:

- Maintaining the protein source for people living along the river.
- Scheduling the operation of the water sluice gate to ensure fish migration up and downstream in order to maintain the diversity of fish species.
- Maintaining and protecting a least 500m of forest on both sides of the river and at least 1,000m on upstream site in order to prevent siltation caused by opening up new paddy land and logging on the upstream site.
- Regular management of the sluice gate for deliberate de-silting from the weir after each heavy rain.

All the above measures should be clearly detailed in the water user group's regulations in order to ensure the effective implementation of a project, which if managed properly will make significant improvements to the livelihood of its upland and lowland user.

4.9 Water usage group

Like the rest of Lao PDR, the Nam Xong in Vang Vieng has a long history of subsistence agricultural livelihoods down to the contemporary lives of its population. Nevertheless, Vang Vieng district is the place of an important and rapid development

due to its geologic resources of limestone and ores, but also owing to its attractive nature and scenery. Therefore, industry and tourism settle in the watershed and add to the list of water stakeholders. Various stakeholders have been identified and are listed below, each one representing multiple water uses:

- **Functionality and effect from weir**

  - **Advantage of weir**

As it is known that sustainable development plan of Lao government aims at agriculture development, so, weir or irrigation plays the role of agricultural development.

Irrigated agriculture is for this reason to create a more conducive environment for irrigated agriculture development. The long term strategy covers the period of 2011-2020. Its direction will be towards re-modeling and re-orienting the mechanism of the various areas of public management that relates to the irrigated agriculture sub sector. The new model for public management will need to be shaped around a holistic perception of irrigation, namely as "irrigate agriculture", a business activity undertaken by farming households and the private sector, and governed by economic incentive (Forestry, 2010). Weir affords water for livelihood in community or village for washing, bathing, and consumption[7] (see picture below). As well as for crop or agriculture, livestock, and fishery.

[7] Observation survey on 30th May, 2014

Figure 4.9 Livelihood in community or village for washing, bathing and consumption.

❖ Disadvantage of weir

As well-known wood weir lend to cut down trees to build weir and multi-repair per year. Without proper management of head of water user group, there finds conflict in providing water between downstream and upstream. This testifies to the lack of solidarity in the community.

CHAPTER 5

CONCLUSION

5.1 Conclusion

This chapter is a highlight of the analysis of this research of significance of weir for the farmer and agriculturist on their livelihood in Vang Vieng district, Vientiane province. It also suggests possible meaning and recommendation for sustainable development on livelihood of villagers water from native weir or traditional irrigation.

Native weir is important for livelihood of villagers of Vang Vieng district. As such there should encourage to the government and private sector to develop technical guidelines on survey, design of weir with technical standards to ensure water storage and provision of water in order to meet the need of people whilst aiming to provide water for long term use for livelihood of villagers in Vang Vieng and to benefit the nation as a whole.

There are many sub-Nam Xong rivers in Vang Vieng area. So, each village is almost fed with water for paddy rice, agriculture in dry and rainy season, livestock and fishery. When people move to live in Vang Vieng in the past, there was no pumping machine, they design native weir to collect water. Nowadays, they continue to the practice. In this case, government recognizes the importance of the weir. The government plays some part by calling upon private sector and foreign country to help, especially, gabion weir and concrete weir which last longer. The government encourage villagers to continue using weir for agriculture and as base of socio-development plan of Vang Vieng district and country. In my view, government and

private sector should play bigger role to ensure water supply, whereby villagers can enjoy life more.

Argument in the use of water from the weir: though there are many sub-Nam Xong Rivers in Vang Vieng district, there are large number of people who use water for agriculture, tourism service, industry, and for consumption. The main problem stems from upstream and downstream water usage that cause problem as below:

Using too much water in upstream area regardless of downstream. There is more demand water for both rice farming usage and other agricultural crops. It the upstream and use more water, the downstream area will have less water. Expansion of farm land demands more water and creating more weirs means more water is retained in upstream area. This leads to problems of relationship among villages and villages. At the one point, head of the weir group loses central because rule cannot be applied strictly except the case of Na Mone village. The solution is to regulate water usage by fixing time for each village to use water and this has to be monitored.

There also exists problem of maintain quality of the water. This happens because garbage are thrown into the river posing sanitation and environment halyard.

Wood weir and damage of forest area: wood weir requires cutting down trees to repair and this lead to reduction of forest area which will end up in fewer water sources. The trend is informed of permanent weir. However, permanent weir like the concrete weir has its own negative side because more water is kept upstream while people downstream get lesser water. This is the cause of Kuang River and Phamom River in dry season, some villages cannot grow rice in dry season, and some villagers go to the city to seek employment.

Weirs management: ownership of weir should be transferred to the village so that villages can maintain the weir and villager can pay for the amount of water they use. Water cost must be kept low and it must be ensured that there is enough water for other areas people must be informed of weir maintenance and of their responsibility. Some permanent weirs are transferred to people in the village to manage, but some are not; interim weir is managed by the village.

This study looks into using water from weir for farming and agriculture in sub-Nam Xong River. Water is used in various ways such as for agriculture, for rice, for crops in dry season, feeding animal, fishery and tourism service especially in Vang Vieng city, and for people's consumption, plus watering fruit trees. Villages also look for food in the forest. Villages can also earn their living by hiring out as farmlands after finishing their own work.

To fully conclude. It is argued that the study fulfill the two objectives cited earlier; that is weir and water resource sustainability. This is clear that with the construction of weir, water is rationally used in both rainy and dry season, or all the year round. Care has been taken to ensure that water can be used equally both in upstream and downstream areas. Weirs are encouraged by the government and propose kind of weir is promoted that is concrete weir for it lasts longer and keep water required by villagers. Thus weir and sustainability of water is well connected; weirs are still in good use nowadays.

Significance of native weir on the livelihood of the people. This is proved by the fact that with the construction of weir, villagers enjoy the use of water for their paddy field, to grow agricultural crop the products of which are sold to feed the fruit trees. The water is also available for some industry, foe tourism, and for consumption of people.

5.2 Recommendation

On the significance of weir on livelihood of villager in Vang vieng district, this research proposes to recommends the following:

- When villagers face to the problem, official district and provincial authorities should be all help solve their problem such as providing fund
- District Official and provincial authorities should monitor the allocation of water strictly, in cooperation with the village.
- Future research should focus on studying permanent weir in the community especially the concrete weir.
- The study of weir at Vang Vieng can be replicated at other place that makes use of weir in order to use its effectiveness.

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APPENDIX

Appendix **A**

Questionnaire (English version)

Head of village

Name....., Village:.....,

Position:.....Date of interview:.....

Time:.....

Gender: Male ☐ Female ☐

Age: less 15 ☐ 15-20☐ 21-25 ☐ 26-30 ☐ more than 30.....

Marital status: Single ☐ Married☐ Divorced ☐

1. Awareness of weir used

   1.1. Do you know? How do you know? Tell us about their history.

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   1.2. How many kind of weir? What are they?

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   1.3. Why do you use weir?

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1.4. How do you solve the water conflicts? It means how you sharing water with another do?

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1.5. What are problems in weir used?

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1.6. How many time yearly maintenance?

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1.7. Where are maintenance labor come from?

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.....

1.8. Does weir maintenance use money? If yes, how much does it cost per each time?

.....

.....

1.9. Where does the source of weir maintenance fund ?

.....

.....

.....

1.10. Do government or private sector have involve in weir maintenance?

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2. How do important of weir to population livelihoodWhat do you think about the important of weir to you and your community?

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2.2. How do people life before have weir?

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2.3. How do people life after have weir?

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2.4. Users are increase or not?

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2.5. How much plantation area is?

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.....

2.6. How much money of your yearly (annual) comes from weir?

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.....

2.7. How do you think about benefits and limitation of using weir to Vang Vieng residents?

Beneficial:.....

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Limitation:.....

.....

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3. What are weir utilize methods for sustainable in your opinion?

3.1. What are your suggestion for solve conflict and improve weir utilize for future

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3.2. What are activities relate to improve weir?

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3.3. What are your expects of weir in future?

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Thank you so much

Questionnaire (Lao version)

Head of village

ແບບສອບຖາມສຳຫລັບນາຍບ້ານ

ບ້ານ: ນາຍບ້ານ..... ເມືອງ ວັງວຽງ ແຂວງວຽງຈັນ

ຊື່.....ເບີໂທ..... ອັນທີ ເດືອນ ປີ.....

ເພດ: ຊາຍ ☐ ຍິງ ☐

ອາຍຸ: ຕ່ຳກວ່າ 15 ☐ 15-20 ☐ 21-25 ☐ 26-30 ☐ ຫລາຍກວ່າ 30

ສະຖານະພາບ: ໂສດ ☐ ແຕ່ງງານ☐ ຢ່າຮ້າງ☐

1. **ຄຳຖາມກ່ຽວກັບການປູກຈິດສຳນຶກຂອງການນຳໃຊ້ຝາຍກັ້ນນ້ຳ**

1.1. ອະທິບາຍປະຫວັດຄວາມເປັນມາຂອງຝາຍ?

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.....

1.2. ທ່ານຮູ້ຈັກຝາຍບໍ? ທ່ານຮູ້ຈັກຝາຍໄດ້ແນວໃດ?

.....

.....

1.3. ຝາຍມີຈັກປະເພດ? ຄືປະເພດໃດແດ່?

.....

.....

1.4. ເປັນຫຍັງຈຶ່ງນຳໃຊ້ຝາຍນຳ້ລົ້ນພວກນີ້?

.....

.....

1.4 ຄວາມຂັດແຍ່ງການນຳໃຊ້ນ້ຳຈາກຝາຍມີການແບ່ງປັນນ້ຳ ຫລື ຄວາມສະເຫມີພາບລະຫວ່າງຜູ້ຕົ້ນນຳ້ ແລະ ລຸ່ນນ້ຳຄືແນວໃດ?

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.....

1.5 ບັນຫາທີ່ພົບພໍ້ໃນການໃຊ້ຜາຍມີຫຍັງແດ່? ແລະ ພວກທ່ານມີວິທີແກ້ໄຂ ບັນຫາແນວໃດ?

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1.6 ໃນແຕ່ລະປີມີການສ້ອມແປງຜາຍກັນຈັກເທື່ອ?

.....

.....

1.7 ແຮງງານໃນການສ້ອມແປງໄດ້ມາຈາກໃສ?

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1.8 ການສ້ອມແປງຜາຍໄດ້ໃຊ້ເງິນບໍ? ຖ້າໃ ຊ້ປະມານເທົ່າໃດຕໍ່ຄັ້ງ?

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.....

1.9 ຈຳນວນເງິນທີ່ສ້າງໄດ້ມາຈາກພາກສ່ວນໃດຊ່ວຍເຫລືອ?

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1.10 ທາງພາກລັດ ແລະ ເອກກະຊົນໄດ້ມີສ່ວນຮ່ວມຫຍັງບໍ່ກ່ຽວກັບການນຳໃຊ້ ຜາຍ?

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2. ຜາຍກັ້ນນ້ຳມີບົດບາດຄວາມສຳຄັນແນວໃດຕໍ່ກັບການດຳລົງຊີວິດຂອງພໍ່ແມ່ ປະຊາຊົນ

2.1 ທ່ານວ່າຜາຍກັ້ນນ້ຳໃຫ້ປະໂຫຍດຫຍັງສຳລັບທ່ານ ແລະ ຊຸມຊົນຂອງທ່ານ? ຖ້າ ມີ ມີຜົນປະໂຫຍດແນວໃດ?

.....

.....

2.2 ກ່ອນທີ່ຈະມີຝາຍ ຊີວິດພໍ່ແມ່ປະຊາຊົນເປັນແນວໃດ?

.....

.....

2.3 ຫລັງຈາກມີຝາຍຊີວິດພໍ່ແມ່ປະຊາຊົນເປັນແນວໃດ?

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2.4 ຮູບແບບການໃຊ້ຝາຍເພີ້ມຂຶ້ນເລື້ອຍໆບໍ່ໃນແຕ່ລະປີ?

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.....

2.5 ເນື້ອໃນການຜະລິດມີເທົ່າໃດ?

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2.6 ລາຍຮັບຈາກການຜະລິດຕ່າງໆໃນໜຶ່ງປີຜ່ານມາຈາກການນຳໃຊ້ຝາຍເປັນແນວໃດ?

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.....

2.7 ທ່ານຄິດວ່າການທີ່ເອົາຝາຍນ້ຳລົ້ນມານຳໃຊ້ເຂົ້າໃນກະສິກຳມີຈຸດດີ ແລະ ຈຸດອ່ອນແນວໃດ ຕໍ່ການດຳລົງຊີວິດຂອງພໍ່ແມ່ປະຊາຊົນເຂດເມືອງອັງ ວງ?

ຈຸດດີ:

.....

.....

ຈຸດອ່ອນ:

.....

.....

3. ພວກທ່ານໄດ້ມີການຈັດການ ການນຳໃຊ້ຜາຍກັ້ນນ້ຳແບບຍືນຍົງຄືແນວໃດ?

3.1 ທ່ານຍາກແນະນຳໃນການແກ້ໄຂແລະປັບປຸງຫຍັງບໍ່ສຳລັບໃນອະນາຄົດ, ໂດຍ ສະເພາະການນຳໃຊ້ລະບົບຜ່າຍກັ້ນນ້ຳໃນໝູ່ບ້ານຂອງທ່ານ?

.....

.....

3.2 ທ່ານຈະມີກິດຈະກຳຫຍັງເຂົ້າໃນການປັບປຸງການນຳໃຊ້ຜ່າຍນ້ຳລົ້ນໃນ ອະນາຄົດ?

.....

.....

3.3 ທ່ານມີຄວາມຄິດເຜີ່ມເຕີມຫຍັງແດ່ກ່ຽວກັບຜາຍກັ້ນນ້ຳໃນອະນາຄົດ?

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ຂໍຂອບໃຈ

Appendix **B**

Questionnaire (English version)

Farmer

Name....., Village:.....,

Position:.....Date of interview:.....

Time:.....

Gender: Male ☐ Female ☐

Age: less 15 ☐ 15-20☐ 21-25 ☐ 26-30 ☐ more than 30.....

Marital status: Single ☐ Married☐ Divorced ☐

1. Have you ever use weir?

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.....

.....

2. What is your purpose of using weir?

.....

.....

.....

3. What are benefits of weir?

.....

.....

.....

4. Explain advantages and disadvantages of using weir?

Advantages:

.....

.....

.....

Disadvantage:

.....

.....

.....

5. Do you think weir system now a day could supply enough for your planting?

.....

.....

6. How much water do you need for your agriculture?

.....

.....

7. What are your water management in dry and rainy season

Dry season:

.....

.....

Rainy season:

.....

.....

8. How do the product from dry and rainy season are?

.....

.....

9. Compare between dry and rainy season which season is better and why?

.....

.....

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.....

.....

10. Do you have any suggestion for government and private sector to weir system management in the future for your communities?

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.....

.....

Thank you so much

Questionnaire (Lao version)

Farmer

ແບບສອບຖາມສຳຫລັບຊາວນາ

ຊື່ ..... ເບີໂທ.....ອັນ ເດືອນ ປີ.....

ບ້ານ.....

ເພດ: ຊາຍ ☐ ຍິງ ☐

ອາຍຸ: ຕ່ຳກວ່າ 15 ☐15-20 ☐ 21-25 ☐ 26-30 ☐ ຫລາຍກວ່າ 30 ☐

ສະຖານະພາບ: ໂສດ ☐ ແຕ່ງງານ☐ ຢ່າຮ້າງ☐

1. ທ່ານເຄີຍໃຊ້ຜາຍກັ້ນນ້ຳບໍ?

   .....

2. ທ່ານນຳໃຊ້ຜາຍກັ້ນນ້ຳ ເພື່ອນຳໃຊ້ເຮັດຫຍັງ?

   .....

3. ຄຸນປະໂຫຍດຂອງຜາຍກັ້ນນ້ຳມີຫຍັງແດ່?

   .....

4. ອະທິບາຍກ່ຽວກັບຄວາມສະດວກ ແລະ ຄວາມຫຍຸ້ງຍາກກ່ຽວກັບລະບົບຂອງ ການນຳໃຊ້ຜາຍ?

   .....

   .....

   .....

5. ທ່ານຄິດວ່າຜາຍກັ້ນນ້ຳທີ່ທ່ານມີຢູ່ຕອນນີ້ພຽງພໍກັບການປະກອບສ່ວນເຂົ້າ ໃນການກະສິກຳຂອງທ່ານຫລືບໍ?

   .....

   .....

   .....

6. ທ່ານຕ້ອງການນ້ຳຫລາຍປານໃດເຂົ້າໃນການຜະລິດກະສິກຳ?

.....

.....

7. ທ່ານມີວິທີການແນວໃດກ່ຽວກັບການຈັດການນ້ຳເພື່ອນ້ຳໃຊ້ເຂົ້າກັບການຜະລິດ ໃນລະດູແລ້ງ ແລະລະດູຝົນ

ລະດູແລ້ງ:

.....

.....

ລະດູຝົນ:

.....

.....

8. ຜົນໄດ້ຮັບຈາກການຜະລິດກະສິກຳລະຫວ່າງລະດູແລ້ງແລະລະດູຝົນເປັນແນວໃດ?

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.....

.....

9. ທ່ານຄິດວ່າລະຫວ່າງລະດູແລ້ງແລະລະດູຝົນ ລະດູໃດໄດ້ຮັບຜົນຜະລິດຫລາຍກວ່າກັນ? ຍ້ອນຫຍັງ?

.....

.....

.....

10.ທ່ານຍາກສະເຫນີຫຍັງເພີ້ມເຕີມຕໍ່ພາກລັດ ແລະພາກເອກະຊົນ ຊ່ວຍເຫລືອແກ້ໄຂແລະປັບປຸງແກ້ໄຂໃນອະນາຄົດ, ໂດຍສະເພາະການນຳໃຊ້ລະບົບຝ່າຍກັ້ນນ້ຳໃນໝູ່ບ້ານຂອງທ່ານ?

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ຂໍຂອບໃຈ

Appendix **C**

Questionnaire (English version)

Official

Name....., Village:.....,

Position:.....Date of interview:.....

Time:.....

Gender: Male ☐ Female ☐

Age: less 15 ☐ 15-20☐ 21-25 ☐ 26-30 ☐ more than 30.....

Marital status: Single ☐ Married☐ Divorced ☐

1. How many kind of weir are there? What are they?

   .....

   .....

   .....

2. What are the benefits of local weir for agricultural, environmental, tourism, biodiversity and water supply in your opinion?

   .....

   .....

   .....

   .....

   .....

   .....

3. Do government and private sector have policy or activity relate to weir utilize?

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4. In your opinion view of future, local weir will still be use or not? Why?

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Thank you so much

Questionnaire (Lao version)

Official

ແບບສອບຖາມສຳຫລັບພະນັກງານ

ຊື່ ..... ເບີໂທ.....ອັນ ເດືອນ ປີ.....

ເພດ: ຊາຍ ☐ ຍິງ ☐

ອາຍຸ: ຕ່ຳກວ່າ 15 ☐ 15-20 ☐ 21-25 ☐ 26-30 ☐ ຫລາຍກວ່າ 30 ☐

ສະຖານະພາບ: ໂສດ ☐ ແຕ່ງງານ☐ ຢ່າຮ້າງ☐

1. ຝາຍກັ້ນນ້ຳມີຈັກປະເພດ? ຄືປະເພດໃດແດ່?

   .....

   .....

   .....

2. ທ່ານຄິດວ່າຝາຍພື້ນເມືອງມີຄວາມສຳຄັນແນວໃດແດ່ ຕໍ່ການກະສິກຳ, ສິ່ງແວດລ້ອມ, ການທ່ອງທ່ຽວ, ການຮັກສາຊີວະນາໆພັນໃນນ້ຳ, ການເກັບຮັກສານ້ຳ ແລະອື່ນໆ ?

   .....

   .....

   .....

3. ທາງພາກລັດ ແລະ ເອກກະຊົນໄດ້ມີນະໂຍບາຍ (ກົດຈະກຳຮ່ວມກັນ)ຫຍັງບໍ່ກ່ຽວກັບການນຳໃຊ້ຝາຍ?

   .....

   .....

   .....

4. ໃນອະນາຄົດຕໍ່ຫນ້າປະຊາຊົນ ຍັງຈະໃຊ້ຜາຍພົ້ນເມືອງບໍ?

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ຂໍຂອບໃຈ

VITA

Lamngeune Souliyavong was born in Savanakhet province, Lao PDR in 1985. She received her Bachelor Degree from National University of Laos, Vientiane Capital, Lao PDR in 2009. She works at the faculty of Environmental Sciences, at National University of Laos for 3 years. She is now working toward the M.A in Southeast Asian Studies, Graduate School, at Chulalongkorn University, Thailand. Her research area is the Significance of Native Weirs in Sustainable Development of Vang Vieng District, Vientiane Province, Lao PDR.