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WATER USE MANAGEMENT IN NAM ROM IRRIGATION SYSTEM OF MUONG THANH VALLEY, NORTHWEST VIETNAM

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ABSTRACT

The research aim was to analyse the main aspects of water use management and stakeholder conflicts within Nam Rom irrigation system, Dien Bien valley, Dien Bien province in the northwest region of Vietnam. The study identified the key stakeholder groups relating to water distribution, viz. Dien Bien provincial People's Committee (DBPC), Dien Bien Irrigation Management Co. Ltd. (DBIMC), Dien Bien Phu city People's Committee, and Dien Bien district People's Committee. The results of this study indicated that the conflicts over water use for irrigation relate to quantity and quality of water supply, decentralized management and water fee exemption policies. The outputs of the study are important for improving water allocation and management in irrigation sector in Dien Bien province.

Keywords: Dien Bien, irrigation, Muong Thanh valley, water management, water use.

Quản lý sử dụng nước tại hệ thống tưới Nậm Rốm trên cánh đồng Mường Thanh, Tây Bắc Việt Nam

TÓM TẮT

Nghiên cứu này nhằm mục đích phân tích những ảnh hưởng chính của quản lý sử dụng nước và mâu thuẫn giữa các bên liên quan trong các hệ thống tưới tại hệ thống tưới Nậm Rốm, cánh đồng Điện Biên, tỉnh Điện Biên, Tây Bắc, Việt Nam. Nghiên cứu này đã xác định những thành phần liên quan chính đến việc phân phối nước bao gồm Ủy ban nhân dân tỉnh Điện Biên, Công ty TNHH quản lý Thủy nông Điện Biên, Ủy ban nhân dân thành phố Điện Biên Phủ và Ủy ban nhân dân huyện Điện Biên. Kết quả nghiên cứu chỉ ra những mâu thuẫn trong sử dụng nước có liên quan mật thiết đến số lượng và chất lượng nguồn cung cấp nước, phân quyền trong quản lý, và chính sách về miễn phí sử dụng nước. Hơn nữa, kết quả này còn đóng vai trò quan trọng trong việc cải thiện việc phân phối và quản lý công tác thủy nông tại tỉnh Điện Biên trong tương lai.

Từ khóa: Cánh đồng Mường Thanh, Điện Biên, quản lý nước, sử dụng nước, tưới.

1. INTRODUCTION

In Vietnam, most irrigation schemes are positioned nearby major water reservoir (rivers and lakes) and are managed by government institutions. The canals draw and convey water from a river to meet the demands of agricultural producers. In fact, a number of government institutions are involved in the management and operation of irrigation services, causing institutional complexities that can affect the water operation and management of the river basin (Harris, 2006).

It is useful to highlight that, based on the Decree 115/2008, the central government subsidizes water fees for famers in relation to regions, types of irrigation systems, and types of water users. The Decree classified clearly the water fee exemption for irrigation of which "Free of charge for the water fee in irrigation

area within the agricultural land for households and individuals engaging in agriculture, forestry, aquaculture and salt production". However, this policy caused some main challenges in case of irrigation sector, for example, the infrastructure of irrigation systems are underdeveloped caused by limited budgets available for maintenance and repair. Also, "irrigation management has been supply driven with 'command and control' approaches designed to meet the needs of paddy rice irrigation". Farmers have little say in system management because irrigation water provided for free. (Turner *et al.,* 2009).

Improvement of irrigation systems' performance is a major production factor that could remove the constraint on agricultural productivity in developing countries in Asia (Ostrom *et al.*, 2011). According to Biltonen *et al.* (2003) policy, institutional and poverty dimensions in irrigated water management in Vietnam were often neglected. There are a lack of linkages between agencies and stakeholders, and the current rules are unclear and inadequate. Therefore, it is imperative that the current policy making, water governance and water management of water use in irrigation systems need to be improved.

Pereira *et al.* (2002) suggested that water management requires measures and policies to avoid water wastage, reduce demand, efficiently use water and raise the awareness of the general public about proper use. Changes in water allocation and delivery policies are necessary measures in the management of water and irrigation systems.

To link with social and ecological interaction, integrated water resources management is proposed as a management system. In this system, water use and management within the hydrological units should be based on the coordination of all available water (groundwater, surface water, and return water), land, and related resources. Additionally, all interests of different economic sectors and hierarchical levels should be co-ordinated in planning, decision making, financing, conserving and developing water resources for a sustainable development and use of water (Dukhovny & Sokolov, 2005).

Nam Rom (NR) irrigation area in Muong Thanh (MT) valley, Dien Bien (DB) province, Northwest (NW) Vietnam was selected for this research. MT valley is divided into two parts: the mountainous region covering an area of 200,000ha, and the flat land with 25,700 ha of which around 6000 ha are under paddy rice called MT Field. MT field is the major rice production area of DB province and NW region of Vietnam (Hao, 2006; Siem & Liet, 2006). The main irrigation system for Muong Thanh field is Nam Rom irrigation system which was established in 1963-1965. Canal irrigation in Nam Rom has long been under public management before transferring to private sector (DBIMC) during the last decade.

The water source for Nam Rom irrigation system is from Pa Khoang Lake which has an area of 600 ha with a capacity of 37.2 million m^3. Problems start from the main water source to the Nam Rom dam (with the length of about 20 km) as in this reach of the river there are three small hydroelectric dams, namely, Thac Trang, Na Loi, and Thac Bay. These hydroelectric power plants are managed and operated by Thac Trang hydroelectric Company, Na Loi hydroelectric Company and Thac Bay hydroelectric Company, respectively. Their operation impacts heavily on the availability of water for irrigation use. In the dry season, the NR River is often over exploited by four dams.

The Nam Rom irrigation system (NRIS) provides regular water supply for Muong Thanh field. However, the field canals were poorly constructed, leading to serious water loss, and as a consequence, a large land area of Muong Thanh valley is often left fallow. Improvements of the irrigation system could increase double rice crops in many parts of this valley. The area positioned at the tail-end of Nam Rom irrigation system usually suffers water shortage. The water-limited issue covers cultivated area of two communes, namely Noong Luong and Sam Mun. Farmers often request NRIS to improve the water conveyance

and distribution canals. Because of water deficits in the Winter-Spring season, rice is grown mainly in Summer-Autumn season. "Lowland rice growing areas could be expanded, if irrigation facilities were updated allowing conversion of one crop areas into two crop areas" (Siem and Liet, 2006).

The present research was targeted at the Nam Rom irrigation scheme under different governance systems in Dien Bien valley. It was specifically focused on the conflict of water use for irrigation among different users and water deficit at the tail-end of this system. In addtion, internal and external conditions affecting irrigation water use at provincial level, district level and farm level were identified. It aims were to solve the conflict in water use for irrigation between several authorities towards increasing the livelihood potential of farmers.

2. METHODOLOGY

2.1. Study area

Nam Rom Irrigation System which is located in DB Phu city and DB district, DB province, Vietnam was selected for this study. This system provides water for the terrace fields in the Muong Thanh field. The irrigation system includes four canal levels: main canal, secondary canal, tertiary canal and in-field irrgation canal. The main canal, the first level closest to the dam, is around 823 m long; the secondary canal, includes the left canal with a length of 14,208 m and the right canal (about 18,051 m long). Secondary canal discharges water to tertiary canals and further to in-field irrigation canals to supply water to nearly 3,000 hectares for two seasons per year. In Nam Rom irrigation systems, NL commune and SM commune are situated at the end of the left canal and the right canal, respectively.

2.2. Data collection

2.2.1. Primary and secondary data

- Secondary data collection

Data and information regarding irrigation systems and policies of water use for irrigation were acquired through authorities and irrigation associations. Relevant data regarding farmland acquisition and utilization were collected from DB Department of Rural and Agricultural Development, Dien Bien Irrigation Management Co Ltd. (DBIMC), Report on status of production – business, socioeconomic of the region, and the Statistical Yearbook of recent years.

- Primary data collection

Household interview: Household interview was applied in two communes, namely NL and SM. In each commune, random sampling method was used to select 30 respondents (households) for questionnaire survey. The household questionnaire survey was used to collect information related to households and its interaction with irrigation systems such as household information, land holdings, farm land area, main crop, and alternative options for water supply. Moreover, household interviews were conducted on the existing situation of agricultural production, water use and HHs' contribution to the operation and maintenance of NR irrigation system.

Key informant interview: Key informant interview was used to interview heads of local governments (heads of communes, villages), agricultural officials, and land officials in order to have a basic view of the water use and management in the area and its effect on local administrative management. The heads of some cooperatives were also interviewed to get essential information about their extraction and use of water. These respondents also helped to cross check the collected data from focus group discussion.

Relevant to DBIMC's data and information, several in-depth discussions were held with the representatives of the company and administrative managers for water use and canal maintenance. Interviews were conducted separately with the heads of units in charge for irrigation operation in the two communes.

2.2.2. Focus group discussion

In this study, the group discussions were carried out randomly in the two communes. The

meetings were divided into six groups and each had 4 farmers. The purpose of the discussion was to understand general information about the study site such as water release, interaction between local people and water association, and their suggestions for local government. This step also helped to identify major problems related to the issue and causes of each problem, to rank the significance of these causes and effects of the problems, and to find out potential solutions from the perception of local people.

2.2.3. Data analysis

The descriptive and analytical statistics were used to identify frequency, percentage, and mean of variable. Data from key household interview, key informant interviews, and focus group discussions were analysed to draw out the main issues relating to water management and the effect on water use in irrigation. Futhermore, these methodologies examines water-related institutions and stakeholder agencies in depth to gain an understanding of their current conflict in water allocation.

2.2.4. Stakeholder analysis

In this study, various tools such as rapid appraisal and discussion with key persons were used for identifying stakeholders. Information was collected from key informants, from focus group discussion and secondary data. Information about stakeholders' interest, impacts and power were collected through questionnaire and in-depth interview. The stakeholders were, then, classified and categorized to reflect their perspectives through their own classifications and definition of parameters. It may particularly identify the winners and losers and highlights the challenges and impacts (Mayers, 2005). The impacts included both side positive and negative impacts in relation to the three big stakeholders, namely, Dien Bien Irrigation Management Co. Ltd., Water Use Associations and local farmers. This research used interest-influence matrix, where stakeholders are placed in a matrix on the basis of the extent to which they are interested in or can influence the issue.

3. RESULTS AND DISCUSSION

3.1. Characteristics of Nam Rom Irrigation System (NRIS)

The DBIMC indicated that the main irrigation system for Muong Thanh field is Nam Rom irrigation system. This system was established from 1963 to 1965 then concreted and maintained several times up to now. This irrigation system includes 4 levels of the canal system. The main canal (the first level closest to the dam) is around 823 m. The secondary canal includes the left canal with the length of 14,208 m and the right canal (about 18,051 m). It then discharges to tertiary canals and further to irrigate nearly 3000 hectares for two seasons per year. The two main canals (the first and second level) are under the management and operation of (DBIMC). Water Use Associations and Farmer organizations manage and operate all tertiary canals and filed canals under Dien Bien Phu city and Dien Bien District Irrigation Authority (Dien Bien Irrigation Management Co. Ltd., 2012).

For water use management in NRIS, the Dien Bien provincial People's Committee promulgated several policies to provide guidance and definition on planning, exploitation, utilization, protection, regulation and management of all water resources and irrigation systems[1]. It clearly classified decentralization of irrigation systems and the area that is subsidized by the irrigation water fee exemption policy. However, it lacked water use rights and responsibilities, water supply supervision, and environmental protection provisions, especially, the rights and duty of the cooperatives who are directly responsible for water distribution and canal maintenance from the main canals to the farm canals. This leads to ineffective water management and water distribution.

There are seven units who are responsible for maintenance and operation based on the

[1] Decision No 15/2010 Issuing regulations on decentralized administration of protection, management, and exploitation of irrigation systems in Dien Bien province.

Decision No 19/2011 Regulations on scale of protection of irrigation systems in Dien Bien province.

regulations and law. This system discharges water to irrigate about 2,566 ha of Muong Thanh field. Totally, 14 water use associations mainly depend on water from NRIS for irrigation as shown in table 1.

3.2. Water allocation for irrigation

In Muong Thanh valley, since 1968, after the construction of Nam Rom irrigation canal systems, water has been provided to meet demand with substantial involvement of local governments. Public allocation was seen as the majority mechanism to allocate water in the whole Nam Rom canal where the state decided what water resources could be used for irrigation, and allocates and distributes water to different water users in the area.

In fact, the Nam Rom irrigation canals allow irrigation to those field areas with elevation lower than the nearby canals. Higher field areas are irrigated by substituted water sources, for example lakes and indigenous irrigation systemss. The longitudinal cross section of the Muong Thanh field is shown in figure 1.

Table 1. Water use associations and irrigated area in NR irrigation system

Canal	Water use associations	Irrigated area (ha)	Units in charge of irrigation scheme operation
Left canal	Noong Bua Ward	31.0	Dau Moi unit
	Nam Thanh Ward	73.4	Thanh Xuong unit
	Thanh Xuong cooperative	302.0	
	Thanh An cooperative	262.0	
	Noong Het cooperative	309.0	Hong Sat unit
	Sam Mun cooperative	273.9	
Right canal + Left canal	Him Lam Ward	18.8	Dau Moi unit
Right canal	Thanh Nua cooperative	26.0	
	Thanh Truong Ward	103.0	Pe Luong unit
	Thanh Luong cooperative	120.0	
	Thanh Hung cooperative	197.5	Hong Khenh unit
	Thanh Chan cooperative	190.0	Phai Din unit
	Thanh Yen cooperative	440.0	
	Noong Luong cooperative	220.0	
Total	14 associations	2566.6	7 units

Source: Dien Bien Irrigation Management Co. Ltd., 2012

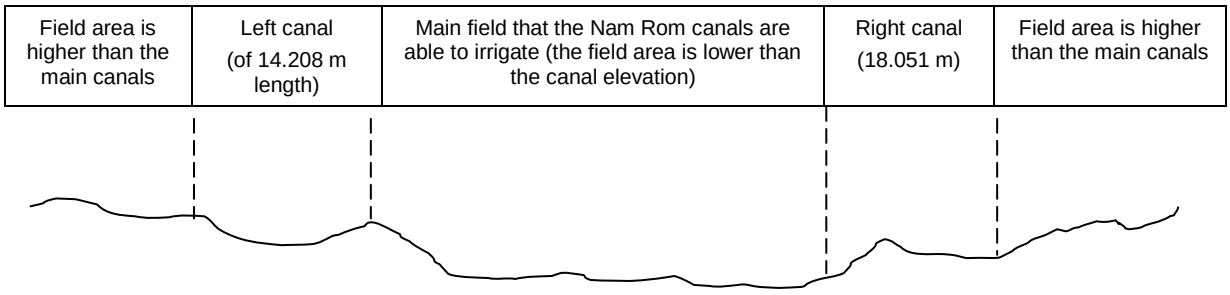

Figure 1. Transection of the Muong Thanh field

Under this water allocation mechanism, water allocation for irrigation in the Nam Rom area is based on the management of several actors. Annually, the Dien Bien Provincial People's Committee approves the plan of irrigated areas and the area of irrigated water fee exemption. The plan decides the clear size of fields in hectares which need water for irrigation and the responsible irrigation agencies for each district. Also, the Dien Bien Department of Agriculture and Rural Development makes a clear seasonal cropping calendar in the whole province. A water distribution plan is developed by the Department of Agriculture and Rural Development of Dien Bien district and Department of Economics of Dien Bien Phu city before cropping season. These departments, based on cropping calendars, then hold a meeting to decide which days the water will be discharged through the Nam Rom canal. Typically, the starting date for discharging water through the Nam Rom canal is from May, 20 for Summer-Autumn season and from December, 25 for Winter-Spring season.

Depending on the plan, the DBIMC distributes and drains water in the Nam Rom irrigation system to meet the requirements of agricultural production and irrigated areas of the Muong Thanh field.

Since water is delivered through the main canals, water is used as a "Common Pool Resource". Fourteen main agricultural cooperatives and other water users together exploit water as much as possible for their fields. From the interview, farmers did not economize on water used for irrigation. They did not have clear right and responsibility in water use.

Each agricultural cooperative plays an important role in water allocation management. Since the water flows to its autonomous canals, the irrigation groups of the cooperative must allocate water from the main canal to the field. However, fourteen cooperatives of the NRIS have less communication among themselves in water discharge and allocation through the canal systems.

From the interview, at the head of the Nam Rom canal, famers found no difficulty in exploiting the water. Because the main canal is higher than the field, the common irrigation method is to run water directly from the canals to the farm by gravity.

On the other hand, farmers at the tail-end like in Noong Luong and Sam Mun commune found it very hard to get enough water for their fields. Since the water has to flow for about 20 km long, it takes nearly 20 to 25 days for the water from the head to get the end-tail of the Nam Rom canal. It is the main reason that the famers at the end tail canal have to wait for a long time to get the water for irrigation. Also, water has leaked out through the canals. The farmers in this area always complain that, they do not have enough water timely for the crops. As a result, water allocation seems to be inefficient in Nam Rom irrigation systems, especially, at the end tail of the canal.

3.3. Situation of water deficit at the tail-end area of the NR canal

In the Nam Rom irrigation systems, NL and SM commune are highly affected by water deficit since they are located at the tail-end of the left canal and right canal, respectively. The main time for water shortage is around March and April during the Winter-Spring rice crop. For the area that is irrigated by substitute water sources, success depends greatly on rainfall stored in the lakes. In drought season, over 70 to 90 ha of this area lack of water for irrigation.

Factually, in Sam Mun commune, agriculture is highly affected by water deficit with the area over 300 ha (both field areas below the canals and above the canal). By capacity, this irrigation system only irrigates an area of 274 ha (around 40% of the total cropping area). The other source of water for irrigation, Hong Sat lake, could irrigate around 150 ha (around 22% of the total cropping area). Up to now, for the area lacking water, the famers cultivate dry-land crops like maize for only one season per year. From the interviews, the main reason for water deficit might be inadequate supervision of the water supply for irrigation. Box 1 states some main causes of lacking water for irrigation at the end of Nam Rom canal.

Table 2. Category of irrigation sector at Noong Luong and Sam Mun commune

Category	Noong Luong commune (ha)	Sam Mun commune (ha)
Total field area	354	694
Field area with elevation lower then the canals	244	542
Field area upper the canals	90	152
Area that irrigated by Nam Rom canals	220	274
Area that irrigated by substitute water sources	90	150
Time for water flows from the head canal to the commune (days)	20-25	15-20
Field areas below the canals effected by water deficit	24	270
Field areas upper the canals affected by water deficit	70	70-90
Months with water shortage	March, April	March, April

Source: Dien Bien Irrigation Management Co. Ltd., 2012

Box 1. Reason for lacking water for irrigation

One household in Pom Lot village of Sam Mun commune said: "Since 2008, the policy of irrigation fee exemptions was issued; the water supplies for cultivation are getting worse. Under the policy, the Government has exempted 100% the payment of the irrigation fee by farmers in this area. However, the payment has been directly sent to the irrigation agencies (like DBIMC, etc), Even those who have supplied water but did not care much about the water quality and quantity. Also, in Nam Rom region, it is lack of supervision on how the water is supplied to the farmers and how the water is allocated through the region. Even when we lack of water and have crop failures, there is no support from the authority. For example, this season, (winter-Spring, 2012), I have a bad crop with the yield only 80 % compared with last year. The main reason was that the water deficit lasted for nearly two months. Up to now, my family and other neighbors did not receive any outside help.

Source: In-depth interview with a farmer at PomLot village, Sam Mun commune

3.4. Key stakeholders in NR irrigation systems

Stakeholders are explicitly recognized through their roles. In Vietnam, for the irrigation sector, the Ministry of Agriculture and Rural Development (MARD) is the main executive agency. The rest works in coordination in decentralized roles to ensure the proper implementation of water management for irrigation. The Nam Rom system is under the management of Dien Bien Provincial People's Committee, therefore, the stakeholders are mostly from provincial to local level as follow.

The provincial-district stakeholders[2] include Dien Bien provincial People's Committee (DBPC); (DBIMC); Dien Bien Department of Agriculture and Rural Development; Dien Bien Phu city People's Committee; Dien Bien district People's Committee; Agriculture and Rural Development office of Dien Bien district; and Economic Office of Dien Bien Phu city.

Among the above mentioned stakeholders, the (DBIMC) is assigned to manage and co-

[2] Based on the Decision No. 15/2010: Promulgating the regulations on decentralization exploitation and protection of irrigation systems in Dien Bien province.

operate the NL canal. It is a state-owned enterprise established in the 1960s to manage, maintain and operate water distribution in the Nam Rom canal system. DBIMC is a juridical organization with administrative, financial and managerial authority. DBIMC is responsible for its profit and losses and liable for its debts to the extent of the value of its assets. Every year, its financial capital is subsidized from the DB provincial People's Committee. DBIMC is established to monitor and evaluate the overall operation and performance of Nam Rom irrigation systems in order to regulate water distribution for irrigation and drainage fairly and efficiently in the irrigation system to meet the requirements of agricultural production, domestic use, environment protection and other economic sectors. Also, it executes the management, exploitation and protection Nam Rom canals in accordance with standards and qualification.

At the local community, the involved stakeholders in this system are the agricultural cooperatives; communal people's committee, irrigation groups of the cooperatives, the village chief, and local community. Of these, the agricultural cooperatives interface with the farmers called the 'Water Users' Organisation (WUOs)' in managing water for irrigation at the communal level. It concentrates on managing contracts between the DBIMC and the farmers of the cooperatives in regard to water supply and the payment for the supplied water. From head-works to on farm canals, many secondary and lower level canals are managed and maintained by the cooperatives.

3.5. Stakeholders' interest, behavior and coalition

Interests and behaviors of the stakeholders would characterize their performance within the project or a system. In case of Nam Rom Irrigation system, stakeholders are represented by different interests and social positions, which affect the whole operation of the system. The table below lists all their interests according to the mandates, roles and status.

There is an inter-departmental committee to help coordinate the cross-sector irrigation system from provincial levels to local level in NRIS. Given the context of the case study, conflict of interests among them and overlapping administrative roles are usually reported due to inappropriate institutional arrangements and weakness of rules and laws. DBIMC seems to take all of the responsibilities while the rest are there to monitor, advice and support. The agricultural cooperatives have a strong role in water transmission and canal maintenance at the communal level but their rights and their responsibilities are unclearly defined in terms of irrigation water management.

3.6. Assessment of the importance and influence of the stakeholders

Based on the description and discussion above, the study investigates how much importance and influence the stakeholders[3] have in Nam Rom Irrigation systems. With questionnaires and in-depth interviews with key actors, the study summarizes the following analysis.

From the Figure 2, it is evident that there are four main stakeholders who are either important or influencial in the DBIM. They are Dien Bien provincial People's Committee (DBPC), Dien Bien Irrigation Management Co. Ltd. (DBIMC), Dien Bien Phu city People's Committee, and Dien Bien district People's Committee. There is no doubt for the developing country like Vietnam that stakeholders who are in power are always the influential decision-makers.

[3] MRC (2005) simplifies the relation between the two through identifying four common types of stakeholders.
A. Least influence, most importance (Im>In): They do not have much influence due to their little power especially local communities, but they are the important groups who are more experienced in the local implementation. They are the most critical groups which need to be engaged during the life of the systems.
B. Most influence, most importance (>Im=In): They could be main decision-makers with intensive expertise.
C. Most influence, least importance (Im<In): This will include donors or agencies that have strong influence in planning and finance or mobilization of people. It may include mass organizations. They may represent considerable risk and will need careful monitoring and management.
D. Least influence, least importance (<Im=In): They have a low stake in the system. They may include groups with people who are marginally affected and are project beneficiaries or collaborators. They require only limited involvement in the participatory process.

Table 3. Stakeholders' interests and behaviors

Stakeholders	Mandates	Potential Roles in system	Marginalized/Status	Behavior
Dien Bien provincial People's Committee (DBPC)	To monitor and issue legal documents for irrigation management and solve local problems.	It is to monitor overall operation and performance of Nam Rom Irrigation systems. It subsidies water user fee for farmer.	Local government (follow what is already decided)	Supporter/ mediator
Dien Bien Irrigation Management Co. Ltd. (DBIMC)	To generate, transmit and distribute water throughout Nam Rom irrigation system in Muong Thanh valley. To manage, maintain and operate the Nam Rom canal system	Supply water mainly for irrigation throughout Muong Thanh field.	Government (purchasing and distributing water)	Supporter/ Beneficiary
Dien Bien Department of Agriculture and Rural Development:	To guide and manage the exploitation and protection of irrigation systems. It makes a clear plan for the crop calendar in Muong Thanh field and consults the irrigated area for water fee exemption.	It makes plan for inspection the management, exploitation and protection of irrigation systems	Government (policy formulation and monitoring)	Strategist/ critiques/ and Advocate
Dien Bien Phu city People's Committee and Dien Bien district People's Committee	Responsible for the administration of strategies and planning in the irrigation sector in NR irrigation at the district level.	Monitor overall operation and performance of Nam Rom Irrigation systems and approve plans for the time to discharge water.	Government	Supporter/ Beneficiary/ mediator
Agriculture and Rural Development office of Dien Bien district and Economic Office of Dien Bien Phu city	To give guidance for operation and maintenance irrigation systems in Muong Thanh valley.	Responsible for making a clear plan for the time to discharge water for irrigation through the Nam Rom canal	Government (policy formulation and monitoring)	Supporter/ Beneficiary/ mediator
Commune People's committee:	To manage and operate water irrigation systems as assigned. Protecting the rights of people in the water use.	Responsible for reconciliation the conflict between farmers and DBIMC.	Local Government	Supporter/ Beneficiary/ mediator
The agricultural cooperatives	To manage water for irrigation at the commune level. Manage contracts between the DBIMC and the farmers of the cooperatives in regard to water supply and the payment for the supplied water	It helps to distribute water fairly and efficiently between cooperative members.	Civil society	Supporter/ Beneficiary
Irrigation group of the cooperatives:	To distribute water from the main canal to the field, and organizing dredging the canal bed.	Responsible for irrigate and ensure water from the main canal to the field as required by water users.	Civil society (2 to 3 members)	Beneficiary
Village chief:	To protect rights and responsibilities of farmer in exploiting water for irrigation at the village and organizing the dredging the canal bed.	Inform to responsible stakeholders about irrigation issues and asking for solving those issues.	Local communities (low socio-economic and political status)	Beneficiary
Local communities from Dien Bien Phu city and Dien Bien district	To fully participate in water use	They are the most affected communities if water deficit happened.	Local communities (low socio-economic and political status)	Advocates/ victims/ beneficiary

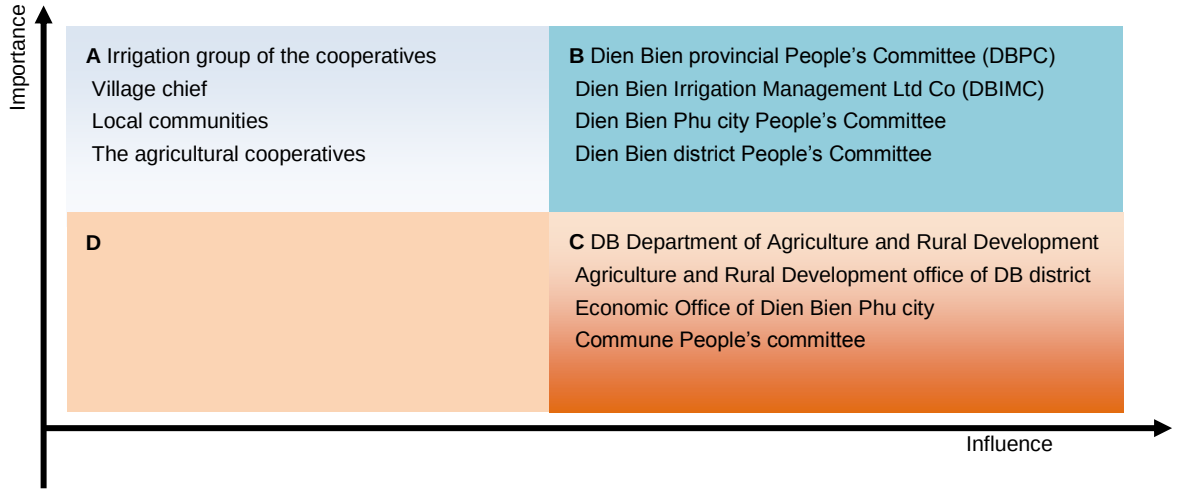

Figure 2. Importance and influence of stakeholder

Note: A (Im>In) = Most Important but Less Influent; C (Im<In) = Less Important but Most Influent; B (> Im=In) = Most Important and Most Influent; D (<Im=In) = Less Important and Less Influent

3.7. Conflict on quantity and quality of water supply in NRIS

In terms of water quantity, it is unequal between water supply for the farmers who live at the head, middle, and end of the Nam Rom canal. Since water flows in NRIS by gravity, at the head and middle of the canal, the water could reach the farm in two to five days. However, at the end, it takes 20 to 25 days before the water runs to the field sites. As a result, in the dry season, water scarcity occurred in several parts of NL and SM commune. Under the laws, water supply must be equal to everyone, and the government supports water fee for all farmers, but, farmers who live further to the canal could not fulfill their demand for irrigation water.

In the same way, water quality is quite different from the head, to the middle and the end of the Nam Rom canal. While the farmers at the head and middle canal are highly satisfied with water quality since it has less garbage, the farmers at the end complained that they are faced with waste in the water used for irrigation. A worker at the DBIMC said that the two main canals run for a total length of around 5 km through the Dien Bien Phu city. Household waste was disposed into the canal by the people who live along the canal as well as waste from around markets.

In fact, Dien Bien Urban Environmental & Construction Joint Stock Company is responsible for collecting garbage in the whole province. However, they just collect the domestic garbage and ignore the garbage in the irrigation system. According to DBIM, the workers of the company had to spend much time collecting waste and garbage. In the management of this irrigation system, water pollution by garbage is the main problem in ensuring quality of water supply. However, the DBIMC alone could not solve this problem. It is important to raise the matter with the main stakeholders like the Dien Bien authorities to take steps on preventing the use of irrigation canals for garbage disposal.

3.8. Conflict raised by water decentralized management and water fee exemption policy[4]

Under decentralization, DBIMC is responsible for maintaining the main canals while the agricultural cooperative is responsible for maintaining farm canals. By the water fee exemption policy, Dien Bien authority supports

[4] Based on Decree 115/2008, detailing the implementation of the Ordinance on Exploitation and Protection of Irrigation Systems

maintenance costs through a payment to the DBIMC, but the agricultural cooperatives have not received anything from the government for maintenance and management of the farm canals. For the expense, the cooperatives have to collect the extra water fees from farmer[5].

In the same manner, there is a shifting power since the implementation of water fee exemption policy. Before this policy, the agricultural cooperatives and Commune People's Committee collected the water fees from farmers and paid them directly to DBIMC. As a result, they took a strong power in negotiating the water supply with this company. Since the changed policy was implemented, DB authority reimburses for the expense caused by the operation and management of the DBIMC. In this sense, DB authority holds the dominant bargaining position and supervision of this system. It can be said that, strong power is held by DB authority although they paid less attention on water supply. On the other hand, agricultural cooperatives have less power and supervisory roles even though they have a strong vested interest. From the interview, the recommendation should strengthen the role of agricultural cooperatives in supervision of water supply for irrigation of the whole system.

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions

There is a growing competition for water use in both quantity and quality for irrigation among different users at the head, middle, and end of the Nam Rom canal system. While the famers at the head and middle of the canal have enough water for irrigation with less garbage, the famers closer to the end face water deficit and dirty, polluted water as well.

Key stakeholders including Dien Bien provincial People's Committee (DBPC), Dien Bien Phu city People's Committee, Dien Bien district People's Committee are responsible to distribute water from the main canal to the fields of the member cooperatives, however, there is unequal water supplies between famers both at the head and the end of the canal.

The civil societies together with agricultural cooperatives and local communities have less power in monitoring and reporting to the government and the irrigation company. Farmers have little voice in system management and reporting the difficulties in irrigation since they are using water free of charge. While the cooperatives have strong responsibility for water allocation at the community level, their rights and duties are unclear in terms of influencing policy and guiding decisions that affect them.

4.2. Recommendations

Coordination and communication processes of the key stakeholders, agricultural cooperatives, and farmers in the whole region should be improved. Annually, the Dien Bien authority should conduct a report to get good feedback on water distribution for irrigation from the agricultural cooperatives, especially, feedback from the cooperatives and famers at the tail-end of the canal;

The provincial authority should create an adequate supervision agency to regulate management and operation of the whole irrigation system. Also, they should share power or strengthen the role of agricultural cooperatives in negotiation of water supply with Dien Bien Irrigation Management Co. Ltd.. To help farmers and agricultural cooperatives strengthen their management capacity in irrigation, regular meetings should be conducted. The meetings would include the DB authority, agricultural cooperatives, irrigation groups and some famers who are elected from the tail-ends of the canal. Their voice could provide evidence to improve irrigation water management.

To prevent the use of irrigation canals from garbage disposal, public education should be undertaken to make urban residents aware

[5] The extra water fee following the Decision no13/2010, issued the decision on irrigation charge, water fee for irrigation in Dien Bien province.

that this practice pollutes their food. The strong regulations on rubbish dumping should be developed.

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