CHAPTER ONE : INTRODUCTION

1.1 Background

Nepal is a small Himalayan Kingdom sandwiched between two large countries; China and India. It is bordered with the Tibetan plateau of China in north while India in south, east and west. It is completely surrounded with the land of India and China, so that, is categorized as a landlocked country. The entire northern border of the country is a lateral wall of eternal ice and snow comprising the Great Himalayan Mountain range of the ten highest peaks of the world, eight are in Nepal, including the highest mountain "Everest" with 8,848 m. high from the sea level. The climate of the mountain region in temperate. The hilly region comprises of the greater part with land masses such as, steep slopes, plain villages and slopes. The sub-tropical climate is remained in this region which is called "Ideal climate" by the people. The southern border of Nepal lies on the upper parts of the vast Gangetic plan. This region is known as the "Terai" which is 30 to 50 km. width and long from east to west. The Terai region is considered to be the most productive area of the country as a whole and, thus, it is called "Granary of Nepal". It lies in the elevation of a few hundred meters above the sea level, and has typical type of climate.

Nepal is predominantly an agricultural country where more than 81% farming people depend on agriculture for their livelihood. Therefore, agriculture is the "Backbone" of Nepalese economy due to its unchallenging contribution to the Gross Domestic Products (GDP) i.e. 46.4% (CBS, 1998).

Mainly, agricultural production in Nepal depends on monsoon rains while its uncertainly has made the low productivity. Hence,

irrigation has proved to be one of the most important means of agriculture production in those areas where the rainfall is not adequate in quantity. Therefore, irrigations identifies as the key component to accelerate, intensify and sustain the agricultural production.

Nepalese farmers have recognized the importance of water resource for century with their own initiatives and have been constructing irrigation infra-structures themselves to increase their agricultural production. The various indigenous irrigation systems prevailing in our country have been managed by the farmers for many years. The tradition of farmers' involvement in the development, operation and maintenance of the irrigation system has given birth to the farmer-managed irrigation systems scattered all over the country (yoder, et al, 1990:12).

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).

Indigenous 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.

The Himalayan Kingdom of Nepal, land locked between India and China occupies an area of about 147000 sq. Kms. The country is divided into three parallel ecological zones running east to west.

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).

1.2 Statement of the Problem

Ecologically, Nepal is divided in to three region. The mountain, the Hill and the Terai. The mountain region is less important for the agricultural production because of its high geographical structure and

fragile climatic condition about 2% of land areas is suitable for cultivation. It is the most sparsely populated region accommodated with 7.3% population. The Hilly region comprises of several attractive peaks, fertile valleus, such as Kathmandu and Pokhara and about one tenth of its land area is suitable for cultivation accommodated with 46% population. Similarly, the Terai region is significant with its high agriculture productive rate. Forty percent of its land area is suitable for cultivation accommodated with 47% population (CBS 1999).

The annual population growth rate is 2.3% (CBS, 1999) and the annual agricultural growth rate is constant as the previous years. Therefore, Nepal has been facing the various difficult problems of feeding its rapidly growing population with a limited arable land and present farming system which have been dominated agriculture production until now.

Irrigated land is unevenly distributed in Nepal because of geo-diversity as well as geological difference most of the irrigated land lies in the Terai region and agriculture practices are better than in the Hills and the mountains. However, the ratio of cultivated land and irrigated land has increased in comparison to the previous years but agriculture production is constant. The conception is developed that agricultural productivity can be increased by bringing more and more land under irrigation and motivating and encouraging the people to mobilize the local resources by using the local techniques, skills, methods experiences and practices for the sustainable development, environmental protection and application of indigenous system in irrigation.

In Nepal, food production is at very low level for the rapidly increasing population, because of unequal distribution of irrigation facility in different regions and poor management system of the local

resources in the irrigation. To solve such problems, the various projects related farmer managed irrigation system have been launched in national level to promote the indigenous irrigation management system. Keeping it in mind, the government has made policies to participate the farmers in irrigation management system activities and encouraged to resolve the problem created in the process. In some cases, the government has developed the infrastructure for irrigation and the responsibility has given to the water users associations (WUA) for the mobilization. In this context studies on the farmer-managed irrigation system (FMIS) are of the great significance to provide the details about the situation of the indigenous irrigation management system to the government policy makers in formulating clear and applied policies for the sustainable development of irrigation management system. This study of the Chandrapur Kulo farmer -managed irrigation system.

Nepal is the second richest country in the world possessing about 2.27 percent of the water resource (CBS, 1999). Because of the lack of well knowledge, practice, experience, technology and methods, the water resources as nature resource is not properly utilized in Nepal only 8, 04, 995 hectare of land area has been provided with irrigation facility till now in which the farmer managed irrigation system possesses 70% (CBS, 1999).

The Chandrapur Kulo constructed in the Jhupra Khola Bhut Chok which is the 3 km biggest and permanent source of water and it is later known as the Chandrapur Kulo. Jhupra Khola is only main resources of water in irrigation. Such as Maheli, Ratu from which Jhupra Khola is made. The canal has its own importance through the environmental very practices, sustainability of irrigation and the promotion of indigenous system adopted and practiced by the local people using their local

techniques, Skills, methods, knowledge experiences and practice on the process of mobilization of water related activities, acquisition, allocation, distribution, operation, maintenance and conflict resolution with their own initiatives.

Farming system, irrigation management system, resource mobilization, socio-economic condition etc are determined by the local cultural and environment condition which has age long history and stamped in the mind of the local. So, experience of the local farmers about the water acquisition, allocation, distribution, resource mobilization and conflict management in the Chandrapur Kulo are efficient and sustainable.

The present study aims at answering the following research questions:

- What is indigenous knowledge, techniques, practices and experiences on the mobilization of farmer managed irrigation system among the locate?
- What is the pattern of water resource utilization in irrigation management system?
- How has irrigation management system been affecting the village economy and the local environment?
- How have people been managing irrigation management system activities: water acquisition, allocation, distribution, resource mobilization, operation and maintenance?
- How do people resolve the conflict occurred in irrigation management system?

- Have local people done any institutional processes to sustain the local environment, irrigation management system and indigenous system with their own initiatives?
- What is the perception of the locate on prevalent irrigation management system and its impact on the socio-economic, socio-cultural condition and local environment in comparison to the previous ones?
- Is it necessary government intervention on the system for its smooth mobilization?

On the basis of above key questions, problems of indigenous knowledge and practice concerning the Chandrapur Kulo irrigation system have been scratched throwing over view on the indigenous irrigation management system initiated and developed by the farmers or the local people.

1.3 Objective of the Study

The general objective of the study is to analyze the indigenous knowledge and practices for the irrigation management. However, the specific objectives of this study are as follows.

1. To analyze the Socio-economic condition of the members of Chandrapur Kulo.
2. To find out indigenous knowledge and practices of irrigation management system.
3. To examine the water distribution pattern conflict management and peoples participation in irrigation system.
4. To make relevant recommendation.

1.4 Significance of the Study

Though, this study entitled "Indigenous knowledge and practice in irrigation management system. A case study of the Chandrapur Kulo of Satakhani VDC, Surkhet District" is an academic research for the partial fulfillment of the requirements of the degree of master of Arts in Humanities and social science an academic as well as practical importance. Practically, this study has investigated the indigenous knowledge and practice of the local people on the process of management of the irrigation.

Therefore, this study is of the great significance in many practical senses as mentioned above because the prior studies have not been undertaken in the study area similarly, it will provide the data based on the irrigation management system which will be useful for the institutional making in promotion of the farmer-managed irrigation system through the view of an indigenous resource management system in Nepal.

1.5 Organization of the Study

The presentation of this study is divided in to seven chapters. The first chapter deals with the introduction focusing on the background, statement of the problem, objectives, and significance as well as organization of the study. The second chapter presents the review of literature relevant to farmer-managed irrigation system and indigenous knowledge on rrigation management system with special emphasis on a brief history, definition, and theoretical perspectives on indigenous knowledge and practice, previous studies on FMIS.

The third chapter, the research methodology, begins with selection of the study area, research design, nature of data, operational variables

and indicators, household census, as well as data collection tools/techniques and data collection tools and techniques comprising of questionnaire, key in formant interview, focus group discussion participant and direct observation, social mapping, data analysis and limitations of the study.

Chapter four, the physical setting and socio-economic characteristics of irrigation users, is divided into two parts. The first part deals two parts. The first part deals with the physical setting of the research site consisting of location, topography and environmental aspects along with climate, flora and fauna, population, land use patter, water resource and the second part deals with population distribution and composition, ethnic composition of the Kulo users, literacy rate, types of family, caste wise occupational level, land status, cropping pattern, variety of paddy, well being status, types and numbers of livestock species, human resources, local tools and natural resources, migration pattern and infra-structures of development of the study site.

Chapter five, indigenous irrigation management system, is divided into three parts. The first part deals with water use activities comprising of water acquisition, water allocation, water distribution and drainage. The second part deals with control structure activities consisting of design, construction, operation and maintenance. The third part deals with organizational activities consisting of decision making, resource mobilization including local materials and technology, natural resource management system and human resource, communication and conflict management of the study area.

Chapter six, summary, conclusion and recommendations, is divided into three parts. The first part deals with summary of the research. The second part deals with the conclusion of the research launched in the

Chandrapur Kulo farmer-managed irrigation system as the indigenous irrigation management system of Satakhani VDC, Surkhet District and the third chapter deals with the recommendations for further corrections, improvements and interventions.

CHAPTER TWO : LITERATURE REVIEW

Various research works have been conducted in the field of irrigation, drinking water, indigenous and modern irrigation system methods techniques and finding out their effectives but only a few research have been done about indigenous irrigation system of Nepal under the agricultural development sector.

Peter Stem (1979) in his book "Small-scale irrigation" has defined irrigation as "any process other than natural precipitation, which supplies water to crops orchards, grass or any other cultivated plants".

Rao (1945) has defined, "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 carying 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".

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.

2.1 History of Irrigation Management

The history of irrigation management system of the Sunken island of Atlantic had an elaboration system of canals for irrigation and it reveals a glimpse of irrigation forming for back 20000 years ago. Hesiod, 3,000 years ago, has said that irrigation having been practice long before his time by the Chinese people. (IIMI, 1982:3)

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. Feudal lords Amshuvarma and Jisnugupta have had constructed a number of Raj Kulos (NIDC, 1984)

According to geographical varieties, the various types of irrigation methods were applied in Nepal, i.e. Pynes terrace well and canal irrigation. After the implementation of planning system, several irrigation projects were undertaken in the various parts of Nepal for the development of canal irrigation.

2.2 Indigenous Knowledge and Practice

"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).

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)

From few year ago, some scientific literature had emerged on the subject matter of indigenous knowledge and practice. After 1980s, scholars, anthropologists, sociologists, economists, historians, government officials, foreign seholaks, researchers and development planness from the various disciplines in Nepal have been throwing some light in the scope of indigenous knowledge and practice and its role in the sustainable development in the various social aspects.

2.3 Review of Previous Studies

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).

Tamang, (1996:141), 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.

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 waer management. (Pradhan, 1994:18)

A three tier organizational structure is formed by the farmers to manage system. This committee, especially had to be active in the monsoon paddy cultivation. If some mistake is done by the users, they are given punishment in cash and kind to maintain irrigation system properly. In the farmer-managed irrigation system the farmers have to work to acquire and distribute water themselves in agricultural production. Beneficiaries of the chhattis Mauja irrigation system are expected to provide labours to operate and maintain irrigation system. The water is allocated and supplied according to demand of the farmers/users. Conflicts occurred in the system are solved through the democratic way. (Ibid, 1992)

Palpa district was also taken as the study area where twenty five basins and Kulos were remained the study of farmer-managed irrigation systems. Many basing were made in the side of the Kali Gandaki and the Tinau Khola and Kulos were constructed from the rivers to irrigate in the river basins. Therefore, the beneficiaries of the system adopt indigenous

knowledge skills, methods and technology for the operation and maintenance in the local level. In Surkhet district, many irrigation basin situated in the sides of many small rivers were taken as indigenous irrigation management systems. All most thirty six basin and Kulos are there near by the side of the Karnali river which carry out the importance of the farmer-managed irrigation systems. Small tributaries are mixed with the Karnali river and the basins and Kulos are contracted by the side of this river to irrigate in the river basins for aricultural production adopting indigenous rexources as well as knowledge, skills, technology and practice (IIMI, 1995:5).

Small farmer-managed irrigation systems (SFMISs) have operated successfully in the Hills and mountain area of Nepal for centuries. There is a large expenditure of labour every year to restore the system or maintain them. In spite of these imitations, FMISS have demonstrated impressive managerial skills that have kept them functioning and contributing to Nepal's food supply (IIMI, 1989:17).

Research issues include the effects of changes in the socio-economic environment on the viability of farmer managed irrigation systems. These systems have been able to adopt to environmental changes. Self-sustained communities are isolated by integrating in to regional and national economic system. The various rapidly changing forces are being to bear on the irrigation organization.

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 2099)

2.4 Indigenous Irrigation Management Systems

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.

Farmeres 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, 1991:4)

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).

To observe indigenous irrigation management systems in the local level, certain organizational systems and water use activities have to be undertaken for the creating, maintenance and preservation of irrigation system existed prevalent in Nepal. understanding the institutional and organizational management for a few irrigation system are facilitated by a matching of the basic concepts of rules, roles and groups with the fundamental tasks of allocation, maintenance and conflict management (Coward, 1980 cited by K.C. and Pradhan, 1996:228).

Nepal is a country where the majority of people depend on farmers-managed irrigation systems. For several centuries, farmers in Nepal have come adopting the land and water resources of the country for irrigated agriculture.

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 mangement systems by activating the farmers participation in the various irrigation programs. The main objectives of irrigation policy 1992 are to systain irrigation devlopment 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, 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.

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).

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.

The present study reveals the holistic approach to generalize indigenous knowledge and practice adopted by the people in the Chandrapur Kulo FMIS on the ground of socio-cultural and ecological aspects. Similarly, it differs from the previous studies and proides socio-cultural approach to asses existing farmer-managed irrigation system as indigenous irrigation management system on the basis of exploitation of the local methods, tools and technology. It helps to visualize the cultural importance of indigenous irrigation management system on the basis of exploitation of the local methods, tools and technology. It helps to visualize the cultural importance of indigenous irrigation management system and gives anthropological insights to comprehend irrigation development and management system. Cultural approach is taken into use

to understand perception, knowledge, skills, methods and socio-economic and socio-cultural aspect rooted in the society. Along with indigenous knowledge and practice of the people, this study helps to investigate, environmental impacts of the Chandrapur Kulo FMIS, process of institutional development and new findings regarding indigenous knowledge of the rural people related to farmer-managed irrigation system as an indigenous irrigation management system.

CHAPTER THREE : RESEARCH METHODOLOGY

This chapter presents the research methodology adopted for the study.

3.1 Selection of the Study Area

The Chandrapur Kulo FMIS, which is located on South of Satakhani VDC of Surkhet District, has been selected as the study site. This is a small scale farmer- managed irrigation system, which serves 36 hectares of land and has 964 beneficiary households. Mainly, water is used for irrigation from the Jhupra Khola (stream) following from the Bhutchok watershed area. As in the other hill irrigation systems, in the Chandrapur Kulo FMIS, the various local skills, tools and techniques have also been adopted by the local people. The farmers have been employing the local skills, techniques, knowledge and practice for the construction, operation and maintenance of the Chandrapur Kulo. This irrigation system have been facing different environmental well as cultural problems for its smooth services. Hence, the people have been tackling the encountered problems with the local experience, technology, knowledge and practice. Therefore, this study has been targeted to explore existing indigenous knowledge and practices adopted by the users' group of the Chandrapur Kulo FMIS. The researcher being a resident of the study area, it is easier to build up rapport to the farmers and to obtain various information regarding in-depth knowledge about social life of the local people, food habits, and experiences through the emic approach on the Chandrapur Kulo FMIS related activities on the one hand, and on the other accessible to have participant observation.

3.2 Research Design

The overall objective of this study is to describe the general life pattern of the Chandrapur Kulo users, their culture (with reference to irrigation) and their adaptive strategy. The main objective of the present study is to explore the indigenous knowledge and practice on the Chandrapur Kulo FMIS. So an exploratory as well as descriptive research design have been used this study. The exploratory research design is preferred to provide an opportunity for considering different aspects of the study. This design is chosen because it is helpful for studying the various aspects of the Chandrapur Kulo FMIS, its significance in agriculture production and its socio-cultural importance. It has tried to explore and describe the socio-cultural condition of the local people and existing local technologies, social organization, agriculture production system and the existing irrigation system. This study, however, does not attempt to test statistical hypothesis of the research site.

3.3 Nature and Sources of Data

Both primary and secondary data have been used for this study. The present study is mainly based on the primary data. The primary data have been collected from the fieldwork. The actual fieldwork has been one calendar of month. The users' group of the command area were the main sources of the primary data. Only the local knowledgeable persons and intellectual personnel's have been obtained from the local institutions i.e. local Water Users' Committee, and District Irrigation Office (DIO), Socket. Similarly, the Department of Irrigation (DOI), Ministry of Water Resources (MOWR) and other related institutions have been consulted. And, the various books, journals, articles, dissertations project reports etc.

Operational Variables And Indicators

Operational variables and indicators help to operate the micro-level study of the socio-economic characteristics of the study area that includes the various aspects related to the Chandrapur Kulo FMIS and a conceptual framework of matrix of irrigation system management activities have been employed for the examination of the system related to the farmer- managed irrigation system as the indigenous irrigation management system.

The Chandrapur Kulo FMIS is a natural water foot fid irrigation system and the water management activities like water acquisition, water distribution, drainage, operation and maintenance decision making, communication, resource mobilization and conflict management are its main components that are systematized with the users' group by using the local experiences, technologies, skills find practices. Thus, activities of irrigation management system as presented in a conceptual framework of matrix of irrigation management activities are. So operational variables and indicators are relevant to show the indigenous knowledge and proactive of the local people on the Chandrapur Kulo FMIS.

Table 1

Variables, indicators and Tools/ Techniques

S.N.	Variables	Indicators	Employed Tools/Techniques
1	Socio-economic characteristics of the system users		
	A. Household socio-economic aspect	- Marital status - Education - Occupation - Caste/ethnicity - Family structure - Land ownership and tendril pattern - Subsistence source - Animals, crop production, food status (deficiency and surplus), indwell- being status	Household census/survey, well being ranking
	B. Community aspect	- Location - Infra- structure and community history - Agriculture an cropping pattern	Participatory observation, social mapping, group interview, key informant interview
2	Water use activity aspect	- Acquisition - Allocation - Distribution - Drainage	FGD and observation, key informant interview
3	Control structure activity aspect	- Design - Construction - Operation - Maintenance	FGD and observation, key informant interview
4	Organizational activity aspect	- Decision making - Resource mobilization - Communication - Conflict management	FGD, participant observation, key informant interview

3.4 Household Census

The universe of this study comprised 96 beneficiary households of the Chandrapur Kulo farmer-manage irrigation system. All the households of the study area were surveyed consisting the various facts related to population, landholding pattern and the socio-economic conditions. So, census method has also been used for the local people, 9 individuals consisting of the former ward leader, a teacher, chairman of the informal WUA, an old-aged person an three active farmers of the head, middle and tail users were interviewed.

3.5 Data Collection Techniques

Data have been collected by using the following tools/techniques.

3.5.1 Questionnaire Schedule

The survey questionnaire were used for the collection of information at the households level. The questionnaire schedule was designed covering the various aspects such as, socio-economic characteristics of the water users (educational sates, land tenure, land-holding patterns, occupation, and population composition etc.). And, various questionnaire schedules have been designed to carryout the concepts of indigenous irrigation management system related activities existed in the study area.

3.5.2 Key Informant Interview

This technique is an important tool employed to generate the key data on various aspects of the system and individual roles in irrigation management system, resources mobilization and conflict management. It is chosen for its flexibility to provide and opportunity for knowing the

respondents' opinions related to the Chandrapur Kulo FMIS. A list of key informants was obtained during observation and consulting to the farmers from among the people of various status, such as, teacher, ward leader, chairman of the WUA, an old aged person and 3 more active Rapid Rural Appraisal (RRA) principle concerning indigenous knowledge, skills methods and technology.

3.5.3 Focus Group Discussion (FGD)

The present study has also included focus Group Discussions (FGDs) to obtain the specific data required for the research of the Chandrapur Kulo FMIS. Among the people of different status i.e. ethnicity/ caste, education and social strata have documented. Likely, various data related to irrigation management activities: Water acquisition, water allocation, decision, drainage, design, construction, operation, conflict management have been dealt with the help of Focus Group Discussions (FGDs). Also, to obtain the data regarding the history of the Chandrapur Kulo FMIS and other irrigation system management related activities, there Focus Group Discussions (FGDs) among the farmers of the head, middle and tail parts each consisting 5 to 10 members have been involved (Annex3). Each FGDS was separately conducted.

3.5.4 Observation

The study were used two types of observations i.e. participant and direct observation. Participant observation is an intensive fieldwork of the researchers. And it usually refers to a situation where the observer becomes as near as may be a number of the group is studying and participates in their normal activities.

Similarly, direct observation is one of the most important techniques of data collection for the social problems and it is also the primary method employed to acquire information about physical structure of the systems including canal walk and drainage which are used as the foundation of anthropological research. During the field works the physical structure of the Chandrapur Kul FMIS has been observed. To ensure the physical conditions of the chandrapur Kulo, the " Nalla Transact" has been employed.

3.5.5 Social Mapping

Social mapping is a common tool in the participatory Rural Appraisal (PRA) dealt with community and social infrastructures that has been used foe the study. Primarily, by the local people the social map had been prepared by pointing of de-marking major aspects of the study area with the facilitation of researcher and the system that include location, temples, roads, forests and the map comprises other aspects of he locality as well as source, canal structure, diversions, drainage, upstream, and downstream locations of the study system.

3.5.6 Data Analysis

The data analysis has been done adopting a systematic way. All the data collected or documented during the desk studies and field work have been processed or edited, first and the errors were avoided, secondly, the data were classified into two major categories: quantitative and qualitative. Thirdly, quantitative data were computed in the Tabular form on the basis of research content. Both simple and complex (cross) tabulation methods have been employed while tabulating the quantitative data concerning literacy rate, economically active people, land holding size, crop yields number of livestock, occupation, and food sufficiency

etc. Similarly, various qualitative data collected during the field study concerning the social life, economic aspects, cultural aspects, agriculture practice and irrigation system management related activities etc. Were incorporated with the qualitative data as per the need of the contents developed. While analyzing the qualitative data, special attention was given to examine the cause and effect relationships of various dependent, independent need of the contents developed. While analyzing the qualitative data, special attention was given to examine the cause and effect relationships of various dependent, independent and extraneous variables included in the study. Moreover, to give strengths to the findings of this study, various figures, maps, charts, photographs, annexes are properly incorporate or illustrative overview and content analysis.

3.5.7 Limitations of the Study

Every social research is bounded with the limitations. Time and money are the main constraints of the research work. It is an academic research for the partial fulfillment of the requirements for the Degree of Master of social science in Rural Development. As the fresh researcher many hardships have been faced in the study. A micro-level study is done in the Chandrapur Kulo drained area of Satakhani VDC of Surkhet District. Despite, the various difficulties the Chandrapur Kulo FMIS has been viewed in a " holistic approach" and its activities can be understood by and "Interdisciplinary approach". However, the study is not free from its limitations, which can be shown in terms of some following points.

1. This study is only confined to the Chandrapur Kulo FMIS of Satakhaui VDC of Surkhet District. So, the findings of it may be

equally applicable in all of other irrigation systems of different parts of Nepal.

Primarily, this is focused on determinant the physical characteristics, historical antecedents, existing management pattern of the Chandrapur Kulo FMIS and hindering factor to the smooth management. Thus, it has not covered all other aspects like women's role, water dynamism, cost analysis, water rights etc.

CHAPTER FOUR : PHYSICAL SETTING AND SOCIO-ECONOMIC CHARACTERISTICS OF IRRIGATION USERS

This chapter presents an introduction to the study area focusing the physical setting of the study site with its location, topography and various environments aspects and the socio- economic characteristics of water user groups with its population, economic activities, education status and other development activities.

4.1 Physical Setting of the Study Area

4.1.1 Location of the Study Area

Satakhani VDC lies on the south east of surkhet district with kalyan and Neta VDCs to the east, VDCs to the south, Jarbuta VDCs to the west Garpan and Pamka VDCs to the North. The research site " the Chandrapur Kulo" catchments area lies in the VDC.

4.1.2 Topography

Satakhani VDC is located in the hilly region of Nepal. It comprises of rocky, terraced land, grazing land and dense foresdt areas. The altitude ranges from 600m. to 1986 m. from the sea level (Sheet No. 2,883, 14B, 1998). The VDC consists of topographical variation ranging from arable sloppy land and the river basin on the southern belt to the dense forest of Rupse mixed bio-diversity on the northern belt. Structure of VDC resembles rectangular. It is srrrounded with small hills in all the directions. The major settlements are existed in the sloppy river basin and small villages where agriculture practice is done for subsistence.

4.1.3 Environmental Aspect

4.1.3.1 Climate

Satakhani VDC has mixed type of climatic conditions with the altitudinal variations. According to land capability Map Sheet No. 62P/8, the VDC has warm and fluid temperate in the southern belt. The upper of the VDC has cool temperate covered by fairly dense mixed forest, sub-tropical and temperate climate with warm summer and heavy rainfall during the monsoon. Because of the fragile environment for agriculture production, the people, in this area, are sparsely inhabited to fulfill the scarcity of resources needed in the daily life.

4.1.3.2 Population

According to National Census, 2001, the population of Satakhani VDC is 9142 of which the females are 4643 comprising of 50.78% and the males are 4499 comprising of 49.22%. This VDC has almost 1498 households.

4.1.3.3 Land Use Pattern

The total land area of this VDC is 4310.46 hectares. Land-use pattern of this VDC can be broadly divided into forestland, rain-fed cultivated land, shrub land, grassland, irrigated land, barren land and landslide area. These land-use patterns cover 2243.47 hectares, 1127.78 hectares, 445.45 hecares, 287.97 hectares, 183.10 hectares, 16.19 hectares and 6.5 hectares land area comprising of 49.49%, 27.17% 10.62%, 8.14%, 4.07%, 0.35% and 0.16% respectively. The dense forestland covers the largest area and the landslide area covers the least area. The physical, socio-economic and cultural factors as will as the altitude and steepness have determined the spatial land-use pattern.

4.2 Socio-economic Characteristics of Water User Groups

4.2.1 Population Distribution and Composition

The population distribution and composition of the research site is presented in table 2.

Table 2

POPULATION COMPOSITION BY SEX

Sex	In number	%
Male	393	47.46
Female	435	52.54
Total	**828**	**100.00**

Source: Field Survey, March 2006

From the table above 2, we observe that there are 393 males with 47.46% and435 females with 52.54% in the research area with the total population of 828 individuals. There are 96 households.

4.2.2 Ethnic Composition of the Kulo Users

The ethnic/ caste composition of the Kulo users is provided in Table 3.

Table 3

CASTE WISE DISTRIBUTION OF THE KULO USERS

Caste	Sex				Total	
	Male		Female		Number	%
	Number	%	Number	%	Number	%
Brahamin	185	47.44	205	52.56	390	47.10
Chhetri	46	52.27	42	47.73	88	10.63
Magar	90	47.62	99	52.38	189	22.83
Thakuri	10	45.45	12	54.55	22	2.66
Kami	16	47.06	18	52.94	34	4.10
Sarki	46	43.91	59	56.19	105	12.68
Total	**393**	**47.46**	**435**	**52.54**	**828**	**100.00**

Source: Field Survey, March 2006

The population of the Brahamin constitutes 47.10% of the local population. Within this community, males are 47.44% and females are 52.56%. Chhetri constitutes 10.63% of the total population in which Banset and Karki are also included. Out of this, mlaes are 52.27% and females are 47.73%. Magar consists of different ethnic geoups : pun, Shrees, Kaucha and Budhathoki in the research area and comprise of 22.83% of the local population in totality. Within this community, males

are 47.62% and females are 52.38%. Only one Thakuri family with 22 members has been residing in the research area comprising 2.66% of the local population. Kami and Sarki group are included in untouchables and are occupational gases known as the blacksmith and the cobblers. Culturally, they observe practices similar to the Magar and linguistically; they are similar to the Brahamin in study area. Among them, the Kami constitutes 4.10%. Within this community males are 47.06% and females are 52.94%. Similarly, Sarki constitutes 12.68% of the local population in which males are 43.81% and 56.19% females are 56.16.

4.2.3 Educational Status

The literacy among the Kulo users is provided in the table below that reveals the actual picture of educational status of the people of the study site. In the first phase, the male educational level is analyzed. Out of the total Brahamin males, male educated, literate and illiterate and lilliterate comprise of 12.97%, 80% and 7.03% respectively. Among the Brahamin males, 18 individuals have passed S.L.C., 5 individuals have passed I.A and only one individual has passed M.A. in the research area. Among the total Chhetri males, male educated individual is nil and male literate and illiterate comprise of 86.96% and 13.04% respectively.

Out of the total Magar males, male educated, literate and illiterate comprise of 8.89%, 84.44% and 6.67% respectively. Only 8 Magar males have passed S.L.C. in the research area, there is only a single Thakuri household with 22 family members in which male educated and literate comprise of 10% and 90% respectively. Male illiterate is nil and only one male has passed S.L.C. as shown in concerning table.

Table 4

CASTE WISE EDUCATIONAL LEVEL

Caste	Sex													
	Male							Female						
	Educated		Literate		Illiterate		Total	Educated		Literate		Illiterate		Total
	No	%	No	%	No	%		No	%	No	%	No	%	
Brahamin	24	12.79	148	80	13	7.03	185	7	3.41	152	74.15	46	22.44	205
Chetri	0	0	40	86.96	6	13.04	46	0	0	29	69.05	13	30.95	42
Magar	8	8.89	76	84.44	6	6.67	90	0	0	71	71.72	28	28.28	99
Thakuri	1	10	9	90	0	0	10	0	0	11	91.67	1	8.33	12
Kami	0	0	14	87.5	2	12.5	16	0	0	15	83.33	3	16.67	18
Sarki	0	0	33	71.74	13	28.26	46	0	0	35	59.32	24	40.68	59
	33	**8.40**	**320**	**81.42**	**40**	**10.48**	**393**	**7**	**1.61**	**313**	**71.95**	**115**	**26.44**	**435**

Source: Field Survey, March 2006

* Educated = People, who have academic qualification of S.L.C. and above are taken under the educated.

** Literate = people, who can write their name and students up to class 10, are taken under the literate.

*** Illiterate = people, who cannot read and write, are taken under the illiterate.

Like wise, among the total Kami Males, male educated are nil. Male literate and illiterate comprise of 87.5% and 12.5% respectively. Similarly, among the Sarki males, male educated is nil. Male literate and illiterate comprise of 71.74% and 28.26% respectively.

Similarly, in the second phase female educational level is analyzed. Out of the total Brahamin females, female educated, literate and illiterate comprise of 3.41%, 74.15% and 22.44% respectively. Among eight educated females, seven individuals have passed S.L.C. and only one individual has passed I.A. Among the total chhetri females, female educated is nil. Female literate and illiterate comprise of 69.05% and 30.95% respectively.

Out of the total Magar females in the research area, female educated is nil. Female literate and illiterate comprise comprise of 71.72% and 28.28% respectively. One Thakuri family does not have female educated. Female literate and illiterate comprise of 91.67% and 8.33% respectively.

Among the total Kami females, female educated is nil. Female literate and illiterate of the Kami group comprise of 83.33% and 16.67% respectively. Similarly, out of the total Sarki group, females educated are nil. Female literate and illiterate comprise of 59.32% and 40.68% respectively.

4.2.4 Types of Family

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 an

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 I is crammed into a single house of a cluster of houses.

The types of family of the Kulo users are provided in Table 5.

Table 5

CASTE WISE FAMILY SIZE

Type of family/Caste	Nuclear		Joint		Extended		Total	
	No	%	No	%	No	%	No	%
Brahamin	26	57.78	20	44.44	2	33.33	48	50
Chhetri	5	11.11	7	15.56	0	0	12	12.50
Magar	11	24.44	12	26.67	1	16.67	24	25
Thakuri	0	0	0	0	1	16.67	1	1.05
Kami	0	0	3	6.67	0	0	8	3.12
Sarki	3	6.67	3	6.67	2	33.33		8.33
Total	**45**	**100**	**45**	**100**	**6**	**100**	**96**	**100**

Source: Field Survey march, 2006

From the table above we are seeing that out of the total 96 households, Brahamin caste covers 48 households. This cast is educationally, socially, politically, and economically knows as active people in the research area. Among them nuclear, joint and extended family comprise of 57.78%, 44.44% and 33.33 respectively. This caste does not live in the extended family.

The Chhetri caste covers 12 households in which nuclear and joint family, in the study area; consist of 11.11% and 15.56% respectively. The Magar caste covers 24 households with nuclear, joint and extended family comprising of 24.44%, 26.67% and 16.67% respectively. Only one Thakuri household of extended family is existed with 16.67% out of total

extended family. The Kami caste has only 3 households of joint family with 6.67% out of the total joint family. Similarly, the Sarki caste covers 8 households of nuclear, joint and expended family with 6.67%, 6.66% and 33.33% respectively.

Among all the castes existed in the research area, 90 households consist of nuclear and joint family and only 6 households consist of extended family. The average family size of nuclear and joint family is 7.5 and the average family size of extended family is 1.

The people of Brahamin and Chhetri castes tend to live in nuclear family. More Magar castes' people live in both nuclear and joint family and Thakuri, Kami and Sarki castes' people tend to live in joint and extended family due to the lace of external intervention in their social life.

4.2.5 Caste Wise Occupation

The table below provides a general picture of caste wise occupation of the Kulo users.

Table 6

CASTE WISE OCUPATIONAL LEVEL OF THE KULO USERS

Caste	Agriculture		Service		Business		Student		Children	
	No	%	No	%	No	%	No	%	No	%
Brahamin	224	46.09	40	58.82	2	66.67	120	46.51	4	30.76
Chhetri	61	12.55	5	7.35	0	0	20	7.75	2	15.38
Magar	102	21.00	8	11.77	0	0	76	29.45	3	23.07
Thakuri	12	2.47	2	2.94	0	0	8	3.10	0	0
Kami	20	4.12	4	5.88	1	33.33	8	3.10	1	7.69
Sarki	67	13.79	9	13.24	0	0	26	10.07	3	23.07
Total	**486**	**58.67**	**68**	**8.21**	**3**	**0.36**	**258**	**13.18**	**13**	**1.57**

Source: Field Survey, March 2006

From the table above we see that out of the total farmers in the research area, people of Brahamin, Chhetri, Magar, Kami and Sarki

possess the occupation agriculture for subsistence applying indigenous knowledge and technology on the process of exploiting the local resources in practice comprising of 46.09%, 12.55%, 21%, 2.47% and 13.79% respectively. In comparison to the people of the other castes, more Kami and Sarki castes' people depend on agriculture.

The service consists of both the government and the private services. Out of total service holders, people of Brahamin, Chhetri, Magar, Thakuri, Kami and Sarki castes have been possessed the various type of services of the government as well as the private secto either in home country or in abroas comprising of 58.82%, 7.35%, 11.77%, 2.94%, 15.88% and 13.24% respectively. In the research area, most people of the fBrahamin and Chhetri castes are found to have hold government job. The young people of the Magar and Thakuri castes are found to have recruited in the British and the Indian army and some young people also go to the gulf countries and India for the civil services. Because of the lack of well education, low social status, economically and politically backward, the Kami and the Sarki castes' people are less in the government services.

Out of the total businessmen, 66.67% of the Brahamin people and 33.33% of the Kami people have been possessing as part time business in the morning and in the evening but they have to depend on agriculture in the time of midday. The people of the Chhetri, the Magar, the Thakuri and the Sarki people do not possess any business occupation in the research area.

Similarly, out of the total students in the research area, school going students of the Brahamin, the Chhetri, the Magar, the Thakuri, the Kami, and the Sarki comprise of 46.51%, 7.75%, 29.45%, 3.10%, 3.10%, and 23.7% Respectively. The Brahamin castes' people comprise of the

highest position in the educational level and the Kami and the sarki have possessed the lowest position because of the social discrimination and conservative sentiments.

The table above shows that out of the total population in the research area, agriculture, survives (government and private), and business and students occupations holders comprise of 58.67%, 8.21%, 0.36%, and 32.76% respectively. Therefore, more people of he 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.

4.2.6 Land Status

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 96 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 Hudda system 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, Magar, Thakuri castes who are so called rich men (upper castes) have been practicing Khetala system on hire from Kami 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 and Kind on the basis of annual Mujuri. As a result, a Hali Phokato is given for cultivation in his own full

responsinilities. 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 Chandrapur, the jungle of the Chandrapur was cut down and pastureland was converted with the purpose of making the Khet land about 200 years ago.

Table 7

LAND HOLDING PATTERN OF THE KULO USERS

Caste	Size of Land (in ropani)			
	Khet-land		Bari-land	
	Ropani	%	Ropani	%
Brahamin	360	52.94	1507	49.62
Chhetri	56	8.24	312	10.27
Magar	186	27.35	844	27.79
Thakuri	8	1.18	81	2.67
Kami	40	5.88	103	3.39
Sarki	30	4.41	190	6.26
Total	**680**	**100.00**	**3037**	**100.00**

Source: Field Survey, March 2006

From the table above we see that the average Khet-landholding per ethnic groups in the research area is 56.66 in which Brahamin, Chhetri, Magar, Thakuri, Kami and Sarki comprise of 52.94%, 8.24%, 27.35%, 1.18%, 5.88% and 4.41% respectively. Among all the ethnic groups, Brahamin holds the greater percentage of the Khet-land and the Thakuri

holds the lowest percentage. Similarly, the average Baari-landholding per ethnic groups is 506.16 in which Brahamin, Chhetri, Magar, Thakuri, Kami and Sarki comprise of 49.62%, 10.27%, 27.79%, 2.67%, 3.39% and 6.26% respectively. Thus, Brahamin caste has possessed greater percentage and Thakuri caste has possessed the least percentage. In the research area, people, who have held Khet-land, are supposed to be men of well status in the society.

4.2.7 Cropping Pattern

Land of this VDC are divided into two types 'the Baare-land" where summer maize, millet, soybeans, beans, yam, cucumber, pumpkins, potato sweet potato as well as winter wheat, barley, leguminous crops etc. are planted and "the Khet-land" where summer paddy and soybeans in the ridges of the Khet-land and winter wheat, peas and oilseed are planted. Out of the total population, 80.32% people depend on agriculture activities for livelihood. Similarly, economically active people in the VDC cover 67.44% (DDC, 1997). Agriculture works and practices are done almost round the year and irrigation words in the study site are especially undertaken in the summer season at the time of seed sowing and harvesting of paddy and wheat planed in the winter is also irrigated twice or thrice in the Khet-land. Words concerning daily activities are divided on the basis of divesion of labor for well mobilization of economice and subsistence activities. Mainly, young men and women are engaged in agriculture works and practices and irrigation activities in the research area and the works of children and old aged people are to look after house and livestock and cooking meals, fetching water, hauling manure, giving fodder to the cattle, fetching firewood in the house. The people have practiced labor exchange system and co-operative works in a time. Though, the agriculture production has not met

the food requirement of the VDC and the people demand on other resources to support their subsistence activities.

The major crops grown in the research area are rice, wheat, maize and corn. Two crops cultivation pattern in a year is practiced there. Monsoon paddy and winter wheat are the principle crops grown in the Khet-land.

Table 8

CROPPING CALENDAR

Crops	Planting month	Harvesting Month
Paddy	June to July	October to November
Wheat	November to December	April to May

Source: Field Survey, March, 2006

Farmers establish seedbed in April month while wheat is about too ripe. A field, which is called "biyar", is ploughed spreading manure of cow, goat, sheep and buffalo and is irrigated. It is ploughed again and again and leveled. In the leveled Biyar, Chhapo of Unniu (Dryopteris cochleata), Ashuro (Adhatoda vasica), Khirro (Ficus species) and Pati (Artimesia vulgais) are used scattering ass over the field to improve the seed of paddy. After one and half months of seed sowing, farmers transplant rice using exhaled and hired labor fin between the second and the third week of June after the harvestation of wheat. Soybeans are planted along the Ali (ridges) of the paddy-terraces. A farmer depending on the amount of land transplants his entire field in a single day. All the farmers frequently irrigate their fields after the transplantation of paddy. If there is not adequate water, farmers irrigate their fields even at night. Farmers of the research area begin to weed paddy once in the first week of August after Harelo Puja while Sime and Bhume Gods are worshipped

thinding that crops would be protected from the natural disaster. From the last week of October within November farmers harvest their paddy after carrying Muhi Dhan and a good day is selected to start eating rice offering to several Gods and Goddesses and is called Nuwange Khane. Various social values and norms are existed on the process of paddy production in the research area rooted in the society as culture.

After harvesting of rice, the sowing of wheat is followed by the last week of November. The dry field is ploughed and seed is sown in the Khet-land. At the same time, wheat is also sown in the Baari-land. Wheat is harvested from the third we ek of April to the second week of May.

4.2.8 Variety of Paddy

The following table provides the variety of paddy planted in the research area.

Table 9

VARIETY OF PADDY

Name of paddy	Area of Land (in ropani)	%
Bindesori	258	76
Mansuli	28	8
Sabitri	54	16
Total	**340**	**100.00**

Source: Field Survey, March 2006

From the table above we see that out of the total land area, Bindesori, Mansuli and Sabitri cover 258 ropanies, 28 ropanies and 54 ropanies land comprise of 76%, 8% and 16% respectively. Traditional varieties of rainy paddy are transplanted in the research area with the long time practices. Modern species of paddy are not reached there until now.

4.2.9 Food Sufficiency

The table below provides a general picture of well being status of food sufficiency of households in the research area.

Table 10

WELL-BEING STATUS

(On the basis of food grain consumption)

Duration (in months)											
Households	4	4.17	16	16.66	46	47.92	26	27.08	4	4.17	96
Months	1-3	%	3-6	%	6-9	%	9-12	%	12 above	%	Total

Source: Key Informants' Interview, March 2006

From the table above well being status of the people in the research area prevails that out of the total households, four households consume food grain for 1-3 month comprising of 4.17% Sixteen households consume food grain for 3-6 month comprising of 16.66%. Like that, forty-six households consume food grain for 6-9 months comprising of 47.92%. Similarly, twenty-six households consume food grain for 9-12 months above and are said to be rich people.

People, who do not produce sufficient food grain for consumption, perform different types of labor works in the fields, farms another sectors of the rich people for livelihood. Besides, these words they fulfill their needs with the earning of young men from the Indian army and the British army soldiers and civil services in India and gulf countries. People, who produce food grain for more than 12 months, sell their produces to the neighbors to whom it is required in the research area.

4.2.10 Types and Number of Livestock Species

The table below provides types and numbers of livestock species kept by the people.

Table 11

TYPES AND NUMBERS OF LIVESTOCK

Name of Species	Number	%	Remarks
Buffaloes Cows Bullocks Goats Pigs	195 75 136 54 7	41.76 16.06 29.12 11.56 1.50	(Pigs are kept only by the Magar people but the untouchables people also eat it)
Total	**467**	**100.00**	

Source: Field Survey, March. 2006

From the table above we see that the types of livestock species are mainly raised in the research area are buffaloes, cows, bullocks, goats and pigs. The total numbers of livestock species are 467 in which the numbers of buffaloes, cows, bullocks, goats, and pigs kept by the people constitutes 195, 75, 136, 54 and 7 comprising of 41.76%, 16.66% 29.12%, 11.56% and 1.50% respectively. Mainly buffaloes are raised by the local people of the research area to produce dun and for the consumption of milk, ghee, whey and meat. Cows are raised to reproduce bullocks a for dung. Bullocks are used to pull Hallo (Plough) at the time of pouching the fields and the farms during the transplantation of crops. Goats are raised for meat and dung and pigs are raised by the Magar

people for meat and celebrate gathering many neighbors at the time of cutting pig. The untouchables also eat the meat of pigs but they do not keep it. Because of the cultural lag, neither the people of upper class neither eat pig nor touch it.

4.2.11 Indigenous Tools/Implements and Natural Resources

The table below provides a general picture of indigenous human resources, tools/ implements and natural resources existed in the research area.

Table 12

INDIGENOUS TOOLS/IMPLEMENTS AND NATURAL RESOURCES

Human Resources	Tools/Implements	Nature Resources	Rank
Farmers	Spade	Water	1
Cobblers	Sickle	Rocks	2
Black-smiths	Bullocks	Clay	3
Carpenters	Plough	Earthen-	4
Masoners	Stick	material	5
		Tree trunks	

Source: Key Informants' Interview, March 2006

The table above portraits that indigenous resources found in the research area. Agriculture does not have any exception and it has determined adaptive strategy of the local people. Therefore, farmers are the main indigenous human resource. Likewise cobblers, blacksmiths, carpenters and masoners have also practiced various types of occupations with the local method, techniques and experiences existed in the society.

Likewise, indigenous tools/implement such as, spade, sickle, bullocks, plough and stick are used on the process of irrigation and agriculture production. Spade is used to clean up the canal, to smash clods of clay, and to dig out the corner of the fields and farms. Similarly, sickle is used to cutb down shrubs and tree trunks remained near by the Kulo and is used to cut paddy, wheat and grass. Despite these, Bullocks are used to pull plough in the time of plugging. Plough is used to plough the field and farm. Similarly, stick is used to push herbs and shrubs remained nearby the canal and to chase out the snakes and harmful insects.

CHAPTER FIVE : INDIGENOUS IRRIGAION MANAGEMENT SYSTEM

The very early evolutionary history of the Chandrapur and the Chandrapur Kulo FMIS in obscure because of the lack of written documents. According to the chairman of the Chandrapur Kulo users Mr Nanda Ram Acharya, vice chairman Purna Bahadur, recretary nararaj Pangali and Local Knowledgeable person Yagya Prasad Dhakal and Ramchandra Dhakal, Chandrapur was the place for grazing the buffalos and cows, in the past, people made temporary houses (huts) and settle 1-2 month in the winter season. After the finishing the grass they left the place. But letter they start to cultivate the land and made permanent houses and they construct the Kulo and gave the name Chandrapur Kulo.

The Chandrapur Kulo was made in 1900 B.S. In the past time the khet land and canal were small in size and in due to courses of time they were extended by the local people using the traditional local technology to increase agriculture production with economic activities for subsistence.

The Chandrapur Kulo constructed in the Jhupra Khola at Bhutchok locate in the northern part. It serves water for irrigation in the Chandrapur for the agriculture productions i.e. paddy in the rainy reason and wheat in the winter and it is known as the Chandrapur Kulo. It is at the height of 750 m. from the sea level (HMG/Survey Department, 1999). The Chandrapur Kulo users' participation in irrigation management system needs to be understood within the context of the local cultural norm and values as well as their indigenous knowledge, techniques, practices and perception about the local environment and sustainable resource management system. The situation of mass practices of knowledge for the management of the irrigation system has characterized as an indigenous

irrigations management system which is dominant prevalent in the rural areas of Nepal. The various techniques practices, experiences and processes adopted by the local are not only reflecting their century long culture but also providing a glimpse of dynamics occurred there. Therefore, irrigation maintenance, resource mobilization and conflict manaement are enforced by the users' group for the agriculture production, environmental protection and sustainable development in the local level.

Because of the inaccessible remote place, the transition existed in the Chandrapur kulo FMIS is verbal. There is no written history concerning irrigation management system. The system has come over with he customary rules and regulation pertaining the legal recognition. Thus, the Chandrapur Kulo FMIS has been launched with the local farmers association on the process of subsistence in the local environment.

People of various castes live in the Chandrapur Village. They have adopted various fundamental and empirical strategies for livelihood. All the castes have equal participation on the process of mobilization of the Chandrapur Kulo FMIS. Rules and regulations developed as the customary laws and culture concerning the irrigation management activities is assigned on the dasis of the caste system and the division of labor. 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 Chandrapur Kulo FMIS is operated on the basis of the conceptual framework of Norman Uphoff to reveal indigenous knowledge rooted in the peoples' mind in practice.

5.1 Water Use Activities

Indigenous irrigation management systems on the use of water are known as water use activities. The activities related to irrigation organization as water use activities are water acquisition, allocation, distribution and drainage. Therefore, the Chandrapur Kulo FMIS is undertaken into operation on the basis of these operational frameworks.

5.1.1 Water acquisition

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, the water resource of the Chandrapur Kulo is a small stream known as the Jhupra Khola, Nal Khola, Ratu Khola, Jaluki Khola which is perennial source flowing from the Ratanangla, Pahad (hill) watershed area. There are several small sources of water around the dense forest such as, Kharkhola, Aishalu gaira, Khani Khola. 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 upper Chandrapur, lower Chandrapur. A small

canal is also constructed below the Kulo KO Bandh for having the objective to irrigate Bhutknet and pull ebridge khet. Usually, the water of both canals is mixed to irrigate the Khet-land of the lower belt. The Chandrapur Kulo is an earthen canal dug by the farmers to convey voters to all the plots of field. Water acquisition related activities such as, design, construction,operation and maintenane of the Chandrapur Kulo are carried out by the local people applying the indigenous knowledge stamped in the peoples' mind in practice. The canal is completely made with the local materials such as rocks, clay, herbs, shrubs, tree trunks and earthen materials, which are available in the study area. Due to the application of local resources and weak geographical setting, the canal is temporary, in summer, there is sufficient water in Jhupra Khola and the water flow with full capacity in the canal. But, in winter, the level of water in the stream becomes low and the dam of the stream is completely closed and downward of the stream becomes dry and the water sinks into the bog.

The volume of water in the stream becomes low in winter season. During the winter season, the farmers in the Chandrapur share water for irrigation on the basis of turn. The beneficiaries in summer season freely use water for irrigation. But, in winter season, the head users get the first turn and the turn transfers to the middle and tail users on the basis of their rituals. Sometimes, the rule of "first come, first serve" is also practiced because of the limited water acquisition condition.

5.1.2 Water Allocation

Water allocation, on the basis of the users' group and the cultivated land, means the sharing of water of the system on the process of irrigation. According to Dhungana (1996), "water allocation means the

entitlement to water from an irrigation system and basis by which are shared among the beneficiaries".

In the Chandrapur Kulo, the process of water allocation among the farmers has been undertaken on the basis of the size of cultivated land, requirement of area, and types of crops grown. Farmers, who have contributed labor, cash and kind during the canal construction, operation and maintenance or one has bought from others, have equal right on the processes of sharing of water and utilization of water.

According to seasonal variations, the boggy land requires less water and the dry land requires much water through the perspectives of irrigation. The rules and regulations concerning water allocation and water rights are not fixed in the Chandrapur Kulo on the processes of irrigation by the users' association. Neither, water allocation process and water right can be bought nor can be sold to the others. Thus, farmers have been applying the local techniques and knowledge on the smooth operation of irrigation system and water allocation process, which is mechanistically, rooted in the peoples' heart as cultural values and norms for crops cultivation with the century long practices.

Because of the dry season, the quantity of water in winter season in Khar Khola becomes low. But the demand of water supply becomes relatively high for crops cultivation. Water is completely diverted into the canal from the dam. Thus, water allocation practice, according to the seasonal variations and the demands of water, is different. The head users of the universe get first turn to irrigate their land followed by the middle and tail users and "first come, first serve system" is also practiced on the process of water allocation. One aspect is that the leakage of irrigated water from the upper terraces modes wet to some parts of the lower terraces with full of water in Guacharo by bogging an urges to the

continuous irrigation process to the lower lying terraces. The strange thing is that the digging of holes in the canal or even in the terrace during the cropping season by mice, to some extent, has created the problem of water allocation and landslide in the command area.

The quantity of water in summer reason in Jhaupra Khola increases remarkably high creating unnecessary discharge flowing the rapid motion to the down stream known as Jaluki Khola and then Aishalu Khola. Water allocation for cultivation, according to the local people, in rainy reason is not intensively required in the sub-canals because water from the upper terraces autonomously flows terrace. In this season, the farmers also frequently do not visit "Khet Ma Pani Herna" (see water in the Khet-land). Therefore, water allocation activity reveals its traditional methods adopted by the local farmer on the basis of long time practice for economic activities on the process of subsistence sustaining the local environment.

5.1.3 Drainage

Drainage, in general, is an activity of the irrigation management system and, in particular, an activity of water use on the basis of physical structure of the natural water sources (rivers/streams). In the Chandrapur Kulo FMIS, the drainage in not man made Jhupurakhola flows down to the southern belt from Rammatta watershed area and the main canal is constructed in the Western part of command area extending from west to east by making dam at Kulo KO Bandh. The access of water in the canal in rainy season is drained to the stream to control water management. Similarly, farmer's drain water to the stream to dry cropping Khet-land and to prepare the land for wheat cultivation in the month of October and November. Water of the boggy spring and damp is drained to the stream by making small canals to dry the land for crops cultivation. In winter

season, water is completely drained to the stream from the dam of elsewhere. While the time comes to wet wheat crop, water is diverted to the canal. The drainage system in the command area is completely temporary but it is easy to mobilize the system because to the availability of local resources and technology.

5.2 Control Structure Activities

The set of irrigation management activities deals with the physical structure for controlling the water. Thus, water control structure related activities: design, construction, operation and maintenance of the system are the physical structure activities fostering water acquisition in the system. Therefore, the existing conditions of water control structure activities such as, design construction, operation and maintenance of the Chandrapur Kulo FMIS are undertaken to study through the perspectives of an indigenous resource management system.

5.2.1 Design

Design means the initial conceptualization and visualization of the framework of the system observing the physical structure by the experts. The Chandrapur Kulo FMIS is completely designed by the local farmers who are known to be the local engineers, organizers, and experts. Thus, the local farmers' experiences, expertise, and indigenous knowledge are applied in practice to design since about 200 years ago.

The prior conception to design of the irrigation system, according to the key informants, has the cultural values and norms because the rice in the study area is taken as "chokho anna" (pure cereal) for offering to Gods and Goddesses during the worships offering their ancestors in Shraddha (A day of offering clod of rice pudding and various cereals to the ancestors), and to have rice once in the special festival.

On the other hand, the alignment of the canal is designed to uplift the socioeconomic condition of the local people by growing more crops with the process of internal resource mobilization. Therefore, the canal has been designed by the local farmers using their own local technology and consulting each other's according to the process of adaptation in nature.

5.2.2 Construction

Construction means the organizational management activities: diversion, alignment and tunnel canal in the physical system. In fact, proof of the canal construction of the Chandrapur Kulo FMIS is not documented. According to the key informants, the work of the canal construction of the system has been stared by Laxmidatta Dhakal and his fellows about 200 years ago. The local expertise and resources are materialized for the construction of canal. The amount of money is not invested because the construction of canal have been collectively made by the local farmers utilizing the available local resources on the application of their own expertise, technology knowledge, and experiences with the long time practice on the basis of trail and error.

The headwork of canal construction is temporary but it is easy to materialize due to the available local resources such as, rocks, earthen materials, tree trunks, and sticks. The earthen wire of diversion structure has been produced the full discharge of water into the canal.

On the process of irrigation practice done in the study area, the major rehabilitation/ improvement works of the system have been done by the labor contributions of the local farmers with their own initiative for the mobilization. But, the VDC has provided the amount of Rs. 50,000 for the rehabilitation/ improvements of the irrigation system in the year 1998/1999. The objective of the amount could not be completed due to

the conflicts on the process of allocation among the beneficiaries and could not be used in the proper place and time. However, some concrete living works of rehabilitation/ improvements have been done at the main canal where seepage and leakage caused heavy loss of water. The problem of water loss and land slides occurred in the universe has been resolving to a considerable extent in the local level. All the land holders have been paying equal labor contribution for the rehabilitation/ improvements works. Activities of the organizational management in the Chandrapur Kulo FMIS. More particularly, the resource mobilization activities, have thrown impact upon the physical activities, especially construction of the system. All the beneficiaries' have equal change in the decision making of the rehabilitation/ improvements of the system that has been well accepted by all the beneficiaries. Therefore, rehabilitation /improvements works related to the canal construction and irrigation have been done with the local farmers' initiation in the water use activities.

5.2.3 Operation

Operation means the continuous process of mobilization of the system on the basis of technology, resources, and physical system. Because of the altitudinal, seasonal and environmental variations, the variations in the operation of the irritation management system are also existed from one place to the. Thus, organizational structure of the hill irrigation management system is also different from the Terai and Mountain irrigation management system. Similarly, the Chandrapru Kulo FMIS is completely by the altitudinal, seasonal and environmental variation on its operational activities. The Chandrapur Kulo FMIS has completely been operated by the local farmers. The formal committee for the operational work is not organized there. There are numerous verbal rules and regulations related to the system operation. Only two temporary

associations were formed to mobilize the amount of Rs. 50,000 rupees given by the VDC fund to Tallo Kulo and Upallo Kulo for operation as well as maintenance. However, the focus of study goes to Upallo Chandrapur Kulo while Tallo Chandraur Kulo also received half of the amount. Thus, the main functions of the local farmers related to irrigation management system are to manage resource, to develop the cultural values and norms concerning farmer-managed irrigation system, and to communicate each other for the operational activities of the system in the study area. Similarly, traditional rules and regulations are also undertaken into practice for the operation of the system. The local or verbal practices stamped in the peoples' mind related to the irrigation management activities have been developed as culture on the process of adaptation in nature utilizing the local resources as well as applying the local technology in the system operation. All aspects of the system are resolved through the democratic way in the study area.

5.2.4 Maintenance

Maintenance means the tasks of repairing and cleaning of the canal for regular and efficient water acquisition, distribution and removal. In case of the Chandrapur Kulo FMIS, the main canal has been constructed with the collective labor contribution of the local farmers. 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 trunds 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.

5.3 Organizational Activities

Organizational activities are concerned with the management of the institutional values and norms that regulate the function in of the organization itself. Decision making, resource mobilization, communication and conflict management are the key points in the organizational activities originated by Norman Up Hoff (1986) for the

smooth mobilization of the irrigation management system and are applied to operate the reality of the Chandrapur Kulo FMIS.

5.3.1 Decision Making

Decision-making refers to the institutional management of the irrigation system on the basis of organizational values and norms. It is one of the most important key points that operate the system in the proper way. The rules and regulations concerning decision-making can be changed forming the new ones.

One the process of operation of the Chandrapur Kulo FMIS, the local farmers make almost ass the decision themselves to regulate the system. Generally, the mass meeting of the farmers is not cussed for the decision-making. Only a few active persons individually occur in the system, all the farmers are called for meeting in the particular place for the decision-making.

At meeting, all the users are free to put forward their views on the occurred problems and decisions making. Internal cases occurred in the system is decided by the users' groups with their own initiative in the local level and is not forward to the upper legal board. Consensus is made when al the participants come into the conclusion of decision. Thus all the decisions and consensus are made on the basis of verbal rules and regulations. People of the research area do not have practice of keeping the record of decisions concluded at meeting in the documentary form, which is practiced in the behavioral way. There is the tradition of keeping record of economic affairs and big disputes in the written form for the future proofs. For the communal issues, the farmers make decisions assembling in-group level whereas the decisions, in case of individual issues, make decisions at household level. They also make decisions consulting the elder persons who have knowledge about the system.

Therefore, decision-making in the research area is made in the local level harmonizing organizational activities in the irrigation management system.

5.3.2 Resource Mobilization

Resources mobilization is the function to handle the management of organization activities of irrigation system. The erective mobilization of cash, labor, and material resources can develop the irrigation system that becomes sustainable. The sustainable development and peoples' participation in the developmental programs have been becoming common through the perspective of the resource mobilization. The concept, in this respect, is developed that the maximum resource mobilization is the synonym of development. Thus, the major functions of farmer-managed irrigation system are to mobilize the maximum local resources to grow more crops for subsistence. Labor contribution; cash contribution a material contribution is the local resources, which can easily be used for the irrigation management and sustainable development. Therefore, the resource mobilization in the Chandrapur Kulo FMIS has been undertaken into research in terms of internal resource mobilization. The internal resource mobilization performs these in diatoms: what are the local resources? How do the farmers collect the local resources? How do the farmers mobilize the local resources? Which determine the sustainability of the system in practice.

The original construction of the Chandrapur Kulo FMIS, according to the key informants, has been started with free labor and material services of the local farmer to fulfill with the purpose of irrigation. Every landholder has paid equal labor contributions in the construction of the system and the local resources are exploited to mobilize the system. Thus, the entire thus, beneficiary households have equal contribution of labor

and cash. Every land holdersin cleaning, repairing and maintenance are compelled to contribute free labor services on the mobilization of the system and local resources. If any one cannot contribute labor, he /she has to pay cash equal to the labor contribution. Therefore, cleaning, repairing and maintenance works of the canal are done once a year before the transplantation of paddy but there is not the tradition of cleaning, repairing and maintenance in the time of transplantation of winter wheat. Nowadays, when the floods damage the canal, the emergency maintenance has to be carried out of labor and cash contribution in the system. According to the local farmers' needs, the resource mobilization is set utilizing the local resources on the application of the local methods, knowledge and technology to sustain the system, local resources and technology. In the research area, the labor and material resources have dominated the cash resource on the process of mobilization of the system for the sustainable use development and environmental protection because all the resources are set according to the cultural values and norms existed prevalent in the society that exploits the nature.

5.3.2.1 Local materials and Technology

Local materials and technology in indigenous irrigation management system is studied in the context of the Chandrapur Kulo FMIS identifying an indigenous resource management system for improving the socio-economic conditions of the local people. No doubt, farmers are local engineers for planning and applying of various local materials and technology on the smooth mobilization of various resources existed in the study area. Indigenous materials, technologies, and resources are used both in irrigation system management activities and in agriculture practices. Various local materials and technologies such as, spade, sickle, stick as well as skills, methods and knowledge are used in

an indigenous irrigation management system and 'Halo', 'Khok', 'Juwa', 'Nara', 'Faruwa' and 'Kodalo' are either used both in "the Khet-land" and in "the Bari-land". Similarly, 'Kodalo' is used to clean and repair the canal, to dig the corner and ridges of the terraced Khet-land and the Baari-land and to smash clods of clay. Sickle is used to cut ripped crops such as, paddy, wheat, maize stalk, millet and so on. Stick is ued to remove herbs, shrubs and chase snakes and harmful insects on the way round. 'Halo', 'Juwa', 'Khok', 'Nara', 'Faruwa' and 'Oxen' are used in the works of ploughing "the Khet land and the Bari land" in the study area.

5.3.2.2 Natural Resource Management System

Local systems of natural resource management are effective and efficient in the Chandrapur Kulo FMIs through the perspective of the indigenous resources management. Local people have better management systems and their management systems are effective, attractive and successful "because of the fact the local residents have both the most stake, in, and most information about, natural resources" (Uphoff, 1986:23). Local natural resource management system in the research area as indigenous system is socially equitable, environmentally sustainable, and economically profitable for subsistence in the surrounding environment. Local people have been utilizing their strategies for coping with the indigenous farmer-managed irrigation system of the Chandrapur Kulo on the application of local natural resources: rocks, clay, brush, leaves, tree trunks and earthen materials. Local natural resources such as, rocks and tree trunks are used to divert the water of stream into the canal and leaves, brush, clay and earthen materials are used to pug leaking in the dam and the ridges of canal. The indigenous farmer managed irrigation system of the Chandrapur Kulo completely undertakes local natural resources to mobilize the system.

5.3.2.3 Human Resource

The local people have developed rituals as culture for sustainable development of various systems in the local environment. Rituals are parts of behavioral repertoire adjusting humans to the natural envoronment (Gurung 1996:124). The relationship between ritual practices and natural enviromnet is undertaken to study on the basis of local manpower prevalent existed in the Chandrapur Kulo FMIS. The division of work is set among the people for equitable and sustainable applicaion of local resources. Thus, people in the study area not only make economic activities with natural resources, but also they possess indigenous knowledge for subsistence pattern in practice.

Local manapower is analyzed on the basis of human resources such as, Hali, Khokari, Bause, Ropari, Khetala, Biyare and Malik in the system mobilization. Every household's head observe the whole system during irrigation and Ropain. The major works of Hari, Khokare and Bause are to make plain and ridge of terraced Khet-land. Biyare's work is to uproot the seed of paddy and to distribute to Ropari and Khetala for the transplantation. After gathering of Roapri and Khetala in Melo, a male starts to transplant paddy by offering to Sime Bhune God and Goddess and ritual is that if a woman starts, the Melo doesn't finish correctly in time. Though, the transplantation of paddy is main work of women Roari and Khetala. If the white Putala is found during the Ropain, an eldest woman among women Ropari and Khetala offers on the forehead of the Khet-land Malik and gets little amount. In the past, women Ropari and Khetala, according to the local people, used to sing Wali song but in the course of time, they completely left it. During the Ropanin, all the workers participated in the system celebrate having Chhepachhep with clay in the middle of Gahara. After having finished the works, all the

workers return back from Melo and celebrate having Sel Roti, Battuke Rote, Jhange Roti, Chatni, Bhat, Raksi, Janda and Chiya by gathering in a clean place or upon the big boulder. But, Brahamins and Chhetris, thinking impurity due to their culture, do not take Raksi, Therefore, system existed in the research site is developed as culture on the basis of indigenous resources use.

5.3.3 Communication

Communication in irrigation management system is an organizational activity that is universal and once does see it (Chamber, 1975:30). The communication system in organizational activities plays dominant role in functioning of the system and transfers knowledge, technology, experiences, idea, decisions, rules and information from to bottom and bottom to top to verify organizational norms in terms of the mass population. Thus, the farmer managed irrigation system in the local level is functioning in intended way using the local material resources and technology and every beneficiary should be aware of the activities of system determined by the community. Similarly, the communication system is adequate for the mobilization of irrigation management system activities: water allocation, distribution, operation, maintenance, resource mobilization and so on.

The communication system in the Chandrapur Kulo FMIS is required to transfer messages to the head, middle and tail users about he cleaning, repairing, maintenance, mass meting, operation of the canal and the sub-canals during the crop cultivation. The farmers, on such an occasion, practice communication through the individual way and the individual roles are determined by the traditional values and norms for communication that obeyed by all the people. The lack of formal committee in the study area, all the activities related to irrigation

management system are mobilized through the individual way that are adjusted to the local atmosphere. If there is special issue occurred on the decision-making about the system, all the member are called for the mass meeting. If anyone becomes absent, the member of the nearest household conveys the message concluded in the meeting or gathering. Therefore, the communication system in the study area has been practiced with the informal way determined by the traditional social values and norms developed as culture in the society.

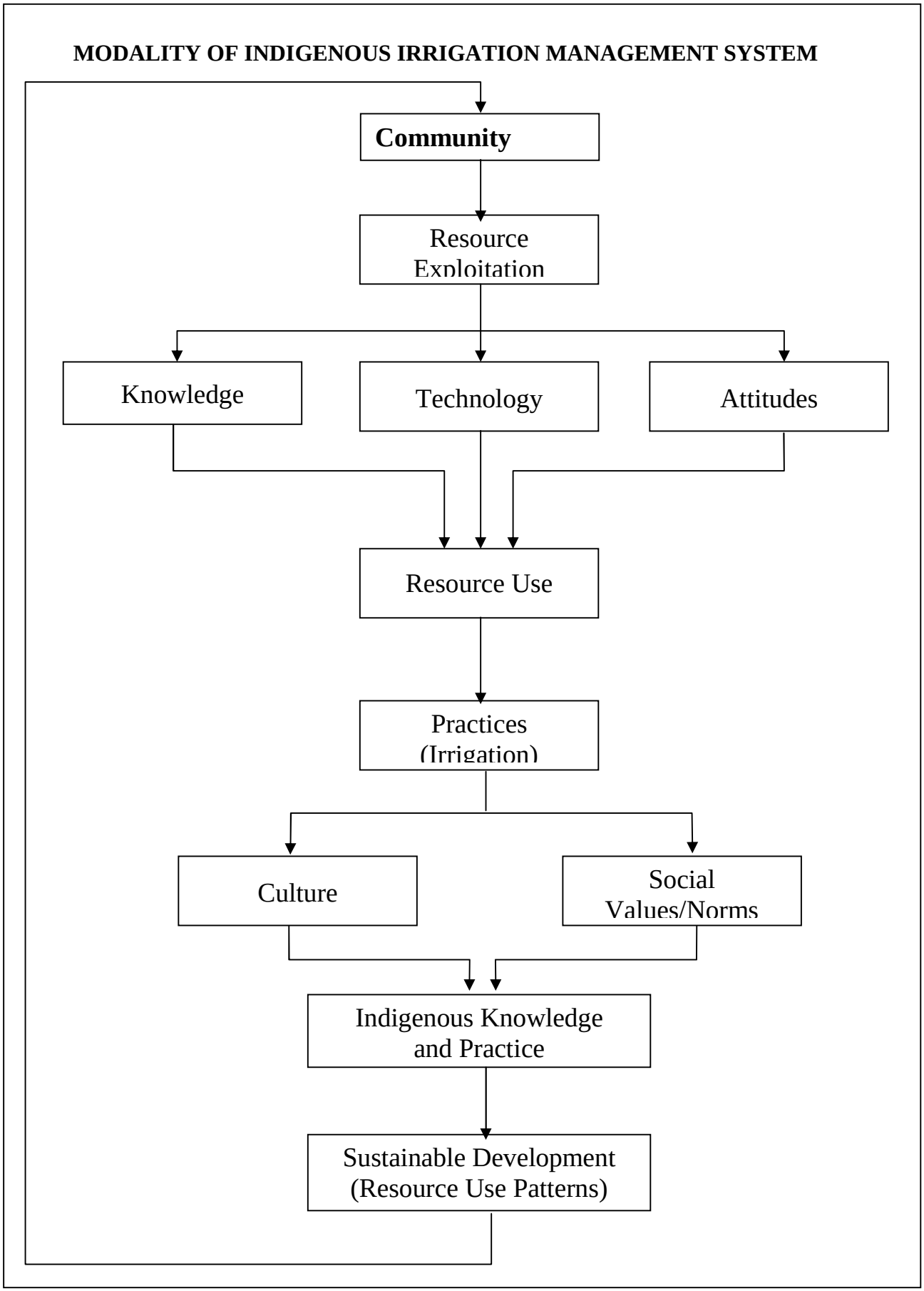
5.3.4 Conflict Management

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 Chadrapur Kulo FMIS 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 Chandrapur Kulo FMIS. The conflicts cases related to the system are of simple nature and are resolved at the farmers' level under the mutual consensus. He conflicts, according to the Kulo chairman, Nanda Ram Acharya had occurred between the Upallo Chandrapur Kulo users and the Tallo Chandrapur Kulo users on the process of amount allocation of Rs. 50,000 rupees that is provided by the VDC fund in the year 1998/1999 for the improvements/maintenance of the system and are found to be resolved under the mutual discussions, suggestions and understanding among the farmers, users' groups and concern parties. Because of the lack of formal committee of irrigation management, the conflict resolution is practiced through the indigenous system or process. Therefore, all the conflict cases related to irrigation have been resolved with the negotiation between the offenders and defenders.

MODALITY OF INDIGENOUS IRRIGATION MANAGEMENT SYSTEM



CHAPTER SIX : SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

In this chapter, summary, findings of the study, conclusion of the indigenous knowledge of the local people in the farmer-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.

6.1 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 indigenous farmer-managed irrigation system in the specific social setting.

The Chandrapur Kulo FMIS, which is loated at the lap of the Badipati Pahad, a fairly dense mixed forest, with bio-diversity, is located at Satakhani VDC, Surkhet. It can be from the District Headquater, Surkhet It can be taken as a model of indigenous irrigation management 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 Jhupra Khola on agriculture practice as economic activities for the livelihood growing of paddy and wheat 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

wheat are grown in a year but the maize also used to grow up before 15 years. 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.

The research has been launched as case study of indigenous knowledge and practice of the multi-ethnic groups: Brahamins (Dhakal, Paudyal and acharya), Chhertri (Khatri, Karki and Basnet), Magar (Pun, Kaucha, Shrees and Darlami) and the untouchables (Kami, Damai and Sarki) of the Chandrapur 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 farmer-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 he Chandrapur Kulo FMIS with the emic approach and it is easier for 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), social mapping and data analysis. All these were accompanied by the observation. Similarly, Norman Uphoffs 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 Chandrapur Kulo FMIS.

Indigenous irrigation management system comprises of water use activities (water acquisition, water allocation, water distribution and drainage), and organizational activities 9decision 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 he basis of division of labor in the Chandrapur Kulo FMIS.

Therefore, the Chandrapur Kulo FMIS 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.

6.2 Conclusions

The Chndrapur Kulo FMIS is an irrigation system managed by the local people in an indigenous way that 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 Chandrapur village of the study site of satakhani VDC is physically isolated because it is inaccessible remote place from the market and road assess. 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 cash 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.

6.3 Recommendations

The Chandrapur Kulo FMIS is a locally developed system for economic arrangements in course of subsistence pattern growing 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 Chandrapur Kulo, I would like to purpose the following suggestions are recommended.

1. Indigenous knowledge and practice adopted by the local people of the Chandraapur Kulo FMIS 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 Chandrapur Kulo FMIS 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 Chandrapur Kulo FMIS 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 rowing 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 ad law for the sustainable use and development.
9. The fundamental framework of the Chandrapur Kulo FMIS 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.

I recommended to the Kulo users to maintain the Kulo properly and use to plant out seasonal vegetables.

GLOSSARY OF THE LOCAL TERMS

Akashe Barsa	:	Seasonal rainfall whenever the most Nepalese farmers depend on it for the crops cultivation.
Ali	:	Ridge of the terraced Khet-land, which blocks the water from bogging.
Baari	:	Dry upland, where crops like maize, millet, buck wheat, potato, sweet potato, barely and soybeans etc. are grown.
Ban	:	Forest where bio-diversity is existed
Bause	:	A man whose task is to repair and build the ridges of the Khet-land.
Bhat	:	Rice, Which is prepared to give to the workers at the end of the work, is prepared mixing with water on the occasion of the Ropain.
Biyar	:	Seedbed where the seed of paddy is growing.
Biyare	:	Both males and females whose assignments are to uproot the seed of paddy and from seedbed.
Chatni	:	Pickle which is prepared mixing salt, dust of chilies, pieces of radish and soybeans, beans and so on.
Chhapo	:	Leaves and tree trunks that are used to grow up the seed of paddy scattering all over the terraced khet-land.
Chhepachhep	:	Celebration among boys and girls spraying water and clay to each other during the paddy transplantation.
Chiya	:	Tea prepared mixing milk, sugar and water.
Gahara	:	A leveled Khet-land where the rice is grown.
Hali Phokato	:	Small terrace of the field that is given to the Hali with full responsibilities to grow up the crops.
Hali	:	A ploughman whose task traditionally is assigned to plough the Khet-land and Baari-land.
Halo	:	A plogh made of wood that is used to plough the Khet-land and the Baari-land pulled by the oxen.
Herelo Puja	:	The ritual to worship to the mice thinking the carriage of the Ganesh God that would be not destroyed crops, lands and canal.
Hudda	:	Reciprocal works practiced by the local people to complete their works with quick and easy way. It, sometimes, can be hired on the basis of daily wage with the rich people.
Janda	:	A misture of several cereals on the process of making alcohol.

Juwa	:	A wooden instrument with the rope and leather and is used to pull the plough tying in the neck of the oxen.
Khet	:	Low land where paddy and wheat are cultivated.
Khetala	:	Women folds who are hired on the basis of wage for paddy transplantation.
Khok	:	An instrument made of with wood and is used to level the khet-land during the paddy transplantation.
Khokari	:	A ploughman whose assignment is to level the Keht-land on the process of paddy transplantation.
Khola	:	Small stream from where the water continuously flows.
Kodalo	:	An iron instrument like the spade and is used to dig the corner of the Keht-land and the Baari-land and is used in the works of canal operation and maintenance.
Kula Ko Bandh	:	The dam built in mouth of the canal from where the water is diverted into the Khalle Dandakhet Kulo.
Kulo	:	The canal by which the water is flowed to the Khet-land.
Maiyan	:	All the member s of the Keht-land and the Kulo Users who have equal right and duty on the mobilization of the system.
Malik	:	Landowner or the Khet-land owner who has the dominant role on the mobilization of the land.
Melo	:	Plance of the Khet-land and the Baari-land where the labors do their work from 10 to 5 o'clock.
Mujuri	:	The quantity of cereal given to the Hali for ploughing the Khet-land and the Baari-land of the rich man that is given on the annual basis.
Muthi Dhan	:	The ritual to cut up handful of paddy to offer to the various gods and goddesses as well as the ancestors.
Nara	:	An instrument made of leather of the buffalo and the oxen tied in Juwa.
Nuwange Khane	:	The ritual to eat rice in the first time selecting good day of the week while the band is played in the specific place.

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Annex - 1

Schedule for Households Survey

1. Name of the household head:
   Caste/Ethnic: Village: Ward No.:
   Occupation: Age: Sex: M/F
2. Details about family members of the informants.

S.N.	Name	Age	Sex	Education	Occupation
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

3. Types of family?
   a) Nuclear b) Joint c) Extended
4. Total land holding size and ownership of the study area.

S.N.	Ownership	Total land area (in ropani)	Irrigated land (in ropani)
1.			
2.			
3.			

5. How long time does the production cover your household's food grain requirements?
   a) 1.3 months b) 3-6 months c) 6-9 months
   d) 9-12 months e) Above 12 months
6. If you have insufficient food grains from your own production, how do you fulfill the requirement?
   a) Purchasing from the village
   b) Purchasing from the market
   c) Purchasing from both the village and the market
   d) Other (specify)
7. If you surplus food production, where do you sell it?
   a) In the village b) In the market
   c) Both in the village and the market
8. Maintenance of the types and numbers of livestock species.

S.N.	Name of species	Number
1.	Buffaloes	
2.	Cows	
3.	Bullocks	
4.	Goats	
5.	Pigs	
6.	others	

Annex 2

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-managed b) 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?

Annex 3

Lists of key Informations and FGDs Members

1. Lists of Key Information
   a) Nanda Ram Acharya (Chairman of the WUA)
   b) Ram Prasad Dhakal (Member of WUA)
   c) Yam Prasad Acharya (Member of WUA)
   d) Mava Raj Pangali (Member of WUA)
   e) Sharada Bhandari (Member of WUA)
   f) Bhakta Bahadur Khatri
   g) Biru B.K.
   h) Renu Thakuri
2. FGDs Members

   Group I - Head Users
   a) Dandapani Lamichhane
   b) Jit Prasad Lamichhane
   c) Dhansingh Thapa
   d) Indra Bahadur B.K.
   e) Chakra B.K.
   f) Bhim Prasad Dhakal
   g) Shahabir Darlami

   Group II - Middle Users
   a) Yam Bahadur Dhakal
   b) Govinda Dhakal
   c) Nanda Bir Sijali
   d) Amar Rokaya
   e) Durga Chapain
   f) Bayar Shaki
   g) Mahant Ramjali

   Group III - Tail Users
   a) Raghupati Risal
   b) Jhanakali Sharki
   c) Belrupa B.K.
   d) Manoj Dhakal
   e) Resham Dharlami
   f) Nabin Poudel

Annex 4

Structure and functions of Organization

1. Before to make the cultivated (irrigated) land, how was the structure of the command area and how was mobilized?
2. When was the work started?
3. When was the committee organized?
4. Types of organization?

   a) Formal b) Informal c) Others
5. Is there any organization for operation and maintenance of the system?

   _____

   _____.
6. What is the nature of organization?

   a) It is formulated by the election process _____

   b) Local people formulated _____

   c) Government and agency formulated _____

   d) Any other _____
7. What is the structure of organization?

   _____
8. How is organization mobilized?

   _____
9. Who does that date place fix for the meeting of organization?
10. What is frequency of major repair and maintenance program in the system?

    a) Once a year b) Once a crop season

    c) Several time d) When needed
11. Who does the farmers inform for repair and maintenance?

    _____

12. Who does the labor share for repair and maintenance?

    a) Government

    b) Voluntary organization

    c) Every farmer contribute labor

    d) Any other

13. What are the bases of water distribution?

    a) Time basis b) Depth basis

    c) Crop basis d) Area basis

14. Is there any conflicts among the farmers? _____

15. How is the conflict resolved? _____

Annex 5

Agriculture Service and Production

1. What are the major crops of the command area?

   _____

2. Allocation of area under different crops in the following year.

Summer crops	Area (in ropani)	Winter crops	Area (in ropani)
a)			
b)			
c)			
d)			

3. What are the cropping patterns commonly following in the area?
   a)
   b)
   c)
   d)
4. What is the most common cropping pattern followed by the majority of farmers within command area?

   _____
5. What is the cropping calendar followed by the majority of farmers?

   _____
6. What is the cropping intensity of the command area?

Annex 6

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 acquisited? _____
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

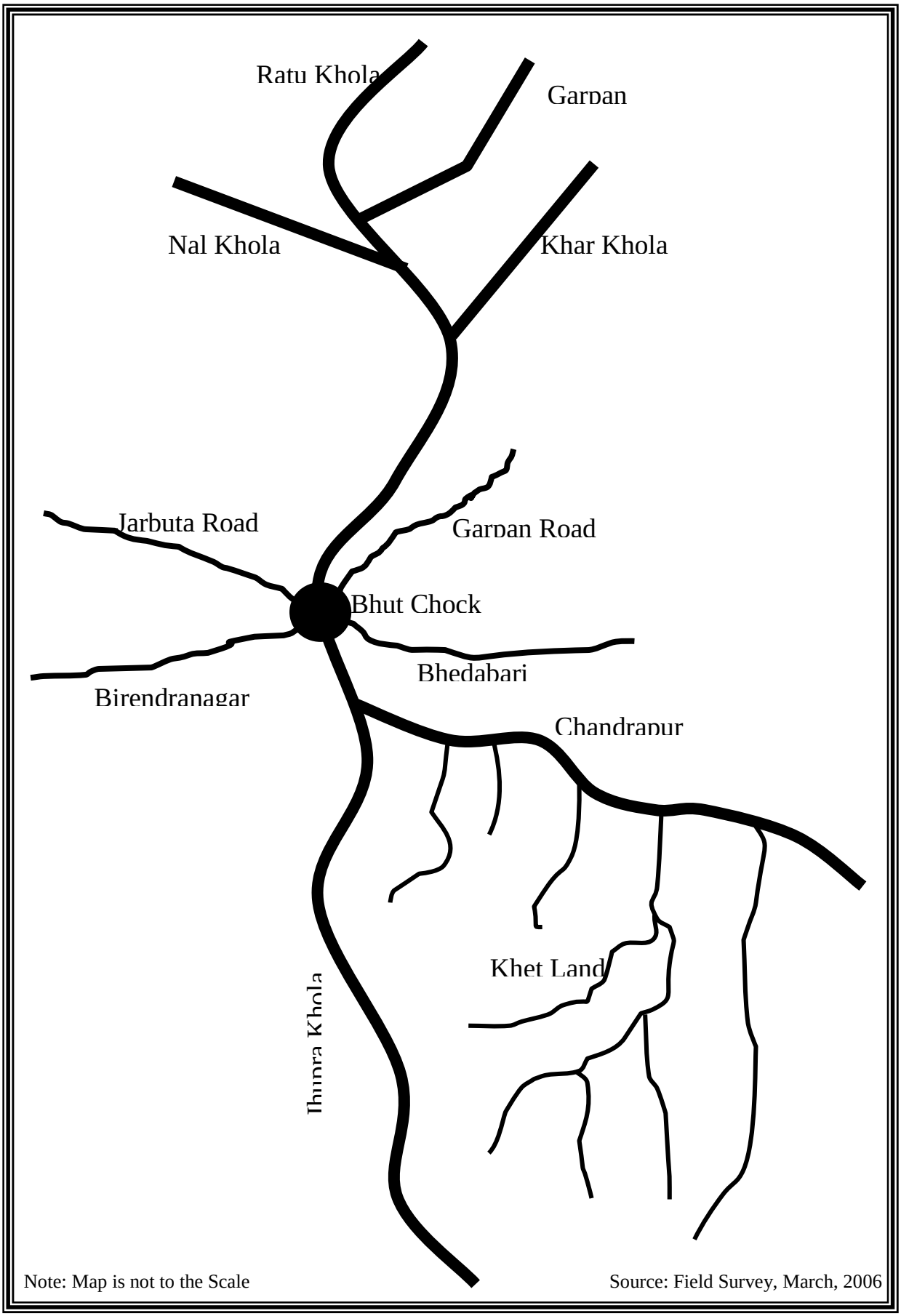
c) Emergency operation and maintenance

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?

PHYSICAL STRUCTURE OF CHANDRAPUR



Note: Map is not to the Scale

Source: Field Survey, March, 2006