Impact Assessment of Irrigation Channel on Household Food Security: A case of small scale paddy farmers in Ugyentse Geog, Bhutan



A Research project Submitted to Van Hall Larenstein University of Applied Sciences in Partial Fulfilment of the Requirements for the Degree of Master in Management of Development, Rural Development and Food Security

By

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This piece of work is dedicated to my husband *Mr*.*Kunzang Tharchen, daughter Tshering Gaki Paydoen, my parents, brothers and sisters.* I thank you all for your blessings and support.

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ABBREVATIONS

- AAEO Assistant Agriculture Extension Officer
- AMC Agriculture Machinery Centre
- AWP Army Welfare Project
- BDFC Bhutan Development Finance Corporation
- CNR College of Natural Resources
- DAO Dzongkhag Agriculture Officer
- DE Dzongkhag Engineer
- DOA Department of Agriculture
- DYT District Yargay Tshogdue (District Development Committee)
- GYT Geog Yargay Tshogchung (Block Development Committee)
- IA Irrigators Association
- MoAF Ministry of Agriculture and Forest
- NIP National Irrigation Policy
- NIA National Irrigation Administration
- NSB National Statistical Bureau
- Nu Ngultrum (Bhutanese currency)
- RGoB Royal Government of Bhutan
- RUB Royal University of Bhutan
- WUA Water User Association

GLOSSARYOF BHUTANESE TERMINOLOGIES

Baeshey Keth - Many wet land Beach Kulo – Middle Irrigation Channel Chiwog – Territorial constituency for the election of Tshogpas to the Geog Tshogde Chu shing – Wet land Drungkhag - Sub - district Dzongda - Chief administrator of a district Dzongkhag - District Dzongrab – Deputy Administrator of a district Geog – Block, smallest geographic unit of administration Gup – Geog head, elected representative for five years Hajira - Wage Kulo – Irrigation Channel Lag Thram – Deeds of Land Title Lajab – Work Supervisor Parma – Customary labor exchange system Pati – Unit of measurement in Lho tsam Kha Pheth Kulo – End Irrigation Channel Seran Kulo – Top Irrigation Channel Tshogpa - Representative of a village or several villages on the GYT Zomdoo – Village meeting

MEASUREMENT

1pati = 2.5 kg 1muri = 50 kg

ABSTRACT

This thesis studied the impact of the Seran Kulo irrigation channel on the food security of the beneficiaries' household in Ugyentse Geog under Samtse Dzongkhag. The study area has irrigation channel constructed with financial support from the Royal Government of Bhutan (RGoB) in the year 2006. The irrigation development has two main components, the irrigation technology and the institutions to manage the technology. The study investigated on the type of participation by the beneficiaries in different stages of the project. The study focused on operation, maintenance, and usage of the irrigation channel by the members of the Water User Association (WUA) and beneficiaries of Seran Kulo before and after construction. These are linked to understand the food security of beneficiaries taking into consideration paddy yield, rice self-sufficiency and accessibility to rice before and after the construction of irrigation channel.

To achieve the research objective, qualitative case study approach was used with topic list to interview 24 beneficiaries (21 males and 3 females) and 6 stakeholders (5 males and 1 female) of the project. The topic lists were pre-tested with two non-beneficiaries of the same geog. Data analysis is based on issues raised by majority of respondents, subjective decision of researcher, observation, comparing of data from person to person and based on use of criteria on land ownership, land cultivated.

The findings from study show that level of participation by beneficiaries' were both functional and passive during different stages of project. After the improvement of channel, beneficiaries continued to practice traditional system of operation and maintenance of channel. The WUA formed by government officials was non-functional due to weak leadership of WUA and poor cooperation among beneficiaries that negatively affected mobilization of funds for repair of the channel. Only half the volume of water at the source reached the field due to poor repair works of channel after construction. Paddy yield increased for the farmers whose fields were located at the top and middle after improvement of irrigation channel. Lands especially located at the tail-end were left fallow by households due to inadequate water available from channel and also shortage of labour in the village. Beneficiary households which had access to water from channel and has enough households. Households with insufficient rice through paddy production depended on cash income from on-farm, non-farm, cash crops and remittances to buy rice from market.

The author recommends proper monitoring system to be developed by Samtse Dzongkhag, capacity building for Agriculture Extension officers in group formation and basic engineering knowledge; focal person in irrigation to be stationed at Dzongkhag level to better facilitate irrigation works. Further, budget for skilled labour should be transferred to geog administration for fast disbursement of wages. The geog administration and AEO should understand the gaps in non – functioning of association and accordingly restructure existing Water User Association.

Key words: Irrigation channel, Participation, Household, Water User Association,

Food Security, Rice Self Sufficiency

CHAPTER 1 INTRODUCTION

This chapter includes country background, problem statement, research objective, research questions and guide to reader.

1.1 Country background

Bhutan is a small, landlocked and mountainous country with an area of 38,394sq.km. It is located between China in the North and India surrounding Southeast and Southwest. The country stretches to a maximum of 300 km in East-west dimension and 170 km in North-south dimensions. 72.5 % of the land is covered by vegetation with altitude ranging from 150 m to more than 7000m above seas level. The climate varies from hot humid in the South to temperate in the North. The average precipitation in temperate regions is around 1000 mm and 7800 mm per year in the subtropical South(National Statistical Bureau, 2010).Plain land is limited to broad river valleys and towards the southern foothills of the country. The country has a population of 672,425 of which 69.1% (NSB, 2007) are settled in rural areas. Agriculture land consists of 2.93 % of the total land of which 27.86 % is utilized for rice cultivation (Ministry of Agriculture and Forest (MoAF), 2011).

Figure 1: Location of Bhutan



map/bhutan-map

Bhutanese economy is one of the smallest and the least developed in the world. It is based on agriculture, forestry, tourism and sale of hydro-power to India. Industrial sector is at a nascent stage. Agriculture and forestry provide the main livelihood for more than 60% of the population. Agrarian practices consist largely of subsistence farming and animal husbandrv. The economy is closely associated with India through strong trade and monetary links, dependent on India's financial assistance. Bhutan's inflation rate was estimated at about 4.3% in 2008. Bhutan has a Gross Domestic Product of around USD \$3.526 billion (purchasing power parity), with annual per capita income around \$5,000 (CIA, 2010).

1.1.1 Food Security and Rice Self-Sufficiency in Bhutan

There is a paradigm shift in the objective of Food Policy of Bhutan from food self-sufficiency to food security. The Bhutan National Food Security Strategy Paper published in 2007hasgivenmore emphasis on food security, in which the ability to access sufficient food by the household is expected to be met from import or locally produced staple food(Peljor and Minot, 2010; Wangchuk, 2010). The objective of the Ministry of Agriculture and Forest for the 10th Five Year Plan is to enhance food security by increasing food production and access through enhancement of cash income of rural population. Shrestha (2004) reported that rice cultivation is one of the main activities for rural economy in rice growing areas in Bhutan. Increased rice productivity has improved access to cash income for the households. Rice is the most preferred crop by the Bhutanese with high demand from rising population, increasing income and rapid urbanization. Bhutan consumes approximately 100 thousand tonnes of rice annually and half the demand is met through import from India (Peljor and Minot, 2010). Therefore, the country aims to achieve 50% food self-sufficiency through domestic rice production (MoAF, 2011).

Generally, productivity of rice depends on physical inputs such as seeds, fertilizers, agrochemicals, irrigation water, land, and labour. Ghimiray et al. (2007) mentioned that to increase rice yields and address food security issue, these essential inputs need to be ensured with easy access to growers in Bhutan. Water for irrigation is a very critical input for rice cultivation but rice cultivation in Bhutan is dependent on monsoon rain which is unreliable. The inadequacy of water supply is a predominant constraint for paddy cultivation in southern foothills in Bhutan (Ghimiray et al., 2007). This region lacks proper irrigation infrastructure or the existing ones are non-functional. Despite regions' potential to increase rice productivity, lack of proper irrigation infrastructure and unreliable monsoon rain are attributed to low rice yield compared to mid altitude rice growers in Bhutan.

1.1.2 Irrigation in Bhutan

Irrigated agriculture in Bhutan is equivalent to paddy cultivation, which is grown seasonally from summer to autumn period depending on the agro-ecological zones of the region. Traditionally, farmers have chosen to grow paddy in areas that have access to water for irrigation below 2600m. For centuries irrigation has been practised by Bhutanese farmers. There are three types of irrigation schemes in Bhutan based on their origin; indigenous irrigation system, assisted farmer initiated irrigation system and Government assisted irrigation system. Irrigation schemes are small scale covering less than 100 ha (Kundell, 2007). The indigenous irrigation system has its physical structures constructed by mobilizing local community for labour and building on locally available resources, often temporary in nature (Bruns, 1993) and managed by beneficiaries community (Dorji, 1989). It was observed that construction, operation and maintenance of indigenous irrigation schemes as a cooperative venture involving organization. At the village level, the beneficiaries elect one of their peers to supervise the operation of the system, to achieve equitable water distribution and to organize maintenance of the system (ADB report 1985 cited in Pradhan 1989). In the assisted farmer initiated irrigation, farmers construct the irrigation system while governments' role is to provide financial and technical support. In the case of government assisted irrigation system, construction is under government assisted programmes but operation and maintenance of all these three systems are performed by farmers (Kundell, 2007).

Development of government assisted irrigation systems in Bhutan commenced in the late 1960s and early 1970s, in which Irrigation Division under the Department of Agriculture aimed to existing irrigation system in the country. Prospective systems for improvement were identified by the district level committee. Once it was approved by the committee, the Irrigation Division provided with technical survey and design. The constructions funds were supported with assistance from government via donor agencies and unskilled labour contribution for renovation works from the community without remuneration (Pradhan, 1989; Dorji, 1989).While management remained with the users, operation and maintenance were supported with yearly budget allocation from the government till 1981. However, government continued to provide financial assistance for major renovations for damages due to natural disasters such as landslides and floods (Kundell, 2007; Pradhan, 1989). There is no clear distinction in literature that indigenous irrigation system received any assistance for improvement from the government. Since improvements in irrigation systems were carried out based on the request put forward to the district committee by the irrigator organization. It is assumed that the indigenous irrigation system was included for assistance.

Dorji (1989p. 273) mentioned that "apart from the labour contribution provided by the beneficiaries no real consideration had been given to formalizing their involvement in implementation of schemes". The small scale nature of irrigation in Bhutan made government to realize the importance of participation of beneficiaries in irrigation development. The National Irrigation Policy (NIP) 1992 was drafted to achieve the participation of beneficiaries in operation and maintenance of government assisted irrigation schemes. The policy emphasized on strengthening local institutions and the formation of Water User Associations. It was initiated to enhance participation and inculcate a sense of community ownership

among beneficiaries in construction, renovation, operation and maintenance of irrigation channels. In Bhutan the WUAs are village based to have local level institution and maintain simplicity in management of irrigation. To receive government assistance for irrigation development, formation of WUA is a pre-requisite in water sector in Bhutan (Yeshey and Bhujel, 2006). However, for more than a decade government induced WUAs in Bhutan were non-functional and inefficient. This is clearly reflected in the revised draft Irrigation Policy (Department of Agriculture (DoA), 2010). This inefficiency was attributed to poor organization within the existing associations and inadequate support by Department of Agriculture in capacity building.

Ugyentse Geog of Samtse Dzongkhag received support from the government for renovation of irrigation channel. The management was transferred to the beneficiaries after formation of WUA. So far no studies have been conducted in the area on operation and management by the beneficiaries and functioning of WUA. Therefore, it is rational to investigate the management of irrigation channel by WUA members and beneficiaries in Ugyentse Geog after the project and its contribution to household food security.

1.2 Problem statement

The Engineering division of Department of Agriculture (DoA) under Ministry of Agriculture and Forest (MoAF) had constructed an irrigation channel benefiting thirty households of Ugyentse Geog under Samtse Dzongkhag in the year 2004. The project was funded by the Royal Government of Bhutan (RGoB). However, the impact of this irrigation project in terms of the sufficiency in paddy production and management of irrigation channel for water distribution, maintenance and functioning of WUA has not been assessed so far.

Therefore, the Agriculture Sector of Samtse Dzongkhag put forth the need to conduct an impact assessment study of the irrigation channel to the beneficiaries. The study broadly covers impact assessment of the irrigation channel on the paddy production at household level. Finally, this study reflects on the participation of beneficiaries at different stages of project and in management of irrigation channel within the context of water distribution, maintenance and usage leading to household food security.

1.3 Research objective

To make recommendations from the study to Samtse Agriculture Sector for other irrigation projects in the Dzongkhag to be implemented within the 10th Five Year Plan (2008 – 2013) by assessing on management of irrigation project and its contribution to household food security.

1.4 Research Questions

To what extent has the Seran Kulo in Ugyentse Geog contributed to the household food security?

Sub questions:

- > How did beneficiaries participate at the inception and other phases of the project?
- > How is the irrigation channel managed by the beneficiaries and stakeholders?
- How does water user association function?
- > How has improved irrigation scheme influenced the paddy production?
- > How did the irrigation scheme improve the accessibility to food?

1.5 Guides for readers

This research report consists of following chapters 1) Brief introduction to background of Bhutan is presented. Irrigation systems, food security and food self-sufficiency topics in Bhutan are discussed. 2) This chapter is on literature review which consists of four sections. In first section, the indigenous irrigation system and government controlled irrigation system is compared and discussed. The second section is focused on the participation, ownership

and management of these systems. The third section is on the local institution in irrigation system and fourth is the effect of government controlled irrigation system on management, rice production and food security. This chapter also consists of conceptual framework and operationalization of concepts with figures presented. 3) The research methodologies consist of justification for selection of study area, access to study area, sampling technique. Further it includes data collection method, data analysis, informed consent, challenges and limitation of research. 4) This chapter briefly describes about the Samtse Dzongkhag and the Ugyentse Geog. 5) & 6) Results on participation of beneficiaries in Seran Kulo renovation, water availability, paddy production is described followed by discussion chapter (7). Finally, conclusion and recommendation from the study is presented.

CHAPTER 2 LITERATURE REVIEW

Two types of irrigation systems; indigenous and government controlled irrigation systems are used for this study to understand participation and ownership of users. This chapter has four sections focusing on the influence of participation and ownership of the users on the water distribution and maintenance of indigenous and government controlled irrigation systems. The management of irrigation system by local institutions in the form of Irrigators community and Water User Association are discussed. Finally, the section consider on the effects of government controlled irrigation system on management, crop productivity and selfsufficiency.

2.1 Indigenous versus government controlled irrigation systems

Indigenous irrigation has been practiced for more than 6000 years in many parts of the world. Such practices were found along fertile river basins in Mesopotamia, the Nile, and the Indus Valley to name a few. Those era farmers witnessed increased crop productivity, produced more than their subsistence. It was achieved from harnessing river water by construction of irrigation channels; drainage structures; check dams and small tanks for water table recharge (Maloney and Raju, 1994). The construction of irrigation infrastructures were from the locally available materials of the community. These were systematically operated and managed by organized societies through labour division, law formulation and political hierarchies (Bjornlund and Bjornlund, 2010). For instance, the indigenous system of irrigation in Bali existed more than 1000 years ago, using the community-based water management approach for its intensive rice cultivation (Suarja and Thijssen, 2003). The system exhibits a unique combination of remarkable engineering works and complex social structures.

Merry (1996) describes that generally, in developing countries government controlled irrigation systems are relatively large compared to indigenous systems. The performance of government controlled (bureaucratic) irrigation systems were found to be considerably low compared to indigenous systems (Meinzen-Dick, 2007; Merrey, 1996). This statement is supported by comparative analysis study of indigenous and government controlled irrigation systems in Nepal. In which, performance was measured through cropping intensities, water availability and technical efficiency of these systems (Merrey, 1996). The lower performance of government controlled irrigation system can be attributed to the focus of government agency on development of the concrete physical infrastructure with the modern technology undermining participation, local knowledge and culture of the users (Kissawike, 2008).

Further, Lam and Ostrom (2009) found that water availability in irrigation channel is not only determined by the technical efficiency of the engineering infrastructure but proper management of delivery process with timing of demand for water complements water adequacy. This statement is supported in evidence from impact study of WECS/IIMI intervention in irrigation systems of Indrawati watershed in Nepal conducted by Lam and Ostrom (2009). They write that deterioration of physical structures of irrigation system did not accompany decrease in water adequacy. It was suggested that even with improvement in physical structures, collective action of users and good management practices were required to increase water adequacy. Such practices would be difficult to achieve without ownership and participation of users in management of irrigation system

2.2 Participation and ownership in irrigations systems

The literature provides several definitions and concepts of participation, which are stated as follows: Westergaard (1986) defined participation as "collective efforts to increase and exercise **control** over resources and institutions on the part of groups and movements of those hitherto excluded from control".

Paul (1987) describes participation as an active process by which beneficiary **influence** the direction and execution of a development project with a view to enhancing their wellbeing in terms of income, personal growth, self –reliance or other values they cherish.

The concept of participation as described by Oakley (1991) is a process that unfolds over the time and whose purpose is to develop and strengthen the capabilities of rural people to **intervene** more directly in development intervention.

Thus, the concept of participation for this study will be as an active process to develop and strengthen the capacity of people to intervene in development interventions. The beneficiaries play an active role to influence the direction and execution of development projects and have control over resources and institutions to enhance their income, personal growth and self-reliance.

In indigenous irrigation system, farmers participated with self-mobilization for labour and also in mobilization of local materials for construction and maintenance of irrigation structures. The participation was found to be deeply rooted and interwoven into the culture and tradition of the community (Groenfeldt, 1991). Farmers participation and ownership over the indigenous irrigation system were proven to be productive and manageable and durable having used for centuries (Groenfeldt, 1991). The example could be cited from community organization (Subak) irrigation system in Bali. In this system the construction and maintenance of irrigation structures, water distribution, coordination in planting, organisation of ritual offerings and festivals were carried with equal responsibilities and participation by members (Suarja and Thijssen, 2003). Other examples are the tradition of community labour in Sri Lanka which is carried out with religious association of service and duty; the annual mobilization of labour to repair the diversion weir across the river and cleaning of canal in northern Thailand (Groenfeldt, 1991).

The irrigation systems during 1950s and 1960s were dominated by government intervention and required centralized control. In government controlled irrigation systems, water was a strategic resource whose ownership and control was with the government agency. The principle actor in those irrigation schemes were the government and their agencies, who performed the role in planning, design of system and delivery of water to farmers. The farmers were passive beneficiaries who used water for cultivation of crops (Meinzen-Dick, 1997). Farmers rarely felt ownership and responsibility (Maloney and Raju, 1994) in government controlled and managed irrigation systems.

In the case of Asia, government agency has the overall ownership, financial responsibilities and control over water resource, reservoirs and the canals. The WUA formed are given responsibility for operation and maintenance (O&M) of lower level irrigation canals. The control of authority remained with the agency staffs at tertiary level and lacked mutual accountability between the staffs and farmers. The management by agency staffs are driven by economic incentives and are often unaware of field situation. Besides, the system is typically bounded with inflexible operation rules (Coward, 1980). Failure in efficient operation and maintenance of government controlled irrigation was recognized as the lack of incorporation of farmers' local knowledge and experiences in decision making (Kissawike, 2008), poor understanding of their priorities (Cifdaloz et al., 2010). The negligence of farmer's participation in contribution to construction, O&M and further development of irrigation(Bruns, 1993; Oakley, 1991) were also attributed to inefficient management of government controlled irrigation systems.

Meinz-Dick (1997) concept of ownership in irrigation system is a combination of rights and responsibilities and is based on investment in capital costs, and commitment to bear full recurrent costs for property. Consequently, it provides greater control over the property

(water, structures, and equipment) and rights to earn income utilizing the irrigation system, which improves incentives for management.

Generally, government claims ownership of both facilities and rights in irrigation system and farmer ownership is found in indigenous systems. Ownership of farmers in government controlled systems has been unrecognized. Accordingly formal recognition is incorporated in many turnover programs through transfer of formal rights from the government to farmers' organizations after the commitment of users to be responsible for expenditure on management of irrigation system (Meinzen-Dick, 1997). Lesson from past experience with subsidies has made to realize the agency that government controlled irrigation systems were unsustainable and fee collection from the users would support participation through ownership. When budgets are linked to farmer contributions rather than government allocation, the agency is more likely to develop a service orientation and value farmer participation. Without such structural changes in the implementing agencies, participation becomes an extra responsibility, which will not receive attention beyond project completion (Meinzen-Dick et al., 1995).

In the mid-1970s, the world witnessed paradigm shift of development intervention and a move towards participatory approach (Meinzen-Dick, 1997; Oakley, 1991). The participatory approach in Philippines was to promote farmer satisfaction with the physical facilities and to strengthen irrigation organizations; which later was expected to be managers of the new or improved systems (Meinzen-Dick et al., 1995). This approach was expected to change the nature of development intervention and benefit the position and interest of beneficiaries.

Participation of beneficiaries and control of operation and management (O&M) in irrigation systems became a major component of policy in irrigation development and reform. The participation in government irrigation system were induced, from Participatory Irrigation Management with input of farmers as a supplement to agency management to Irrigation Management Transfer, in which farmers were given full responsibility for O&M of specific unit of system. Meinzen - Dick (1997) discusses in his work, one of the best documented evidences of induced participation in government controlled irrigation system of the Philippines in 1976, where Ford Foundation-supported pilot project to work with the National Irrigation Administration (NIA) to transfer responsibility, ownership and management of irrigation systems to Irrigators Associations (IAs). In this project, trained community organizers were employed by the agency to work with farmers to facilitate local action. Moreover, financial contribution were collected from farmers for O&M (Shashidharan, 2000) to ensure ownership and better management of system. In few instances, there are involvement of farmers in decision making (Oakley, 1991) and transfer full ownership rights and responsibilities to farmers' organizations (Meinzen-Dick, 1997). During participation by farmers, the most effective participation to be attained required cooperation among farmers of the community using the common resource (Meinzen-Dick, 1997; Coward, 1980). Such cooperation required involvement of a catalyst, either in the form of local leader or external agents to bring farmers together and forging agreements (Meinzen-Dick, 1997).

When users themselves managed the irrigation system, they were responsible for the operation and maintenance of irrigation infrastructure. The users participated in regular maintenance of channels improving the management. The efficiency of the irrigation system enhanced bringing in equal distribution of available water and increasing crop productivity. Similarly, the indigenous irrigation systems in India were efficient and productive with systematic management of the system by the farmers. where high level of productivity was achieved relative to productivity achieved during the era of Green Revolution (Bjornlund and Bjornlund, 2010). Besides, higher performance of irrigation system in government controlled is felt to be achieved with devolution of irrigation management through formation of local institution such as water user association (Vermillion, 1999). Which is believed to encourage participation and ownership of users in government controlled irrigation system.

2.3 Local Institutions in indigenous irrigation systems and government controlled irrigation systems

Institution is referred as concept associated with "ideal behaviour and expectations and used to guide patterns of social behaviour. The actual patterns of social behaviour and interaction are observed in any humans which is the social structure" (Groenfeldt, 2006). Institution is composed of two elements; the role expectation and role performance. Roles enhance to predict the actions and reactions of others and enable social patterns and social organization to emerge. Social organization such as WUA in a large scale irrigation system is formed at the community level. It is defined as a "group of water users who use the same irrigation canal or ditch, and it facilitates the equitable water allocation and maintenance at canal and ditch levels"(Coward, 1980).

According to Burton(2010) management is defined as "the organized use of resources, in a given environment, for the planning, operation and monitoring of certain tasks to convert inputs into outputs according to objectives".

Irrigation community (IC) and Water User Association (WUA) terminology will be used to distinguish local institution for indigenous and government controlled irrigation systems respectively.

In the irrigation community the tasks are systemically related to each other, and to the roles that are performed. The leaders are committed to provide their services to farmers and have clear charter of authority for leadership roles and are accountable to the farmers(Hunt, 1989). Strong leadership is found to have huge impact on the collective action of the users that enhances the proper operation and maintenance of irrigation system(Lam and Ostrom, 2009). The irrigation community is responsible for the overall O&M of the system. Thus the irrigation community has control over water and management of irrigation system. In this system, every sub-unit is strongly and directly articulated to other sub unit. Any complaint a subunit might have is taken to authority, responsible to consider the complaint fairly and quickly. In irrigation communities articulation of one level with another is explicit and close and is integrated with accountability of the leadership (Hunt, 1989).

The collective action required in irrigation for complex management functions is evident in the irrigation communities in various ways. The solutions to management problems however, are unique to each indigenous system, depending upon the particular social-cultural traditions, the particular physical setting, and the particular individuals concerned (Groenfeldt, 1991). The management roles in indigenous systems involving Irrigation Community, can be observed in the water master (velvidane) in Sri Lanka who enjoys customary rights to a share of the harvest in return for fulfilling his duties in distributing water to the users and tending to system maintenance (Groenfeldt, 1991). Further, the distribution of water for indigenous systems differed based on its availability and the user community (Cifdaloz et al., 2010). Example in Pumpa Irrigation system in Nepal, water distribution system is based on the proportion of land owned by users. When water is in plenty, distribution is on continuous flow basis but during scarcity distribution is based on time following rotation from head to tail. But in other irrigation systems in Nepal rotational water distribution system is practiced during monsoon for paddy cultivation, receiving water shares based on size of land holding.

The most frequently needed management function in indigenous irrigation systems is labour mobilization. Particularly where streams are prone to flooding, the canal needs repairs, cleaning, and a repair of earthen dams or sluice gates before the cultivation begins. Farmers contribute labour in construction and maintenance of their irrigation systems. The maintenance of irrigation structures differed based on the location and situation of the communities. According to Berg (2008) in Nepal, maintenance activities are carried through

collective labour input depending on the agriculture cycle for regular and emergency maintenance. Labour mobilizations were either based on each household's size of land holdings or commitment of each household to send one representative or head of household for the work. Their involvement is part of their community life and fits in with a complex set of economic, social and often kinship relationships linking them with their fellow farmers and with the leaders who are managing the irrigation system (Groenfeldt, 1991).

Government agency is of the opinion that solution to unequal water distribution, inadequacy in water, and declining crop productivity is participation of farmers and forming a social organization such as Water User Associations (WUAs). The perception of government agency is farmers are unorganized and need to be organized under this social organization to contribute in O&M of irrigation system (Meinzen-Dick, 2007; Hunt, 1989; Coward, 1980). Meinzen-Dick (2007) argues the need for institutions because of interconnected nature of the hydrologic cycle, where water need to be shared among users and use by one person generates externalities for others especially during water scarcity. So, need to increase the productivity of water was required with better governance, institutional and policy reform. Meinzen-Dick et al.(1995) supported that in irrigation development policies and reforms, group formation by farmers for control of irrigation system was a major component. These WUAs are induced by the bureaucrats in government controlled irrigation system. It was expected to reduce the operating costs of government agency that controls the system and utilization of scarce resource. Moreover, free – riding behaviour of some members was expected to be eliminated (Hunt, 1989).

The association induced by government has no evidence of being able to achieve the integration like that of the indigenous irrigation system. There is no articulation between the association and agency controlling the system. More emphasis is given to the physical infrastructures than the maintenance and distribution of water to the farmers (Hunt, 1989; Chambers, 1988). The WUAs in Philippines in the NIA had made effort to organize the association and farmers. This agency has found to make concerted effort in bureaucracy, neglecting farmers in the system (Hunt, 1989).

Moreover, this initiative of government to induce association at local level was done to full fill bureaucratic needs to control over irrigation. This act is often observed to make the farmers of irrigation association managerially dependent, ineffective and at worst, to erode local collective action or so called 'erosion of the autonomous functioning of village management systems (Mosse, 1999). The effect of government intervention is evident from the dissolution of traditional institutional arrangements in tank irrigation system in Tamil Nadu. In which, after the collapse of traditional institutions during the colonial period in India, WUA formed after Independence lacked ownership leading to ineffective management of the system (Mosse, 1999). The effects of WUA formed by government agency on management and food productivity will be discussed further in following section.

2.4 Effects of government controlled irrigation on Management, Production and Self-Sufficiency

The intensification of agricultural practices with modern irrigation infrastructure in government controlled irrigation systems have been focusing more on physical structure, which has reduced agricultural productivity, affecting food security and the collapse of age old management systems (Bjornlund and Bjornlund, 2010). For instance, after the introduction of Green Revolution by the government in Indonesia, production increased initially with intensive use of water by ignoring the subak (social organization) irrigation system. However, this brought about disruption in the tradition of the subak organization resulting in gradual decline in production adding up cost due to water shortage and pest infestation (Bjornlund and Bjornlund, 2010).

In India after independence, government showed little interest in development of existing traditional irrigation systems promoting the construction of large structures and exerting control over resources from the institutions of local communities. To promote use of new structures, subsidies in various forms were provided to farmers decreasing the usage of old irrigation structures, inhibiting community ownership and disrupting the traditional management system within the communities of indigenous irrigation system (Bjornlund and Bjornlund, 2010). In the case of Bali, government intervened with the construction of dams and combined the individual irrigation system into one irrigation scheme. Such interventions were carried out without consultation with farmers/members of subak in the project planning period. This brought in conflict between the farmers of individual irrigation systems (Sutawan, 1989).

Financial investment by Government and Aid agencies in development of irrigation system had focus on physical structures undermining the importance of local institutions(Chambers, 1988). It was believed to improve the agricultural productivity ignoring the potential disruption of mutual dependencies and reciprocal relationships among farmers in the community (Ostrom and Gardner, 1993). Moreover, services delivered from government implemented irrigation projects were not satisfactory. Where, government support in construction of concrete irrigation infrastructure brought about unequal distribution of water, and inadequate water supply.

Hunt (1989) pointed out that poor management with unequal distribution of water and inadequate water supply in government controlled irrigation system is due to gap created in physical infrastructures and social relationship between the government authorities and the farmers. Where, bureaucracy pay little attention to farmers field in providing proper connection of canals in distribution and no involvement of farmers in planning and design of system. In consequence, farmers closer to the main canal get more water than the others resulting in less equity in distribution of water among farmers and crop productivity lower than its potential.

The water availability and food security are interconnected issues which is critical on the livelihood of rural people. Water availability contributes to achieving food security by influencing the food production processes (Loe and Bjornlund, 2010; Datta, 2000; Chambers, 1988). Food Security is defined as "it exists when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 1996). The unequal water distribution and inadequate water supply is evident that normal agriculture production practices of crops are interrupted, decreasing yield and ultimately, creating threat to food production and food self sufficiency of community (Datta, 2000). The yield will be in particular affected in paddy because; adequate water requirement through irrigation is synonymous to paddy production.

According to Pike (1995) low agriculture productivity especially of paddy in India has been mainly attributed to poor water management practices, low level of maintenance of the canals and inefficient distribution of water among the farmers. The Irrigation Sector in India gave more emphasis on the infrastructural improvement of the irrigation system, neglecting the management resulting to poor ownership for irrigation systems among the farmers.

2.5 Conceptual Framework





Source: "Self field work" (2011)

The conceptual framework as shown in fig. 2 gives the outline of the study. It illustrates that participation of beneficiaries in different stages of irrigation project influences the ownership of the irrigation channel by the beneficiaries. During the project, they participate in planning, design and construction of the channel. Furthermore, when beneficiaries exhibit ownership for the channel, they also participate in operation and maintenance of the channel. Such collective action among beneficiaries contributes to better management of the irrigation system. The negligence of farmer's participation in these activities resulted to inefficient management of irrigation system (Bruns, 1993; Oakley, 1991). For a better management of the irrigation system, participation and ownership of the irrigation channel by beneficiaries was very important. In the case of indigenous irrigation system, farmers participated with self-mobilization for labour, local materials for construction and maintenance of irrigation structures. The participation was found to be deeply rooted and interwoven into the culture and tradition of the community (Groenfeldt, 1991).

Further, for proper management of the irrigation system, association in the form of WUA were formed. The WUA were responsible for management of the irrigation system with the participation from the users. Hunt (1989) pointed that improper management and unequal distribution of water attributes to lower productivity of crop that affects the food self-sufficiency and food security of household.

To further make the conceptual framework clear, concepts such as 'participation' and 'food security' are operationalized with indicators as shown in fig. 3 and fig. 4. These indicators were used in developing topic lists for the interview. Later these indicators are used to describe and discuss in findings and discussion chapters. As shown in fig. 3 food security has four dimensions, i.e, food availability, food accessibility, utilization and stability. Due to limitation of time for study, food availability and food accessibility are considered for the study. In this case study, the concept of availability of food refers to paddy production and capitals; accessibility to the economic access of paddy. The indicators for these two dimensions were

used to get insight on paddy production and economic access to rice by the beneficiaries before and after the improvement in irrigation channel.

The indicators for both the concepts that are in bold letters are used in results and discussion that are presented in chapters 5 and 6 of the report.



Figure 3: Operationalization of Food Security

Source: "Own field work" (2011)

Note: Some of the indicators in the Operationalization of 'Food Security' and 'Participation' concepts are repeated as they are interlinked between dimensions of the concepts.

Figure 4: Operationalization of Participation



Source: "Own field work" (2011)

CHAPTER 3 METHODOLOGY

This chapter includes the description and justification of selecting the study area, access to study area, sampling technique and method of data collection. Further, this chapter also describes data analysis, challenges encountered, limitation of the study and informed consent.

3.1 Justification of study area

The study was conducted at Ugyentse Geog in Samtse Dzongkhag. The Dzongkhag was selected because of my networks that could help me in collecting necessary information and conducting interviews during data collection from the geog. In the Dzongkhag very few irrigation channels are supported by government. The one in the chosen geog was suitable for the study.



Figure 5: Bhutan map showing Samtse Dzongkhag and Ugyentse Geog

To address irrigation shortage and lower dependency on rain, Samtse Dzongkhag has constructed three irrigation channels with financial support from Government and donor agencies. The irrigation channel in Kuchidaina of Yoeseltse Geog has been under operation for a year and prospect to gather in depth insight was minimal. The second channel located under the same geog is not functional due to unequal distribution of water for the tail users attributed to technical default during construction. Therefore, Ugyentse Geog was selected as the area for the research study.

Source: Rai, A (2011)

The Seran (Top) Kulo (Irrigation channel) was constructed with financial support from Royal Government of Bhutan (RGOB) in the year 2004 during the Ninth Five Year Plan (2002 – 2006). The channel is 870 metres long, benefiting 30 households from 4 villages in the geog. This channel has coverage of 37.34 ha of wet land. Beneficiaries cultivate paddy for one season using water from this channel as well as are dependent on rain water during monsoon.

3.2 Access to study area

Prior to data collection, a permission letter was requested from the College of Natural Resources (CNR), Royal University of Bhutan (RUB) as my parent organization and from Van Hall Larenstein University. After arrival in Samtse Dzongkhag, permission for data collection in Ugyentse Geog was approved by the Dasho Dzongrab during the absence of Dasho Dzongda. The geog administration and AAEO of Ugyentse geog were informed to provide necessary support and cooperation during data collection in the geog.

3.3 Sampling technique

The Seran Kulo project had 30 households as beneficiaries. From 30, only 24 beneficiaries could be interviewed (refer table 1). As the other 6 beneficiaries were unavailable having migrated either to work or live with their children in towns. Their lands were sharecropped by beneficiaries and non-beneficiaries in the village. To get in depth information on irrigation project, other stakeholders included DAO, AAEO, Gup; Chairman, treasurer from WUA and Lajab(supervisor) of channel were interviewed to understand their roles, involvement of beneficiaries in different stages of project and policy of government in irrigation projects.

Table1: Data collection sampling

Respondents	No. of Respondents
Beneficiaries' households of irrigation channel	24 (women + men)
Key Informants	
 District Agriculture Officer (DAO) 	1
• Gup	1
 Assistant Agriculture Extension Officer (AAEO) 	1
Chairman of WUA	1
Treasurer	1
Lajab	1
Total	30

Source: "Own field work" (2011)

Note: Chairman, Treasurer of WUA and Lajab were also the beneficiaries of the project.

3.4 Methods of data collection

Qualitative case study approach was used to gain in depth insight on how the Seran kulo contributed to household food security of the study area considering the participation and management of irrigation channel by the beneficiaries. This is in line with Verschuren and Doorewaard (2010) who state it as research strategy during which the researcher tries to gain a profound insight into one or several objects or processes that are restricted in time and space.

Data collection was carried out from the 19 July 2011 till the 4 August 2011. During the data collection, researcher first introduced to respondents as master student pursuing her studies at Van Hall Larenstein University; the Netherlands. The respondents were informed that the research was conducted as part of the programme and based on the findings from this research on Seran Kulo and its impact on food security of beneficiaries' households; recommendation will be given to the Agriculture sector of Samtse Dzongkhag. The respondents were explained the main aspects of the research and few respondents had to be convinced that questions asked are nothing new to them and it's about how they participated in the irrigation project and paddy productivity before and after construction of channel.

The data were collected through one to one interview of beneficiaries and stakeholders using a topic list (appendix 1). Topic list was used as guide that had lists of topic to be asked during the interview. The researcher was free to ask questions without following the sequence of the list but the flow of interview. Topic list consisted of topics to understand and get in depth information on the participation of beneficiaries in different stages of irrigation project, management of existing irrigation channel, functioning of WUA and benefits to the household in achieving food security. The beneficiaries were interviewed at home and in the paddy field. For stakeholders, topic list included their level of involvement, responsibilities in different phases in irrigation project. Since 79% (table 2) of the respondents were uneducated, verbal communication was used to convey the information about the research to the respondents. The local languages used during interview were in Lhotsham, Dzongkha, Kurtoep, and Sharshop. Interview with the DAO was conducted in English.

Topic lists were pre-tested with two paddy farmers of another chiwog of the Ugyentse geog. One of the respondents during pre-test was engaged in construction of new irrigation channel in Kuchidaina, yet to be completed. Researcher got clear idea of how they participated in the project and formation of WUA. Pre-test was conducted to check the relevance and validity of the topics in the study area. Irrigation channel and beneficiaries' paddy fields were visited to observe the

condition of channel, understand the management of water and to observe paddy cultivation activities.

Secondary data for the research was collected at Van Hall Larenstein University through desk study using books, online journals and articles available at Wageningen University Library and search engines such as scopus, google scholar, google were used. National Irrigation Policy (NIP) 1992 documents were used from the geog office for the research.

3.5 Data Analysis

In a day, two or three beneficiaries were interviewed and some notes were taken while interviewing them. After returning back in the evening, information were categorized based on the topics used for interview and entered into Microsoft excel. This was done to make information clearer and systematic for analysis. The data selection for analysis was based on

- Particular issues that was raised by majority of respondents
- Subjective decision was taken by researcher in considering some of the respondents as key respondents and the data provided by them were given more emphasis.
- Comparing of data collected through person to person interview with observation of the study area.

3.6 Challenges

The data collection period coincided with paddy transplantation season and farmers were engaged in land preparation as well as transplantation activities. Paddy transplantation was delayed due to late monsoon rainfall this year. Some were engaged in other social activities and could not be met both at home and in the field during day time. So, some of the interviews were conducted in the evening when respondents returned from work.

3.7 Limitations

This research is a case study and findings from this study may not be applicable to other areas in Bhutan. Besides, government officials involved during the Seran Kulo projects were transferred to other Dzongkhags and could not be interviewed. The reports and official documents expected to be referred during research were not available. The data gathered for this research is based on the views and information shared by the respondents especially on the project aspect. No such study was conducted earlier in the Dzongkhag. Further, beneficiaries who were involved in the project meetings were the parents who were not available for the interview. They no more lived in the village and were staying with their children in town. The children left behind, who were farming in the village did not have information to share on the irrigation project.

3.8 Informed consent

Before the start of interview, beneficiaries were asked on their willingness to participate in my research.

CHAPTER 4 SAMTSE DZONGKHAG AND UGYENTSE GEOG

Samtse Dzongkhag is located southwest of Bhutan. The Dzongkhag is bordered by Chukha Dzongkhag in the East, Haa Dzongkhag in the North and the Indian States of West Bengal in the South and Sikkim in the West. The Dzongkhag has a population of 65,387 with population density of 49 persons per Sq.km. It has total land area of 1309.1 Sq.km with Dorokha and Sipsu as its two Drungkhags. The Dzongkhag has 15 geogs i.e Samtse, Chengmari, Ugyentse, Yoeseltse, Namgyel Chhoeling, Sipsu, Charghary, Pagli, Bara, Biru, Dungtoe, Denchukha, Dorokha, Tendu and Tading (NSB, 2010). The Dzongkhag has Bhutan Fruit Products Ltd, Army Welfare Project (AWP) Distillery, manufacturing and Mining industries. Samtse Dzongkhag is connected to other Dzongkhags through road that passes via West Bengal state.

Samtse falls under Subtropical climate with elevation ranging from 300 – 3800 meters above sea level. It experiences temperature from 15 to 30 degree Celsius and receives annual rain fall of 1500 mm – 4000 mm. The Dzongkhag has 76% of its total area under forest cover and 8% is used for agricultural cultivation. The remaining 16% of total area falls under other category (NSB, 2010).During monsoon season, heavy rain causes landslides and floods resulting in soil degradation/erosion and damage to water distribution to seasonal irrigation system. Drought is frequently reported in October.

Based on the acreage of wetland, Samtse ranks second after Punakha Dzongkhag. Samtse has rice growing acreages of 7,547 acres producing 6,266 tonnes annually and yields 870 kg/ha. The Punakha Dzongkhag has highest production with 12,981tonnes a year with yields up to 1,524 kg/ha in the country (MoAF, 2009). Difference in yield gap and low productivity is attributed to inadequate irrigation facilities with predominant rain fed irrigation. Rice is grown in undulating terrain from gentle (<10) to steep (300) slope. Soil has high sand content which have poor water and nutrient holding capacity. The average rice Production in Samtse Dzongkhag is around 0.8 - 0.9 tons/ac and they grow mostly local varieties under rain-fed condition. About 91% of rice growing area in this region is rain dependent (Thinley et al., 2010).

The main cash crops grown are areca nut, ginger, orange and cardamom. In the foothills of Yoeseltse, Ugyentse, Chengmari, Samtse, Sipsu and Tendu Geogs paddy is cultivated. Majority of wet lands are located in the foothills of these geogs and rice is the main staple food. In the northern geogs of Denchukha, Dungtoe and Dorokha, besides paddy cultivation, people also grow maize, orange and cardamom crops (NSB, 2010).

Ugyentse Geog is located southwest of Samtse Dzongkhag and is 17 km away from the Samtse town. Geog consists of 5 chiwogs with 11 villages. The total population of the geog is 1830 people with 257 households (Personal communication with Gup August, 2011). It has an area of 21.13sq.km with altitude ranging from 300 m to 1500 m. The geog experiences hot humid summer and cool winter. It receives an annual rainfall of 1500 mm to 4000 mm. The land used for agriculture purpose are; dry land 548.27 ha, wet land 503.29 ha, Citrus 80.89 ha and areca nut 2.55 ha. The farmers grow paddy, millet, maize and mustard for home consumption and ginger, orange and areca nut as cash crop (Personal communication with AAEO June, 2011).

CHAPTER 5 PARTICIPATION OF BENEFICIARIES IN SERAN KULO PROJECT

This chapter describes how beneficiaries participated in different stages of Seran Kulo Irrigation project. It also includes the participation of beneficiaries in management of channel before and after the project and functioning of WUA. In addition levels of participation by beneficiaries in the project is described.

5.1 Seran kulo Irrigation Project

Seran (top) kulo (channel) before the project was a mud walled channel built by forefathers of the present farmers used for irrigating baeshey keth (many wet land) consisting of 37.33 ha of wet land of the beneficiaries. The channel was dug and side walls were built with mud and stones. The channel has seasonal source but small volume of spring water at the source was available during dry season. Since the channel had mud wall, during monsoon large volume of water washed off some portion of channel creating leakages. In addition to this, loss of water was reported to be more through seepage in the earthen channel. Further, crabs drilled holes in the channel increasing seepage of water and requiring frequent repair of channel. The traditional channel caused more loss of water and smaller volume available for paddy cultivation compared to improved one. There are two other kulos below Seran kulo, named 'Beach kulo' and 'Pheth kulo'. They are still continued to be maintained with its traditional structure, irrigating paddy fields located besides baeshey keth.

5.2 Project stages

5.2.1 Project inception

The beneficiaries of the channel requested financial support from the government to improve the traditional structure with concrete cement. This issue was raised several times in chiwog and Geog Yargay Tshogchung (GYT) Zomdoo at the geog level chaired by the Gup. Subsequently, this request was presented by Gup to Dzongkhag Yargay Tshogdue (DYT). After considering its importance and potential in increasing paddy productivity of the farmers, DYT approved the request and included in 9th FYP as one of development projects. The project received funding support from the Royal Government of Bhutan (RGoB) in the year 2004.

The key respondents shared the reasons for replacing traditional channel with concrete ones. There were three reasons for initiating this project i) the mud walled channel developed holes both from the water force and the crabs in the channel area. Due to more leakages, only half the total volume reached the paddy field with more loss along the channel. ii) There was frequent stealing of water by other farmers during the peak season for paddy cultivation who were entitled to use water from Beach and Pheth kulo. iii) the land area through which the Seran kulo passes through was prone to erosion and land slide during heavy rain fall. Moreover, traditional channel would be more risky in that area affecting the other two channels below when the whole slope slides down. It was expected from the project to benefit the farmers in increasing water availability to their field reducing the loss of water through seepage in channel.

Once the request was approved by DYT and included in the FYP programme, engineer from the Dzongkhag visited the channel for the survey. In which the length of the existing channel was measured to propose budget for renovation. During the visit of Engineer, Gup coordinated in mobilizing concerned people in the project, such as the AAEO, Tshogpa and some beneficiaries. After the budget was released, beneficiaries were informed to provide free unskilled labour and stone for the construction. Each beneficiary household was asked to provide one unskilled adult labour per day till the completion of the project. The other construction materials such as cement, sand, gravels, stone chips and skilled labour were provided by the government. Lajab (supervisor) was appointed among the beneficiary based on his qualification and ability. He was responsible to maintain attendance of labour contribution, keep record of construction materials received and monitor the construction work progress in the absence of engineer.

5.2.2 Project formulation

There was no community meeting with beneficiaries to gather information on planning of the construction work. The information on the rainfall pattern in the area, paddy cultivation season was not discussed with beneficiaries that would affect the planning of the work. Although in the Multidisciplinary Feasibility study of NIP guidelines shows the need to understand all the other social aspects of the project area. The researcher assumes that government officials involved would be acquainted with such information of the region. Moreover, beneficiaries were not consulted on the suitability of channel design.

5.2.3 Implementation phase

After the approval of budget, Gup was responsible for procurement of construction materials through tendering from suppliers. The construction materials were transported till the road point by the suppliers. These materials were later carried by the labour contributed by beneficiaries from road till construction site before the beginning of construction. Labour was mobilized by Lajab after arrival of construction materials. The engineer instructed the masons and other labours to build the channel according to the design approved by the government and the ratio of the input materials. One of the beneficiaries suggested the design of channel to have thick cemented floor with curved edge to be more durable. The logic behind was it would reduce loss of water through leakage formed after eroding of cemented wall and floor by the water pressure. Such idea of beneficiary was not entertained by the engineer, but insisted to continue with same design. This shows that participation of beneficiaries in planning phase was poor.

In the case of labour contribution, data gathered from one to one interview gave a picture that some beneficiaries contributed hired labour and some did not participate in construction work. Besides Lajab did not have strict monitoring and supervision over labour contribution. There was no levying of penalty for not contributing labour by the households. This encouraged some beneficiaries who were free – riders to take advantage of it and were also benefiting from the project. Such negligence from Lajab in labour contribution and delay in skilled labours wages prolonged the work. Further, tenure of the former Gup was over and there was no one to follow up the work progress of project in the geog. Engineer could visit sometimes at the site.

Later, the new Gup of the geog made it mandatory for all the other 4 chiwogs in the geog to provide customary labour from each household in completion of the construction work. This was arranged because beneficiaries could not complete on the planned period. The nearly 1km long channel was half completed towards the end of 9th FYP. The work had to be completed before June 2006, because the allocated budget for the project will be withdrawn by the government. This is done due to closing of financial year. The remaining 500 m of the channel was divided among these chiwogs. During that particular period, many people worked together in construction of channel. The construction lacked engineering expertise and masons were not enough to head the work. Due to lack of time unskilled labours replaced the masons and worked on their own to complete their share of work. However, the work got completed on time by compromising the quality.

Overall, the quality of the channel was poorer than expected which was not appreciated by the beneficiaries. Cracks and holes were formed within short duration and also the crabs could easily drill holes in the channel increasing loss of water. After comparing data from the key informants, the following reasons could be attributed to poor quality of the channel:

i) Lack of proper monitoring and coordination of construction work as well as no proper record of labour contribution among beneficiaries by the Lajab. Some of the beneficiaries did not contribute labour and cooperation in the community was disturbed. Later farmers were engaged in paddy cultivation activities and construction work was stopped.

ii) The construction lacked technical experts; engineer could seldom visit the construction site. Moreover, beneficiaries had no idea of construction processes and it was new experience for them.

iii) Skilled labour (mason) were not enough for the construction work. Due to delayed payment of their wages two among four did not turn up. At times unskilled labours were reported to be working in place of mason during their absence.

iv) Lack of curing of channel during dry season.

The way the project was implemented especially the construction part of the channel did not give good image to the beneficiaries in participatory approach of government in development projects. Researcher assumes that those beneficiaries who participated in construction felt it like a burden. One of the key informants shared during the interview that the poor progress of work due to above mentioned reasons made beneficiaries exhausted with never ending construction works at the channel. Besides, they had to work in their own fields. The experience of this Seran Kulo project made farmers cultivating adjacent field of Baeshey Keth to leave their irrigation channels with traditional structures. They did not want financial support from government to improve the existing traditional channel. This indicates that although there was increase in the yield (discussed in detail under section 6.4.1) after renovation of channel, increase in paddy yield did not compensate the labour work contributed by beneficiaries in construction of channel.

5.3 Management of irrigation channel

5.3.1 Operation of channel

There was no difference in the operation and maintenance of channel before and after the renovation of channel except for the collection of maintenance fees from the beneficiaries. Water distribution practice followed by beneficiaries was same as before the renovation of channel. Farmers divided the available water before the start of land preparation under mutual understanding after gathering at the end of channel. Details on water availability and water distribution are explained under the following paragraphs.

5.3.1.1 Availability of water in the channel

The water source for the channel is seasonal and depends upon the monsoon rainfall in increasing its volume. The water is available for 4 months from May till September in a year. During heavy rain, muddy water along with sand and stones flowed through the channel. Once the monsoon season was over, water in the channel was reported to be dry but during spring season small volume of water flowed in the channel.

The volume of water in the channel was observed and reported to be reduced by 17 respondents out of 24 and only half of the total volume of water was available for paddy cultivation. Reduction in water volume was experienced after 3 years of construction completion. This was due to the leakages from the holes formed at the bottom corner at different points of the channel (annex 3). These holes were further aggravated by crabs found around the locality. Moreover the collected data and observation at the source reveals that drinking water for the villages located downhill shared the same source. The source for irrigation water was used for drinking water as well for the last 3 years (appendix 3). This further reduced the availability of water in the channel which used to benefit those beneficiaries whose fields were located at the middle from the channel to raise paddy nursery. During the month of May paddy nursery was raised by farmers where small volume of water from the channel was used.

The water for paddy cultivation was inadequate especially for paddy fields located towards the tail end of the channel before as well as after the construction. Farmers disadvantaged with location of their fields had to depend on rain water. For the fields located at the top and middle from channel, although water was not adequate, channel water was used as standby during delay in rainfall after construction. Some paddy fields had access to spring water that grew from underground during the monsoon season. Such temporary sources were gift of nature that benefited farmers in paddy production. Others had to wholly depend on rain water due to inadequate water from the channel. However, for good harvest farmers need to depend on rain fall. The water for paddy cultivation was most required during the milk stage when there was formation of grain in the panicle of paddy. One of the respondents stated that "during milk stage, water is very crucial. If water is inadequate at this growth stage, panicles are empty and harvest is poor".

Researcher observed that the water source was protected with barbed wire fencing and vegetation maintained by the community with new plantation at the source. This was initiated by forestry sector of the geog to conserve the water source from drying up and community was responsible to maintain it.

5.3.1.2 Distribution of water

Traditional system of water distribution was continued by beneficiaries after construction of channel. Farmers had mutual understanding among themselves in division of available water; farmers knew the time when to begin land preparation and paddy transplantation with onset of monsoon season. Consequently, informal decision by few farmers of date and time was informed to rest of the beneficiaries. All the farmers gathered near the end of channel to take their own share of water. Any one of them could take the initiative to equally divide the available water among all the beneficiaries through secondary channels. The secondary channels were the earth dug channels to connect water from main channel to individual fields. Equal division of water among users were till the land preparation. During paddy transplantation water to other fields were blocked and diverted to the field where transplantation on that particular day was carried on. This was done to increase the volume of water in the field. The date for transplantation was fixed and accordingly labours are arranged. Once transplantation was over in all the fields, water was distributed in rotation for 1 day and 1 night for small land size and extra 12 hours for bigger land.

5.3.2 Maintenance of channel

For maintenance of channel, before the renovation influential head of the village decided to carry out maintenance of channel before the cultivation of paddy begins and as and when required during heavy rainfall. Information was then passed to others users of the channel verbally in the community. Maintenance includes, clearing of debris, sands and stones brought in by rain and clearing of bushes near the channel. Since the channel was mud walled, users dug some soil and add on it to block water running out of channel. The adult member of the household joined for the work. However, after renovation, not much change in organizing the maintenance activity because it was coordinated by the same person in the village. The researcher assumes that farmers had to depend on the channel water when there was no rainfall. Hence, they could claim their share of water after contributing labour for maintenance. After a year of completion of construction, the leakages in the channel were repaired with left over construction materials. During this maintenance, few beneficiaries participated in the activity. This work was coordinated by one of the influential local leader of the chiwog who was also the beneficiary of the project. Water User Association formed did not initiate such work and followed the system as it was before the renovation of channel. There was no system of penalizing those who did not contribute in maintenance work. The WUA initiated in collection of maintenance fees from the beneficiaries for future.

5.4 Water User Association

Before the renovation of channel, there was no association as such to organize and coordinate the operation and maintenance of channel. The users managed the channel themselves with mutual understanding between each other. In which they contributed labour from each household when time for paddy cultivation season began. Those farmers whose field had access to water from irrigation channel participated for regular maintenance before the paddy cultivation and worked together to have access to irrigation water.

The WUA formed among the beneficiaries of the Seran Kulo was non-functional. Five out of 24 beneficiaries were not aware of either the formation or existence of such association. WUA was formed one year after channel construction was completed. The AAEO and engineer organized meeting in the geog with beneficiaries, in which five members were appointed among the beneficiaries. They were responsible for proper management of the channel. These members

could read and write and researcher assume that they were appointed based on their literacy among the others. The researcher assumes after observation and interview with other stakeholders that members of association were not pro-active with their responsibilities. The association did not have any evidence of written bylaws for proper coordination and systematic functioning of the group. The members of association never received any kind of trainings from DOA. The only remark focused by the respondents for the association was on the collection of amount worth Nu. 60 (1 euro) and Nu. 120 (2 euro) per year from the beneficiaries. Treasurer collected the amount based on their size of land located in Baeshey keth. They collected it to keep the budget for future maintenance of the irrigation channel since financial support from the government was over after the completion of construction. However, the fee collection was discontinued when some of the beneficiaries refused to pay the amount. The amount collected was given to the Secretary of the association but there were rumours of money being kept either in Bhutan Development Financial Cooperation (BDFC) or with the secretary of WUA. During the interview, secretary of the association was not available in the village.

According to National Irrigation Policy procedural manuals (Bleeker et al., 1994) WUA constitution and Bylaws were required to be formulated by the beneficiaries with facilitation of irrigation officer (appendix 2). This responsibility of facilitator was later transferred to Agriculture extension officer. WUA constitution and Bylaws were developed to ensure:

- Proper operation of the irrigation system
- Fair distribution of water
- Timely and proper maintenance of the irrigation system

The guidelines in NIP states that beneficiaries were to include clearly in the Bylaws on types of maintenance of channel, how much money to be collected from the users and on what basis. Addition to this, beneficiaries were to use the fund for maintenance and improvement of channel only. The amount to be allocated for maintenance was left to the severity of damage and condition of channel by the WUA. During major damages due to landslides and floods, government provided financial support for the maintenance.

Viewing the current situation of the WUA, the present AAEO of the geog tried to facilitate in restructuring of the association but success to bring beneficiaries together were in vain. Researcher assumes that the interest to rejuvenate the association was weak or they were not aware of its benefits and consequences of not having such association in future.

Water guard was appointed by the association after the construction of channel and he was paid 7 pati paddies per year for clearing fallen boulders, stones and releasing the metal gates to avoid flooding in the channel during heavy rain. The services provided by water guard were not satisfactory because he was engaged in his own farming activities and was not available as and when required. Therefore, beneficiaries decided not to have water guard and discontinued after 2 years. Before renovation of channel, there was no water guard but was organized among the farmers for such clearing works in the channel.

The data collected from the beneficiaries and members of association shows that maintenance of channel after construction was carried on under the initiative of the former Tshogpa of the Bahungaon village. Maintenance activities such as clearing sand and stones inside the channel and bushes around it before land preparation for paddy cultivation were carried out yearly. Where, beneficiaries were reported to participate in these activities. However, during repair of the channel after a year of construction in which cracks and holes developed were repaired with support from few beneficiaries. There were no strict criteria being implemented in mobilization of the labour. Researcher assumes that few concerned people gather informally in the village and discuss on maintenance activity. The date and time is being informed verbally to all the beneficiaries' household but few interested ones participate in maintenance of channel.

Few of the beneficiaries were concerned with deteriorating condition of the channel. They tried to continue in mobilizing fees for repairing the leakages but response to such initiative had been poor so far.

Researcher realized during interview with respondents and informants that during the renovation of channel, Ugyentse geog did not have its own Agriculture Extension Officer (AEO). The extension services were provided from Changmari geog. Couple of years ago, irrigation sector got merged with the Department of Agriculture. Although the responsibilities related to pre-construction of irrigation channels and group formation of users in irrigation projects following the NIP procedural manual were transferred to AEO. It was realized that they lacked training in group formation and had no knowledge on engineering aspects of irrigation channel. Such trainings prescribed in NIP were well versed with the earlier engineers in the past. The new engineers seem to be lacking such trainings and progress as well as success in irrigation so far in the Dzongkhag was poor. Besides, AEO had multitasking job to perform such as farm road, irrigation channel construction, attend meetings in the geog and Dzongkhag and also provide extension services in agricultural production. According to the DAO, "focal person for irrigation is required at the field level. Due to late start of development activities in the region, shortage of manpower in the Dzongkhag, and ignorant of farmers' participation, success in irrigation is poor".

5.5 Levels of participation

Overall, the level of participation of beneficiaries in this project can be considered as functional and passive participation (fig3) as categorized by Pretty et al. (1995). The beneficiaries' participated in seeking for financial and technical support from government through local governance institution which facilitated in linking farmers need to government developmental objective. This exhibited functional participation among beneficiaries in which people participate by forming groups to meet predetermined objectives of organization and are dependent on external facilitator. However, they had no influence in decision making, control over resources and direct in different stages of the project. They were to follow the instruction of government officials and were required to contribute labour and stones during construction of channel, indicating passive participation by beneficiaries.

CHAPTER 6 PADDY PRODUCTION AND RICE SELF SUFFICIENCY

This chapter illustrates the findings in the form of tables and describes the characteristics of respondents, sharecropping of wetland, labour system, paddy production and compares to understand rice self-sufficiency with ownership of wetland, land cultivated and household size and labour availability of respondents.

6.1 Characteristics of respondents

6.1.1 Age groups and Education level of respondents

	Educatio	on Level	
Age Groups	Cannot Read and write	Can Read and Write	Total
30 - 40	4 (80%)	1 (20%)	5
41 - 50	5 (71%)	2 (29%)	7
51 - 60	5 (71%)	2 (29%)	7
61 - 70	5 (100%)	0	5
Total	19 (79%)	5 (21%)	24

Table 2: Education level of respondents

Source: "Own field work" (2011)

Table 2 above shows that the literacy rate of beneficiaries was very low. Only 5 respondents out of 24 could read and write in English and Dzongkha while 79% of respondents were illiterate. Respondents who could read and write were members of WUA and 2 worked for geog administration. Due to low literacy of beneficiaries, verbal communication was prominent in mobilizing labour or sharing information in the meetings and village. The age groups show that half of respondents belonged to old age group indicating farming community consisting of old aged farmers. This indicates the labour shortage in village where old aged group of farmers are still engaging in farming.

6.1.2 Land ownership

In Bhutan land owners were legally entitled with Lagthram (land deed) from the Land Commission of Bhutan. All the 24 respondents, owned chushing (wet land) ranging from 0.1 ha to more than 1.0 ha (table 3), that depended on irrigation channel for paddy cultivation. For this study dry land was not included because the study was on impact assessment of paddy production and rice self-sufficiency with the improvement of channel. There were 2 respondents who were sharecroppers on the absentee land owners (beneficiaries). They did not own the land in Baeshey Keth. So, under land ownership a 'None' category is included in those tables of the report.

Land ownership	Se	Total	
wetland (ha)	М	F	Total
None	1 (50%)	1 (50%)	2
0.1 - 0.5	10 (91%)	1 (9%)	11
0.6 - 1.0	8 (89%)	1 (11%)	9
Above 1.0	2 (100%)	0	2
Total	21 (87.5%)	3 (12.5%)	24

Table 3: Land ownership of respondents

Source: "Own field work" (2011)

Table 3 shows that 11 respondents out of 24 had wetland from 0.1 to 0.5 ha followed by 9 respondents with wetland from 0.6 to 1.0 ha. These two categories had the highest (20 out of 24) numbers of land owners showing that land size owned by respondents were small. There were 2 females that owned land and 1 female respondent was sharecropper. In Bhutan, females are legally entitled to own land. Compared to Southern part of Bhutan, land ownership in Eastern and Western parts of the country is pre-dominated by females (OECD, 2011)

6.1.3 Household size, labour and bullocks owned

Land ownership	Househo	ousehold Size Household Labour Bullock ov		Household Labour Availability			ullock ow	ned
wetland (ha)	1 – 5	6 – 9	None	1 – 4	Above 5	None	1 pair	2 pair
None	2	0	0	2	0	1	1	0
0.1 - 0.5	9	2	5	6	1	5	6	1
0.6 - 1.0	6	3	3	5	0	4	2	2
above 1.0	2	0	1	1	0	1	1	0
Total	19 (79%)	5 (21%)	9	14	1	11	10	3

Table 4: Labour availability and bullocks owned by respondents

Source: "Own field work" (2011)

Table 4 above shows household size, labour availability and bullocks owned by the respondents. Out of 24 households, 19 households had 1 to 5 household members, and 5 had 6 to 9 members. This shows that majority of beneficiaries had small household size. As many as 14 households could contribute less than 4 labours for paddy cultivation and only 1 household owning land size ranging between 0.1 to 0.5 ha had 5labours within household. The households that contributed more labour were able to lease in and sharecrop more lands from other farmers. This point will be presented under section 6.5. There were 9 households that could not contribute labour from household and these households left their land either fallow or leased out or sharecropped out due to labour shortage from household.

Ten households owned 1 pair of bullock and 3 households owned 2 pairs of bullock for ploughing field for cultivating paddy. However, 11 households did not own bullock and they either hired from others or leased out the land to others. Two respondents left their land fallow due to inadequate water from the channel.

6.2 Sharecropping of wetland

Land ownership wetland (ha)	Leased in	Leased out	Sharecropped in	Sharecropped out	Cultivate own land	Total
None	1	0	1	0	0	2
0.1 - 0.5	2	2	2	2	5	13
0.6 - 1.0	1	3	1	0	2	7
above 1.0	0	1	0	0	1	2
Total	4	6	4	2	8	24

 Table 5: Number of respondents leasing and sharecropping wetland

Source: "Own field work" (2011)

The researcher observed that leasing land and sharecropping was a pre-dominant practice among the beneficiaries and non-beneficiary farmers in the village as shown in table 5. Ten respondents were engaged in leasing land and 6 respondents in sharecropping. Out of 24 respondents, 8 were involved in cultivating their own land.

6.2.1 Rules for leasing land and sharecropping

Generally, the agreement in leasing or sharecropping depended on the mutual understanding between two parties involved. There were no fixed rules to be followed among the beneficiaries. In the case of leasing, leaser leased out land for fixed quantity of paddy at the end of harvest and no expenditure for hiring labour and ox was borne by the leaser that was incurred during paddy cultivation. For share cropping, agreement varied among beneficiaries; among 6 sharecroppers 2 share croppers had arrangement for the expenditure for hiring oxen and labours during cultivation. These land owners left one third of harvest to cover up these expenditures. The remaining sharecroppers practiced 50:50 where, leaser gave land for cultivating and lessee borne the

expenditure during paddy cultivation. Subsequently took 50 percent of harvest based on the yield of the season.

Leasing in land and sharecropping practices was used as one of the coping strategies to achieve rice self-sufficiency by those farmers with less land holding but with labour available within the household. Those beneficiaries who leases out the land for sharecropping were either working or living with their children in towns. Others residing in the village did not have household members to work in the field (table 5). As stated by one of the 56 years old respondents that "I am alone in my house, my wife is dead and all my children are working in town making their own living. I don't need to work anymore; I have worked enough when I was young. Due to labour shortage, I gave my land on lease and it's wise for me to do this and I get 16 muri (800 kg) of paddy which is more than enough for me the whole year".

However, leasing in and share cropping of land depended on the accessibility and adequacy of water from the channel. Land located at the end or corner to the channel were not preferred for leasing in compared to land located at the top and middle from the channel.

Lands located at the end of the channel were kept fallow and interview with beneficiaries revealed that it was due to labour shortage and inadequate water available for paddy cultivation. 71 years old beneficiary said that "this season I have to leave large proportion (0.8 ha) of my land fallow and is because of labour shortage and inadequate water in my field located at the tail- end. These days all the children are enrolled into schools. The households are running short of farm labours. After schooling they migrate to urban areas and we have scarcity of labour in the village. I do not get hired labour for ploughing my field. The community prefers 'parma' but my household cannot contribute labour to work in other's field".

A female respondent aged 32 shared similar views "I left my land fallow for past 2 years. Labour is scarce in the village and I don't get labour for hire. I alone cannot manage field work with domestic chores and my husband has to go to town to earn cash for the family. The water is not adequate to grow paddy if there is no rain, yield is low and need to buy rice for rest of the year".

6.3 Labour system

The predominant labour arrangement practice in the village was through 'Parma system' between households. In this system, labour arrangement is based on the understanding between households. For instance, if he/she works for 1 day in others field later it was returned with labour for 1 day from the previous household. During such exchange of labour one meal is provided by the household that engages those labours in their farm.

However, there were households who had to hire labours in cash or in exchange of paddy (table 6); this practice is called as 'Hajira'. For 1 day labour 2 pati and 3 pati was paid after the harvest for men and women respectively. The detail of Hajira is presented in table 6. The work usually began at 8 am in the morning till 4 or 5 in the evening. These systems were practiced before and are still continued after the construction of channel.

Paddy Cultivation Activities	Male		Female	
Faddy Cultivation Activities	€*	Pati*	€*	Pati*
Land preparation and making				
bunds along terraces	4.2	0	0.0	0
Transplanting	0.0	0	1.7	2
Weeding	1.7	2	1.7	2
Harvesting	2.5	3	1.7	2

Table 6: Wages paid to hired labours per day

Source: "Own field work" (2011)

1 Pati* = 2.5kg paddy 1 €* = Nu. 60

During the paddy cultivation season, strong male labours with bullock were the most on demand as well as to prepare bunds along the terraces before paddy transplantation. For this reason men were paid relatively higher wages than women. The women were engaged in paddy transplantation (appendix 3), weeding and in harvesting both were involved.

6.4 Paddy production

Farmers in the villages grow paddy from the month of July till October. The fertility of the land was replenished by tethering of cattle in the field during the fallow months after the harvest. Paddy seedlings were raised by month of May or depending upon the rain. Animal draft (appendix 3) was observed to be used for ploughing the field by all the respondents, some owned a pair or two while others hired the oxen along with labour on 'hajira' for cash. Although the fields are suitable for operating power tillers, it is not preferred. It ploughs deeper into the earth than the traditional plough, which farmers feel will give poor yield. Moreover they could not afford to purchase it even with subsidy by MoAF and neither hire from others. They expressed the convenience and benefit of keeping ox over a power tiller. The use of butachlor herbicide after 4 days of transplantation was common among all the beneficiaries available from Agriculture extension office in the geog. This reduced the number of weeding to once.

6.4.1 Paddy yield

Location of wet No. of land Cultivator		Fallow land	Land Leased out	Average Yield (Kg/ha)
Тор	5	0	5	2018
Middel	5	1	1	2071
Tail-end	6	1	0	1691
Total	16	2	6	1927

Table 7: Paddy yield of Baeshey Keth for year 2010

Source: "Own field work" (2011)

Considering the location of land from the channel, paddy yield was analyzed by dividing paddy produced (kg) over land cultivated (ha) for year 2010. The quantity of paddy produced was converted from muri to kilograms. Table 7 shows that difference in paddy yield for land located at the top and middle is negligible whereas the yield from the tail - end is comparatively low with 1691kg/ha. The above results represents, water from the channel is available for land located at the top and middle. The researcher assumes that water from the channel is not available and inadequate for end users resulting into comparatively low production. The average yield from Baeshey keth is higher than the average yield of Samtse Dzongkhag which was 870kg/ha (MoA, 2009). There were 16 respondents cultivating land for paddy production. The increase in yield can be attributed to improvement in irrigation structure although yield was low for tail – end paddy growers. However, it was shared by the agriculture extension of geog that paddy yield for year 2010 was higher compared to last couple of years. The good harvest was due to timely rainfall during the milk stage of paddy crop.

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Location	C	Total			
Location	Increase	Same	Don't know	rotar	
Тор	6	1	3	10	
Middle	2	5	1	8	
Tail-end	1	4	1	6	
Total	9	10 5		24	

Source: "Own field work" (2011)

After the renovation of channel, the respondents experienced slight increase in the yield of paddy (table 8). There were 9 respondents who experienced slight increase in paddy yield and 6 out of 9

had land located at the top. The table above shows decreasing in no of respondents from land located at top to tail end that had increase in paddy yield after the construction of channel. These respondents attributed increase in paddy yield to improvement in structure of the channel.9 out of 10 respondents experienced same yield in paddy and they had land located at the middle and tail – end of channel. There were 5 respondents who had no idea in change of yield. These were the beneficiaries who had leased out land to other farmers or left out their land fallow. The respondents cultivating paddy felt that if the leakages could be fixed they assume that more water would be available for cultivation.

6.5 Economic access of rice by the household

Considering the data collected from the interview, rice was grown for the purpose of selfconsumption. There are three tables below used for comparing rice self-sufficiency for year 2010 with land owned, land cultivated and household size of respondents.

Land Ownership	Rice Self S	Total		
wetland (ha)	Yes	No	TULAI	
None	1 (50%)	1(50%)	2	
0.1 - 0.5	5 (42%)	7 (58%)	12	
0.6 - 1.0	4 (50%)	4 (50%)	8	
above 1.0	2 (100%)	0	2	
Total	12 (50%)	12 (50%)	24	

Table 9: Land ownership and Rice Self Sufficiency of respondents for year 2010

Source: "Own field work" (2011)

Table 9 above shows the land ownership and rice self sufficiency of respondents for Year 2010. Rice sufficiency among respondents was 50:50 where 12 respondents had their household self-sufficient with rice and other 12 respondents' households were not. As shown in table 9, 5 (42%) out of 12 households were self-sufficient with rice that has land holdings ranging from 0.1 to 0.5 ha. In case of land holding from 0.6 to 1.0 ha, rice self-sufficiency was 50% and 100 % for respondents with land holdings above 1.0 ha. This result indicates that households were rice self-sufficient with increasing land holdings.

Table 10: Land cultivated and Rice Self Sufficiency of respondents for year 2010

I and cultivated (ha)	Rice Self S	Total	
	Yes		
0.1 - 0.5	2 (22%)	7 (78%)	9
0.6 - 1.0	6 (55%)	5 (45%)	11
above 1.0	4 (100%)	0	4
Total	12 (50%)	12 (50%)	24

Source: "Own field work" (2011)

Table 10 shows that rice self-sufficiency improved in households that cultivated more lands. The land size for paddy cultivation was increased either by leasing in or sharecropping. This change can be seen comparing table 9 and 10, where 6 respondents were rice self-sufficient from 4 respondents with 0.6 to 1.0 ha land holding (5% increase) and 4 respondents from 2 that had land holding above 1.0 ha.

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Household	Household Labour Availability		Rice Self- Sufficiency		Total	
Size	None	1 - 4	Above 5	Yes	No	
1 - 5	7	12	0	8 (42%)	11 (58%)	19
6 - 9	2	2	1	4 (90%)	1 (10%)	5
Total	9	14	1	12 (50%)	12 (50%)	24

Source: "Own field work" (2011)

The table 11 shows that large households size (6 - 9) were self-sufficient in rice, represented by 90% of respondents and many of their household members were engaged in paddy cultivation. For instance, one of respondents owns 0.4 ha of wet land, leases in and sharecrops 1.83 ha of land from others. The respondent has 9 household members and among them 5 is engaged in paddy cultivation activity. It was also an advantage to respondent in the "Parma System" the customary labour exchange tradition in the community. This household was found to be self-sufficient in paddy. This indicates that household with adequate labour were rice self-sufficient. Although there was increase in paddy yield for land located at top and middle, this changes did not bring in major improvement in achieving rice self sufficiency of household after construction of channel. However, household shown as rice insufficient under 6 - 9 household size (table 11) because many members were school going children and land had to be leased out due to labour shortage and harvest was not enough for the household members.

Rice self-sufficiency for small household size was 42% indicating that 58% of respondents' had less or did not have their household members engaged in paddy production or land size was not enough for household to grow paddy. Due to labour shortage, land is leased out or sharecropped and the share was not enough for the household's members. Such households supplemented their rice by accessing market through alternative source of cash income. Among this group, one of the respondents stated that "it is better to lease out land if it has access to water for paddy cultivation rather than investing on it. The yield on an average is low with inadequate water. Moreover rice grown from small piece of land is not enough for the whole year and need to buy from the market. I prefer off farm work in town which gives me cash income and this income supports me and my family to meet basic necessities in the household which working in the farm cannot be fulfilled".

Land Ownership(ha)	Economic Access to Rice					
	On Farm	Non- Farm	Sale of Cash crops	Nonfarm/ cash crop	Remittances	Total
None	1	0	0	0	0	1
0.1 - 0.5	2	1	2	1	2	8
0.6 - 1.0	1	2	0	0	0	3
above 1.0	0	0	0	0	0	0
Total	4	3	2	1	2	12

 Table 12: Economic access to rice for the year 2010

Source:"Own field work" (2011)

The 12 respondents whose households were rice self-sufficient after paying paddy to labours (table 9) did not sale their excess rice. They instead gave it to their children living in town or stored it to be used for next cropping season to prepare meal for labours. The beneficiaries' household that could not produce enough rice for a year bought it from the market. The cash income to have access to rice was generated through on farm (farm labour), sale of cash crops (areca nuts and ginger) and seasonal migration for non-farm works in towns and also from remittances as shown below in table 10. Out of 12 respondents, 4 worked on farm as day labour for daily wage, 3 left for nonfarm works in town, 2 depended on cash crops, 1 on both nonfarm and cash crop and 2 on remittances for cash income. The remittances were in the form of cash or rice sent by their children. One of the beneficiaries reported of eating maize and millets in their daily diets to reduce dependence on rice.

These respondents were dependent on above mentioned sources for cash income to purchase rice from market before as well as after the construction of channel. The researcher assumes that to achieve rice self-sufficiency, household labour contribution and water availability in wet land were very crucial factors influencing paddy production in Baeshey Keth in Ugyentse geog.

CHAPTER 7 DISCUSSION

7.1 Participation of beneficiaries

The reconstruction of Seran Kulo was funded by Government in the 9th FYP after it got approved through the GYT and DYT committees. Decentralization of central government power to the DYT at Dzongkhag level and GYT at Geog level was initiated during the early 1970s and early 1990s under the dynamic leadership of the Fourth King of Bhutan. This was to empower people at the grass root level to participate in planning and decision making of local development activities (UNDP, n.d). The beneficiaries participated in chiwog Zomdoo to raise issue to reconstruct the traditional structure to modern concrete structure. Although materials for traditional structure were locally available but the durability of structure built was poor. There were more leakages requiring frequent repair with less water available for cultivation. The request was initiated by some influential group of people among beneficiaries and rest supported the idea to improve the channel. This irrigation system was assisted farmer initiated irrigation system (Kundell, 2007). It was first time support for construction of irrigation channel in the geog. Farmers did not have clear idea of to what extend government will support the project and were not aware of their roles during the project stages.

More over water users lacked information that was required to be transferred through meetings organized by engineers and Agriculture extension. According to the NIP 1992, feasibility study and multi-disciplinary study was required to be conducted with participation from water users before the approval of the project. Further, pre-construction meetings with beneficiaries prior to implementation of project would have created awareness of government policy and general idea of the project before inception.

The government provided financial and technical assistance for construction. Unskilled labour contribution without remuneration was mandatory to be provided by the community (Pradhan, 1989; Dorji, 1989). According to Shashidharan (2000), to ensure ownership and better management of irrigation system, financial contributions were collected from farmers for O&M. Further, subsidies by government were unsustainable and fee collection from the users supported participation through ownership (Meinzen-Dick et al., 1995). The water users of Seran Kulo also contributed free labour and stones for renovation of the channel. This was to ensure ownership and participation through proper management of channel after completion of construction by the government. Since there was no documentation of the project, agreements such as letter of undertaking for WUA, formation of WUA, compensation to water guard and agreement on labour contribution could not be accessed. Researcher assumes that the project did not follow the procedure of NIP resulting into delayed formation of WUA and poor maintenance of the irrigation system. Facilitation by concerned government officials was lacking in participation at different stage of project. For effective participation of farmers, cooperation among farmers could be achieved with involvement of catalyst in the form of external agents (Meinzen-Dick, 1997; Coward, 1980).

Gap in the management system by the former and present extension officers were observed at the geog office. It was evident from the official documents following the NIP procedures of the upcoming new irrigation channel in the geog. Such lapses in the management system of the government officials also affect users' participation and functioning of association with poor facilitation during the initiation and implementation of the project.

The procedural modules of NIP (appendix3) shows the need for active participation of the beneficiaries during the planning and implementation phase of the project with discussion on regular progress, feedbacks with engineer, agriculture officer and water users. However, such activities might not have been organized during the project when suggestion on the design of the channel by one of the beneficiaries was declined and accused for use of more materials in construction. Farmers knowledge, ideas and experiences in decision making (Kissawike, 2008) were neglected which is evident from the above incidence during construction of the channel.

7.2 Induced WUA and leadership

Water User Association formed by the extension officer among beneficiaries after construction of channel was non-functional. The officer bearers of the association did not execute the roles and responsibilities properly resulting to poor O&M of the irrigation system. WUA were induced by government officers to reduce operating costs of government and manage the scarce resource and avoid free - riding behaviour in the system (Hunt 1989). However, even in the induced association such problems still persisted without any improvement in the system. Induced WUA by government made the farmers managerially dependent, ineffective and erode local collective action of traditionally managed system in the village (Mosse, 1999). For instance, in Seran Kulo, WUA were ineffective and management of channel continued to follow the traditional system. Further, its ineffectiveness could be observed in poor condition of channel with leakages. Non-functional association indicates there were no formal trainings given to the association members on management. As per NIP Pre - Construction Meeting I, WUA were entitled for study tour to understand management by WUA of other geogs and implement it in ones' own system. Further, training on banking and bookkeeping of cash contribution mobilized from the water users and expenditure incurred during the maintenance of the channel was to be provided by agriculture extension agent of the geog.

Moreover, researcher realized that farmers need to be organized (Meinzen-Dick, 2007; Hunt, 1989; Coward, 1980) under strong leadership. Strong leaders and their leadership provided necessary support for collective action in O&M of Irrigation channel in Nepal (Lam and Ostrom, 2009). This leadership was lacking in the association for proper management of the system. This was evident from the low turnover during regular maintenance and poor condition of the irrigation structure. Due to poor leadership in the association, repair of channel and other routine maintenance was carried out under the leadership of former Tshogpa. The poor ownership and collective action among beneficiaries may be because of no strict penalty being imposed by the association to free-riders among users during construction as well as in maintenance of channel. Free-riders were equally benefited from the channel without participating. This weakness in the association could be the principle cause of poor cooperation among the users. In fact, farmers did not see the need for imposing fines in systems with strong leadership and good working order (Lam and Ostrom, 2009). However, strong leadership was lacking in Seran Kulo project during and after construction.

According to concept of Lam and Ostrom (2009) water adequacy in the channel is influenced more by collective action and good management practices among users than deteriorating physical structure. This particular statement is apt for this case study. The fact that Seran kulo had many leakages formed and large volume of water available at the source was lost along the way and only half of the water was available for the users. This brought about inadequate water for paddy cultivation. The collective action among beneficiaries and good management with proper maintenance of channel would have kept the irrigation channel in good condition. This would have prevented leakages along the channel and increasing water availability at the field. Therefore, good combination of physical structure and management practices among users would bring about adequate water in the field.

7.3 Paddy yield and rice self sufficiency

During the renovation of Seran Kulo, participation of some beneficiaries in contribution of labour was lacking which disrupted the cooperation among beneficiaries in the community. This act of some beneficiaries may be reason for not contributing the fee collected for future maintenance of channel by WUA. The condition of channel was observed to be deteriorated with many leakages with poor management. Water inadequacy affected the paddy yield of tail – end users with comparatively low yield of 1691kg/ha than land located at top (2018 kg/ha) and middle (2071 kg/ha).

According to Pike 1995, low paddy productivity in India is attributed to poor water management practices and low level of maintenance of canals. Further unequal water distribution and inadequate water supply would interrupt normal agriculture production practices decreasing yield affecting food self sufficiency of community (Loe and Bjornlund, 2010; Datta, 2000; Chambers,

1988). Similarly, this study found that water management and its availability affected paddy yield, which was evident from the difference in paddy yield among top, middle and tail-end located lands. Although the average yield (1927 kg/ha) was higher than the Samtse Dzongkhag (870kg/ha) but due to unequal distribution and inadequacy of water for tail – end user, the yield was low with 1691kg/ha.

Paddy cultivation in Bhutan is labour intensive (Ghimiray et al., 2007) engaging many people. One of the factors in increasing paddy yield is availability of labour. The households self-sufficient in rice are the ones who had enough labour from household. These households in addition to cultivating own land leased in or sharecropped more land that had access to available water from the channel. These increased paddy production of household and were able to achieve self-sufficiency in rice (table 11). The households with labour shortage leased out, sharecropped or left land fallow. Such households were not self – sufficient in rice and adopted alternative source of cash income to purchase rice from market.

Although, there was increase in paddy yield none of respondents sold rice for cash income. Ghimiray et al. (2007) found that in Bhutan quantity of rice marketed by farmers was quite low. This was attributed to high consumption of rice by the households. Wages for farm labour were paid from the paddy produced due to shortage in farm labour. This led to reduction for home consumption and was supplemented through off farm, on farm work, cash crops and remittances. Researcher assumes that rice produced may not be so much in excess for sale. They had to store it till next season to arrange food for labours. Therefore, slight changes in yield did not bring improvement in self sufficiency of households after the construction of channel.

CHAPTER 8 CONCLUSION AND RECOMMENDATIONS

The beneficiaries of the Seran Kulo irrigation project participated in seeking financial and technical support from the government, facilitated by local governance institutions at the inception of project. During the other stages of project, beneficiaries participated by contributing free labours and stones for construction works but could not influence on planning and decision making. Besides, lack of proper monitoring by Lajab in labour contribution, shortage of skilled labours and lack of technical expertise during construction works resulted in poor quality channel.

Beneficiaries participated in operation and maintenance of channel. After improvement in channel, beneficiaries continued to follow the traditional system of water distribution and maintenance. Water availability increased for the land located at top and middle but was inadequate for tail – end users even after construction. Water availability was found to be low in the field due to many leakages developed along the channel. The complete water volume did not reach the fields. Therefore, farmers considered channel water only an alternative during delay in rainfall.

The WUA induced by government officials i.e AAEO and engineer were non-functional and bylaws of association was not implemented. WUA has initiated in appointing water guard and collection of fees for future maintenance of channel. However, this was discontinued when few beneficiaries refused to pay the amount for maintenance and water guard was withdrawn as his service was not satisfactory to beneficiaries. Maintenance of channel was found to be initiated by an influential leader even after WUA was formed. Further, discontinuation of maintenance fees resulted in poor maintenance of leakages developed in the channel resulting in more loss of water through seepage.

After the construction of channel, water availability improved and paddy yield increased for land located in top and middle, however, tail – end users' experienced inadequate water and there was no increase in paddy yield after improvement of channel. Land located in tail – end left their land fallow due inadequate water from channel and also shortage of labour. Households that had adequate labour from households leased in or sharecropped more land that had access to water in order to increase rice self- sufficiency. These self-sufficient households did not sale rice but stored to be used for next cropping season. Rice insufficient households adopted alternative source of cash income from on farm, nonfarm, sale of cash crops and remittances to buy rice from market.

The following are the recommendations for the Agriculture Sector and Dzongkhag Administration of Samtse Dzongkhag that could benefit for the improvement of the present condition of the irrigation system. This is also to improve on proper planning and implementation for the future upcoming irrigation developmental activities in the Dzongkhag.

The procedural manual of NIP 1992, has detail procedure to be followed before and after the irrigation project is requested by the farmers to the government. Active participation from beneficiaries and government officials were lacking in the project and implementation of guidelines of National Irrigation Policy was not realized during the project. To overcome such gaps in management of project, there should be proper monitoring system to be developed. The DAO and Dzongkhag Engineer (DE) should be responsible to monitor twice in the initial and implementation stages of the project. Where work plan should be developed by concerned field staffs. There should be a joint evaluation on channel quality to be conducted in presence of experts from the headquarter, after the completion of project.

There is need in capacity building of Agriculture Extension Officers in the geog through trainings on group formation, basic knowledge on agriculture engineering such as in construction of irrigation structures and farm road construction (this is one of the major activities in rural development in Bhutan). It was realized during interview, agriculture extension officer had no formal trainings on facilitation in group formation and lacked knowledge on agriculture engineering. This would supplement their role to monitor such projects at the field level with engineers.

The Dzongkhag should facilitate with agriculture extension to timely review the trainings for WUA members on management of association.

Focal person in irrigation should be stationed at Dzongkhag level to assist the Agriculture Extension Officers and engineers and for overall monitoring of irrigation in the Dzongkhag. This action would help to overcome shortage of manpower in the Dzongkhag.

The Dzongkhag Agriculture Sector need to explore the feasibility to store water when its in plenty with the irrigation experts. This will increase the availability of water in the field during water scarce period.

During the construction of the channel, masons wages were covered by the government but due to delay in the payment of wages, 2 out of 4 did not turn up for the work. Further, engineer was not available for regular monitoring of work and could seldom visit the site. Overall, technical expertise in engineering was lacking in this project. This was one of the factors for poor quality of channel that developed into many leakages within short duration after completion of project. Masons had key role to play in construction in absence of engineer. Apart from budget for procurement of construction materials, budget for mason wage should be given to the geog administration for quick and timely disbursement.

The Gup, Geog Administrative Officer and Agriculture Extension Officer along with all the beneficiaries of Seran Kulo including WUA members should participate in a meeting to understand the gaps in poor functioning of the association and accordingly restructure the existing WUA.

REFERENCES

- Berg, T. R. 2008. Irrigation Management in Nepal's Dhaulagiri Zone: Institutional Responses to Social, Political and Economic Change. Ph.D, Aalborg University.
- Bjornlund, V. & Bjornlund, H. 2010. *Incentives and Instruments for Sustainable Irrigation*, UK, WIT Press.
- Bleeker, P., Gaudet, J. & Nepal, S. 1994. Development of Wua Constitution and Bylaws. *In:* Department of Agriculture (DoA) (ed.). Thimphu.
- Bruns, B. 1993. Promoting Participation in Irrigation: Reflections on Experience in Southeast Asia. *World Development*, 21, 1837-1849.
- Burton, M. 2010. Irrigation Management : Principles and Practices, Wallingford [etc.], CABI.
- Chambers, R. 1988. Managing Canal Irrigation: Practical Analysis from South Asia, Cambridge Univ Pr.
- CIA. 2010. *The World Fact Book* [Online]. Available: https://www.cia.gov/library/publications/the-worldfactbook/fields/2012.html [Accessed 30 May 2011].
- Cifdaloz, O., Regmi, A., Anderies, J. M. & Rodriguez, A. A. 2010. Robustness, Vulnerability, and Adaptive Capacity in Small-Scale Socialecological Systems: The Pumpa Irrigation System in Nepal. *Ecology and Society*, 15.
- Coward, E. W. 1980. Irrigation Development: Institutional and Organizational Issues. *Irrigation and agricultural development in Asia: Perspectives from the social sciences*, 15–27.
- Datta, A. 2000. Water and Food Security: Perspectives from Bangladesh. *In:* Peter P. Mollinga (ed.) *Water* for Food and Rural Development: Approaches and Initiatives in South Asia. New Delhi: Sage Publications Pvt.
- Department of Agriculture (DoA) 2010. National Irrigaiton Policy (Revised 2011). Thimphu: Royal Government of Bhutan.
- Dorji, T. 1989. Farmer Managed Irrigation Systems in Bhutan. *In:* Robert Y. & Juanita T. (eds.) *International Workshop of the Farmer Managed Irrigation Systems Network.* Chiang Mai, Thailand: IIMI.
- FAO. 1996. World Food Summit: Rome Declaration and Plan of Action [Online]. Available: <u>www.fao.org/wfs</u> [Accessed 30 May 2011].
- Ghimiray, M., Wangdi K., Chhetri, G. B., Bockel, L. & Punjabi, M. 2007. Rice Commodity Chain Analysis. Available: <u>http://www.moa.gov.bt/moa/downloads/downloadFiles/MoADownload7ek1905rn.pdf</u> [Accessed 16 February].
- Groenfeldt, D. 1991. Building on Tradition: Indigenous Irrigation Knowledge and Sustainable Development in Asia. *Agriculture and Human Values*, 8, 114-120.
- Groenfeldt, D. 2006. Multifunctionality of Agricultural Water: Looking Beyond Food Production and Ecosystem Services. *Irrigation and Drainage*, 55, 73-83.
- Hunt, R. C. 1989. Appropriate Social Organization? Water User Associations in Bureaucratic Canal Irrigation Systems. *Human Organization*, 48, 79-90.
- Kissawike, K. 2008. Irrigation-Based Livelihood Challenges and Opportunities : A Gendered Technography of Irrigation Development Intervention in the Lower Moshi Irrigation Scheme in Tanzania. Proefschrift Wageningen
- Met lit. opg. Met samenvatting in het Engels en Nederlands, s.n.].
- Kundell, J. 2007. Water Profile of Bhutan. Available: <u>http://www.eoearth.org/article/Water_profile_of_Bhutan</u> [Accessed 30 May].
- Lam, W. F. & Ostrom, E. 2009. Analyzing the Dynamic Complexity of Development Interventions: Lessons from an Irrigation Experiment in Nepal. *Policy Sciences*, 43, 1-25.
- Loe, R. d. & Bjornlund, H. 2010. Incentives and Instruments for Sustainable Irrigation, UK, WIT Press.
- Maloney, C. & Raju, K. V. 1994. *Managing Irrigation Together: Practice and Policy in India*, Sage Publications India Pvt. Ltd.
- Meinzen-Dick, R. 1997. Farmer Participation in Irrigation 20 Years of Experience and Lessons for the Future. *Irrigation and Drainage Systems*, 11, 103-118.
- Meinzen-Dick, R. 2007. Beyond Panaceas in Water Institutions. *Proceedings of the national Academy of sciences*, 104, 15200.
- Meinzen-Dick, R., Reidinger, R. & Manzardo, A. 1995. Participation in Irrigation. Environment.
- Merrey, D. J. 1996. Institutional Design Principles for Accountability in Large Irrigation Systems, Iwmi.

- Ministry of Agriculture and Forest (MoAF). 2011. *Land Cover Map Updated* [Online]. Available: http://www.moaf.gov.bt/moaf/?p=2216 [Accessed 3 June 2011].
- MoAF 2009. Department of Agriculture Agriculture Statistics 2009. Thimphu: Ministry of Agriculture and Forest.
- MoAF. 2011. *Policy Objective* [Online]. Thimphu: Ministry of Agriculture and Forest. Available: <u>http://www.moaf.gov.bt/moaf/?page_id=7</u> [Accessed 11 June 2011].
- Mosse, D. 1999. Colonial and Contemporary Ideologies of 'Community Management': The Case of Tank Irrigation Development in South India. *Modern Asian Studies*, 33, 303-338.
- National Statistical Bureau 2010. Statistical Year Book 2011. Thimphu: Royal Government of Bhutan.
- NSB 2007. Poverty Analysis Report 2007. Thimphu: National Statistical Bureau.
- NSB 2010. Annual Dzongkhag Statistics. Samtse: National Statistics Bureau
- Oakley, P. 1991. The Concept of Participation in Development. *Landscape and Urban Planning*, 20, 115-122. OECD. 2011. *Gender Equality in Bhutan* [Online]. Available:

http://www.wikigender.org/index.php/Gender_Equality_in_Bhutan. [Accessed 7 September 2011].

- Ostrom, E. & Gardner, R. 1993. Coping with Asymmetries in the Commons: Self-Governing Irrigation Systems Can Work. *The Journal of Economic Perspectives*, 7, 93-112.
- Paul, S. 1987. *Community Participation in Development Projects,* Washington D.C, The World Bank.
- Peljor, N. & Minot, N. 2010. Food Security and Food Self-Sufficiency in Bhutan. Available: http://www.ifpri.org/sites/default/files/publications/bhutannote04.pdf [Accessed 12 March].
- Personal communication with AAEO June. 2011. *RE: Profile of Ugyentse Geog.* Type to ugyen yangchen.
- Personal communication with Gup August. 2011. RE: Ugyentse Geog Information. Type to Ugyen Yangchen.
- Pike, J. G. 1995. Some Aspects of Irrigation System Management in India. *Agricultural Water Management*, 27, 95-104.
- Pradhan, P. 1989. Irrigation Development in Bhutan. Kathmandu: International Irrigation Managment Institute.
- Pretty, J. N., Irene, G., Thompson, J. & Scoones, I. 1995. Particpatory Learning and Action: A Trainer's Guide. IIED.
- Shashidharan, E. M. 2000. *Civil Society Organizations and Irrigation Management in Gujarat, India,* New Delhi, Sage Publications India Pvt Ltd.
- Shrestha, S. 2004. An Economic Impact Assessment of the Rice Research Program in Bhutan. Available: <u>http://www.freewebs.com/samjhana/Reports/Bhutan%20rice%20impact%20report.pdf</u> [Accessed 11 June].
- Suarja, I. G. & Thijssen, R. 2003. Traditional Water Management in Bali. *LEISA-LEUSDEN-*, 19, 25-26.
- Sutawan, N. 1989. Farmer-Managed Irrigation Systems and the Impact of Government Assistance: A Note from Bali, Indonesia. *Public intervention in farmer-managed irrigation systems*.
- Thinley, K., Chhetri, M. & Gurung, B. R. 2010. Rice Mechanization in Samtse Dzongkhag. Available: <u>http://www.amc.gov.bt/downloads/Strategy%20for%20Samtse%20Dz.pdf</u> [Accessed 23 August 2011].
- Vermillion, D. 1999. Property Rights and Collective Action in the Devolution of Irrigation System Management. *Collective Action, Property Rights and Devolution of Natural Resources Management. Food and Agriculture Development Center.*
- Verschuren, P. & Doorewaard, H. 2010. *Designing a Research Project,* The Hague, Eleven International Publishing.
- Wangchuk, D. T. 2010. *Redefining National Food Security* [Online]. Business Bhutan. Available: <u>http://www.businessbhutan.bt/?p=2360</u> [Accessed 10 June 2011].
- Westergaard, K. 1986. *People's Participation, Local Government and Rural Development: The Case of West Bengal, India,* Centre for Development Research, Copenhagen.
- Yeshey & Bhujel, A. K. 2006. Equity and Traditional Irrigation Water Sharing Systems in Lingmutey Chhu Watershed. In: T. Meyer, Stephens, P., & Beukeboom, H.J.J (ed.) A Series of Case Studies on Community-Based Forest and Natural Resource Management in Bhutan. Thimphu: Council for Renewable Natural Resources Research of Bhutan (CoRRB) & Social Forestry Division (SFD).

APPENDICES

Appendix 1 Topic lists

- a. Background of the beneficiaries (Name, Sex, Age, Household size, formal education level)
- b. Natural capital (Access to irrigation water, land ownership (land owned, share cropping, land leased in, land leased out)
- c. Physical capital (Draft animal, machineries)
- d. Human capital (no. of household members engaged in paddy cultivation, labour hired from outside, exchange of labour)
- e. Production (yield (kg) before and after the project, acreage before and after the project, consumption of rice by HH members per year, self-sufficiency of HH in rice, kind of rice, quantity of rice bought)
- f. Economic access (barter, sale of rice, substitution with cheap rice)
- g. Level of participation (passive, information giving, consultation, material incentives, functional, interactive and self- mobilization, influence of elite group on decision making)
- h. Project identification (who proposed the irrigation project?, why ?, what procedure followed?)
- i. Project formulation (local knowledge, existing irrigation system, feedback on planning by beneficiaries, expected benefit by beneficiaries)
- j. Project implementation (how involved?, beneficiaries' contribution)
- k. Water availability (when, how adequate it is?)
- I. Water distribution (who does?, why?, how?, when? (relation to paddy growth stage)
- m. Labour mobilization (collective action, what criteria? (age of HH representative, sex of HH representative, land size), remuneration, frequency, penalty)
- n. Resource mobilization (How? (cash from beneficiaries, financial support from government), finance of WUA and its record)
- WUA (rules & regulations, formation of WUA(why?, how?, no. of meetings/ year, agenda for meeting(who bring it out, participation by farmers?), penalty, power structure (influence by elite group)

Stakeholders

- 1. Chairman of WUA
 - WUA (rules & regulations, formation of WUA (why?, how?, no. of meetings/ year, agenda for meeting, participation by farmers/members), power structure (influence by elite group), finance of association (sufficiency of money, participation of beneficiaries in money contribution (fee collection), penalty)
 - Distribution of water (who does?, how?, why?)
 - Idea of Water availability throughout year, paddy yield, NIP,
 - Maintenance (how is labour mobilized?, criteria for labour contribution by HH, cash collection as substitution)
 - Involvement of government (support to WUA in management training, type of training, how often do they provide, participation of farmer in training) training preferences)

2. Treasurer

• WUA (rules & regulations, formation of WUA (why?, how?, no. of meetings/ year, agenda for meeting, participation by farmers/members), power structure (influence by

elite group), finance of association (sufficiency of money, participation of beneficiaries in money contribution (fee collection), penalty)

- Distribution of water (who does?, how?, why?)
- Idea of Water availability throughout year, paddy yield, NIP,
- Maintenance (how is labour mobilized?, criteria for labour contribution by HH, cash collection as substitution)
- Involvement of government (support to WUA in management training, type of training, how often do they provide, participation of farmer in training) training preferences)

3. Lajab

- Responsibilities in construction of channel,
- WUA (rules & regulations, formation of WUA (why?, how?, no. of meetings/ year, agenda for meeting, participation by farmers/members), power structure (influence by elite group), finance of association (sufficiency of money, participation of beneficiaries in money contribution (fee collection), penalty)
- Distribution of water (who does, how, why)
- Idea of Water availability throughout year, paddy yield, NIP,
- Maintenance (how is labour mobilized?, criteria for labour contribution by HH, cash collection as substitution)
- Involvement of government (support to WUA in management training, type of training, how often do they provide, participation of farmer in training) training preferences

4. Gup

- Local governance (role in irrigation project, formation of WUA)
- WUA (rules & regulations, formation of WUA (why?, how?, no. of meetings/ year, agenda for meeting, participation by farmers/members), power structure (influence by elite group), finance of association (sufficiency of money, participation of beneficiaries in money contribution (fee collection), penalty)
- Maintenance (how is labour mobilized?, criteria for labour contribution by HH, cash contribution)
- Involvement of government (support to WUA in management training, type of training, how often do they provide, participation of farmer in training) training preferences)

5. Extension Officer

- Linkage between farmer and DoA (role in irrigation project, formation of WUA, extension service in paddy production)
- WUA (rules & regulations, formation of WUA (why?, how?, no. of meetings/ year, agenda for meeting, participation by farmers/members), power structure (influence by elite group), finance of association (sufficiency of money, participation of beneficiaries in money contribution (fee collection), penalty)
- Distribution of water (who does?, how?, why?)
- Idea of Water availability throughout year, paddy yield, NIP,
- Maintenance (how is labour mobilized?, criteria for labour contribution by HH, cash contribution)
- Involvement of government (support to WUA in management training, type of training, how often do they provide, participation of farmer in training) training preferences)

6. District Agriculture Officer

- Role in irrigation project, formation of WUA
- WUA (rules & regulations, formation of WUA (why?, how?, no. of meetings/ year, agenda for meeting, participation by farmers/members), power structure (influence by elite group), finance of association (sufficiency of money, participation of beneficiaries in money contribution (fee collection), penalty)
- Distribution of water (who does?, how?, why?)
- Idea of Water availability throughout year, paddy yield, NIP,
- Maintenance (how is labour mobilized?, criteria for labour contribution by HH, cash contribution)
- Involvement of government (support to WUA in management training, type of training, how often do they provide, participation of farmer in training) training preferences)

Appendix 2National Irrigation Policy 1992, procedural manual

- 1. Module 1 Preliminary Investigations
- 2. Module 2 Multi-disciplinary Feasibility Study
- 3. Module 3 Pre-Construction Meeting I
- 4. Module 4 Pre- Construction Meeting 2
- 5. Module 5 Development of WUA Constitution and Bylaws
- 6. Module 6 Banking and Bookkeeping Training
- 7. Module 7 Development of WUA Constitution and Bylaws
- 8. Module 8 Establishment Period Inspection Visit
- 9. Module 9 Dzongkha Water Users' Associations Conference

Appendix 3 Pictures of irrigation channel and paddy cultivation activities

Fig a) Irrigation channel source protected with barbed wire

Fig b) Source of irrigation channel showing water tank for drinking water



Fig c) & Fig d) Collection of water at the source



Fig e) & Fig f) Loss of water through seepage at the source and along the channel



Source: "Own field work" (2011)

Fig g)& Fig h) Land preparation activities with bullocks on terraces



Fig i) & Fig j) Women engaged in transplanting of paddy seedlings



Source: "Own field work" (2011)