

## APPRAISAL OF AGRICULTURAL SYSTEM IN LAOS PDR

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### Abstract

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This study proposes agricultural system analysis and evaluation. The field activities in the pilot project of Nam Houm Irrigation Project, Laos PDR were collected by undertaking field observation, interviewing stakeholder and focal group discussion. The results of the focal group discussions and interviews were shown that the main problems in the area were low production, insufficient water supply and high cost of production. The suggestion to improve this situation includes provision of improved farming technology through training and extension and improved water management. The recommended solutions were to include strengthening of WUGs through intensive education and to involve membership, to improve financial transparency, to implement roles, rules and regulations (RRR) strictly. The poor condition of irrigation facilities were resolved by repairing irrigation canals and structures, strict implementation of the RRR and increase of repair funds through better Irrigation Service Fees (ISF) collection.

**Key words:** stakeholders, agricultural system, water resources management, Nam Houm Reservoir Lao PDR

### Introduction

Water resource is essential for human survival in the world. There are many problems on water resource in Lao PDR. The government is well aware of the need to its water resources, as one of the nation's few comparative advantages for economic development. In recent years, the Government of Laos (GoL) has moved significantly to develop its water resource management capacity. The GoL plays an essential role in protecting forest areas in water resource management and is widely appreciated; the improved protection of upland catchments is a prominent feature of policy for a variety of downstream benefits especially agriculture and hydropower. Among these, the Nam Houm River is the one of the main tributaries of the Nam Ngum River which has provided the basis of population stability and civilization at Naxaythong district in Central part of Lao PDR by constructing invaluable water structure such as Nam Houm Dam, which provides a controllable water release pattern over the year and serves about 1500 hectares (ha) of

paddy field in dry season. According to the Nam Houm Irrigation project, 2400 ha could be fully cultivated if the reservoir is filled up with full capacity at 60 MCM (1 MCM = 10<sup>6</sup> m<sup>3</sup>) at the end of rainy season. Currently, the Nam Houm Irrigation Project is fully turned-over to the Nam Houm Water User Association (WUA) for operation and maintenance including the ownership of the system (MRC, 2006; DOI, 2007).

However, the processes have not been made smoothly and successful because there are a lot of challenges and issues that still remain unresolved. These problems include poor and deterioration of existing irrigation structures, lack of stakeholders' incentive due to low income from rice cultivation caused by uncertainty and unavailability of market particularly in the rural area, and low cropping intensity under irrigation in the dry season. In other words, farmers are not willing to grow rice in dry season and these results in the serious problem of profit cost. The government, therefore, currently is working on rehabilitation of existing facilities together with strengthening of WUA to recover and upgrade their function before

Irrigation Management Transfer (IMT) will materialize. But WUAs are not able to manage assets sustainable. Irrigation schemes are not well maintained and water user organization is very weak. Scheme infrastructure depreciates rapidly with the lack of maintenance and repair resulting in investment intensive rehabilitation cycles of usually less than 10 years. Village development funds (VDF) have in general failed to contribute to irrigation maintenance and development and IMT has not improved system sustainability.

It seems that, the issue of the above objectives for stakeholders in water management in the project is of prime importance. The review and analysis of participatory irrigation management reflect to many problem aspects such as the level of stakeholders participation, and financial sources. Today, water resources management is seen as an ongoing process and different stakeholders as an essential part (Grimble and Chan, 1995; GWP, 2000; Alzaidi et al., 2013). Stakeholders need to participate in water management to effectively integrate the goals of efficiency, sustainability and equity for all sections. Supporting stakeholders in managing their water resources to make choice and to reach a common understanding on the necessary arrangements for sharing and allocating water-related goods and service is the basis on which stakeholders have to seek a well-informed decision (Heathcote, 1998; Chenoweth et al., 2002). The various methods were developed to help express the value of water-related goods and services in quantitative, monetary units and to increase irrigation efficiency (Rogers et al., 1998). The previous study investigated along with the questions on the conceptual model, stakeholder participation and institutional arrangements through which the operation of the canal (Svubure et al., 2010). To make the transition to more sustainable water management, most analysts recommend managing water based on river basins and increasing stakeholder participation in water management (Wester et al., 2003).

Several case studies are not fully comprehensive; that they cannot represent every activity which needs to be in participation strategy (Wester et al., 2003; Svubure et al., 2010). However, they do represent a broad cross section of some of the issues and challenges.

This study thus proposed the agricultural system analysis and evaluation. This study will also present the field activities in the pilot project: Nam Houm Irrigation Scheme by undertaking field observation, interviewing stakeholder and focal group discussion.

## Materials and Methods

### Study Area

The pilot project of this study is the Nam Houm Irrigation Scheme, Laos PDR. The Irrigation Scheme is a reservoir ir-

rigation system located at Naxaythong District in Vientiane Capital, Lao PDR. Its irrigated area is covered by 2 districts – Naxaythong (where most of the area is located) and Xaythani (the end of the Main canal). It has 21 beneficiary villages, 19 villages at Naxaythong district and 2 villages at Xaythani district. The Nam Houm Irrigation Scheme has an estimated irrigation service area of 4,200 hectares during wet season and 1,800 hectares during the dry season.

The reservoir and main canal were constructed in 1977 to early 1982 through government funds and free labor provided by villages in Naxaythong and government staff of the different Ministries in Vientiane Capital under the supervision of the Department of Irrigation (DOI) of the Ministry of Agriculture and Forestry. The design was prepared by Vietnamese Irrigation Engineers. In 1990 to 1994, the Mekong Secretariat (now known as the Mekong River Commission) supported the construction of the N1 secondary canal which benefits more than 400 hectares. The construction work was contracted to an Italian Construction Company and was supervised and monitored by a Project Officer from the Mekong Secretariat and Project Personnel composed of DOI Staff. The location and schematic plan of the study area are shown in Figure 1.

### Population and Random Sampling

The population and random sampling is formulated total five groups of the sampling: i) the local authorities of the beneficiary villages in the project such chief of the villages, women, senior in the village totaling 21 persons; ii) all chairmen and blocks leader of WUA, Water User Group (WUG), accountants; iii) the farmers and water master, which have cultivated area in the head of the canal (main or secondary), totaling 10 persons; iv) the farmers and water master, which

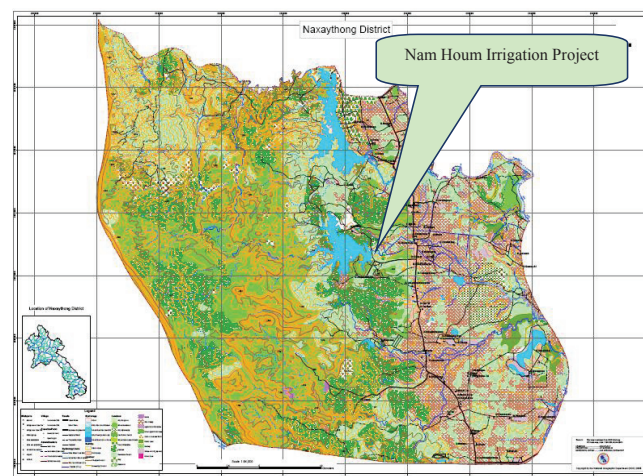


Fig. 1. Location of the Nam Houm irrigation project, Lao PDR

have cultivated area in the middle of the canal (main or secondary), totaling 10 persons; and v) the farmers and water master, which have cultivated area in the tail of the canal (main, secondary or tertiary), totaling 10 persons.

### **Primary Data Collection**

Using questionnaires for interviewing of the groups sampling such as farmers groups, water masters, block leaders which are formulated above. The interview will identify major factors in water resource management as follows:

- (1) Institutional factors - interview the groups sampling and review the government policy to the WUA.
- (2) Technical factors - interview the technical staffs and review the design and construction drawings of the scheme.
- (3) Socio-economic factors - interview with public and private stakeholders' interview with individual farmers of the group sampling.

### **Statistic of Data Analysis**

The statistic of data analysis will use the technique tools of Strength, Weakness, Opportunity and Threat (SWOT) analysis for describing the factors of farmers' participatory in water resource management and irrigation management.

## **Results and Discussion**

### **Analysis of Field Observation**

The analyses of field observation are summarized as follows:

- (1) WUAs are not actively performing their functions on maintenance and collection, and water distribution
- (2) The coverage of WUAs - area coverage are too big 550 hectares to 950 hectares and the number of farmers is too large, more than 600 farmers per WUA. This situation results to difficulty on mobilizing farmers for group work and meetings. To resolve this, the irrigation block organizations must be strengthened to promote better cooperation and mobilization of farmers.
- (3) The organization of the WUAs must be re-studied to conform to: hydrologic boundaries and water distribution schedule (i.e. by secondary canals – sub groups by turnouts) and in smaller coverage for easier mobilization. Coverage of WUAs must be responsive to method of water distribution – i.e. For Nam Houm, the division (2 divisions) for water scheduling is not in consonance with WUA coverage (3 WUAs).
- (4) An IMT contract must be formally agreed and signed with WUAs to include provisions on sharing of responsibilities (repair and maintenance) and benefits (Irrigation Service Fee, ISF sharing) and also incentives for high collection and sanctions for low collection (i.e. share of WUAs is much low-

er during first 40% collection and higher above 60% collection); i) for first 50% collection (20% to WUAs and 80% to Nam Houm Irrigation System Office, NISO); ii) for second 50% collection (60% to WUAs and 40% to NISO).

(5) No regular funds for major repairs are allocated annually resulting to gradual serious deterioration of facilities and structures. No definite source of such fund. For major repair needs, the Nam Houm ISO has to prepare a program and submit such to the provincial government for approval. For the last 10 years very minimal repair funds was allocated. The allocation of ISF collection shows very minimal share is allocated to repair funds – 25% from the NISO share and only 5% from the WUA share, while the allocation for NISO administration, remunerations of Water User Association Executive Committee (WUAEC) and NISO supervision is 60%. Since funds for repair is a primary need, this must receive higher allocation.

(6) ISF collection percentage is very low at an average of 27.55% per year as experienced in 2002 to 2007. ISF collection must be improved through intensive collection campaign; intensive education of members/farmers and transparency of financial transactions.

(7) As a pre-requisite of IMT, rehabilitation of facilities with the active involvement/ participation of WUAs must be done to ensure that functional facilities are turned-over to WUAs instead of turning-over problematic facilities. IMT of non-functional facilities is like transferring problems to WUAs instead of O&M responsibilities with a potential of better benefits.

(8) The present monitoring and information system for the system needs improvement. The system must promote monitoring and recording of data and information that can be made available on time for irrigation system management decisions. An Irrigation Management and Information System must be developed for systematic monitoring and management of the system and the WUA – recording of irrigated and planted areas, crops/varieties, harvesting/yields/production, discharges if possible especially at the head works, status of irrigation facilities and structures, repair and maintenance needs, etc.

(9) A procedure of planning and implementing repair and rehabilitation works through the participation of WUGs/ WUA must be formulated for nationwide application.

(10) The Government must re-study the process of IMT in Lao considering complexity of the scheme (i.e. reservoir versus run-off the river type weirs; small schemes versus large schemes; O&M Cost – pumps versus gravity; and WUG/ WUA capability – phased or gradual turnover starting from secondary canals to main canal to headwork level based on evaluation of WUA/WUG capability.

(11) Policies and procedures on O&M must be done for every system besides the RRR developed for the registration of the WUA. This O&M Policies and procedures must be developed through consultations at all levels of the WUA from the general membership to the WUAEC and village authorities. Such document must be signed by the WUA Head, Village Chiefs and then forwarded to the District Governor through the District Agriculture and Forestry Extension Office (DAFEO) for approval. This will give the WUA authority to implement the policies. The implementation of the policies can also be supported by the Village Authorities and the District Government.

(12) The WUG must first be registered as WUA – a legal entity before the Transfer Agreement is signed. Without the registration, the WUG cannot sign a contract/ agreement as a legal entity.

### Appraisal of Irrigation Project

The Num Houm Irrigation Project is jointly managed by government and farmers. Therefore, stakeholders involved in water management in the project consist of the Ministry of Agriculture and Forestry (MAF) level down to farmer organizations. The management appraisal of the project is described as follows:

#### (1) Organization chart

The project is operated by Num Houm project office belonged to the Provincial Agriculture and Forestry Service Of-

fice (PAFSO) of Vientiane capital under the Ministry of Agriculture and Forestry. As shown in organization chart in Figure 2, there are 4 main units under Num Houm project office namely agriculture and extension unit, irrigation unit, livestock unit and forestry unit. The irrigation unit is fully responsible for irrigation water management through 3 Water User Associations (WUAs). There are 11 water user groups (WUGs) in total working under WUAs, of these permanent members are 960 persons and temporary members are 380 persons. The agriculture service unit supports mainly for agricultural extension work such as training on agriculture production, technical on fertilizer application, pest and disease protection, etc.

#### (2) Responsibility of stakeholders

At the-office level, the project is being managed by 6 officials in the irrigation unit including Head, Deputy Head, 3 irrigation engineers, and 1 agriculture extension staff. The Head and the Deputy Head oversees the overall management and supervision of Operations and Maintenance (O&M) work. Each irrigation engineer is assigned to supervise O & M work for each Water User Association (WUA). The responsibilities of administrative level include: O&M of the dam and reservoir, O&M of main canal. The arrangement of budget proposals for major repairs of all irrigation facilities and structures within the scheme, is that this proposal is submitted from the District level to Provincial level and then to Central Government.

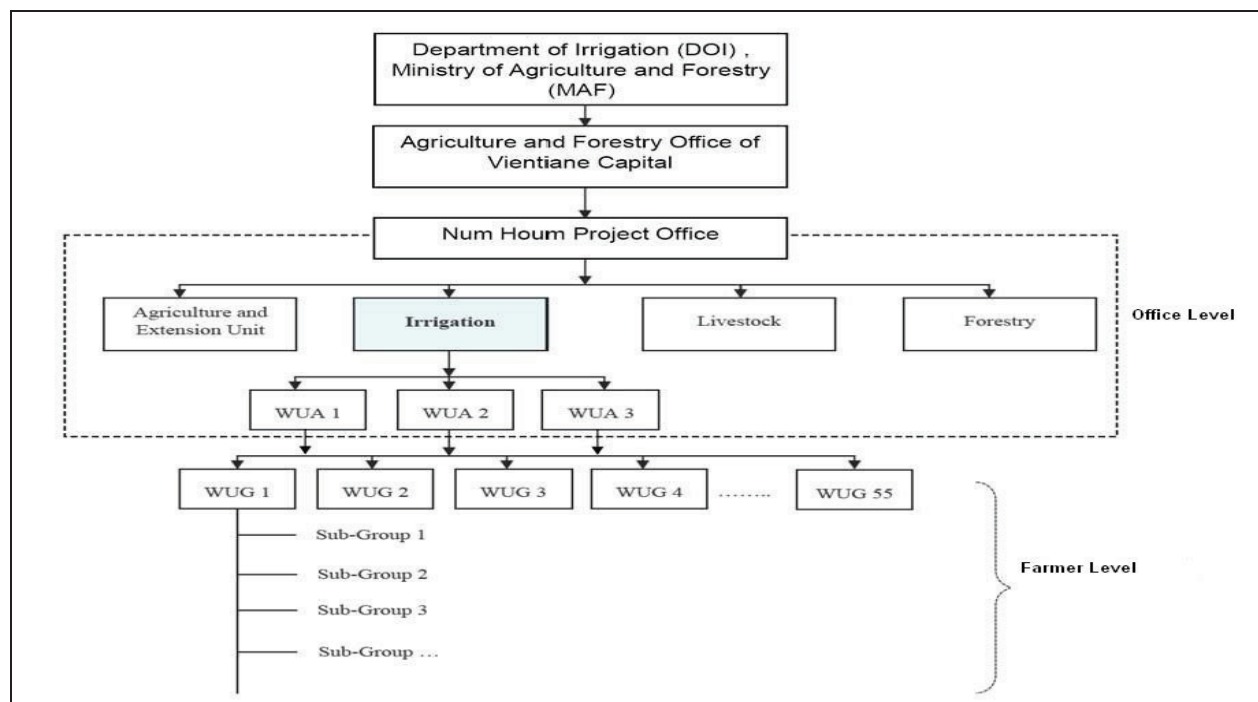


Fig. 2. Organization Chart of Num Houm Irrigation Project

Overall planning and supervision of the water allocation include planning, implementation, monitoring and evaluation, and Coordination with the district and provincial government for emergency repair needs of the scheme.

At the farmer level, the O&M work is under responsibility of WUGs (55 WUGs as total). The responsibilities cover the O&M work from intake of secondary canal. The steering committee is formed with 1 project official (WUA), WUG head (farmer), and chiefs of the villages that command area belong to. The steering committee performs the functions of planning, problem-solving, decision-making, supervision, and technical assistance.

The organizational set-up of the WUGs consists of a leader, two deputies, and one accountant. The main task of this level is the responsibilities for water distribution, routine maintenance, and assisting unit group to collect Irrigation Service Fees (ISF). The detailed responsibilities of WUGs are listed below. Coordination and under supervision of WUAs for irrigation schedule is done by planning, monitoring water distribution, maintenance of major repairs of irrigation facilities and structures within the boundary-command areas from secondary canals to farm level, collection of ISF and remittance of ISF collected from farmers to the project, and monitoring progress-planted area under boundary of WUG to estimate ISF collection.

The O&M work at lower levels is carry out by a unit consisting of one head and one deputy. The group has responsibilities of O&M work at on-farm level from intake of tertiary canal.

### (3) Level of water management

The water management and service are conducted as follows. The reservoir and the main canal operation is the responsibility of the WUAs under the project office. The WUGs are responsible for operating of the secondary canal level coordinating with the project office and their unit groups. The unit groups cover activities at the tertiary and on-farm level. The beneficiary household is summarized Table 1.

### Project Constraints and Problems

According to the project, the constraints can be summarized as follows:

- (1) Limited budget due to poor ISF collection and limited funds from the provincial or central government,
- (2) Limited experience and capability of staff,
- (3) Poor condition of irrigation infrastructures,
- (4) Insufficient vehicles to facilitate O&M work,
- (5) Weakness in WUG functioning, especially that WUG3 is not functioned as planned because of lacking participation.
- (6) Some WUG's boundary command areas are too large, 550 ha with more than 600 beneficiaries, making it difficult to manage because of large command area.

**Table 1**  
**Beneficiary households**

Groups	Beneficiaries		
	No. of village	Total households	Beneficiary persons
WUA1 (N1)	7	441	4 970
WUA2 (RMC)	6	501	7 559
WUA3 (LMC)	6	644	7 821
Total	19	1 586	20 350

### Focal Group Discussions and Interviews

The results of the focal group discussions and interviews show that the main problems in the area are:

(1) Low production, the yield of rice is ranged from 2.8 to 3.45 T.ha<sup>-1</sup> in wet season and 3.5- 4.15 T.ha<sup>-1</sup> in dry season, while cucumber and long bean are 6 to 10 T.ha<sup>-1</sup> due to poor soils; poor seed quality; pest and diseases infestation; insufficient water supply and high cost of production. Suggestion to improve the situation includes provision or introduction of improved farming technology through training and extension and improved water management.

(2) Weak WUA, due the collection of ISF is not well successful. ISF collection percentage is very low at an average of 27.55% per year as experienced in 2002 to 2007. ISF collection must be improved through intensive collection campaign; intensive education of members/farmers and transparency of financial transactions. Weak sense of responsibility and participation of farmers are also the reasons for the low percentage of ISF collection – weak cooperation of members; weak implementation of the WUG Roles, Rules and regulations, poor transparency of financial transactions (financial reports not religiously prepared and not informed to members); poor monitoring and recording of irrigated areas and ISF payments. Recommended solutions include strengthening of WUGs through intensive education and involvement of membership, improving financial transparency and strict implementation of RRR.

(3) Poor condition of irrigation facilities and structures due to limited funds for repair, poor maintenance, cases of vandalism (destroyed gates, animals going in and out of canals), and lack of distribution ditches for some farms. The major forms of damage to main canal or secondary canals are caused by: weeds, trees, grass growing and silt built up, erosion by animals climbing up and down, humans and vehicles. In addition to weeds trees should not be allowed to grow on the canal banks for a number of reasons: (i) they reduce water capacity of the canal; (ii) when trees become top-heavy and the canal banks are wet, trees may fail into the canal breaking away section of the banks; (iii) roots of trees growing on the outside bank of the canal will grow towards water in the

canal. These roots may encourage water leakage and possibly failure of the bank, if the water flow, by this means becomes too great.

All most structures on the secondary canals are no control gates no staff gauges for measurement of water discharge that difficult to know how much water release into rice field. Many drain culverts were constructed in this scheme, but some drain structures are poor functions due to no erosion protection at the downstream side. It is destroyed paddy fields in downstream. In wet season, it insufficiently release discharge from the rice field, as results the rice field have been flooded every year. To resolve this, repair of irrigation canals and structures is necessary; and there should be strict implementation of RRR and increase of repair funds through better ISF collection.

(4) Decreasing water supply – due to degradation of watershed. The situation of water source at present indicates that discharge in recent year is decreased due to degradation of watershed by logging and cutting of tree and burn to be a rice field still exists in the watershed. This must be reviewed by the government's policy. Cutting of trees and destroying forest in catchments area, it is influenced inflow discharging into the reservoir. During the first construction of the dam flow discharging over emergency spillway about 1.5 meters height. In reservoir were deposited sediments in every year (specially the wet season months). When this happen deposition of sediments in front of the dam, it will decrease storage capacity of the reservoir, it caused irrigated area for planting in dry season decreasing too. Decreasing capacity of the reservoir also influence of recreation, environments etc;



Meeting in Nam Houm Project



Meeting with WUAs



Household interview



Field observation

**Fig. 3. Field observation and meeting with WUAs**

On the other hand, sedimentation of reservoir should be considered. The percentage of sedimentation carried by the streams varies from stream to stream, and on the characteristics of the catchment area. The sediment particles try to settle in the bottom of the river due to gravitation force. As the quantity of silting increases, the capacity of reservoir reduces. If the silt is not removed from the reservoirs, its quantity will continuously increase and will make the reservoir useless in longer course of time. The cleaning of reservoir is required from time to time to remove floating trees, bushes, and silt. The floating trees may create undesirable appearance and may obstruct the boats and other recreation and tourism purposes in the future. The cleaning or clearance of the reservoir may be done manually or mechanically. For water distribution practices, water balance is considered before every cultivation season. If the storage kept as high as 189.1 MSL (in other words 60 Mm<sup>3</sup>) at the end of rainy season, a constant amount of water will be supplied continuously to the farm with no limitation, otherwise will delivery as rotation method. However, a rotation method is applied when water in the reservoir is insufficient. When available water level under normal level, cultivated area are estimated according to water storage e.g., in 2003, water level of 186.41 MSL (36 Mm<sup>3</sup>) could irrigate only 1 500 ha.

The photos of the focal group discussions, interviews, meeting with WUAs and field observation are show in Figure 3.

## Conclusions

This study presented the analysis and evaluation of agricultural system in Laos PDR. The Nam Houm Irrigation Project, Laos PDR was selected as a pilot project. The field activities were collected by undertaking field observation, interviewing stakeholder and focal group discussion. The analyses of field observation were summarized. The management appraisal of the project was described in term of organization chart, responsibility of stakeholders, and level of water management. The project constraints and the problem were summarized. The results of the focal group discussions and interviews were shown that the main problems in the area were low production, weak WUA, poor condition of irrigation facilities and structures, and decreasing water supply.

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