

# **Institutional Analysis of Nam Tan Irrigation System in Laos**

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## **1. Part I: System Structure**

The case is from western Laos in which a new irrigation system has been constructed by the central government. The project is administered by an agency of the central government but has incorporated an indigenous irrigation role as part of the administrative organization. The Nam Tan irrigation system is located in the province of Sayaboury in western Laos. It is within the Muong Phiang Valley, which is about 21 km long from north to south and about 5 km from east to west at its widest point. The floor of the valley is generally flat and 350 m above sea level. The mountains to the west rise, first, to about 750 m and then rapidly to 2000 m.

### **1.1 The Commons Dilemma**

#### **Potential Appropriation Problem or Poor Coordination of Appropriation**

The problem is poor coordination of appropriation in water distribution among the villages. Water users are split into groups of 21 each having a water headman that acts as a link between his water-user group and the external project administration and also as a water guard, protecting the group's delivery from other water users who are near to the supply channel. This role is important as there have been conflicts recorded between water-user groups due to illegal appropriation of water by removing parts of the public infrastructure that enabled the water to be rotated to the block whose turn had arrived, causing water shortages in that block.

#### **Potential Under-provisioning of Public Infrastructure**

This is not explicitly stated and does not seem to be an issue at the time of this initial project, though it forms a major part of the robustness analysis and the post-project period to present.

### **1.2 Biophysical Context (IAD)**

The public infrastructure (PI) is the irrigation system with a concrete diversion dam on the Nam Tan River. From this diversion structure, two main canals convey water to a left- and right-bank command area. The system provides supplementary irrigation for wet rice cultivation during the rainy season (approximately April-May through Sep-Oct), and water for a limited area of rice cultivation during the dry season. The irrigable area of the left bank is estimated to be 1127 hectares; to the right bank is estimated to be 919 hectares. Each is further divided into two subsections, or blocks. A varying number of watercourses, or laterals, is found in each of the four blocks of the system.

The overall pattern of water distribution involves 3 different levels. First, water is continuously served to both the left- and right-bank main canals. Second, within the command area of each bank, water is rotated between blocks. On the left bank, water is delivered to a block for 6 days at a time. On the right bank, each block receives water for a 3-day period. Third, within the block receiving water, water is distributed simultaneously to all laterals.

### **1.3 Attributes of the Community**

The approximately 2000 hectares of the command area serve nearly 900 farmers who live in 11 different villages. The size of holdings is relatively equal in the command area, since at the time the irrigation project was initiated, water users were allocated farm holdings of approximately 3 hectares each. New settlers were assigned plots of this size, and established residents with less than this size were assigned additional land to raise them to this minimum size. Resident farmers holding more than 3 hectares did not have their additional land confiscated. There are no very large landowners in the area, resident or absentee.

### **1.4 Rules in Use (IAD)**

#### **Position Rules**

There are 3 positions in this study:

- (1) *Project administration* - Staff from the Directorate of Agriculture are assigned to Nam Tan to serve as central administrative staff. The project also has an extension staff, to work with farmers in the irrigation system and an irrigation staff of engineers for operation and maintenance.
- (2) *The Farmer's Association* - The Association is segmented into 21 small groups (12 on the left bank and 9 on the right bank) that are congruent with the physical layout of the irrigation system. These small groups are composed of water users whose fields are contiguous and who (in most cases) receive their water from a common watercourse in the system.
- (3) *The water-user organization* - These officers include the usual president, vice-president, secretary and treasurer, as well as other specialized officers, including a water headman. The water headman is an adaptation of a leadership role found in this area of Laos prior to the present irrigation development activities.

#### **Boundary Rules**

The members are those farmers in villages within the irrigation command area whose fields were included under the Nam Tan project.

#### **Choice Rules**

- To perform his role satisfactorily, the water headman must act as a link between his water-user group and the external project administration. He also must act as water guard, protecting the group's delivery from other water users who are near to the supply channel.
- The water headman must be on hand at the time the water is rotated as witness to the fact that the central administration was doing its part to operate the system as scheduled.
- Maintenance and repair of either the diversion structure or the canals is a basic activity for which all groups must arrange.

#### **Aggregation Rules**

A project staff member assigned to the task is charged with ensuring timely delivery of water to the block whose turn has arrived. The staff typically does this by going to a specific turnout, closing the gate delivering water to a lateral and allow the water to enter a different lateral whose turn it now is.

### **Scope Rules**

- Water headmen are elected by the user groups they are intended to serve. The water users have the ability to review his performance to consider his continuance or dismissal.
- The water headman is dependent on the water users and not the bureaucracy for the payment of his fees which is in kind - about 16 kilos of unmilled rice for each hectare of land served.

### **Information Rules**

There is no information on information rules in the original case study.

### **Payoff Rules**

There is no information on payoff rules in the original case study.

## **1.5 Summary and Discussion**

The pre-project organization was of 2 major types. First, in villages that irrigated their fields by constructing very small diversion dams on shallow streams, such small dams requiring the labor of perhaps 2-4 water users, no village leadership role for irrigation existed. Leadership resided in each of the small work groups. In villages that constructed one large diversion dam to serve nearly all farmers in the village, specialized roles for administering irrigation activities were present. These villages selected an individual to act as water headman (*nai nam*). This role was separate from the role of village headman (*nai ban*). In some instances, the water chief was assisted by a group who acted as a water committee or council (Coward, 1980).

In pre-project organization, the water headman role required little or no articulation with external authorities. The village irrigation systems which they administered were self-contained, local systems, not dependent upon or linked with entities outside the village. After the project was implemented, the focus of the water headman was on ensuring that water is delivered to members of his group during their scheduled period. Poor coordination of appropriation and illegal exploitation of the resource resulted in tensions between the water-users and the project administration. Subsequently, it was decided to expand the role of water headman to act as interface between the water-users and the project staff.

## **2. Part II: Dynamic Analysis – Robustness**

This update is based on the Nam Tan Rehabilitation Project that was implemented in Sayaboury Province from February 1992 – June 1998. It was found that the Nam Tan project described in Part I had not achieved its full potential because of subsequent failures to strengthen farmers' organizations, especially in effective water management and the marketing of produce (UNDP, 1999). The rehabilitation effort was meant to increase the province's capacity to produce rice to ensure food self-sufficiency and limit environmental degradation of hillslopes by shifting cultivation.

### **2.1 Update on the Commons Dilemma**

The original project saw land allocated at 3.0 ha per family, the position in 14 villages supplied by the irrigation scheme (implying the number of villages supplied grew to 14 from 11 since 1975). The landholding had decreased since 1975 to 1.8 ha per family due to increases in population and

diminishing irrigation had impoverished many households. In 20% of the cases landholding had been reduced to less than 1.0 ha with an average family size in 1992 of 6.32 members, implying economic hardship for many families (UNDP, 1999).

The irrigation system had failed to a point where 10% of the perimeter families claimed to have no irrigated water whatsoever. A further 63% stated that the water they received was insufficient and only 27% thought it satisfactory. Farmers in the area reported that illegal removal of irrigation water was as high as 51% (UNDP, 1999). Shifting cultivation, which the project was designed to prevent, had increased as the irrigation system broke down. The system as a whole was relying on subsistence agriculture.

After the Second Indochina War in the 1960s and 1970s, a significant number of refugees were assisted in resettlement from Thailand by UNHCR and they relocated to villages in the irrigation command area. But in very few cases was irrigated land available to them. This has resulted in significant population pressures that has put tremendous strain on the system. The average amount of land they could cultivate was about one-third of a hectare, because, it was difficult to clear and more difficult to weed the crop. The only alternative employment available to these families was on the land of farmers in the irrigated command area.

## **2.2 Shocks, Capacities, Vulnerabilities**

### **.....to and of the Resource (Link 7 to R)**

- The project had one negative environmental impact – the reduction of the dry season flow of the river Nam Phiang by the 7 small weirs constructed to increase the irrigable area. Six of these weirs block the flow of drains that flow into this river and the largest one of them blocks the flow of the river itself. This loss occurred in addition to loss of water from the Nam Tan, a major tributary of the Nam Phiang, whose bed is totally dry below the weir feeding the irrigation scheme.

### **.....Between Resource and Resource Users (Link 1 between R and RU)**

- The main canals were damaged by buffaloes using them for drinking and bathing, although there were WUA rules banning this practice. The canals were also used by village families in enormous numbers for bathing and washing clothes and in some cases for drinking water (UNDP, 1999). This posed health risks to resource users through this kind of utilization of canal water.

### **.....to and of the Resource Users (Link 8 to RU)**

- Return and resettlement of refugees after the Indochina War led to a significant increase in the number of families moving to the Nam Tan command area but a lack of land available to them and tremendous pressure on the existing system. This forced resettled families to live upland outside the irrigation command area in considerable poverty and supplementing their non-irrigated farming practices with either reliance on harvesting forest products or as laborers for farmers within the irrigated command area.
- Government relaxation of the rules on slash and burn agriculture have also acted to impede diversification of crops used and has resulted in local farmers preferring low yield paddy crops

with minimal utilization of fertilizers and pesticides. Reasons given for this included lack of access to external markets and the lack of capacity to store or preserve alternative crops.

**.....Between Resource Users and Public Infrastructure Providers (Link 2 between RU and PIP)**

- Even after the rehabilitation of the Centre and training provided for many provincial and district technical staff, little progress had been made in improving the provision of support services to the farmers in the command area. The problem facing the farmers turned out to be the poor organization of the Water User's Groups (WUG) that were organized without a proper understanding of the complexity of the system and the need for preventive maintenance on canals and structures.

**.....Between Public Infrastructure and Public Infrastructure Providers (Link 3 between PI and PIP)**

- The collection of the Irrigation Service Fee (ISF) remains a serious problem with only between 60 – 70% of the water users ever paying their fee to the block. This has serious consequences for the operation and maintenance of the scheme and has serious implications about the system becoming self-sustaining. The WUA calculated that the funds were insufficient to meet the operating and maintenance demands of the irrigation system. Compounding this problem was a general operating cash shortfall of approximately 35% ISF collection failure annually (UNDP, 1999).

**.....Between Public Infrastructure and Resource Users (Link 6 between RU and PI)**

- The weir on the Nam Tan was cleared of silt once a year and the main canals were weeded twice yearly by labor brigades raised by the village chiefs. These tasks, while effective in themselves, were inadequate to prevent the development of major erosion damage to the canal slopes. Such maintenance required a program of routine maintenance. Also equity issues arise as families that have no land in the irrigation command area but live in villages in this location are required to join the labor brigades clearing the weir and weeding canal embankments (UNDP, 1999).

**.....to and of the Public Infrastructure (Link 7 to PI)**

- Outside of the original project plan, rehabilitation restored quality and functionality to the main and secondary canals but also increased the complexity of their operation and maintenance as they allow the water level in the canals to vary, which results in flow in offtakes to vary as well. This leads to waste of irrigation water and seriously hampers optimal distribution of available water.

## **2.3 Robustness Summary**

Prior to project implementation, water provision and management of this provisioning had degraded to the point where yields were dropping below subsistence levels for families farming in the Nam Tan command area. The farmers had no organization capable of operating and maintaining the system. Operation and resource extraction appeared to have been independent of each other and without regard to the general good of the community.

Post-project implementation has seen mixed results. Even farmers at the tail end of conveyance systems and distribution canals reported they were happy with the water they were getting and the number of farming families fully served increased by 650 from pre-project numbers. It was found after the project implementation that the organizational capacity of beneficiary groups was increased by block and zone formation of the farmers and the organization of village women managers and recipients of revolving funds and micro-credit. The WUA was reconstituted with a Management Committee, though its capability to manage the irrigation system was found to be needing improvement.

Community cohesion had strengthened and water provision to farming families in the command area, including those in the periphery, increased through the formation of the WUA. However, the payment of the ISF still saw a 30% default rate which strongly suggests that the farmers are not up to par with the complexity of operation and maintenance and are unable to comprehend the need for planned preventive maintenance beyond their own block and tertiary infrastructure levels. Furthermore, they saw the disbursement of funds for system maintenance as the responsibility of the Province.

There was considerable disconnect between the increased complexity of the system and the know-how and capability of the farmers to maintain it. The project has also had insufficient success in weaning farmers away from growing low-yielding paddy crops and practicing subsistence and slash and burn agriculture and towards alternative and less water-intensive crops. There are several reasons for this including the fact that there is lack of access to external markets and storage infrastructure for the alternative crops and the agricultural extension services have not addressed these needs adequately. Secondly, the relaxed attitude of the government toward slash and burn agriculture and the resultant environmental degradation has encourage farmers to continue with local tried and true methods.

The irrigation scheme had been made more reliable in both the wet and dry season and the area had been increased to provide better water distribution. At the block level, irrigation performance had improved substantially, but at the level of the main and secondary canals the potential for good operation, especially in the dry season, had yet to be realized (UNDP, 1999). This leads to the implication that in achieving improvement in system performance at lower levels, higher level system performance is compromised to a certain extent. This implication is reinforced by the fact that farmers created with their own labor an effective system of water distribution at the tertiary canal and field level but had no conception of planned preventive maintenance at main and secondary canal levels.

### **3. Part III: Case Contributors**

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### **References**

Coward, E W Jr (1980). Local Organization and Bureaucracy in a Lao Irrigation Project. Cornell University Press, Ithaca, New York. Chapter 15: 329-344.

UNDP (1999). Lao PDR: Nam Tan Irrigation Rehabilitation Project – Report of the Final Evaluation. United Nations Development Programme.