CHAPTER ONE

Introduction

1.1 Background:

Irrigation plays a key role in the development of agricultural sector which has remained the backbone of the country's economy. Although agriculture sector contributes the most to gross national production, the development in irrigation has been less than expected. The agriculture sector has still to rely largely on rainfall. Frequent drought and excessive rain have hampered the actual growth of agricultural reduction on one and, while on the other, the rapid population growth has led to a situation of food import for meeting the growing demand. In this context, it has become essential to emphasize on the irrigation development for increased agricultural production from the limited and with the use of surface and groundwater resources available in the country.

Nepal is predominantly an agricultural country where more than 80 percent of its population are engaged in agriculture. Agriculture is the backbone of Nepalese economy due to about 40% is contributed to the GDP. Nepal has a cultivated area of 18 percent of its total land of which two thirds is potentially irrigable. Out of it only 17% of cultivated area has year round irrigation. Water is the white gold and coal of Nepal. It covers around 10% of the total land. Since Nepal is heavily dominated by agricultural activities, irrigation is the prominence factor for ameliorating crops production. Increasing population size of the country crops demand is soaring and famine is facing across the country.

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rain have hampered the actual growth of agricultural reduction on one and, while on the other, the rapid population growth has led to a situation of food import for meeting the growing demand. In this context, it has become essential to emphasize on the irrigation development for increased agricultural production from the limited and with the use of surface and groundwater resources available in the country. While planning for irrigation development, it is also necessary to maintain co-ordination between irrigation and agricultural production programmes towards achieving maximum benefit. It has also become important to entrust full responsibility of the operation and management of irrigation systems to user farmers after soliciting their organized participation in the identification, feasibility studies, selection and implementation of irrigation systems.

In Nepal, for the irrigation of terraces made by the rive basins; farmers divert water of the rivers by making temporary barriers filled with boulders. 'Bhimsen-Kulo' in Gorkha, 'Argali-Kulo' and Tallo-Kulo' in Palpa and other "Raj-Kulos' in Kahmandu valley are the typical examples of ancient irrigation system (Parajuli, 1999:3)

The late king Prithvi Narayan Shah, the founder of modern Nepal, has directed on the importance to land reclamation and settlement, "In case, there are homes on lands which can be converted into fields, these shall be shifted elsewhere, irrigation canals shall be constructed, and the fields shall be cultivated" (Yadav, 1999).

Many changes have been taking place. There has been increase in population growth. This has put more pressure for the increased demand on food. This situation puts more pressure in the irrigated agriculture. In 1990s it is recognized that water is a scarce resource and it will continue to be a scarce resource so increase of agriculture production per unit of water has to be increased. Hence, this new situation also puts pressure in the management of irrigation system for irrigated agriculture. Multiple use of water

has increased so the same source is in competition with drinking water, irrigation and small hydropower. Drying of source of water of these systems due to depletion of forest coverage has contributed in the hardship of water availability. Climatic change has also contributed in the shortage of water for the use by the people.

Irrigation management is not only one-dimensional activity. It has multidimensional activities. They include managing organizations, which operate and deliver water. It also deals with farmer's organization, agriculture credit, extension services and market conditions and water right issues. Hence, irrigation management is to be seen as social, institutional and technical activities. It is no longer considered irrigation management only as technical problem. Changes in irrigation management mean the establishment of multi-disciplinary irrigation department open to the farmer's participation in irrigation management. The irrigation management changes also have to respond to the irrigated agriculture and increasing productivity per unit of water. (www.dlc.dlib.indiana.edu)

Irrigation has been the most important development strategy in the field of agriculture. In the indigenous method of irrigation streams and rivers have been tapped by farmers co-operatively from the unknown. The living standard of the population is also directly related to the status of agricultural production. Therefore, the underlying poverty in the country can be alleviated and the economy can be boost-up only by increasing agricultural production. On the other hand largely depended agricultural production on monsoon rains and risks associated with it's uncertainly are the most powerful factors explaining the present level of low productivity. So, irrigation has been proved to be one of the most important means of increasing agricultural production. The production of agricultural crops highly fluctuated. Some years are very dry and some years are wet and some parts receiving more rainfall but other parts are drier. There are

more than 600 rivers in Nepal. In terms of water resources Nepal is the second rich country however its utilization is very minimal.

Irrigation system of Nepal has been running through agency managed and community managed in which the later is a crucial one in comparison to the former practiced in the world. Now, community managed irrigation is the most crucial factor due to community is the central focus and community stimulus in managing it welcomes sustainability in water resources management. Community managed irrigation system is regarded as the indigenous irrigation practices which are the very old methods for irrigating land brought in practice by people. It is also considered as the "old is gold" method to combat with water famine zone of Nepal.

Although there is most important role of irrigation for the development of agriculture in the country only small portion of the cultivated land area is irrigated through the government or agency-managed irrigation system. According to irrigation dairy 1997 only 30% out of the total potential irrigation land area has been irrigated through the government or agency managed irrigation system and rest of 70% is managed by the indigenous irrigation practices namely community managed irrigation.

Indigenous knowledge (farmer knowledge) system is an important aspect of rural society. Rural people, though uneducated, possess invaluable fund of knowledge about the environment on which their livelihood depends their knowledge, local technology innovation and skills have been helping them to survive in the hostile and unforgiving environment such knowledge initiated and developed by the local people for survival of their communities and culture is referred as indigenous knowledge (IK). Today, in the process of advanced economic development, such local means of survival are looked irrational and unscientific and are often sacrificed for modern industrial technologies. However, they can be the basis of sustainable development as

they can be the basis of sustainable development as they still ensure livelihood for many rural poor.

Indigenous knowledge (IK) refers to the empirical knowledge of group of longtime inhabitations of a specific locate, and the principles underlying its generation, organization meaning and diffusion. Alkeri defines indigenous knowledge as the accumulated knowledge, skills and technology of the local people derived from the direct interaction of human being and their environment (Alteri, 1991 cited by Titilola, 1994:19). Much of such knowledge is derived from generation to generation usually verbally. It is the knowledge that people have gained through inheritance from their ancestors.

It is a people derived science and it represents people's creativity, innovations and skills (Kohana, 1993:11). Rai characterizes the general characters of indigenous knowledge as follows:

1) Indigenous knowledge is initiated, derived and evolved by the local people themselves.
2) It is based on accumulated experiences of people down from generation to generation.
3) It is rooted in socio-cultural structure of society and the peoples strategies to cope with the environment.
4) It is dynamic, flexible, improvement seeking, cost effective and can have scientific validity.
5) It has a potential role in sustainable development. (Rai, 1996:20)

Indigenous knowledge is a major resource of the poor who have limited access to basis and essential material resources. The study of IKS would encourage the local people to feet or sense of legitimacy in their knowledge and brief system. Such introspection could contribute to the empowerment of local communities enabling then to take an active role in shaping their own future (Gurung, 1994 Cited by Rai, 1996:20) In Nepal, where poverty rate has been increased very steadily, the promotion of indigenous knowledge and IK-based technologies could be seen as a part of poverty alleviation programs.

As in many cases increasing rate of poverty is directly or indirectly correlated with the loss of many subsistence indigenous knowledge and resource potentials.

Farmers have developed their own irrigation system taking account of geographical condition topography soil and social structure of the particular location over a period of long time back. The tradition of farmers involvement in the development operation and maintenance of irrigation system has given birth to a magnitude of farmer managed system scattered all over the country. (Pradhan and Yoder; 1991). In the world of irrigated agriculture; Nepal is now being known as' land of farmer managed irrigation system because more than 70% of the agriculture land is irrigated by farmer managed irrigation system (FMIS) (Ansari and Pardhan 1991).

In indigenous irrigation management system, the control is completely in the farmers hands and the water distribution is practiced in the rotational way. In indigenous irrigation management systems, the beneficiaries, participation in decision making is called to address particular problems through periodical meetings of the beneficiaries for the use of the farmers indigenous knowledge and practice and skill in deciding a particular design, shape and size. Therefore, they should be encouraged to utilize irrigation technology, skill and knowledge and practice in agriculture production effectively.

The water users local perception in existing indigenous irrigation management system must be recognized and incorporated in the development process. The farmers' indigenous knowledge and practice, experiences, expertise and skills are to be utilized in irrigation development and organization. So, they are known to be as engineers, community organizers, experts, and consultants in the various development sectors. Pertaining and farmer to farmer exchange programs are carried out having the intention of tapping the indigenous irrigation management systems based on organizational and institutional arrangement. As a result the government of Nepal also has carried out the policy to involve farmers as real partners in irrigation development.

Nepalese farmers have, by and large, recognized the importance of water resources for centuries and have been constructing irrigation systems at their own initiative to intensify their agriculture production. Irrigation development in the country remained in the hands of the people for many years. This tradition has given birth to the FMISs scattered all over Nepal. These systems have developed their own rules, norms and procedures of management. In the FMISs, farmers are responsible for all management activities, encompassing water acquisition from the source to delivery to the plant in the field and management of the system including the resource mobilization and management of resources for O&M. In most of the systems, the extent of the need for resource mobilization for O&M of the irrigation systems have influenced the structure of the organization.

In Nepal, FMIS occupies special status in the national economy and food security system. It is estimated that 40% of food production is produced out of 15,000 FMIS in hill areas and 1700 systems in the tarai of Nepal. Out of the irrigated area in Nepal, almost 70% fall under the FMIS. They are the vibrant systems. FMIS have long history and they are still active institutions in Nepal. Hence, FMIS are the national heritages like other national monuments of Nepal. Again, FMIS are the symbol of democratic values. The community owning the system manages the resources on their own. Hence, FMIS has special place in the irrigated agriculture in Nepal. Farmers have developed their own irrigation systems taking account of geographical impediments and limited services from the government in the past. They have managed their systems by adjusting the operation to the soils, climate, topography and social structure of the particular location over a period of many years. These environmental conditions, which vary tremendously throughout Nepal, have contributed to different patterns of irrigation organization. In addition to distinctively different organizational patterns for the well defined tasks of water acquisition, allocation, and distribution, methods of system O&M, and organizational activities regarding conflict management, communication, resource mobilization and decision making vary. The various patterns of organization are also related to the physical type of irrigation system: hill, river valley, or Tarai system. (Pradhan, 1989)

Nuwakot district, a part of Bagmati zone, is one of the seventy-five districts of Nepal. The district, with Bidur as its district headquarters, covers an area of 1,121 km² and has a population (2001) of 288,478. The district is located between the latitude of $27^0$48' to $28^0$06' north and longitude of $84^0$58' to $85^0$30' east and surrounded by Sindhupalchok in the east, Dhading in the west, Rasuwa and Dhading in the north and Kathmandu in south. The study area Manakamana VDC is situated at about 12 km. north from Bidur (headquarter of Nuwakot) which is located 27°59'57"north and 85°10'25"east (www.wikimapia.com). There are different irrigation projects which are running since the long. Among them "Adheri Khola Irrigation Project" introduced is 2044 B.S. funded by District Irrigation Office" of Nuwakot. However, it was first attempted by local people of this VDC is 2006 B.S. constructed by a local person Dharma Data Ojha, who invested Rs. 600/- at that time. Since, 58 years it irrigation have been managing local people themselves. There are two wards covered by this project for year-round irrigation facility the coverage area of this project is about 30 hec. consisting around 250 households are its direct beneficiates. There are 3 user groups in this project and each headed by male.

1.2. Statement of the problem:

Nepal is a mountainous country with a great deal of physical and cultural diversity. It is a realized fact that economy of Nepal can be productive only when human resources and physical resources are mobilized in an institutional level. Nepal is most depended upon the initiatives and efforts of individuals and groups scattered throughout the country and where people's participation is most crucial to the strength of the nation.

In Nepal, Farmer Managed Irrigation Systems (FMIS) occupies special status in the national economy and food security system. Out of irrigated area in Nepal, almost 70% fall under farmer managed irrigation systems. They are the vibrant systems. The history of FMIS is long and they are still active institutions in Nepal. Hence, FMIS are the national heritage of Nepal. Secondly, FMIS are the symbol of democratic values. The

community owning the systems manages the resources on their own. They evolve the rules and regulations on their own and implement them with consensus within the community. Hence, first FMIS has a special place in irrigated agriculture in Nepal (Pradhan, 1989). Similarly Manakamana VDC's **Adheri Khola** Community Managed Irrigation System has been in practice almost for the last 58 years ago. People of this village have been utilizing the water resources of **Adheri Khola** river for irrigating their fields. The total irrigated land is estimated to be around only 30% all over the VDC, which is managed by this method of irrigation system. Management of this system is done by farmers or water users themselves. The working hours are decided in terms of the size of land holding pattern, contribution and deliberation.

There is wide reporting of water theft, delay in paying leving, over-utilization of canal by landlords, lower chance of peasants and sharecroppers in utilizing water, organizational representative ness problems among local water users and so one farmer's participation in this irrigation system is the best exemplary model to cope with the water scarcity zones of this area. Therefore, to analyze and inquire the impacts of community managed irrigation system, this research study has been an impetus of it. As a result the researcher has made an effort to calculate and compare between agency managed and farmers managed irrigation.

1.3. Objective of the study:

In general, this study is to examine and analyze the impacts of community managed irrigation system. Specifically, it intends:

1) To study the management aspect of irrigation system of the study area.
2) To examine the socio-economic conditions.
3) To suggest measures for improvement.

1.4. Significance of the study:

Nepal is rich in the context of rivers. There are almost 6000 rivers in the country with total length of about 4500 km. These rivers are draining in every year but due to lack of technology, technical expertise and resources flowing water is not useful

for the economic development of the country. Therefore, irrigation development is important concerns for increasing food grain production to feed rapidly increasing population. Nepal has abundant water resources for irrigation development not only for surface irrigation but also for ground water development. (Pandey. 1987)

The irrigation distribution systems are rudimentary and lack of permanent structure such as diversion weirs, intakes and cross drainage structures. Uninterrupted irrigation facilities, proper technology on well farming system and high yielding varieties of seeds are important to improve the agricultural sector to the desired level. Realizing the fact that the Government of Nepal has undertaken many irrigation projects with the assistance of several foreign agencies. Therefore, this study that has intended to analyze the impact of irrigation on cultivation as well as to the status of farmers. It has further provided valuable information on the modes of irrigation practices and socio-economic changes by **Adheri Khola** Irrigation Project. The findings of the study could be indicative to whole country and bring the agenda that community managed irrigation system is the best method to curb with irrigation related disputes.

1.5. Limitation of the Study:

This research study has only covered the study area of Manakamana VDC particularly the Adheri Khola Irrigation Project. It has taken the data from this particular project area however it has not rushed from the related national agencies to inquire grounded data. But, this study limited has been to only the community managed irrigation users of the study site.

1.6. Organization of the study:

This study has been divided in to six chapters:

The first chapter contents background, statement, objective and significance, limitation of the study. Like wise, chapter two organizes with literature review. The chapter contents research mythology applied in the study. Similarly, chapter four has organized with introduction to the study area. Chapter five and six relates to data presentation and analysis and summary, conclusion and recommendation respectively.

CHAPTER - TWO

Literature Review

Since literature review is the most crucial component of the research to gain others experiences, this study will also be based on the published and unpublished scholarly journals, expertise books websites etc. In addition to this research study will be made efforts to collect genuine ideas through previous researchers and scholars.

Irrigation related various literatures will be reviewed and now, it is presented below;

Irrigation is the artificial application of water to the soil usually for assisting in growing crops. In crop production it is mainly used in dry areas and in periods of rainfall shortfalls, but also to protect plants against frost.

Additionally irrigation helps to suppress weed growing in rice fields. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed farming. Irrigation is often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area.

Irrigation is also a term used in the Medical/Dental fields and refers to flushing and washing out anything with water or another liquid.

Archaeological investigation has identified evidence of irrigation in Mesopotamia and Egypt as far back as the 6th millennium BC, where barley was grown in areas where the natural rainfall was insufficient to support such a crop.

In the Zana Valley of the Andes Mountains in Peru, archaeologists found remains of three irrigation canals radiocarbon dated from the 4th millennium BC, the 3rd millennium BC and the 9th century CE. These canals are the earliest record of irrigation in the New World. Traces of a canal possibly dating from the 5th millennium BC were found under the 4th millennium canal.[4] Sophisticated irrigation and storage systems were developed by the Indus

Valley Civilization in Pakistan and North India, including the reservoirs at Girnar in 3000 BC and an early canal irrigation system from circa 2600 BC. Large scale agriculture was practiced and an extensive network of canals was used for the purpose of irrigation.

There is evidence of the ancient Egyptian pharaoh Amenemhet III in the twelfth dynasty (about 1800 BC) using the natural lake of the Faiyum Oasis as a reservoir to store surpluses of water for use during the dry seasons, as the lake swelled annually as caused by the annual flooding of the Nile.

The Qanats, developed in ancient Persia in about 800 BC, are among the oldest known irrigation methods still in use today. They are now found in Asia, the middle east and north Africa. The system comprises a network of vertical wells and gently sloping tunnels driven into the sides of cliffs and steep hills to tap groundwater. The noria, a water wheel with clay pots around the rim powered by the flow of the stream (or by animals where the water source was still), was first brought into use at about this time, by Roman settlers in North Africa. By 150 BC the pots were fitted with valves to allow smoother filling as they were forced into the water.

The irrigation works of ancient Sri Lanka, the earliest dating from about 300 BC, in the reign of King Pandukabhaya and under continuous development for the next thousand years, were one of the most complex irrigation systems of the ancient world. In addition to underground canals, the Sinhalese were the first to build completely artificial reservoirs to store water. The system was extensively restored and further extended during the reign of King Parakrama Bahu (1153 – 1186 CE).

The oldest known hydraulic engineers of China were Sunshu Ao (6th century BC) of the Spring and Autumn Period and Ximen Bao (5th century BC) of the Warring States period, both of whom worked on large irrigation projects. In the Szechwan region belonging to the State of Qin of ancient China, the Dujiangyan Irrigation System was built in 256 BC to irrigate an enormous area of farmland that today still supplies water. By the 1st century AD, during the Han Dynasty, the Chinese also used chain pumps that lifted water from lower elevation to higher elevation. These were powered by manual foot pedal,

hydraulic waterwheels, or rotating mechanical wheels pulled by oxen. The water was used for public works of providing water for urban residential quarters and palace gardens, but mostly for irrigation of farmland canals and channels in the fields.

In fifteenth century Korea the world's first water gauge, woo ryang gyae (Korean), was discovered in 1441 CE. The inventor was Jang Young Sil, a Korean engineer of the Choson Dynasty, under the active direction of the King, Se Jong. It was installed in irrigation tanks as part of a nationwide system to measure and collect rainfall for agricultural applications. With this instrument, planners and farmers could make better use of the information gathered in the survey.

By the middle of the 20th century, the advent of diesel and electric motors led for the first time to systems that could pump groundwater out of major aquifers faster than it was recharged. This can lead to permanent loss of aquifer capacity, decreased water quality, ground subsidence, and other problems. The future of food production in such areas as the North China Plain, the Punjab, and the Great Plains of the US is threatened.

At the global scale 2,788,000 km² (689 million acres) of agricultural land was equipped with irrigation infrastructure around the year 2000. About 68% of the area equipped for irrigation is located in Asia, 17% in America, 9% in Europe, 5% in Africa and 1% in Oceania. The largest contiguous areas of high irrigation density are found in North India and Pakistan along the rivers Ganges and Indus, in the Hai He, Huang He and Yangtze basins in China, along the Nile river in Egypt and Sudan, in the Mississippi-Missouri river basin and in parts of California. Smaller irrigation areas are spread across almost all populated parts of the world. (www.en.wikipedia.org)

Often people farm in a place where enough rain falls during the year (and at the right times) to water the plants just with rainfall. Farmers don't have to worry about the plants getting enough rain. That's called "dry farming" because the farmers don't have to carry water to the plants. (www.historyforkids.org)

2.1. History of FIMS in the World

There have been changes in the irrigation management over period of time. In 1960s, the increase in agriculture production was conceived by more investment in the irrigation infrastructure development. Around 1980s, it was found that irrigation infrastructures being built over period of time have been deteriorated. It is recognized that the participation of the beneficiaries is import for the better maintenance and management of the irrigation systems so there has been promotion of participatory irrigation management. Irrigation has traditionally consumed a large proportion of the world's water. At the beginning of the century, 90% of water use in the world was for irrigation. By 1960, it was about 60% (Biwas 1993). In defense of this water use, Wallingford (1997) pointed out that irrigated agriculture produced 40% of food and agriculture commodities from 17% agriculture land. This makes food security critically dependent on irrigation. The dependence is most critical for Asia where 60% of food production is from irrigated lands. Similarly, long term impact has been felt in irrigation sector in Nepal. (www.dlc.dlib.indiana.edu)

2.2. Nepal: Building on Traditional Strengths

Nepal has a long tradition of direct farmer participation and cooperation in irrigation development. About 70,000 farmer-managed irrigation schemes, ranging in size from very small to thousands of hectares, account for 70-80 percent of the country's irrigation. In general these systems achieve high levels of performance over long periods of time without government cost or involvement. Such systems, however, are frequently damaged by landslides and floods beyond the capability of farmers to repair alone; most can be improved substantially with modern materials and construction techniques. (www.worldbank.org)

Our recorded history shows that in the Lichhavi Era, there was a good deal of provision for agriculture. Feudal lords, Amshuvarma, Jisnnugupta etc. had contributed a lot of improve agriculture. They had made a number of Raj Kulos (indigenous traditional canal) to irrigate the arable land (CDC: 1984)

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The irrigation sector in Nepal is facing new challenges. FMIS is not exception. FMIS is facing the challenges brought by population growth, pressure for increased demand on food, environmental degradation and unavailability of local construction materials and competition on the allocation of water. FMIS is at the crossroad. There are both internal and external challenges to FMIS. The internal challenges are of design, of construction materials due to the depletion of the local construction materials, competition on the use of water, stagnated economic development, new legislation either ignored the existence FMIS or attempt is made to bring these systems under the control of local administration ignoring the need for development of polycentric system to strengthen the democratic values at the grassroots level and the process of assistance by the government to FMIS. (www.dlc.dlib.indiana.edu)

The majority of irrigation land in Nepal is under community managed irrigation system. They have showed that the traditional system of irrigation has stood for centuries. They from the backbone of Nepalese agriculture. So, we have some faith in the tradition technology irrigation system in the common interest of the farmers. (Pradhan etals: 1983)

The Government of Nepal has received financing from the World Bank toward the cost of the Irrigation and Water Resources Management Project, and intends to apply part of the proceeds for consultant services. The services include the technical assistance in improving quality of sub projects selection, preparation, design, construction supervision, monitoring and evaluation of Farmer Managed Irrigation System (FMIS) in accordance with IWRMP guidelines for Surface as well as Groundwater sub projects. In addition to this, the consultant shall prepare and update the implementation manuals and guidelines including social and environmental management plan. And also assist and conduct the institutional capacity development works of DOI and WUA and other stakeholders involved in IWRMP. (www.doi.gov.np)

In Nepal, of the total geographical area of 14,718,100 ha., the land suitable for arable agriculture is estimated to be about 2,641,000 ha. Of this land, the potential irrigable area under surface and groundwater sources is about 1,766,000 ha. owing to the rugged topography and landform. With limited irrigable area and need for enhancing agricultural production to meet the food demand of the growing population, the government has been making conscious efforts in the development of irrigation infrastructure, which is a prerequisite to agricultural productivity enhancement.

Infrastructure development, for year round irrigation, through optimal utilization of the country's surface and groundwater resources and promotion of participatory and inclusive management is the need of the time for poverty alleviation and sustainable development.

2.3. Review of the Current Situation

Historically irrigation development in Nepal began with the initiative and investment of farmers in numerous farmer managed irrigation schemes and that the governments' investment began only after the era of planned development.

Several small, medium and large irrigation schemes were developed in different parts of the country utilizing the surface and groundwater resources under internal and external funding sources upon the inception of the Five Year Development Plans. The development of these irrigation schemes have

contributed significantly in supporting food production. In the hills, priority on the development irrigation infrastructure has been on small and medium irrigation schemes. The government has also supported rehabilitation and improvement of Farmer Managed Irrigation Systems (FMIS) developed by the farmers with their own initiative and local resources.

In the irrigation schemes in operation, initiatives are towards the formation of Water Users Organization and their capacity building and promotion of joint management and management transfer programs to achieve sustainable operation and maintenance through inclusive and participatory management.

The target set for the development of irrigation infrastructure during the Tenth Plan period was 193,600 ha, through development of new irrigation schemes in 129,600 ha and rehabilitation and improvement of FMISs in 64,000 ha, that included 52,600 ha under surface and 77,000 ha under groundwater schemes. At the end of the Plan period, the achievement in the development of irrigation infrastructure was in 87,485 ha, including development of new schemes in 73,187 ha and rehabilitation and improvement of FMISs in 14,298 ha that include surface (25,504 ha) and groundwater (47,683 ha) schemes. Similarly, in the irrigation schemes in operation, programs towards promotion of sustainable operation and management through capacity building of water users' organization and rehabilitation and improvement of essential irrigation infrastructure continued throughout the Plan period. (Three-year interim Plan 065-066)

Nepal portrays a rich tradition of community efforts in natural resource management especially in water resources, forestry, and pastures. Customary norms have delineated water as community resource with elaborate usufruct rights and community governance structures for the management and utilization of these resources by village societies. Apart from these community-based values and norms, state policies and practices have historically been conducive to reinforced community roles in natural resource management. The edict of King Ram Shah in the 17th century mandated water resources related conflicts to be settled at the community level itself. Though such mediation had to take into account local power structures, it

nevertheless allowed community initiatives and governance structures to evolve. In Nepal, over 70 percent of the irrigated agriculture is undertaken through farmer managed irrigation systems.

Both forestry and water resources in Nepal have been subject to various policies and programs spun by the government and multiple donors. In the irrigation sector, only as recent at the 1970s did farmer managed irrigation systems (FMIS) gain recognition within the plans and policies of the state. Truly these FMISs have contributed to food and water security of the nation based primarily on community efforts mediated by their own power relations. (www.dlc.dlib.indiana.edu)

Agriculture is the oldest occupation in the world. The historical background of this occupation may be traced back as old as the human civilization itself. (Uprety: 1980)

Either food grain giving plants of a large tree of the nature water is the life blood for both of them. Supply of water plays an important role in the food grain production, but solar radiation, temperature, rainfall, crop density, growth duration of variety, level of grain yield fertilizer application, seepage and percolation of water from the soil can bring great difference in the amount of water requirement for plants.

There are various methods of irrigation. They include the following:

1. Surface Irrigation
    a. By flooding free flooding broader method, or check method.
    b. Furrow irrigation
2. Sprinkler Irrigation
3. Sub-surface or sub-irrigation.

Surface irrigation is the type of irrigation, where in supply of water in a cultivated land is made through the flow of water from higher to the lower ground of the cultivated land. In the sprinkler irrigation, water is sprinkled as rainfall in the farm land and in sub-surface irrigation supply of water to the

cultivated land is made available through the capillary action of the water especially formed below the surface of cultivated land (Sharma: 1980)

In the process of food grain farming water is one of the most essential elements for a plant. Food cannot be produced without land and fresh water. Increased output depends on more intensive and effective use of the land and water. In this respect, water can be made available to the farmland through different ways, natural and artificial water is normally supplied to the plants by nature through the agency of rain or precipitation which includes natural supply of water and artificial supply of water in a cultivated land. This process is known as irrigation (Poudel 1985).

The impact of Chitwan Irrigation Project on agricultural production with reference to Narayanpur VDC. He has used random sampling technique and primary data, which was collected, through sample survey. Both quantitative and qualitative methods wee used for analysis. He has concluded that, in the study area before Chitwan Irrigation Project was developed paddy cultivation depended upon monsoon rainfall and covered only 25% of total land irrigation. After project was developed paddy cultivated area was increased to 55% of the total land. They paddy yield has also been raised to 19 quintal per bigha (Pagni 1986)

An impact of Sirsa – Dudhara Irrigation Project in Syangja District. This study was mainly based on the sources of primary and secondary data. IMC also used descriptive method. He concluded that Sirsha – Dudhara Irrigation project has brought great social change in this area. He has stated that before irrigation, people could not produce sufficient food grain and they had to import rice and wheat, from other the irrigation facilities. People's socio-economic status and their living of standard are not increasing. Even after the implementation of Kamala Irrigation Project, due to the farming tradition, unknown about fertilizer and farming technology, production and productivity of land did not improve (IMC: 1989)

To know the impact of Rampur Irrigation Project such as an cropping pattern, cropping intensity and crop yield in Chitwan district. He has used the random sampling technique to collect data and conclude that there is significant

change before and after irrigation on cropping pattern. In the study area before irrigation project about 62 percent of the cultivated area districts. All this conditions have changed after the availability of irrigation facility people were able to produce more crops in two seasons. Their annual income and social status have highly developed due to the increase of agricultural production. In conclusion, IMC notes that irrigation is an important factor for the improvement of agricultural productivity of land (Dahal: 1991)

Department of Irrigation gained every department of irrigation program regarding the operation of cropping calendars and water delivery schedules should involve the farmer through water user groups. This promotes a felling of membership within the farmers groups. In new irrigation system farmers must be involved from the start of the planning the system. A training program for the farmers as well as for fields staff should be held to instruct them in the proper use of irrigation water and use of irrigation and drainage facility. The DOI field staff should also be trained in developing knowledge and skills for water users group organization and system operation and maintenance. This allows for an analysis of the systems performance to be made and for corrective measures to be adopted for future improvements. (DOI: 1992)

"Irrigation includes all open action or practices in artificially applying water to the soil for growing crops. It also includes in general sense, the conservation and storage of water supply the carrying of water from the source of supply to the irrigable area and distributing it to the lands it may involve, in many cases, the development and bringing to the surface of water form under ground source by pumping or other means to the lands which can not be reached by gravity from the source of supply". (Rao, 1945)

In sum the various definitions by the researchers and scholars have been given related to irritation management system in the time span. Thus, it can be said that irrigation management system is the process of the supplying the necessary amount of water artificially for the agriculture production or plants. Nepal has abundant natural water resource but it has not been a long history of irrigation in Nepal. In the past Raj Kules were taken into use by feudal lords Amshuvarma and Bisnugupta have had constructed a number of Raj Kulos (NIDC, 1984)

"Indigenous" refers to the point of origin, the source of origin and the source of initiative indigenous systems many incorporate elements and processes from the outside world, provided the initiative for their incorporation is local (Gill, 1996:24). Thus, indigenous knowledge and practice refers to system generated by internal initiative of the people from within the local community and it is initiated and developed by the local people for the survival of their communities and culture is known to be indigenous Knowledge and practice. It has evolved from many years of experiences and trial and error problem solving by people working to meet challenges, they face in their local environments, drawing upon resources, they have at hand (Mooluse, 1989, cited by Messer Schmidt 1992:5)

Indigenous knowledge and practice is the accumulative local skill, technology and methods of the people that is derived from the interaction of human beings and their environment. It is also a lump of experience, skill and technology knowledge and practice of the people for adaptation in ecology that passes from one generation to another and it helps to make over creative, innovative and skillful to the people. Thus, indigenous knowledge and practice is initiated, derived and evolved by the local people themselves by applying easy and cheap skills, methods and technologies and it has potential value for sustainable development. Though, it is not efficient to solve modern problems arising in the human society, however in recent year, the experience and important of indigenous resources management systems have been recognized by the government and scientific community (Thapa, 1996:1).

Indigenous irrigation management system examines the construction, operation, maintenance and preservation of the local irrigation system adopted by the local people in the backward area. On the other hand, farmer-managed irrigation systems reveal locally adopted indigenous knowledge and practice regarding various irrigation management activities, i.e. water acquisition, water allocation, water distribution, resource mobilization and conflict management (Pradhan 1982, 1983, 1990; Martin and yoder 1983a, 1983b, P. Pradhan, 1983a, 1989a b, Martin 1986, yoder 1986, cited by K.C. and Pradhan, 1996:227).

Indigenous irrigation management systems, in general, have self-sustainability and more effective then agency managed irrigation systems. Greater self-sustainability and effectiveness of these systems have been attributed largely to more effective mobilization of local resource for their operation and maintenance and well defined right to water use (IBID, 1996:228).

The farmers, women, rural artisans, cattle herders, shamans, traditional healers and others are the source of indigenous knowledge and practice in Nepal. Thus indigenous knowledge and practice appears to ensure livelihood for the rural people. Nepalese farmers have not adopted the official recommendations on the use of indigenous resource management systems. They experiment themselves and apply that method in the process of using indigenous knowledge and practice. Farmers knowledge and skills result from years of observations experience, trial and error impasse by the need to survive with the available resources under the various stressful and unfavorable environmental conditions (Budhathoki, Gurung and Lohar, 1996:82)

Nepal is regarded as a "water rich" country. The spatial and temporal distribution of Nepal's water resources create surpluses at some times and places and shortages at others. Surpluses occur at many places along hill and mountain water resources. Many of the small streams in the hill and mountain water resources. Many of the small streams in the hill and mountain districts have been fully exploited by farmer managed irrigation systems. The larger rivers, however, are so deeply incised that the only means of exploiting their water resources would be via costly life irrigation schemes (Thapa and Pradhan, 1994:69).

The wide range of studies on indigenous knowledge and practice in the rural communities of Nepal; has revealed their importance in irrigation development. Farmer-management irrigation systems resemble indigenous water resource management of subsistence of the local people which involve operation, maintenance, allocation and distribution. Farmers make decision regarding the use and management of irrigation based on their indigenous knowledge and practice because irrigation is vital for both survival and culture. Gradually, the norms, values, rules and roles relating to irrigation management system have evolved in the mind of the Nepalese people. The farmers have collectively and

individually devised, decided upon, designed constructed, planned, implemented, maintained and improved indigenous systems for the management of natural resource through many countries. (Tamang, 1996:141)

The water resources of the smaller Terai stream are fully exploited by existing irrigation schemes, generally, farmer-managed irrigation schemes and the medium and major irrigation projects are overlapped by the farmer managed irrigation systems in the Terai. Irrigation development prospects in Nepal are especially centralized in the Terai because of the huge mass of land, high potentiality of agriculture production and down flow of the big river.

Rajpur irrigation project located in the plains of western Nepal is one of the largest farmer-managed irrigation system in Nepal. Before hundred years, building of the Burhi Kulo irrigation system was started to construct from the Karnali river at the initiative of the Tharu community leaders. Therefore, Tharus are called "born irrigation engineers". The present government policy of Nepal for irrigation development has made to participate the beneficiaries in farmer-managed irrigation system and well responsibility of operation and maintenance is given to the farmers because of the limited resources and a ceiling on the cast of the rehabilitation has to be fixed. The issue talked how to assist farmer-managed irrigation schemes without damaging their capacity and self-reliance. Irrigation systems in Nepal have become sources of communal unity and harmony. In a homogenous ethnic society, the working of irrigation associations has to be effective government intervention in rehabilitation or modernization of farmer-managed irrigation system has created a dependency. Nearly one third of the Rajpur farmer-managed irrigation system is occupied by the external ethnic groups migrated from hills and purchased from original inhabitants (Tharus) (IIMI, 1992:4)

One most important example of Farmer-managed irrigation system is Chhattis Mauja. Before 150 years, the permission of construction of canal was given to Setha Tharu from the Tinau river in Butwal and linked with the Kumari village. Then, the Chhattis Mauja irrigation system come into existence as large size farmers-managed irrigation system which was designed to serve Chhattis Manjus or village and it is a also called "Kumari Irrigation system", for it served

the Kumari village in the beginning. The water users are participating in the decision making process concerning water management. (Pradhan, 1994:18)

The Chindrapur Kulo FMIS is included in the hill farmer-managed irrigation systems as an indigenous irrigation management system situated in Satakhani VDC in Surkhet District of western region because of the new technology and the government assistant have not reached there. Therefore, the local resources are mobilized on its construction, operation and maintenance by using the local skills, technology, methods and practice. (DIDWP, Surkhet 1999)

Today's human setting is a result of the basin's settlement pattern in ecology and the ensuring human development in the various aspects and use of the land and the river system in farmers-managed irrigation management systems.

The role of farm irrigation and water utilization division (FIWUD) extended in to the development of small gravity irrigation system in the hills. Farmers in each systems have developed an organization structure that fits the needs of their system in its particular environment setting. The structure has evolved over many years and continues to change. Some organization are very sophisticated and have a written constitution, well defined roles and paid functionaries (Pradhan and Yoder, 1990:8).

The important strengths of farmer-managed irrigation systems in Nepal are set up based on local resources and they have ability to respond for maintenance with well defined rules, roles and organization for operation, maintenance and mobilization. Unreliability of the physical structures existed in the farmer-managed irrigation systems because of environmental instability resulting from floods land slides and soil erosion. Most farmer-managed irrigation systems are well managed institutionally but operation is below their potentiality because the government of Nepal also had identified farmer-managed irrigation system to expand and intensify irrigation development in the country (IIMI, 1991)

Some of the farmer-managed irrigation systems have come performing to meet the basic needs of Nepal's growing population. Farmer managed irrigation systems in the recent years could be employed to improve the value of assistance being given to improve and expand these systems. Some

farmer managed irrigation systems are assisted by the various projects and they conduct their work jointly collaborating with the systems. Farmers participation in the design and implementation was mandated to ensure the operation and maintenance. Systems build and managed by farmers in diverse environment exhibit a wide range of management capacities. Because of the awareness programs of assistance by government agencies intended to make the system productive and sustainable.

The government of Nepal also has declared policy to preserve and promote indigenous irrigation management systems by activating the farmer's participation in the various irrigation programs. The main objectives of irrigation policy 1992 are to sustain irrigation development and environmental protection. In the various aspects of irrigation, the farmers have to be given opportunities to use their knowledge, skills, experience and technology in irrigation development (National irrigation policy/HMG, 1992:2) irrigation systems in which farmers take overall management responsibility, a continuous basis and control the water from resource to disposal of access as drainage are referred to as indigenous irrigation management systems.

The farmer-managed irrigation systems were built, operated and maintained by the farmers themselves with little or no help from state or outside agencies. They contribute substantially to the agricultural production of the country, have been managed well and, in general, give better yields. Usually, their infrastructure is simple and lacks provision for water control and management. In other words, they run on the tradition of self-help. The agency-managed irrigation systems, on the other hand, in spite of their recurrently increasing operation and maintenance costs, have not improved their performance. When they were taken over by the state, the old irrigation systems were thought to have much potential for increased performance, as they were rudimentary, lacked permanent structures, were susceptible to damage during floods and to silt problems and had high water losses. In consequence, farmers had to contribute much labour and resources to run these systems. This led the government to rethink its irrigation strategy. By the mid-1980s the government became aware of the importance and strengths of the farmer-managed irrigation systems for the country's

agriculture. There was also recognition of the scope for improving the systems through their rehabilitation and the extension of irrigated area, which would be possible by minimizing water losses and improving management efficiency. Besides, the operation and management requirements (labour and cash) could also be reduced to a manageable level. With this realization the strategy on irrigation development shifted to the participatory approach. With the aim of streamlining government's efforts and investment in a sectoral approach, two specific projects, namely the World Bank/IDA loan-funded Irrigation Line of Credit (ILC) and the Asian Development Bank loan-funded Irrigation Sector Project, have been implemented. UNDP provided the technical assistance for both projects. (www.fao.org)

FMISs in Nepal have operated successfully for centuries. Most FMIS diversion structures are constructed from brushwood and boulders, and are therefore temporary and often washed away during monsoon season. The FMIS canals are generally unlined and prone to damage. There is, typically, a large expenditure of labour every year to restore the systems or to maintain them. In spite of these physical limitations. FMISs have demonstrated managerial skills (at community level) that have kept them functioning and contributing significantly to Nepal's food supply. The total area of the FMISs can be either entirely managed by farmers or assisted by specialized agencies.

The modernization of irrigation systems and improved water management practices could lead to a reduction in irrigation water withdrawal. On the other hand, a higher cropping intensity on the irrigated areas (only 16 percent of the irrigable areas are irrigated year-round), which would be desirable because of the increasing need for food supply, would result in increased agricultural water withdrawal.

Nepal is mainly a rural society, and there is a traditional belief that water is a god-given free commodity. Only the water supplied to urban areas for domestic use is charged on a volumetric basis. Irrigation water is levied as a service charge. This charge is levied only for the public irrigation systems. It varies from US$1.3 to 8.0/ha depending upon the type and source of supply. (FAO. 1995)

Large investments in irrigation have been an essential element in the increase in food production. However, the era of rapid expansion in irrigated areas has passed and the annual rate of increase in irrigated area has dropped from its peak of 2.5 percent in the early 1970s to a create of 0.7 percent, which represent almost 2 million ha per year. In the same period, the costs of irrigation development have grown exponentially as more compels and more expensive irrigation works are required to develop the increasingly scarce water resources. At the same time, competition for water has sharply increased among users in the different sectors. Particularly critical is the situation in arid and semi-arid regions where few water resources of good quality remain for irrigation development and the only options are the use of marginal quality water and greater efficiency in water use. In the coming decades, access to water will become an issue of global concern and competition.

The scarcity of water is closely linked to food security, and the vital question remains as to whether the growth in agricultural production required to sustain population growth and reduce rural poverty can be met with the dwindling water resources available for irrigation. Based on UN estimates, the world population will be 8100 million in 2020, compared to the present 5900 million. To meet food requirements in 2020, FAO estimates that food production from irrigated areas will need to increase from the present 35 to 45 percent (FAO, 1995).

Despite the researcher efforts to review various literatures, still it is fact that lack of related literature is the grounded reality felt in this study. However, in considering that Community Managed Irrigation System was the best is the end will be the best management option of irrigation like Nepalese agrarian society more literatures were focused on it. Since, research itself is the endless topic that is way, the researcher too may luck of empirical studies. But what are reviewed are completely related with this topic and provides more about this topic for upcoming researchers.

CHAPTER- THREE

Research Methodology

3.1. Research Design:

In spite of various research designs this study has curried out on the basis of descriptive as well as analytical research designs. Similarly, case study research design has been applied for making an attempt to bring real data of the study area. To generate the impacts of FMIS for rural development, it has used analytical research design where as for interpretation of data gathered descriptive research design has been maintained.

3.2. Rationale of the Selection of Study Area:

Manakamana VDC located in Nuwakot has diverse characteristics in terms of economy, socio-cultural and geographical structure. Besides, it has lavish portion of paddy land. Out of various community managed irrigation systems, **Adheri Khola Irrigation Project** has been an exemplary model in this VDC. Thus, the researcher has selected to expand its beauty throughout the country and with a hope of promotion of community managed irrigation system. It is well known fact that community oriented development is being targeted to introduce all over the world in the 21st century. Realizing this fact, this study also has aimed to recommend that FMIS is the ultimate strategy to kick-out water related disputes seen in this VDC. In addition to these, bound of time and finance is the another attraction to select this site.

3.3. Sampling Procedure:

The universe of this study has been the community managed irrigation users of the Manakamana VDC. Out of devotement projects launched in this VDC this study has selected **Adheri Khola Project** through quota sampling. There are 262 user house holds and this study has been sampled on 15 percent households via random sampling.

3.4. Sources of Data Collection:

This study has been attempted to explore the impacts of community managed or farmers managed- irrigation system in Nepal in general and study area in particular. Thus, the primary data has been gathered from the participants in this study area. Accordingly, the secondary data has also used for the study that has been agglomerated from published or unpublished written documents, from previous experience of FIMS users.

3.5. Tools and Techniques Data Collection:

This study has been limited on the following data collection tools and techniques:

3.5.1. Household Survey:

To generate fact data from the study area household's survey has applied. It had been used questionnaire to gather data from the individual respondents.

3.5.2. Key informant Interview:

To dig out the actual information on effectiveness of Community Managed Irrigation System in this project area key informant interview has been used to those who are chairperson of user groups committee, teachers and politicians of this community. It has also applied it to related of irrigation department.

3.5.3. Focus Group Discussion:

Since, FGD is a technique of data collection, it has been also applied the FGD by forming homogenous groups out of heterogeneous groups of the population. This has been effective to those who are backwards, deprived, disadvantaged and marginalized.

3.5.4. Field Visit and Observation:

As the study is a case study, the households selected in sampling has been visited two times throughout the project coverage. It has observed the condition of the people before and after this project launched.

3.6. Data Analysis:

After agglomerated the data from the study, the computer program has been taken and simple statistics tools like table, graphs had been applied to analyses the collected data. The results of the tables and graphs had been analyzed by descriptive method.

CHAPTER FOUR

Introduction of the Study Area

4.1. The Nuwakot District

Nuwakot district is a part of Bagmaati Zone with an area of 1121 sq.km locationally, this districts lies in the Central Development region. Biddur as its district headquarter. This district is surrounded by Sindhupalchok in the east, Dhading in the west, Rasuwa and Dhading in the north and Kathmandu in the south. This district has been elevated in different heights ranging from average 600 to 1500 meters. The district is situated between the latitude of $27^0$48' to $28^0$06 north and longitude of $84^0$58' to $85^0$30' east.

Historically the district was the administrative center of nine Kotes (Settlements) hence it was named as Nuwakot. These kotes are Belkot, Kalikakot, Bhairabkot, Malkot, Dhuwakot, Pyaskot, Simalkot, Dhaibungkot and Salyankot.

4.1.1. Population Distribution of the Nuwakot District

Table no. 4.1

Distribution of Population and Education

S.no.	Status	Male	Percent	Female	Percent	Total	Percent
1	Population	142731	97.93	145747	50.52	288478	100.00
2	Literacy Rate	89064	62.40	59319	40.70	148278	51.4
3	Population growth rate			1.62			
4	No. of Households			53169			
5	Average household size			5.43			

Source: Population Census 2001.

From the above table 4.1, total population of Nuwakot is 288478 with male 142731 (49.48%) and female 145747 (50.52%) and population growth rate is 1.62. There are 53169 households with average household size 5.43 and the population density is 257 person/sq.km. 7.35 percent people are urban area in Nuwakot. There are one municipality, 61 VDC and three electoral reason. The total literacy rate of Nuwakot is 51.4% with male 62.4% and female 40.7% (CBS 2001)

4.1.2. Distribution of Population by Economically Active in Nuwakot

The data in table 4.2 shows economically active and inactive population. The finding is vice versa in district. Similarly economically active population is higher than economically inactive population.

Table no. 4.2

Distribution of Economically Active Population

S.No.	Status	Male	Female	Total	Percent
1.	Economically Active	127768	55675	183443	63.59
2.	Economically Inactive	14963	90072	105035	36.41
	Total	**142731**	**145747**	**288478**	**100.00**

Source: Population Census 2001.

In Nuwakot, 63.59 percent population actively participation in economically activities with 127768 male and 55675 female, where as 36.41 percent are economically inactive population.

Main occupation is agricultural where 198761 (68.9%) population involve out of 288478 and 49772 (93.61%) household involve in agricultural out of total 53169 household of Nuwakot. 29087 hector agricultural land in Nuwakot. 11402 ha. (39.20%) land are irrigated out of total agricultural land.

4.1.3. Crops Production in Nuwakot District

Nuwakot has the 29087 ha. cultivable land and other less cultivable land too.

This district is agriculture zone and it has been occupied by these crops especially as in the table 4.3

Table no. 4.3

Crops Production

S.No.	Crops	Area/ha
1.	Maize	19660
2.	Paddy	18764
3.	Wheat	6220
4.	Millet	5900
5.	Potato	1700
6.	Other	1824

Source: Population Census 2001.

This table shows that, the major crops of this area in Maize which has occupied by 19660 ha. The second is Paddy which occupies 18764 out of total land. Likewise Wheat, millet Potato and Others are counted in descending respectively.

4.1.4. Water Resources of Nuwakot District

There are various sources of water which has been irrigating 11402 ha. of total land. Out of which >50 percent land has the year-round irrigation facility. The deferent sources of water to irrigate these lands has been shown in this below table 4.4.

Table no. 4.4

Resources of the Irrigation

S.No.	Irrigation sources	Irrigating Land (ha.)	Percent
1.	Rain water	6177	54.17
2.	Kulo	5078	44.54
3.	Pound/Wells	98	0.86
4.	Boring	18	0.16
5.	Others	31	0.27
Total		**11402**	**100.00**

Source: Population Census 2001.

This table no. 4.4 mirrors out that rain water is the major source of irrigation i.e. 54.17 percent which irrigates 6177 ha. of total land. Similarly, Kulo has irrigated 5078 ha. i.e. 44.54 percent of the total land. Pound/wells, Boring and other cover 0.86 percent, 0.16 percent and 0.27 percent respectively.

4.1.5. Distribution of population by Mother Tongue

The different ethnic groups living in Nuwakot district are distance. The ethnic comprises majority of Tanang, than after Brahnin and Chhetri. Similarly, largest majority of population of Nuwakot district speak Nepalli as a mother tongue which cover more than 58 percent population. After Nepali, Temang speaking population is second largest. The data in the table 4.5 shows the detail figure about the linguistic population.

Table No. 4.5

Distribution of Population by Mother Tongue and Cast/Ethnic Groups

S. No.	Mother Tongue	No. of Population	Percent	S. No.	Cast/Ethnic Groups	No.of Population	Percent
1	Nepali	167894	58.20	1	Tamang	111122	38.52
2	Tamang	106073	36.77	2	Brahmin	59715	20.70
3	Newar	8452	2.93	3	Chhetri	38743	13.43
4	Gurung	952	0.33	4	Newar	21924	7.60
5	Sherpa	721	0.25	5	Rai	9577	3.32
6	Other	4385	1.52	6	Other	47397	16.43
	Total	**288478**	**100.00**		**Total**	**288478**	**100.00**

Source: Population Census 2001.

From the table 4.5 we know that the majority of Tamang ethnic groups which is 38.52 percent, Brahmin 20.70 percent, Chhetri 13.43 percent, Newar 7.60 percent, Rai 3.32 percent and other 16.43 percent. Similarly The different mother tongue groups composition are Nepalli 58.20 percent, Tamang 36.77 percent, Newar 2.93 percent, Gurung 0.33 percent, Sherpa 0.25 percent and other 1.52 percent.

4.1.6. Religious Population of Nuwakot District.

The Table 4.1.6 is about the distribution of population according to their religion. The largest majority population of Nuwakot district are Hindu, Bhuddha covers second majority and Kirat covers third majority of population of the district.

Table No. 4.6.

Distribution of Religious Population

S. No.	Religious	No. of Population	Percent
1	Hindu	176866	61.31
2	Bhuddha	109420	37.93
3	Kirat	1471	0.51
4	Muslim	375	0.13
5	Christian	115	0.04
6	Other	231	0.08
	Total	**288478**	**100.00**

Source: Population Census 2001.

From the table 4.6 we know that the majority Hindu religious 61.31 percent, Bhuddha 37.93 percent, Kirat 0.51 percent, Muslim 0.13 percent, Christian 0.04 percent and Other 0.08 percent.

4.2. The Manakamana Village Development Committee (VDC)

There are one Municipality and 61 VDC in Nuwakot district. Among them, the Manakamana VDC has been selected as a study area. The study area geographically located 27059'57" north and 85010'25" east (www.wikimapia.com) covering approximately an area of 9.33 sq.km. The VDC has been elevated in heights ranging from 640 to 1434 meters. It lies in about 12 km (2.5 kosh) north from Bidur (district headquarter of Nuwakot district). This VDC is separated by Laharepauwa VDC in the east, Fikuri VDC in the west, Thulogaun VDC in the north and Tupche VDC in the South. The Laharepauwa and Thulogaun VDC are located in Rasuwa district and Fikuri and Tupche VDC are located in Nuwakot district. The river (Adheri Khola, Trisuli Khola, Falakhu Khola) flow at this area and play significant role in irrigation. This area lies in Trisuli River Wetland area inside Sub-wetland Adheri River.

4.2.1. Population Distribution of Manakamana VDC

According to the population census of 2001, the total population of Nuwakot district was 288478 male 14273 (49.48%) and 145747 (50.52%) female. Similarly, 1832 (48.93%) male and 1912 (51.07%) female out of the total population 3744 in the Manakamana VDC. Population density 401.2 person/sq.km in Manakamana VDC, 2.06 population growth rate and total literacy rate 52.2 percent with 61.5 percent male and 43.6 percent female. There are 720 household with average household size 5.2.

Table No. 4.7

Distribution of Population and Education

S.no.	Status	Male	Percent	Female	Percent	Total	Percent
1	Population	1832	48.93	1912	51.07	3744	100.00
2	Literacy Rate	1127	61.50	834	43.60		52.20
3	Population growth rate			2.06			
4	No. of Households			720			
5	Average household size			5.2			
6	Population density			401.2 person/sq.km			

Source: Population Census 2001.

4.2.2. Distribution of Population by Mother Tongue

Largest majority of population of Manakamana VDC speak Tamang language as mother tongue, which cover more than 56 percent. After Tamang, Nepali speaking population is the second largest, which is 41.72 percent. And Sherpa 1.07 percent, Gurung 0.45 percent and other 0.16 percent. The data in the table 4.8 show the detail figure about the linguistic population.

Table No.: 4.8

Distribution of Population by Mother Tongue

S.No.	Mother Tongue	Population	Percent
1.	Tamang	2119	56.60
2.	Nepali	1562	41.72
3.	Sherpa	40	1.07
4.	Gurung	17	0.45
5.	Other	6	0.16
	Total	**3744**	**100.00**

Source: Population Census 2001.

4.2.3. Religious Population

The table 4.9 is about the distribution of population according to their religion. The largest majority population of Manakamana VDC are Bhuddha which cover 58.55 percent. Hindu cover 40.87 percent, Christian 0.53 percent, Sikh 0.03 percent and Islam 0.03 percent of population of the VDC. The detail about it have under table 4.9

Table No. 4.9

Religious Population

S.No.	Religion	Population	Percent
1.	Bhuddha	2192	58.55
2.	Hindu	1530	40.87
3.	Christian	20	0.53
4.	Sikh	1	0.03
5.	Islam	1	0.03
	Total	**3744**	**100.00**

Source: Population Census 2001.

4.2.4. Ward-wise Population Distribution in Manakamana VDC

Population composition of this VDC in diverse in nature. Population itself is an indicator of prosperity. Likewise, considering this fact the below table 4.10 shows the ward-wise population distribution of this VDC with total households:

Table No. 4.10

Population of Manakamana VDC

Ward No.	No. of Households	Population	Male	Female	Average household size	Population growth rate
1	58	278	129	149	4.8	1.68
2	62	351	185	166	4.9	2.01
3	87	411	204	207	4.7	1.81
4	101	510	243	267	5.0	2.01
5	109	575	284	291	5.3	1.44
6	**81**	**395**	**203**	**192**	**4.9**	**3.23**
7	51	334	161	173	6.5	3.47
8	**73**	**417**	**196**	**221**	**5.7**	**2.55**
9	**88**	**473**	**227**	**246**	**5.4**	**1.14**
Total	**720**	**3744**	**1832**	**1912**	**5.2**	**2.15**

Source: Population Census 2001.

This above table 4.10 depicts that total households of this VDC is 720 consisting of total population 3744 based on CBS 2001 A.D. Out of total population Male has occupied 1832 and other rest are female, total no. of household are 720, average family size is 5.2 and total population growth rate is 2.15 percent.

Among nine wards of this VDC, this research study has confined in ward no. 6, 8 and 9. Out of total population of this VDC these wards consist 1285 in which 659 are female and remains are males. The average size of the family of these wards in 5.33 and annual population growth rate is 2.31. This shows that these wards have the high population growth rate caused by fertile land.

4.2.5. History of the Adheri Khola Irrigation System

There are various projects in irrigation sector among which Adheri Khola. It is te crucial and largest one in comparison to the others. This project has been started in 2008 BS and ended in 2009/02/09 BS with the financial support of Dharma Datta Ojha of 50 percent and Pyure Ojha rest 50 percent i.e. is total

Rs. 300/- rupees to open the track only. This project has been designed by Mr Sonam Tamang and Padam Bahadur Sapkota had maintained it in 2013 BS.

Upto 2008 BS , the people of Archale didn't have access to irrigation facilities. Farm lands wrer left barren through the time since Mangsir to Baishakh. Land had been turned just grazing land. People used to think impossible to irrigate the land here. The Andheri river was flowing aside but people didn't venture to talk about the irrigation facilities basically due to two reasons. The first was that they were very poor to invest in such projects and they didn't have access to government resources. The second reality was to fetch water from a high cliff was impossible in itself and they didn't have refined technical knowledge.

The traditional ways of living was guided by theology and consequently believe in god. People who are able used to perform daana (donation) to accomplish Mokshya (emancipation).

In 2008 BS, Mr Dharmadutta Ojha from neighboring Gogane village decided to bear the risk to irrigate the land of Archale. People recurrently cite his name as he was the most influential person of that time but he was not alone in this movement. His another friend called Pyure Ojha (Exact name unidentified) contributed the 50% of the amount expensed there. Another person Padama Bahadur Sapkota was also notable because he worked for five and half month regularly without a penny. Mr Sonam Tamang was the technician as well as labourer to finalize the irrigation project.

This project had restructured and Cement built in 2043 BS with assistance of Rasuwa Nuwakot Integrated Rural Development Programme supported by Asian Development Bank. This project in construction period was monitored ad evaluated by District Irrigation office Nuwakot and handovered to the local community. It now managing by local community and the out come of it is effective in comparison to agency made. The 3 wards of this VDC namely 6, 8 and 9 are its coverage. These wards occupy approximately 2600 ha. land of the total land.

Chapter Five

Data Presentation and Analysis

Socio-economic Characteristics of Water User Groups

This chapter presents and analysis the primary as well as secondary information agglomerated lowesated form the field survey. It is the most important chapter which draws the conclusion of the research study. Data has been gathered from the household survey in questionnaire form. These data has been presented and analyzed as following:

5.1. Occupation

Manakamana Irrigation project is a rural area, larger amount of population of the study area (households) engaged in agriculture. But the process of rural area is trying to slightly diversity the occupational structure of its dwellers. Almost the entire households are more or less, related with agriculture either as a primary or animal husbandry is a secondary. Since this area is a zone of agriculture, respondents also are mostly engaged in agriculture. Therefore, more people of the study area have been depended on agriculture for subsistence in the local environment. The business occupation is in the lowest position because of the inaccessible remote place, low economic condition and the lack of transportation. It has shown in this table.

Table No.: 5.1.

Main Occupation of the Respondent

S. No.	Occupation	No. of Respondents			
		Main	Percent	Secondary	Percent
1	Agriculture	31	77.5	4	10
2	Service	3	7.5	2	5
3	Animal Husbandry	2	5	30	75
4	Retail Trade and Shop	3	7.5	3	7.5
5	Other	1	2.5	1	2.5
	Total	**40**	**100**	**40**	**100**

Source: Field Survey, 2008

According to the table 5.1, the highest proportion of population, viz. 77.5 percent engaged in agriculture as main occupation and 75 percent engaged as a secondary occupation in animal husbandry. Service and Retail Trade and Shop include the second highest number of population, viz. 15 percent as a main occupation and Agriculture and Retail Trade and Shop include as a secondary occupation. A remarkable number of people, viz. 2.5 percent are engaged in the other activities that include tailoring, carpentry, handicraft, fishing etc. Among the remaining other economically active people and some are unemployed. The occupational chart would illustrate clear picture of the occupational structure of household in figure 5.1.

Figure No.: 5.1

5.2. Possess of Land

The present land holding size in the country is quite unfavorable from the point of view of equitable distribution. More then 50 present of the households have less than one hectare of land or more than 10 percent of the total area under cultivation, while four percent of upper class control about fourty percent of the total land. *(K.N. Pykural, Impact of rural development programme on income, employment and output of small and big farmers, CEDA, pp., 106-107)*. Because of the existing land the number of small holders is expected to be much higher in the study area. The size of landholding is smaller in this area. The land holding size the study area is presented in the following table 5.2.

Table No.: 5.2.
Land Ownership Ratio

S.No.	Possess of Land	Household	Percent
1	Less 5 Ropanies	4	10
2	6-10 Ropanies	6	15
3	11-20 Ropanies	15	38
4	20-50 Ropanies	9	23
5	More than 50 Rop.	2	5
6	Landless	4	10
	Total	**40**	**100**

Source: Field Survey, 2008

Table 5.2 indicates that, 10 percent family has not land and 63 percent family has low land viz. below 20 ropani. In this, 25 percent family has very marginal land viz. below 10 ropani. 5 percent people have more than 50 ropanies of land. It depicts that 11-20 ropani land acquisition has occupied by 38 percent population where as 5 percent population has acquired more than 50 ropani land. Similarly, there are 10 percent landless households who has been engaging in share-cropping, wage labour and rented farmer.

Figure No.: 5.2

5.3. Entirely Cultivated Land

45 percent families have fully cultivated land and 55 percent families have partial cultivated land.

Table No.: 5.3.
Entirely cultivated land

S.No.	Cultivated land	Household	Percent
1.	Fully Cultivated	18	45
2.	Partial Cultivated	22	55

Source: Field Survey, 2008

Figure No.: 5.3

5.4. Types of Land

Land, which is supposed to be the symbol of political, social and economic prestige, in the research area, is considered to be an important immovable property. Total 36 beneficiary households are owners cum cultivators of the land. All of them work in their own lands. During the transplantation and harvesting reason of crops, the people of the upper castes conduct Warm Parma system for working with quick and easy way. The people of lower castes practice gathering young lead and lad of the village and they are sold to the big land owners as labors on cash in the season of transplantation and harvesting of paddy, wheat, maize, and millet. Similarly, the people of Brahamin, Chhetri castes who are so called rich men (upper castes) have been practicing Khetala system on hire from Kami, Damai and Sarki castes (so-called lower castes of untouchables) on the basis of daily wages. Some people of economically well starts have come keeping Hali for ploughing Khet and Bari land both in cash. The land is mainly categorized into two types: Khet (lowland) and Bari (upland). Because of the marshy land, paddy is predominantly cultivated in the Khat- land for subsistence. Farming system in the research area is completely practiced applying the local methods, skills, techniques, knowledge and experiences for the survival on the basis of long time trial. Thus, due to the possibility of availability of water from the Manakamana, the forest (Jungle) of the Manakamana was cut down and pastureland was converted with the purpose of making the Khet land.

Table No.: 5.4.
Land Type

S.No.	Type of Land	Household	Percent
1.	Khet (Irrigated Land)	21	52.50
2.	Bari (Not Irrigated Land)	2	5.00
3.	Khet, Bari & Forest Land	2	5.00
4.	Khet & Bari	7	17.50
5.	Khet & Forest	1	2.50
6.	Bari & Forest	3	7.50
7.	Lend Less	4	10.00
	Total	**36**	100

Source: Field Survey, 2008

This table 5.4 shows that, Khet has occupied by respondents is 52.5 percent which indicates high necessity of irrigation. Likewise, 5 percent respondents have Bari (not irrigating land). In respect to total respondents, 10 percent are

landless i.e. 4 out of 40 sample households. It has made clear that, majority has the cultivable land. It is shown under the following vein diagram.

Figure No.: 5.4

5.5. Composition of Age Group in study area

Table and the chart show the distributing of population according to their age group. The age grouping is made intervals below 9, 10 to 19, 20 to 29, 30 to 39, 40 to 49, 50 to 59 and 60 over. Majority of respondents (39%) belonging to 20 to 39 years, whereas second majority (26%) belonging to below 19 years. The detail data is given in the table 6.

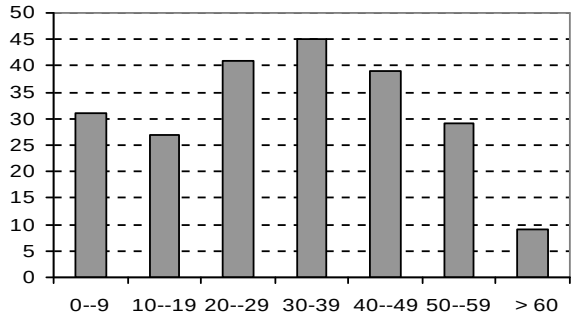
Table No.: 5.5.
Composition of Age Group

S.No.	Age Group	No. of Population	Percent
1	0--9	31	14
2	10--19	27	12
3	20--29	41	19
4	30-39	45	20
5	40--49	39	18
6	50--59	29	13
7	> 60	9	4
Total		**221**	**100**

Source: Field Survey, 2008

The age group chart would illustrate clear picture of the compotation of age group of household in figure 2.

Figure No.:5.5



5.6. Information about Family

Family is the basic and universal social structure. It is the first institution in the history of man. Family is regarded as the primary stage of the social institution, where every child enters into the process of socialization of the community. One the basis of structure, family is divided into three categories: nuclear, joint and extended family. A nuclear family consists of the husband, wife and their children. A join family is the combination of two of more than two nuclear families consisting of parents, married sons unmarried grandsons and grand daughters who have been adopting common property, living, footing and working.

Similarly, an extended family is the merger of several nuclear families consisting of an old man and his wife, their sons, the sons' wives and the sons' children and It is crammed into a single house of a cluster of houses. The types of family of the Irrigation users are provided in Table 5.6.

Table No.: 5.6.

Types of Family

S.No.	Type of Family	Family	Percent
1	Nuclear Family (up to 5)	18	45
2	Joint Family (6 to 9)	17	42.5
3	Extended Family (Large above 10)	5	12.5
	Total	**40**	100

Source: Field Survey, 2008

The above Table No. 5.6 shows that, of the 45 percent families were nuclear, 42.5 percent were joint families and 12.5 percent were extended families.

5.7. Sex Ratio

The sex ratio showed the non balance of sexes in a population. The data shows that the sex ratio is 94.12 males per hundred females.

Table No.: 5.7.
Sex Composition in Study Area

S.No.	Sex	Total population of study area	Percent
1	Male	104	47%
2	Female	117	53%
	Total	**221**	**100%**

Source: Field Survey, 2008

Figure No.:5.7

The table 5.7 and the figure 5.7 shows the distribution of population according to the sex ratio, female population higher then male population. 53 percent female population and 47 percent male.

5.8. Distribution of Respondents According to Education Qualification.

In this study area is found educationally backward out of 40 respondent 22.5 percent have passed SLC and above and rest of them are under SLC. Majority of respondents (30%) are illiterate and second majority (20%) are only literate, similarly 15% are primary, 12.5% are secondary and 10% are SLC pass and so on. The detail distribution is show in the table 5.8 and the chart.

Table No.: 5.8

Education of the Respondent

S.no	Education	Respondent person	Percent
1	Illiterate	12	30
2	Literate	8	20
3	Primary	6	15
4	Secondary	5	12.5
5	S.L.C.	4	10
6	Intermediate	3	7.5
7	Bachelors	1	2.5
8	Master	1	2.5
	Total	40	100

Source: Field Survey, 2008.

Figure No.: 5.8

Table No.: 5.9

Education of the Respondent in Population

S. No.	Age group	No. of Population	Running Education or Educated	Percent
1	6-9	17	15	88.24
2	9-19	33	29	87.88
3	20-29	39	19	48.72
4	30-40	42	12	28.57
5	40-49	35	9	25.71
6	>50	34	5	14.71
Total		**200**	**89**	**44.50**

Source: Field Survey, 2008.

Out of total population, the researcher found 55.5 percent people are illiterate and only 44.5 percent people are literate, under 19 age group around 88 percent people are going to school or college, similarly, 49 percent in 20-29 age group give continuity in education, the researcher found just 14 percent literate people in above 50 age grope and only 9 percent people are literate in above 50 years group.

5.9. Land Irrigated by Respondents

Irrigation is the key to agricultural production. It is the most essential for running paddy farming generally. Paddy farming in this study area is a major cercal crop and it is covered almost all cultivated land. The facility of year round irrigation after this project in this study site is vitally increased. It out of total respondents land possession average 11.55 ropanies/household been completely irrigated throughout the year after this project. It has been shown in this table.

Irrigation (Rop.)
Average 11.55 Ropanies

Source: Field Survey, 2008.

This above table mentions that out of 40 households land majority of the land has been irrigated in comparison to their average possession.

5.10. Irrigation Facility.

Irrigation has played an important role in increasing the production as well as cultivated area. In the context o our study area, the Adheri Khola has irrigated the cultivated area of ward no. 6, 8 and 9 of Manakamana VDC. To some extent, these areas were barren meadow after the construction of AKI Project. The agro-production and cultivated area have been increasing in recent years. But before the construction of AKIP, present study area not sufficiency irrigation facility causes highly barren and meadow field. Before the construction of AKIP, there was not any regular means of irrigation.

Table No.: 5.10.

Sources of Irrigation before AKIP

S.No.	Source of Irrigation	Number of Households	Percent
1	Kulo	-	0
2	Khola	4	10
3	Rain fall (monsoon)	36	90
4	None	-	0
	Total	**40**	**100**

Source: Field Survey, 2008.

Table no. 5.10. shows that, 90 percent of the household has not any source of water for irrigation before Adheri Khola Irrigation Project, they were depended upon rainfall or monsoon for irrigation and only 10 percent of the household has source of irrigation was Khola.

5.11. Women Participation in User Groups.

In it project cover area has three user group in ward no. 6, 8 and 9 in Manakamana VDC. Every ward has one/one user group. Women participation in every user committees is touched but not in equal numbers. This is shown in table. The above table 5.11. shows the condition of women participation in the user group. In comparison to male, females are minimally participated. Out of total user committees, women participation has average only one in each committee. It predicts the condition of women in decision making process in Nepal.

Table No.: 5.11.

Women Participation

S. No.	User Group	No. of Women	Total Member	Percent of Women	Women Participation in Water Use
1.	Ward no 6 UG	3	9	33.33	Around one women participation in every household
2.	Ward No 8 UG	4	11	36.36	
3.	Ward No 9 UG	5	11	45.45	
	Total	**12**	**31**	**38.38**	

Source: Field Survey, 2008.

Table 5.11., user group of ward no 6, 33.33 percent women participation out of nine member, in ward no 8, 36.36 percent women participation out of 11 member. Similarly, 45.45 percent women participation out of 11 member in user group of ward no. 9.

In irrigation activities, around one women participation every family i.e. maintain, project, in use water, or every decision making process.

5.12. Method of Water Utilization.

The water resources in this community has distributed and managed by various methods. It is shown in this table 5.12.

Table No.:5.12

Method of Water Utilization

S.No.	Method of Utilization	Household	Percent
1	Priority to maintain	6	15
2	1st in day	11	27.5
3	Roll by Roll	23	57.5
	Total	**40**	**100**

Source: Field Survey, 2008.

This table depicts that, 57.5 percent said that the user households of this project distributed water by the method of Roll by Roll, other 27.5 percent First in Day and rest 15 percent said that Priority is given to the maintenance contribution.

5.13. Changing Pattern of Agriculture Inputs

In the study area from the settlement period farmers were using traditional agriculture inputs in farming. However, in spite of so called traditional knowledge in farming due to high productivity power of land is decreasing day by day. So, now a days farmer are attracted to grow much food in small area of land. There are using modern seeds, fertilizers, equipment and insecticide in farming.

The productivity of agriculture depends upon several factors such as: types of seed, fertilizer, equipment etc.

1. Seeds

After the availability of irrigation facility, people have increasingly used improved seeds. The table 5.13 shows the use of different seeds before and after the Adheri Khola Irrigation Project.

Table No.:5.13

Use of Seed in Household (2044-2065)

S.No.	Before Irrigation	Percent	Types of Seeds	After Irrigation	Percent
1.	33	82.5	**Local**	19	47.5
2.	7	17.5	**Improved**	21	52.5
	40	100	**Total**	40	100

Source: Field Survey, 2008.

The table shows that, before the availability of irrigation, 82.5 percent households have been found to have used local seeds and only 17.5 percent households have been found to have used improve seeds whereas, this figure changed to 47.5 percent and 52.5 percent household respectively now a days.

2. Fertilizer

When we talk about agricultural development, fertilizer is a most important component. The table no 5.14 shows the type fertilizers used by the households.

Table No.:5.14

Use of Fertilizer in Household (2044-2065)

S.No.	Before Irrigation	Percent	Types of Fertilizer	After Irrigation	Percent
1.	24	60.0	**Compost**	19	47.5
2.	2	5.0	**Chemical**	3	7.5
3.	14	35.0	**Both**	18	45.0
	40	100	**Total**	40	100

Source: Field Survey, 2008.

The table shows that, before the availability of irrigation facility. 60 percent households have been found to use compost fertilizer whereas, figure has changed to 47.5 percent households. In the same way 5 percent households have been found to use chemical fertilizer and 35 percent households used

both before the availability of irrigation whereas, this figure has changed 7.5 percent and 45 percent after the availability of irrigation facility.

3. Equipment

Equipment means agricultural inputs which are used on the process of production. The following table 5.15 show the types of equipment used before and after the availability of irrigation. Here, traditional equipment means, traditional spade, plough etc. Whereas, modern equipment means ironed plough, modern spade ect.

Table No.:5.15

Use of Equipment in Household (2044-2065)

S.No.	Before Irrigation	Percent	Types of Equipment	After Irrigation	Percent
1.	35	87.5	**Local**	28	70.0
2.	5	12.5	**Improved**	12	30.0
	40	100	**Total**	40	100

Source: Field Survey, 2008.

The table shows that, before the available of irrigation facility, 87.5 percent households have been found to have traditional equipment and 12.5 percent households used modern equipment. But after the irrigation facility this figure have been changed to 70 percent and 17.78 percent households respectively.

5.14. Change in Crop Production

Expansion of irrigation has increased the production of crops between 2044 BS and 2065BS. It is due to the increase of irrigation facility in a cultivated land. The table 5.15 shows the agricultural production and causes of increased the crop production before and after of the project.

Table No.:5.16

Causes of Increased in Agricultural Production

S. No	Agricultural Production increase after project	Household	Percent	Causes of Increased
1	Yes	37	92	- Achievement of irrigation facilities - Utilization of improved seeds - Utilization of fertilizers - Using modern equipment etc.
2	Unknown	1	3	
3	As it is	2	5	
	Total	**40**	**100**	

Source: Field Survey, 2008.

5.15. Production Sufficiency Status Before and After this Project.

Adheri Khola Irrigation Project has a positive impact on farmers because of increased production. The following table 5.17 shows the production sufficiency status before and after the availability of the irrigation facility.

Table No.:5.17

Production Sufficiency Status in Household

S. No.	Before Irrigation	Percent	Sufficiency Condition (in monthly)	After Irrigation	Percent
1.	3	7.50	≤ 3	0	0.00
2.	6	15.00	3 - 6	1	2.50
3.	10	25.00	6 - 9	7	17.50
4.	21	52.50	> 9	32	80.00
	40	100.00	Total	40	100.00

Source: Field Survey, 2008.

The table 5.17 shows that, before the availability of irrigation facility, 7.5 percent households belonged to less or equal to 3 months production sufficiency class, 15 percent households 3 to 6 months production sufficing class, 25 percent households 6 to 9 months production sufficing class and 52.5 percent households above 9 months production sufficiency of surplus class. This figure has changed to non of less then 3 percent, 2.5 percent, 17.5 percent and 80 percent households after the availability of irrigation facility. This figure also shows that the availability of irrigation has significantly improved the production sufficiency status of the households in the study area (figure no. 5.15)

Figure No.: 5.15

5.16. Status of Living Standard Before and After this Project.

In the study area, before irrigation the living standard of the farmers was not good enough. The impact of irrigation was so impressive. But the irrigated are mainly occupied the observation of their houses, social status, ways of celebrating festival, living style etc. seem similar before and after irrigation. Therefore, on the other hand irrigated area other communities to income and saving status, living standard has been changed after irrigation due to the impact of the study area. So, the living standard of people irrigated area has been modernized. Table 5.18 denotes the status of living standard before and after Adheri Khola Irrigation Project.

Table No.:5.18

Status of Living Standard Before and After Irrigation (in household)

Particular	Before Irrigation	After Irrigation
A. House Type		
Made with fired bricks and covered wood or grass	28	1
Made with soil and stone and covered teen	12	35
Cemented	0	4
B. Use of Fuel		
Fire wood	39	23
Gover gas	1	13
Kerosene	0	4
C. Toilet		
Local	12	14
Cemented	-	26
No toilet	28	-
D. Drinking Water		
Public tap	3	6
Private tap	-	24
Made from (Gov/NGO)	-	15
E. Consumer accessories		
Watch	3	34
Radio	2	28
T.V.	-	11
Modern Furniture	-	3
Ornaments	13	27
Cycle	-	17
Motorcycle	-	7

Source: Field Survey, 2008.

The above table 5.18 shows that the changing pattern of living standards after this project intervention in this area. It has shown that before this project,

houses were made with fired bricks and covered wood or grass and stone and soil with teen roofs were 28 and 12 respectively. In the same respect the vice verses can be seen and 4 cement built are also created in this area. It is clear out that bit by bit, the living standard of the people is positively changed in all respects.

5.17. Management aspect of the Adheri Khola Irrigation Project

Management of the irrigation is itself bottom live of the community managed irrigation project. This project also confined by the community based irrigation; maximum aspect of the maintenances goes to community people. This has been shown in this following table 5.19.

Table No.:5.19

Management Aspect of the Project in Household

S.no.	Management aspect of the project	Household	Percent
1	Community asset	37	92.50
2	Government	2	5.00
3	If other	1	2.50
	Total	**40**	**100**

Source: Field Survey, 2008.

This table 5.19 shows that 92.5 percent of the respondents viewed on community managed has the highest that other sectors. The rest respondents viewed on other sectors which is very minimal in portion.

5.18. Natural Calamities

Nepal itself is in the high risk zone in terms of natural calamities. It frequently adjoins with various terrified disasters. This project situated in Hilly zone of the Nepal, it has also suffered from the different natural hazards which are shown in this table.

Type of Natural Calamities

1. Land slides
2. Siltation
3. Flash foods
4. Marshland

There are several types of natural calamities among which Land Slides, Siltation, Flash Foods and Marshlands are major. Among them Siltation is the vital problem based on field survey and key informant taken in this study.

5.19. Community Participation in Management.

In 21st century is the age of community based development. Experience, skills and technology gained for century long by the local people give the strategic vision of the indigenous knowledge and practice on the process of exploitation of resources.

Numbers of indigenous irrigation management system related studies in the context of world have been done. In a way, have been developed by the scholars. Of them, Norman Uphoffs conceptual framework (1986) of irrigation management system related activities such as, water use activities (acquisition, allocation, distribution, and drainage), control structure activities (design, constructions, operation, maintenance) and organizational activities (decision making resource mobilization, communication and conflict management) is undertaken as practical one. Therefore, the Adheri Khola Irrigation Project FMIS is operated on the basis of the conceptual framework of Norman Uphoff to reveal indigenous knowledge rooted in the peoples' mind in practice. In the considering this fact, this project Adheri Khola Irrigation Project has the highest level of community participation. The levels of community participation has been shown in this table 5.20.

Table No.:5.20

Community Participation in Management

S.no.	Participation	Household	Percent
1	Yes	33	82
2	No	5	13
3	Unknown	2	5
Total		**40**	**100**

Source: Field Survey, 2008.

This table 5.20 shows, 82 percent respondents favoured that community participation is enough in this project. It has resulted that level of community participation has played crucial role in project sustainability.

Figure No.: 5.19

5.20. Sufficiency of Irrigation from Project (Head, Middle and Tail)

Being a permanent river Adheri Khola due to availability of water. So that, Head, Middle and Tail parts water is sufficiency. But the diversion for the intake of this project, due to heavy flood, heavy rainfall, landslide and erosion occur and canal banks and bed were severely destructed and low quantity of water reached in the canal. These situation focuses middle and tail parts are decreasingly of water. In the canal and the reason for their people of head parts are stole water and use randomly.

5.21. Maintenance of Adheri Khola Irrigation Project

Maintenance means the tasks of repairing and project prescription of the canal for regular and efficient water acquisition, distribution and removal. In case of the Adheri Khola Irrigation Project CMIS, the main canal has been constructed with the collective labor contribution of the community. In the study time, the maintenance works, in general, have been carried out according to the needs of cultivation and, in particular, before the transplantation of summer paddy in the month of June and the works include removing of grass, gravel, dry leaves, and tree trunks accumulated in the main canal which blocks the flow of water. The sub-canals are maintained by the individual farmers according to the need of the users' group. Thus, maintenance activities in the main canal and sub-canals are corresponded with the cultivation of paddy and wheat in the study area. So, the routine maintenance works have been undertaken before the plantation of winter what and summer paddy. Farmers assemble in the fixed place of the command area as informed by the active farmers to discuss about the requirement and to mobilize their collective labor and kind resource in the canal maintenances. If any one is absent, he/she is obliged to pay cash instead of the physical labor in the study area.

Similarly, the tasks of emergency maintenance mainly involve the removal of mud, rock, leaves and herbs from the main canal and the sub-canals and the construction of the damaged parts of the main canal by the over flooding where the emergency problems are encountered in the system. When the heavy rain fall causes the landslide and damages the main canal and the sub-canals, the first person who witnesses the landslide, in forms to the fellow

farmers or the users' groups and then, the farmers assemble and mutually undertake the maintenance works.

Therefore, formal organization and written rules and regulations for harmonious management of the irrigation system related activities have not undertaken into practice an all the activities are mobilized by the verbal rules existed from the time immemorial in the research area. The maintenance of the system has been materialized by the local farmers using the local skills and knowledge in organizational management activities in practice as well as the physical system from the informal way.

5.22. Conflicts in Water Utilization

Conflicts related to water use and rights are the single most things that affect the system as a whole. Therefore, now a day's conflict management in irrigation system has been a great challenge and no systems are free from the conflicts. When more than one individual or groups possess the right to use a particular resource system at a time, conflict to irrigation system, particularly the farmer managed ones, can be considered as community property resources system to which every member of the community is ensured of equal access; single individuals does not possess the right to use or abundant the system water conflicts occur primarily due to every members attempt to claim high right to the system no less than any other. Water conflicts can be broadly grouped in to three different classes depending on the type of parties between, which they occurs:

a. Conflicts between irrigation system.
b. Conflicts among water users within a system.
c. Conflicts between water users and the concerned agency.

Forms of Conflicts

In the study area, mainly four forms of conflicts are reported in water management such as fight each other, blaming each other, stolen of water and claiming or right. The forms of conflicts are given table 5.21.

Table No.:5.21

Forms of Conflicts

S.No.	Forms of Conflicts	Frequency	Percent
1.	Fight each other	2	10.53
2.	Blaming each other	7	36.84
3.	Stolen of water	4	21.05
4.	Climing for right	6	31.58
	Total	**19**	**100.00**

Source: Field Survey, 2008.

Table 5.21 shows that, nearly 37 percent of conflicts are related to the blaming each other. Followed by 32 percent conflicts presented there in claiming for right. Similarly, 21.05 percent and 36.84 percent are stolen of water and blaming each other respectively.

5.23 Conflict Management

Conflict is the manifestation of competition, discussion and dispute with the physical threat, fight, war and so on. If two groups, at a tie, possess the right to use material resources system, the conflict occurred in its use, is a universal phenomena. Therefore, conflict resolution means to solve the problems occurred in the management system of organizational activities. These activities can be occurred in case of the farmer-managed irrigation system which is a common property of the local people. Thus, the conflict may occur among the members of the users' groups, individuals and systems, and inter-groups within the system, and outsiders and system on the process of mobilization of organizational activities in the irrigation management system.

Water conflicts and its resolutions in the Adheri Khola Irrigation Project CMIS are common phenomena because activities related to irrigation. The rules and regulations of irrigation management system can not wholeheartedly be obeyed by all the members of head, middle and tail users. Though, the people of the study area, solve the problems occurred in the system in the local level with their own initiation. That's why, where the conflict, there the resolution.

The conflicts related to water use and rights, which are the great challenges, have affected the system as a whole. Water rights, turn overlapping, water stealing, water rights of the up stream and the down stream, and the canal encroachment are the major causes of the conflicts occurred in the Adheri Khola Irrigation Project CMIS. The conflicts cases related to the system are of simple nature and are resolved at the farmers' level under the mutual consensus.

MODALITY OF INDIGENOUS IRRIGATION MANAGEMENT SYSTEM

Chapter Six

SUMMARY, CONCLUSION AND RECOMMENDATIONS

In this chapter, summary, findings of the study, conclusion of the impact of community managed irrigation system in practice and recommendations in preserving and promoting the indigenous knowledge and practice for the sustainable developments and environmental protection in Nepal are undertaken into overview.

Nepal is the second richest country in the world possessing about 2.27% of the world water resource (CBS, 1999). However, the availability of water varies in all parts of Nepal according to season and location. Thus, the water resources the country, according to the process of acquiring water from the source (Sharma, 1996:37). Similarly, water acquisition is made from surface or sub-surface sources, either by creating and operation physical structure like dams or weirs or by actions. Water acquisition related activities such as design, construction, operation, maintenance of Adheri Khola Irrigation System are carried out by NG's, INGO's and local people are involved. Since this system has permanent Head, middle and Tail work. Water acquisition is no difficult. But raily season heavy rainfall, landslide, flood and winter season of the discharge at the source decreased for the causes middles and tail water users association not sufficient of water. Therefore, the winter season tail WUG not sufficient of the water.

Summary

The indigenous irrigation management system has became more significant to incorporate farmers' age long ideas, experience, practice and self-help attitudes on the process of mobilization of the community managed irrigation system in the specific social setting.

The water resource of the Adheri Khola Irrigation Project is a small stream known as the Adheri Khola,. There are several small sources of water around the dense forest. The stream from the main source of weather to the dam is about 4 km. The dam of canal is constructed at the Kulo KO Bandh. The main canal is about 3 km. and while it reaches to the command area and is divided

in to several sub-canals with the objective of irrigating ward no. 6, 8 and 9 Manakamana VDC.

The Adheri Khola Irrigation Project CMIS, which is located at the lap of the Baskote Paharo, a fairly dense mixed forest, with bio-diversity, is located at Manakamana VDC, Nuwakot. It can be taken as a model of community manage irrigation system practiced by the local people applying the local tools, techniques, methods experience and knowledge for about 200 years with the customary rules and regulations. As an autonomous unit, the Users' Groups have been using water resource of Adheri Khola on agriculture practice as economic activities for the livelihood growing of paddy and maize crops in summer and winter reasons respectively.

Agriculture system is absolutely practiced a about 60% people of the study area and the others are students, teachers, foreign job holders and skill labors but they are also not in isolation from the agricultures. Two crops cultivation patterns including monsoon paddy and winter maize are grown in a year. Indigenous irrigation management system related activities are completely initiated, operated and maintained by the Users' Group using the local tools and technology. Large quantity of the Khet-land (low land) is no the ownership to the people of he Brahamin caste and more untouchables work on the basis of wage in the time of crops cultivation. Because of the lack of transportation, communication and modernization process in irrigation and agriculture system, improved varieties of seeds, fertilizers and technology have not reached until now.

Community manage irrigation system comprises of water use activities (water acquisition, water allocation, water distribution and drainage), and organizational activities, decision making, resource mobilization, communication and conflict management). The tasks related to irrigation organization have been done with the local farmers' invitation as those have become ritual and developed as culture in he local environment due to the lack of written rules and regulations, the traditional social values an norms are the laws for governing the people and here system. Similarly, functions of irrigation organization have been practiced on the basis of division of labor in the Adheri Khola Irrigation Project CMIS.

The research has been launched as case study of community managed Irrigaing System of the multi-ethnic groups: Brahamins, Chhertri, Tamang and the untouchables (Kami, Damai and Sarki) of the Archale village in indigenous irrigation management system. Because of he heterogeneous society, cultural values and norms concerning farmer-managed irrigation system, to some extent, are determined by the existing case system. In fact, the research site is completely isolated from the process of modernization. External intervention for the management of the system is nil. So, various potentialities of indigenous resource management system to improve the socio-economic condition of the rural people are identified on the basis of the local people visualizes the empirical knowledge and practice, transformation from one generation to the another, organizational development and diffusion of the system. Dynamic insights and techniques have been gained through the long time trial and error in responses to the changing circumstances. The pattern of interaction and institutional arrangements of the system have been shaped by the cultural values and norms as well as the local skills, methods and techniques for the smooth mobilization of the system by exploiting the nature. Therefore, institutional arrangements, organizational processes, and technologies for the management of community-managed irrigation system have been retained as indigenous knowledge in practice and have facilitated by the concepts of rules, roles, and groups with the tasks of indigenous irrigation management system related activities. Thus, the beneficiaries of the universe have been able in creating an irrigation organization for managing the system that becomes useful to incorporate indigenous knowledge of the people. Indigenous knowledge and practice can be characterized flowingly:

The local people on the basis of the accumulated experiences evolve indigenous knowledge and practice. It passes down from generation to generation. It is the integration of internal and external knowledge in practice. And, it provides an interdisciplinary overview and practice, scholars and the learners. Similarly, indigenous knowledge and practice, in such a way is developed as culture to adjust in the local environment. It is dynamic and flexible processes and has scientific validity that reveals a model of sustainability. It carries out the socio-cultural values and norms flourishing in the local environment.

The present study is a micro-level study of the Adheri Khola Irrigation Project CMIS with the emic approach and it is easier for the rapport building to the farmers. On the process of field study, census was used to select the respondents for the analysis of holistic aspects of the universe. Old aged, knowledgeable and intellectual persons were selected for providing insights and views into the irrigation management system. The methodologies applied to analyze various activities are interview, case study, operational variables and indicators, household census, questionnaire, group and key informants, focus group discussions (FGDs) and data analysis. All these were accompanied by the observation. Similarly, Norman Up offs conceptual framework related to irrigation management activities is adopted to operate the indigenous knowledge and practice of the local people in the context of the Adheri Khola Irrigation Project CMIS.

Therefore, the Adheri Khola Irrigation Project CMIS is operated, maintained and mobilized by the local farmers on the basil of traditional social values and norms developed as laws in the society flourishing in the specific environment by exploiting the nature for sustainable use, development and environmental protection. This project has facilitated equally to all members which is its good will in various respect and regarded as exemplary model CMIS in Nepal.

Conclusion

The Archale Kulo CMIS is an irrigation system managed by the local people initiated, operated, organized and maintained possessing valuable skills and technology as the indigenous engineers, system organizers, planners and implementers. The local people have a lump of practical knowledge and experience of the system managements and resources mobilization.

The local people using empirical knowledge, skills, methods, and technology for subsistence in the local environment have maintained the system. The system has been acknowledged on the socio-economic and the socio-cultural grounds having objective to fulfill the food requirements of the local people for livelihood. This, in a way, becomes a bridge between traditional insights, assumptions, experience, skills and technology on the sustainable use, development and environmental protection. In this respect, the local human resource, local tools and technology, strategy of natural resources management system, collective indigenous knowledge, experience, skills and

attitudes of the people and their initiation and participation on the process of the resource exploitation seem to be more sustainable.

No doubt, the Archale village of the study site of Manakamana VDC ward no. 6, 8 and 9 is physically isolated because it is inaccessible remote place from the market and road access. The local people, therefore, have been used their own fundamental knowledge, skills and resources on the canal construction as well as the system management, human resource mobilization based practice is dominantly done than the environment and operation and maintenance works of the system have been done with the available local tools, technology and resources. Thus, the system on the basis of long time trial and error have been developed by the beneficiaries of the multi-ethnic groups with the integrated indigenous knowledge and practice that has been sustained the system, resources, skills, technology and the physical environment.

Recommendations

The Adheri Khola Irrigation Project CMIS is a locally developed system for economic arrangements in course of subsistence pattern growing maize, paddy and wheat as that provides insights of the indigenous knowledge and practice of the local people. On the basis of the above mentioned findings of indigenous knowledge and practice in irrigation management system of Adheri Khola Irrigation Project, I would like to purpose the following suggestions are recommended.

1. Indigenous knowledge and practice adopted by the local people of the Archale Kulo CMIS has to be encouraged in all the phases of irrigation management system for sustainable development in local and national level.
2. Farmers are taken as the local engineers, experts and organizers of irrigation management systems. Thus, the representative of the farmers has to be involved in planning, designing, demonstration, operation and, maintenance of the system to promote and preserve indigenous systems.
3. Government and other agencies related to irrigation organization should be aware about the value of indigenous knowledge of the local

people for implementing irrigation system management related activities in agriculture production.

4. Institutional development of the Adheri Khola Irrigation Project CMIS needs external economical and technological supports from the government another concerned sectors for its sustainable use, development and environment protection.
5. An inventory of agricultural, financial, spatial, technical and environmental aspects of the Adheri Khola Irrigation Project CMIS has to be made to promote indigenous knowledge of the local people in practice.
6. Policies concerning indigenous irrigation management system have to be made and taken into force for the smooth mobilization of the system.
7. Traditional system of irrigation management is not sufficient to increase agriculture production for reducing the scarcity of the rapidity roaring population. Thus, traditional, local and external systems have to be integrated to highlight the indigenous irrigation management system.
8. Local people have to be encouraged, motivated and induced for their age long experiences in the indigenous irrigation management system and having practiced the local rules and regulations and law for the sustainable use and development.
9. The fundamental framework of the Adheri Khola Irrigation Project CMIS has to be established from the perspective of the indigenous irrigation management system as an autonomous unit.
10. Government and NGOs should provide the training and seeds to the farmers to produce vegetable and cash crops which helps to increase their economic condition.
11. Women's active participation should be enhanced in decision making process.
12. Irrigation canals should protect from the landslide by encouraging User Groups in plantation of tree in canal side.
13. Siltation carried by bank cutting of the river should be checked by creating sand reservoirs near to the river in the canal way.

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Appendix – 1

Impact of Community Managed Irrigation System

(A Case Study of Adheri Khola Irrigation Project of Manakamana VDC, Nuwakot District)

QUESTIONNAIRE FOR THE HOUSEHOLD SURVEY

Personal Information

1. Name of the Respondents:

   Age: Locality:

   Address:

2. Marital Status:

   a. Married: ☐ b. Unmarried: ☐ c. Divorced: ☐

   d. Widow ☐ e. Separated: ☐

3. Education:

   a. Illiterate ☐ b. Literate ☐ c. Primary ☐ d. Secondary: ☐

   e. S.L.C. ☐ f. Intermediate ☐ g. Bachelors ☐ h. Master Degree☐

4. Main occupation:

   a. Agriculture: ☐ b. Service: ☐ c. Animal Husbandry☐

   d. Retail Trade and Shop ☐ e. If other (specify)

5. Secondary Occupation

   a. Service ☐ b. Animal Husbandry ☐

   c. Retail Trade and Shop.☐ d. If other (specify)

6. Household Member:

Members	Gender	Age	Education	Primary Occupation	Secondary Occupation

7. Information about Family

   a. Nuclear Family (up to 5) ☐ b. Joint Family (6 to 9) ☐

c. Joint Family (Large above 10) ☐

8. Household Composition:

a. Total number of Male: ……. b. Total number of Female: …….

9. Who is the Head of the .Family?

a. Male: ☐ b. Female: ☐

10. How much land do you possess?

a. less 5 Ropanies ☐ b. 5-10 Ropanies ☐ c. 11-20 Ropanies ☐

d. 21-50 Ropanies ☐ e. More than 50 Ropanies ☐ f. Landless ☐

11. Is your land entirely cultivated? a. Yes ☐ b. No ☐

12. How much land does irrigate by this project? ..... ….. Ropanies

13. Type of land:

Sno.	Land Type	Area in ropanies	Cultivation ownership			Remark
			Self	Rented out	Rented in	
1.	Khet					
2.	Bari					
3.	Grazing land					
4.	Forest land					

14. What were the methods or sources or irrigation before this project in this area?

a. Kulo ☐ b. Khola ☐ c. Rain fall (monsoon) ☐ d. None ☐

15. Is this project sufficient are there in this project? a. Yes ☐ b. No ☐

16. How many user committees are there in this project? …….. groups.

17. What is number of women participation in user committees?

a. …… b. ……

c. …… d. ……

18. What is the method of utilization of this water resource?

…… …… …… ……

19. What are the conflicts seen in water use?

a. …… b. ……

c. …… d. ……

20. How long does it irrigated the land?

a. Up to 3 months ☐ b. 3 to 6 months ☐

c. 6 to 9 months ☐ d. Year round ☐

If not enough, what are the ways it applying?

……

21. What are the types of new seeds introduced after this project intervention?

a. …… b. ……

c. …… d. ……

If you use new seeds, is your income increased?

a. Yes b. No c. As it is d. Unknown

22. After this project implementation has your agricultural production increased?

a. Yes b. No c. As it is d. Unknown

If increases in crop production, what are the causes?

a. Achievement of irrigation facilities.

b. Utilization of improved seeds.

c. Increase in cultivated land.

d. Utilization of fertilizers.

23. How does this project managed?

a. Community asset ☐ b. Agency ☐

c. Government ☐ d. If other (Specify) ☐

24. How does contribute for the maintenance of the irrigation system?

a. Cash ☐ b. Labour ☐

c. Less cash more labour ☐ d. More cash less labour ☐

25. Is this water project required timely maintained? a. Yes ☐ b. No ☐

26. Does it suffer from natural calamities? a. Yes ☐ b. No ☐

27. If yes, how do you maintained?

a. User groups ☐ b. Individual ☐ c. Community ☐

d. Daily observer ☐ e. If other (Specify) ☐

28. How to collect money, if it is necessary to maintain?

a. Every household ☐ b. Average landholding ratio ☐

c. Average family member ☐ d. Extra activities ☐ e. If other (Specify) ☐

29. Is community participation enough for all management?

a. Yes ☐ b. No ☐ c. Unknown ☐

If no, how can you curb this problem?

……

30. What are the problems associated with it?

……

……

31. What is your suggestion to measure its existing problem and recommend it as an alternative to solve the water management problems?

……

……

……

Appendix – 2

Impact Of Community Managed Irrigation System

(A Case Study of Adheri Khola Irrigation Project of Manakamana VDC, Nuwakot District)

Checklist for the key Informants and Group Interview

1. Land use of command area (in ropani)?
   a) Irrigated b) Rain-fed c) Forest
   d) Grazing e) Homestead f) Others
   g) Total land h) Cultivated land
2. Population in the command area?
   a) Male ……. b) Female …….. c) Total ……..
3. Beneficiary households in the system?
   a) Head aspect …… b) Middle aspect …….
   c) Tail aspect …… d) Total
4. Nature of the sources in the system _____
5. Type of climate found in the area?
   a) Tropical b) Sub-tropical
   c) Warm d) Temperate
6. Canal's type in the system? _____
7. Name of the system …….
8. Source of water supply …….
9. How old is the system …….
10. Types of the system
    a) Farmer-managedb) Agency-managed
    c) Government-managed
11. Nature of the system
    a) Temporary b) Semi-permanent
    c) Permanent
12. What major development and reforms were done in the past?
13. In which season does the demand of irrigation water increase?
14. What is the basis of the water allocation?
15. Who does the water distribute?
16. Is there sufficient water for the irrigation in the system?
17. Where and how is the water drained?
18. When and how are the maintenance work done?
19. How do people participate in operation and maintenance?
20. If anyone does not participate, what are the systems of punishment?
21. What is the process of decision-making?
22. How does the people communicate?
23. Who is guiding the contributors at resource mobilization?
24. What types of conflict are faced in the system?
25. What is the process adopted to resolve the conflicts?

Appendix – 3

Impact Of Community Managed Irrigation System

(A Case Study of Adheri Khola Irrigation Project of Manakamana VDC, Nuwakot District)

Check-list for Focus Group Discussions (FGDs)

1. When was this system stated to build?
2. What is the types of water source?
3. How long is the physical system?
4. What is the type of structure of canal?
5. What type of activities and reforms were done in the past?
6. Number of canals in the system? _____
7. How is the water acquainted? _____
8. What is the status of water acquisition? _____
9. What is the basis of water allocation?
10. Are the beneficiaries satisfied from the present waer allocation?
11. What are the methods of water distribution?
12. What are the rules and regulations for water distribution?
13. Who is responsible for water distribution activities?
14. How is the excess of water drained?
15. In which seasons/months drainage management works are done?
16. What is the purpose of operation and maintenance?
    a) Improve b) Preventive c) Other specify
17. What is the work done in operation and maintenance?
18. If not participate what are the rules of punishment?
19. What are the rules and regulations of operation?
20. What are the processes of operation?
21. How is the meeting called?
22. How do they make the decision over the issues?
    a) Vote b) Veto c) Consensus d) Other
23. What is the process of communication?
24. Who is responsible for communication tasks?
25. What types of resources are mobilized?
26. What are the basis of resource mobilization?

27. What are the purposes for resource mobilization?
    a) Construction
    b) Routine operation and maintenance
    c) Emergency operation and maintenance
    d) Other specify …….
28. What types of punishment are made if anyone does not mobilize the resource required?
29. What are the main causes of conflict?
30. What types of conflicts mainly occur in the system?
    a) General b) Complex c) Both
31. Who is responsible to resolve the conflicts?
32. What are the bases and rules for conflicts resolution?
33. What are the main factors of hindering or problems for the smooth irrigation system activities?
34. How is the problem affecting the irrigation system activities?
35. How do farmers tackle the problems?