

**IMPACT OF RATIKHOLA IRRIGATION PROJECT ON  
ECONOMY OF THE COMMUNITY OF TILAHAR, MODI-6  
PARBAT**

**A Thesis**

*Submitted to the Faculty of Humanities and Social Sciences  
Department of Anthropology, Prithivi Narayan Campus, Pokhara  
in Partial fulfillment of the requirements for the Master's Degree in  
Anthropology*

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## **RECOMMENDATION**

This is to certify that Mr. Bijaya Raj Gautam has worked for the full period time prescribed by the department of Anthropology for the completion of this dissertation under my supervision. It is recommended that his M.A. thesis entitled “**Impact of Ratikhola Irrigation Project on Economy of the Community of Tilahar, Modi-6 Parbat**”, which symbolizes the results of his investigations, submitted for evaluation.

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## **LETTER OF APPROVAL**

The evaluation committee has evaluated and accepted this dissertation entitled “**Impact of Ratikhola Irrigation Project on Economy of the Community of Tilahar, Modi-6 Parbat**” submitted by **Mr. Bijaya Raj Gautam** for the partial fulfillment of the requirement for masters of Arts in Anthropology.

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## TABLE OF CONTENTS

### *ACKNOWLEDGEMENT*

### *LIST OF TABLE*

### *LIST OF FIGURE*

	<i>PAGE</i>
<b>CHAPTER- I: INTRODUCTION</b>	<b>1-5</b>
1.1. Background	1
1.2. Statement of the Problem	3
1.3. Objectives of the Study	4
1.4. Significance of the Study	4
1.5. Limitation of the Study	4
1.6. Organization of the study	5
<b>CHAPTER – II: LITERATURE REVIEW</b>	<b>6-21</b>
2.1 Theoretical Review	6
2.2 History of Irrigation in Nepal	14
2.3 Issues Related to Irrigation	18
2.4 Review of the Previous Studies	18
2.5 Conceptual Framework	20
<b>CHAPTER –III: RESEARCH METHODOLOGY</b>	<b>22-26</b>
3.1 Rationale for Selection of Study Site	22
3.2 Research Design	22
3.3 Nature and Sources of Data	22
3.4 Sampling Procedure	23
3.5 Data Collection Tools and Techniques	23
3.6 Methods of Data Analysis	24
<b>CHAPTER IV: SOCIO-ECONOMIC AND NATURAL ENVIRONMENT OF THE STUDY AREA</b>	<b>27-32</b>
4.1 Socio-economic Profile	27
4.1.1 Population Structure	27
4.1.2 Ethnic Composition	29
4.1.3 Literacy and Education	29
4.1.4 Occupational Structure	30

4.1.5 Cultivated land in own family	31
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## **CHAPTER –V: IMPACT OF IRRIGATION PROJECT IN THE STUDY**

<b>AREA</b>	<b>32-50</b>
5.1 Cultivated Land before the Irrigation	32
5.2 Production of Crops before Irrigation Facility	32
5.3 Productivity of Crops	33
5.4 Cultivated area before and after irrigation	34
5.5 Production of Crops	36
5.6 Changes in Crops Production	36
5.7 Productivity of Crops after Irrigation Facility	38
5.8 Changes in Agricultural Productivity	38
5.9 Cropping Pattern	39
5.9.1 Cropping Pattern before the irrigation Project	39
5.9.2 Changes cropping Pattern after the irrigation project	40
5.9.3 Changes in cropping pattern after the irrigation project	40
5.9.4 Changes in the livelihood of people after irrigation	41
5.9.5 Cropping Calendar	45
5.10 Use of Chemical Fertilizer	45
5.11 Changes in the occupational structure	46
5.12 Food Grain Sufficiency	47
5.13 Income from agricultural product	47
5.14 Expenses of people in the study area	48
5.15 Expenses rate in agricultural sectors	49
5.16 Problems of the Irrigation Project	50

## **CHAPTER-VI: SUMMARY FINDINGS, CONCLUSION AND**

<b>RECOMMENDATION</b>	<b>51-54</b>
6.1 Summary Findings	51
6.2 Conclusion	54

### ***Appendix - I, II, III***

### ***References***

## **List of Tables**

<b>Tables</b>	<b>Page</b>
4.1 Economically active and depended population	28
4.2 Ethnic Composition	29
4.3 Literacy composition by sex	29
4.4 Academic status of literate population	30
4.5 Cultivated land in Own Family	31
5.1 Cultivated area before the irrigation	32
5.2 Crop production before the irrigation	33
5.3 Productivity of crops before the irrigation	34
5.4 Cultivated area before and after irrigation	35
5.5 Production of different crops after irrigation facility	36
5.6 Production of crops before and after irrigation	37
5.7 Productivity of crops after irrigation	38
5.8 Productivity of crops before and after irrigation (in quintal)	39
5.9 Cropping Pattern before the irrigation	40
5.10 Cropping Pattern after the irrigation	40
5.11 Major cereals before and after the project	41
5.12 Major vegetables before and after the project	42
5.13 Extra foods before and after the project	42
5.14 Major clothes before and after the project	43
5.15 Major housings before and after the project	43
5.16 Educational investment before and after the project	44
5.17 Psychological condition before and after the project	44
5.18 Cropping Calendar	45
5.19 Use of Chemical Fertilizer before and after irrigation	46
5.20 Food Grain Sufficiency	47
5.21 Income from agricultural product in 2017	48
5.22 Expenses of People in 2017	48
5.23 Expenses rate in labor	49
5.24 Expenses rate in Agricultural sector	49
5.25 Problems of Ratikhola Irrigation Project	50

## **List of Figures**

<b>Figures</b>	<b>Page</b>
2.1 Conceptual Framework	21
4.1 Economically active and dependent population	28
4.2 Occupational structure	31
5.1 Production of Crops before and after irrigation	38



## **CHAPTER - I**

### **INTRODUCTION**

#### **1.1 Background**

Nepal is a landlocked mountainous country situated in the middle belt of the mighty Himalayan range. The country is rectangular in shape and is enclosed between 26°22'N to 30°27'N latitude and 80°4'E to 88°12' E longitude. The east west average length is 885 km and north south average width is 193 km. The total area is 147,181 sq km with the population of about 26,494,504.

Agriculture is the source of livelihood of Nepalese people. Agriculture contributes more than 35.68% of total gross domestic production and gives employment to large percentages of the population (Pant and Joshi, 2060). Nepal is predominately an agriculture country where 74% of its total economically active population is engaged in agriculture (Rajbhandari, 2071). The volume of the national income is generated from agricultural sector. The agricultural production account neat about 70% of the total exported value of the country.

Nepal has uneven distribution of land and population. The hill is mountainous together account for 43.01% of total population of Nepal supported by 43% of cultivated land. The terai constitutes 57% of cultivated land inhabited by only 50.27% of the total population (CBS, 2011). So agriculture can be considered as the pole of Nepal in its all round development. Agricultural development is an essential part of the socio-economic development of the study area.

The total cultivated land of the country Nepal is about 18%, where rice, maize, wheat, jute, tobacco, sugarcane, millet, oilseeds are the main crops (Rajbhandari, 2071B.S.) and 33% of land area of Nepal could be potentially cultivated of irrigation and soil fertility management facilities were available (Karan & Ishi, 1997 A.D.). The main crops are mainly produced in summer season when rainfall is generally adequate. Most of the rainfall is concerned with in a few month of the year. About 80% of the total annual rainfall occurs within the period from the June to September (Lamichhane, 2000). So, the crop production can't give amount of profit without irrigation facility.

Irrigation is any process other than natural precipitation which supplies water to crops, orchards, grass or any other cultivated plants. Irrigation generally is the purpose of supplying the moisture essential for plant growth. However, a broader and more

inclusive definition is that irrigation is the application of water for the soil for any number of the following purposes:

- ↻ To add water to soil to supply the moisture essential for the plant growth.
- ↻ To provide crop insurance against short duration droughts.
- ↻ To pull the soil and atmosphere there by making more favorable environment for plant growth.
- ↻ To wash out or dilute salts on the soil.
- ↻ To reduce the hazards of soil piping.
- ↻ To soften tillage pans.

Those things which have the power of regenerate and available in the nature are called the natural resources. So anthropology of natural resource management is a concept which deals us to know about the proper management of the resource by the people of the particular place socially and culturally. Some resources are used to fulfill our basic needs and some are used as commodities Anthropology adds a concern with the ways in which people bring their cultural imagination to bear on the utility of natural resources like water. Irrigation is one of process of natural resource management essential for our life. The economy of people is determined by the natural resources. The skills, knowledge and techniques of people help to consume the natural resources. The proper use of these resources provides us a lot of benefits. People of different places have different cultures. The knowledge and skills of people are also different to the people of different places.

Irrigation project plays vital role in agriculture for the food grain, vegetable and fruits production. The surface irrigation is the main system in various parts of the country. By tradition method of irrigation are Pynes, terraces, well and canal irrigation in Nepal (Shrestha, 1986). Now a day, in the hills and the valleys various project are launched for the development of canal irrigation in the context of Nepal.

The yields of particularly all crops are increased by a rational and specific application of water. The quantity of water to give best result for the certain crop in a specific area can be determined experimentally. Any quantity less than or in excess of optimum gives smaller yields (Singh, 1975).

In the Western development region of Nepal many hill irrigation projects have completed many canals. Among them Fewa Tal irrigation project, Bijayapur irrigation

project, Seti irrigation project, Ratikhola irrigation project, Chapachour irrigation project, Phalebas irrigation project, Pakuwa irrigation project etc. are prominent.

Modi Rural Municipality-6, Tilahar is situated at the North eastern part of Kusma Bazar in Parbat district. It has covered 1020 hector land of the district (District Profile, 2018). The command area lies in Modi Rural Municipality-6, Tilahar and the canal has about 4 km length. The net irrigated land has 123 hector in the dry season; where rice, maize, wheat, oilseeds, vegetable are the main crops. Agriculture production can be insured by irrigation of land during the time of famine.

Modi Rural Municipality-6, Tilahar has 4614 populations with 1168 households (District Profile, 2018). About 244 households and 1456 populations are living in the Ratikhola irrigation catchments area. The causes of population growth an economic status is heavily based on agriculture sector and it can be improved by developing agriculture system. By the development of irrigation facilities particular community, society or locality can uplift its stander through agricultural development.

## **1.2. Statement of the Problem**

Nepal is an agricultural country depending on the uneven and uncertain monsoon rain. It is said that Nepalese agriculture is the gamble of the monsoon. Water is essential for the plant growth. But the monsoon in Nepal is irregular and uncertain and varies from year to year and place to place. Due to the uncertainty of monsoon, sometimes heavy flood destroys all of the crops and even the precious human lives. Sometimes great famine occurs and directly affects the un-irrigated land. Therefore, the irrigation is the most essential thing to solve these problems to increase the agricultural production and productivity on un-irrigated land.

Nepal is one of the richest countries for water resources in the world. But the crop production almost entirely depends on monsoon rain. The economic conditions of the Nepalese farmers are measurable. Lack of capital, lack of skilled and capable manpower, rugged topography, transportation problem, brain drain, etc are responsible for the development of irrigation project. Due to those problems, proper irrigation facility is not developed in Nepal. In this way, these key factors are responsible for low economic growth also. Recent years the government of Nepal has been lunching various large and small scale irrigation projects in different parts of the country. Ratikhola irrigation project is also one of them.

Modi Rural Municipality-6, Tilahar has only one irrigation project. It has about 10% population is under the poverty line. The crops production as well as economic status of this command area has been changing rapidly than before. This study therefore tries to find out the socio-economic status of farmers, living standards, production on crops, cropping intensity before and after irrigation facility.

This study attempts to answer the following general questions:

- What is the socio-economic condition of Ratikhola irrigation command area?
- How many household and population are benefited by the irrigation facility?
- Which pattern of food & consumption has been changed?
- Which aspects of people are changing?

### **1.3. Objective of the Study**

The general objective of this research is to find out the economic impact on the community of Ratikhola Irrigation Project. The specific objectives of the study are as follows:

- ☞ To study the socio-economic impact of Ratikhola irrigation project.
- ☞ To identify the feeding habits of the farmers with the change of cropping pattern after the irrigation project.
- ☞ To access the change of living stander of the farmers after the irrigation projects.

### **1.4. Significance of the Study**

Ratikhola irrigation project is the medium scale project of Nepal. This project has not tried to study anyone. So, this study will be helpful for any researcher, who is interested to know about the socio economic impact of this project on the people and society. It explores the problems related to agriculture and project sector which is helpful for management of the project in order to meet the desired objectives and goals. This study is highly important for formulating and implementing plans and policies to accelerate growth of agriculture that affects the livelihood, education, health, occupation, income, expenses, food, social prestige, etc of farmers.

### **1.5. Limitation of the Study**

Modi Rural Municipality-6, Tilahar has only one irrigation project and 1367 households with 5306 population and 123 hector lands has been irrigated. Lack of

financial assistance, time, skilled manpower, and all the impacts of the project could not be studied and expressed properly. It covers 123 hector land irrigated. There are 244 household and 1456 population involved in the study area.

### **1.6. Organization of the Study**

The study site of economic impact of Ratikhola irrigation project is on Tilahar, Modi Rural Municipality-6, Parbat, Nepal. With the help of various bases the present thesis is divided into six chapters. The first chapter presents with the introduction. It consists of the statement of the problems, objectives, significance of the study area, limitation and organization of the study. The second chapter is associated with the literature review, which is related to theoretical, conceptual and various impact study of the irrigation project. The third chapter presents the research methodology used on the study. The fourth chapter deals with the socio-economic and natural environment of the study area. The fifth chapter deals about the impact of Ratikhola irrigation project in the study area. In the end summary, findings and conclusion have been given in the sixth chapter.

## **CHAPTER-II**

### **LITERATURE REVIEW**

#### **2.1 Theoretical Review**

All living body is made up of cells in which water is one of the basic components. Streams and Rivers are sources of water. If we go back to prehistoric period, we find that settled and civilized life had started at the bank of rivers. In this context, Hoebel (1958/195-196) describes the importance of rivers in development of civilization as:

More important pottery or artifacts were the new gardening techniques that were developed in the full Neolithic in the great river valleys of Mesopotamia (the Euphrates and Tigris), Egypt (the Nile) and the western Pakistan (the Indus). In the flood water low lands it was possible to carry on intensive gardening to the extent that continuous settlement code developed along the Nile while in Mesopotamia and Pakistan full cities emerged. The development of towns into cities changed the whole scheme of the life for more and more of humanity from that time onward Civilization means “city making” where civilization took over the primitive tribesman moved into town and became an urbanite of whom the most sophisticated were “urbane” or he remained on his land as a satellite peasant villager.

Thus from evolutionary point of view also rivers and streams are of great importance. Another fact is that, today also almost every city or town is situated or developed at the bank of the river. This also illustrates the importance of stream. From this point of view it can be argued that Ratikhola has been playing a significant role in the development of Modi-6 (Tilahar and Gijyan) various approaches have been developed and applied anthropology that has proved to be quite useful in studying and solving the contemporary human problems. Anthropology provides attention not only towards human life and culture but also towards ecology and natural resources management.

Anthropology itself also has been successful in the study of natural resource management system. In fact, it has been providing important insights into the management of various natural resources. Burton et al, (1986) wrote that: the study of natural Resources Management (NRM) system is an anthropological subfield which is

logically tied to anthropological traditions and which concerns an applied niche not well served by other social sciences. They further argue that anthropology is relevant to NRM in two reasons. First, anthropology has a tradition of considering biological data whereas biological models are rare in other social sciences. Second, Anthropology critically depends upon ethnography a tradition which is less well developed in other social sciences. The combination allows for a unique understanding of the relationship between the natural and social environments.

Generally, a resource can be defined as any component of man's environment whether they can be living or non living things, human skills or knowledge that can be used for producing valued goods and services. Similarly, natural resources also called as the gifts of nature are mostly defined as any part of natural environment i.e. living or non living by which we can produce valued goods and services. Sharma et al (1994:224) also asserts that:

In general natural resource is any component of the natural environment such as air, water, soil, forest, wildlife and minerals. Specifically, the materials of nature available for use as inputs to economic activity either by direct consumptions or by use in the production (such as oil deposits and forests) or by serving as the receptacle for arising in the activities of consumptions and productions.

Garima and Berkers (1989) argue that Resources are assets for the creation of human satisfaction or utility, including income. However, this misleadingly narrow definition of resources ignores the inter dependency of the various components of ecosystem and understates the ecological value of resources. The broader ecosystem approach, on the basis for sustainable development broadens the definition of resources. In particular, it makes their values consistent with the notion of sustainability in the long run.

Garima and Berkers further argue that in the ecosystem perspective resources cannot be treated as mere factors of production. While resources may be defined in terms of human wants, they cannot be treated as more tradable assets because much of the ecological value of resources is not reflected in the short term market value. Thus the ecosystem or holistic view that takes into account of all ecosystem components and their interactions (including those involving human societies) is a realistic approach in the long run. The ecosystem view of resources makes much more sense than the more narrowly market oriented definition of resources.

So, in human ecological terms natural resources are not only the assets to fulfill human needs but also the assets that play an important in marking the ecosystem sustainable. Further the ecological view of natural resources takes their holistic account of both as the component of an ecosystem as well as assets that fulfill human needs. Thus time has come for the natural resources a specialist and intellectuals to redefine and broaden their reflection on natural resources and also to review the literatures on natural resources to highlight their ecological value along with economic one. Otherwise a strategy for natural resource conservation will not be effective to conserve these resources from over exploitation.

Resources are the means of source if supply or support. It is a useful or valuable possession for quality of a country, organization or person.

Any source of supply or support is available in nature for meeting the needs of human beings can be called natural resources. For ex- Forest, Water, Pasture, etc. There are two types of resources i. Renewable Resource ii. Non Renewable Resource

The term Resource is derived from the Latin word 'Surgere' which means the image of spring that continuously rises from the ground. Nature has a power of self regeneration with the advent of capitalism; natural resources become the parts of the nature which were required as inputs for industrial production and colonial trade. Nature has turned into a container for raw materials waiting to be transformed into inputs for commerciality production.

The resources on which every person have a same right for consume and responsible for manage then are called as common resources. These types of resource do not belong to individual property is a social concept and property right do not refer to relations between man and thing but rather to the sanction behavioral relations among men that arise from the existence of things and pertain to their use. Some of the properties of Regime are:

- i. Communal form of property ownership means that community denies to the state or any individual. The right to enforce with any person's exercise communally on rights.
- ii. Common property resources are the resources accessible to the whole community of a village and to which individual has exclusive property right.
- iii. Common property means that the group has a collective responsibility for resources which tends to guarantee care and conservation, the austerity ethnic



means that consumption pressures tend to be low removing one major or stimulates to resource abuse.

- iv. Common property resources are defined as property shared by specified group of people with specified right as opposed to open excess resources.

Water is considered as common resource. Some of the theoretical arguments are as follows which is given by different authors:

E. Ostrom argues in his theory of common pool resource that:

CPR is a type of good consisting of a natural or human-made resource system (e.g. an irrigation system or fishing grounds), whose size or characteristics makes it costly, but not impossible, to exclude potential beneficiaries from obtaining benefits from its use. Unlike pure public goods, common pool resources face problem of congestion or overuse, because they are subtractable. A common pool resource typically consists of a core resource (e.g. water or fish), which defines the stock variable, while providing a limited quantity of extractable fringe units, which defines the flow variable. While the core resource is to be protected or nurtured in order to allow for its continuous exploitation, the fringe units can be harvested or consumed.

Analyzing the design of long- enduring CPR institutions, Ostrom identified eight design principles which are prerequisites for a stable CPR arrangement:

1. Clearly defined boundaries
2. Congruence between appropriation and provision rules and local conditions
3. Collective- choice arrangements allowing for the participation of most of the appropriators in the decision making process
4. Effective monitoring by monitors who are part of or accountable to the appropriators.
5. Graduated sanctions for appropriators who do not respect community rules.
6. Conflict- resolution mechanisms which are cheap and easy to access.
7. Minimal recognition of rights to organize
8. In case of larger CPRs: Organization in the form of multiple layers of nested enterprises, with small, local CPRs at their bases.

Common property systems typically function at a local level to prevent the overexploitation of a resource system from which fringe units can be extracted.

The management of common-pool resources is highly dependent upon the type of resource involved. An effective strategy at one location, or of one particular resource, may not be necessarily appropriate for another. In *The Challenge of Common-pool Resources*, Ostrom makes the case for adaptive governance as a method for the management of common-pool resources. Ostrom outlines the five basic protocol requirements for achieving adaptive governance. These include:

- Achieving accurate and relevant information, by focusing on the creation and use of timely scientific knowledge on the part of both the managers and the users of the resource.
- Dealing with conflict, acknowledging the fact that conflicts will occur, and having systems in place to discover and resolve them as quickly as possible
- Enhancing rule compliance, through creating responsibility for the users of a resource to monitor usage.
- Providing infrastructure, that is flexible over time, both to aid international operations and create links to other resources.

Encouraging adaptation and change to address err

A.W. Bennett argues that:

Water as a resource moves, it is a transient substance. People are wishing to utilize it and store for agriculture and human consumption which imposes a problem of sharing. Likewise, sharing of fluid requires a co-operative relationship. Similarly, the nature of water as a transient resource argues for co-operative sharing because if each user maximizes his use, the finite supply diminishes and other users are deprived. If this point is reached, either co-operative measures to distribute the goods or a third party empowers to penalize to those who violate the ruler of sharing of will emerge.

Garrett Hardin argues in the theory of Tragedy of the commons as:

Resources may be consumed because the individuals are primarily concerned with maximization of their share of resource which eventually results in ruin. Ruin is the destination toward which all means such each perching his own interest in his society that believes in the freedom of the commons. Freedom in the commons brings ruin to all.

But Hardin forgets the importance of institutional arrangement within which economic behavior occurs.

E.D. Martin argues that:

Water is one of the class of natural resources which are termed 'fugitive' fugitive resources are mobile and must be capture before they can be allocated to individuals or groups. Since such capture and allocation posses the problems of exclusion, institutional regulation of these resources tends to develop early common property institutions are the most important means of regulation of fugitive resources. A commons is a resource that is exploited by a group that has certain membership criteria. There are group right and duties with regard to resource. A group will try to exclude non member from using the resources and it will regulate the use by the members also. A farmer organization can be thought of as the scarcity and manages of common property. Property rights in water emerge because of scarcity.

Riparian doctrine in the theory of water rights,

According to this doctrine theory every properties of the lands on the banks of the river has naturally an equal right to the use of water which flows in the stream in right to the use of water which flows in the stream in the adjacent to his land. This doctrine defines the collective ownership of water by the owners of adjacent land. It treats water as a tree resources and the doctrine has been retained mainly in the region where water is relative plentiful.

Prior Appropriation doctrine:

According to this doctrine, Water rights belong to these individual groups who first put the water for beneficial use. It allows individuals to occur water rights without having own reparation land and permits the use of water on land regard less of its location from stream/river from which it is directed. Water rights are no longer vested in the land and water can be transported and use virtually anywhere. Anyone who first began to use the water has the "prior rights". A farmer managed irrigation system exhibition the characteristics of the common property and the irrigation organization rules to produce by which it osculates can be seen as "endogenous" responses to the problems of the management of common property.

Prachard Pradhan in his theory of indigenous system argues:

Once the resource becomes the community property, the group must organize to preserve it and distribute the benefits of the members of community. This requires

available community based organization ashes immersed FMIS. He further says that in well organized irrigation system irrigation related tasks are performed collectively by the beneficiaries or group agreements are carried out by all individuals. Similarly, put management and decision related to irrigation are based on the primal that water as a community property. Theoretical nation of organization under common property Resume in water. Irrigation has to be treated as hydrological engineering, agricultural, economic organizational and institutional entity. Irrigation has to be understood as ‘socio- technical process which combines both material resources and people. Four basic sets of activities, decision making and planning, resource mobilization and management communication and coordination and complete resolution constitute the core of irrigation system. Five major functions of irrigation organization are:

- i. Resource mobilization
- ii. Water acquisition
- iii. Water allocation
- iv. System maintenance
- v. Conflict resolution

Water is a common property, so every member is responsible for irrigation system. Resource mobilization is the most visible organizational activity in irrigation management particularly. The skilled and unskilled manpower should be mobilized. Capital for maintenance and repairing. Information from different people and materials are needed to be mobilized. Water Acquisition is the process of acquiring water from surface by creating physical structure. Water Allocation means to distribute water to the people in certain amounts and at certain times who had contributed labor casts and kind to the construction, operation and maintenance activities of the system. System maintenance is the process of repairing and clearing of the canal for regular and efficient water acquisition distribution and removal. There will be the competition for consuming water. The conflict in irrigation system depends on the location of the farms of the farmers. So, all the upstream, midstream and downstream farmers should create a chance to talk as a group. So, that greater appreciation of each other and problem can be generated fascination can be minimized. So, the distribution of water to all types of farmer without creating a problem is a conflict resolution.

Agriculture is considered as the oldest occupation of the world. The historical background of this occupation may be traced back as old as the human civilization (Upreti, 1980). It is supposed that the irrigation & agriculture may have developed simultaneously probably irrigation started when pre-historic man planted crops in low area. Mediterranean Agriculture has long tradition after four million at proto-agriculture experimentation, agriculture emerged in the eastern Mediterranean basis seventy five hundred years ago (Bufzer ET. Al.1985). The Egyptians used water from the Nile to irrigate adjacent field as early as 5000 B.C. Historical records show that king Menes (who live around 350 BC) had a large masonry dam built to control the Nile river and provided water for irrigation (Encyclopedia, 1973). Babylonian records that irrigation works were in use before the reveal that irrigation works were in use before the time of king Hammurabi about 2200 B.C. (Encyclopedia, 1975). The practices of irrigation spread to China from Babylonia. The Chinese Pilglain Sunghan has mentioned that the Pamir region used the water of the river of irrigation. The history of irrigation in Nepal at least Kathmandu Valley is as old as its adjacent land (Mallick, 1982). Mallick adds that rice was cultivated in Nepal since the Vedic period which provides that Nepal has a long history of irrigation practices.

Water is normally supplied to the plants by nature through the agency of rain or rainfall, which included nature, supply of water and artificial supply of water in a cultivated land. This process is known as irrigation. Irrigation as the nature or artificial application of water to soil, for the purpose of supplying moisture which is essential or beneficial to plant growth are essential (Singh, 1975). An artificial device used for the supply of water to the cultivated land is irrigation. Therefore irrigation is mainly device to supply the necessary amount of water required to the plants of cultivated land.

The sources of irrigation are classified as canal's tube-well, Bore holds and Pumping sets, tank, pound & natural flow or combination of two or more of specific sources (CBS, 1986). The process of utilization of water involves the construction of engineering. Works of appreciable magnitude it would be called artificial irrigation (Singh, 1979)

There are three major irrigation methods which are given as follows:

- a. Surface irrigation
- b. Sprinkler irrigation
- c. Sub-irrigation

## **2.2. History of irrigation in Nepal**

It is difficult to say the actual date of beginning irrigation in Nepal. The farmers were irrigating their land by tapping stream water since long, lifting water by human efforts was prevented in the hills.

From the recorded history in the medieval period during of Malla dynasty, irrigation canals (Rajkulo) were constructed by the Government to irrigate the different regions inside the Kathmandu valley. Later on during Shah Dynasty irrigation canal appears to be constructed in the Gorkha region of Nepal (Bhimsen Kulo). During Rana Period, farmers started building their own canals in the Terai plains of Nepal. The 16 and 36 villages' canals of Rupandehi are classical examples. Likewise, canals are found in Babai Karnali Rivers, built by local people. Engineering construction of Sarada canal started possibly between 1920 and 1922; likewise the Trijuga canal was constructed in 1928. Construction of Government started the construction of irrigation canal. Juddha canal of Bara is another example. Dept. of irrigation was restructured from earlier canal and Geology department systematic irrigation development started after 1950 (Sharma, 1997).

Master plan for irrigation development in Nepal, 1900 has attempted to provide comprehensive information in this regard. The important Government developed projects before 1951 revolution were mostly in the Terai of which 5000 ha. Chandra canal (1928) is best known and serving till today. After fifties construction of medium size Terai irrigation project (Kankai, Manusmara, Sirsa-Dudhaura, and Tilawe etc) was carried out. The 1954 Koshi agriculture with India led to the construction of Sunsari Morang (66000 ha.), while the 1959 Gandaki agreement to Narayani (38000 ha.) and west Gandaki, command area development in these large projects was initiated in sixth and seventh plan periods and is still continuing presently 50 Government developed surface irrigation systems in Terai (Sharma 1997).

In the history of modern surface irrigation, Fewa Tal irrigation project and Bijayapur Irrigation project are the first in Pokhara and its periphery. These projects were completed during the first five year plan. Bijayapur– Begnas irrigation projects (II), Hemja Irrigation projects etc. are other irrigation projects in Kaski.

Dedkali was popular lifting in Terai. Some small plots of Terai were traditionally irrigated by the terrace to terrace bears in rotation in the hills. Bhimsen Kulo and Rajkulo

in the Kathmandu are example of ancient irrigation system (Sharma 1992) in Nepal. Many irrigation projects were built under the Rana Prime Minister.

An indigenous type of canal was built in Pokhara Miruwa in the early period of Rana rule. Now it out of operation and reduced to ruins which exist even today.

Before the implementation of the periodic development plan in 1956 only three canals Via Chandra canal (in 1946) (Shrestha 1981) were considered under Rana Regime, several irrigation projects were constructed since 7<sup>th</sup> plan and since 10<sup>th</sup> plan have been constructed many large irrigation projects in Nepal. Now a day in the hills of Nepal, various irrigation projects have been introduced for the development of canal irrigation.

The policies and plans related to irrigation in Nepal are:

### **2.2.1 Irrigation Master Plan:**

Canadian international Water and energy consultants in association with East Consult P. Ltd, Nepal prepared 'Master plan for irrigational devr, in Nepal in 1989. It has touched only a few aspects of social issues such as 'participation' & 'access of water resource'. It has also stressed the importance of beneficiary participation in all stages of project formulation, leading to full responsibility for O & M of each completed project. It has also mentioned about water charges, water charge would be levied on the principle of raising the funds required for operation and maintenance from user them. Small and some medium surface irrigation projects would be handed over to water user groups after the completion of the projects. The concept of 'affordability' has been mentioned. It also mentioned the concept of 'distribution of benefits' to the large no. of farmers.

### **2.2.2 Irrigation Policy:**

The first IP was formulated in 1992 and was first revised in 1996. IP is seems to be more sociological. IP has clearly focused on social issues of irrigation development. Efforts would be made to construct and rehabilitee more irrigation system and projects by mobilizing people's participation in the private sector. IP also aims at increasing gradually the organized users' participation at various stages of irrigation devr. And here by reduce the govt. responsibilities and operation and maintenance of the projects.

The social issues such as 'participation', "institutional representation, distribution of irrigation benefits, cost sharing bef<sup>n</sup> the govt. and farmers are including in IP. IP also recognized the plurality of actors' engaged in developing and managing the irrigation

system. The scale of technology in irrigation projects also has been addressed. Mention has also been made about the water included disasters and their mitigation such as protecting the irrigation structure and developing plan for soil conservation in the fragile area through the mobilization of popular participation.

### **2.2.3 Irrigation Regulation:**

The IR has been framed by HMG exercising the authority conferred by the Water Resource Act (1992). It has also addressed a no. of aspects of social issues regarding the debt and management of irrigation system. The IR has presented a topology of irrigation system which helps us to understand the motive of the govt. to develop irrigation in a participatory way. The topology is as follows: i. Irrigation systems constructed and managed by the govt. itself. ii. Irrigation system jointly constructed and managed by government and WUAs iii. Irrigation system turned over to WUAs by the government IV. Irrigation systems collectively constructed and managed by the water users themselves. v. Irrigation system constructed and managed by the private sector by obtaining license. IR also makes the provision for the turnover of the government managed irrigation system to the WUA. IR has categorically specified the duties of the individual farmer irrigator as follows: i. to pay irrigation water charge and any other charge or free levied. ii. To use available irrigation properly and inform immediately to WUA or concerned irrigation office if any structure of irrigation is damaged. iv. To assist WUA and irrigation office for the construction. The social issues addressed by IR are institutional representation, distribution of benefits, cost sharing, pluralism, access to water resource, allocation, etc.

Ninth Plan has also mentioned the long term the long term concept of the irrigation development. The objectives of long term irrigation development are:

- i. Irrigation system that can be controlled by the farmers and the area of year- round irrigable land will be increased in accordance with long term APP.
- ii. Women are encouraged to participate while forming WUA.
- iii. Incentive mechanism will be used to WUAs for the management of water keeping in view of demand, supply and water conservation.

The objectives of Ninth Plan for irrigation are:

- i. To assist the agricultural production.
- ii. To increase water utilization efficiency of surface and ground water projects.



- iii. To hand over the managerial responsibility of irrigation system to WUAs by increasing the participation.

Ninth plan has separate working policies for the development of both ground water and surface irrigation. NGOs and CBOs will be involved in this process. DOI will contribute to identify the appropriate technology and managing trainings to the drillers and farmers as well as playing a leading role in group and other works concerning the tube well installation. Similarly, for the surface irrigation small and medium sized irrigation project will be constructed along with the participation of farmer users on a demand driven basis and upon the completion of such projects. Dysfunctional farmer managed irrigation system will also be rehabilitated along with the farmer's participation of farmer user on a demand driven basis. The small and medium sized govt. /agency managed irrigation system will be handed over to the users' group by rehabilitating. Ninth plan also aims at informing users about the opportunity cost of water and making farmers understand that water is an economic good.

Ninth Plan also states that the users' group will be made participate in the formulation of irrigation policy, decision making process, plan formulation and implementation; monitoring and feedback mechanism and they will also be encouraged to form federation both at district and nations level for the preservation of their rights.

It's aim was to reduce the cost estimate of the irrigation project. The documents of Ninth Plan cover a large no. of aspects of social issues to be addressed like distribution, cost sharing, pluralism, gender integration, scale of technology, etc.

The geographical structure of Nepal is not plain. So, here is difficult to provide the facility of irrigation. The canal which has to be constructed may not remain for long term in the hills. People do not want to participate for maintenance. All want to consume more water than others.

In Western Development region, various types of hill irrigation project, Bijayapur irrigation project, Ratikhola irrigation project, Begnas irrigation project, Hemja irrigation project, Gaduwa irrigation project, Seti irrigation project (Kaski), Saedikhola irrigation project, Rampur plant irrigation project, Pakuwa irrigation, Phalebas irrigation, etc are important hill irrigation in this region of these projects. The impact study of Ratikhola irrigation project is going to be done in this work.

### **2.3. Different issues related to irrigation according to various rules and regulations.**

1. According to Irrigation Law, 2049 irrigation refers to the methods and methodologies required to take water to farming land from water resource for the purpose of good cultivation. According to it, there is formation of consumer's committee.
2. In the side of project in safety management too people are aware. According to Irrigation Plan, 2070, consumer's committee is formed and made them responsible in their task related to the responsibilities and facilities of irrigation project.
3. By the use of modern irrigation technology from small, medium and large rivers, rivulets and streams it is planned to irrigate all the land of Terai, Hill and Mountain by the construction and use of various irrigation projects. This plan is partially fulfilled by keeping the matter of environmental conservation in mind. This had helped a lot in the poverty mitigation in the country.

### **2.4. Review of Previous Studies**

The massive literature in the field of agriculture shows the resources of this sector. Various institutions, research schools, sociologists, economists, geographers have undertaken several research works, conversing the impact of irrigation in Nepal.

Some irrigation impact-evolution study has been carried out by Agriculture Project Research Center (APROSC).

Among them the impact irrigation studies of Gajun irrigation project (1978), Khageri irrigation, Mahakali irrigation project (1979), Begnas irrigation project (2010) etc. constitute valuable literature in this field. In the report of Khageri irrigation project, it has printed out that diversified occupation depends up on agriculture where 73% of land is irrigated. More farmers have adopted improved variety of paddy and maize. Employment is higher in irrigated area where there is higher production, income, expenditure and saving. Irrigation has help for 69.66% income in output per Bigha land. Report has concluded that Khageri Canal is very poor due to the serious setting problems (APROSC, 1978). APROSC has analyzed Dedgauntar irrigation project, small farmer have got the highest percentage of irrigated land (61%) highest impact of irrigation is on the small formers. There is an increase 11.21% in employment per Ropani and farm income is higher in the project area 50% two times.

Baidya (1968) in his research "Farm irrigation and water management principles and practice" reported that the irrigation is very important factors. He also stated that the relationship between irrigation and crops production has been positive and also stated that irrigation cannot be developed due to lack of skilled manpower and modern technology, modern equipment and capital.

Leaky & T.B. Wills (1977) in his study "Food crops of the lowland Tropics" studied on irrigation and defined broadly as the artificial control of soil, moisture for agricultural purposes with the aim of increasing crop production. In Physical terms this control is achieved by applying water on the land when soil moisture became depleted and at the same time by making provision for the removal of excess water from the soil surface of profile.

Pokherel (1981) in the study of "Impact of Rural Development Program on Economic Employment and Output of small and big farmers" found holding of land is still quite concentrated on a few hands. The cropping intensity of small farmers is higher than that of the big farmers. Access to irrigation facilities to big farmers is higher than that of small farmers. Per hectare ratio of big farmers is smaller but they are leading in the local committee in all sectors.

Pangani (1987) studied on the topic of "impact of Chitwan irrigation project at Chitwan district". According to his conclusion production has been slightly changed due to irrigation facilities. So, this project has brought great reforms in the agriculture sector in then Narayanpur VDC of Chitwan district.

Lasmal (1989) carried out impact of the "Bijayapur irrigation project" who has pointed out that a large number of farmers are benefited by irrigation facility. Rice, wheat & vegetables has increased production tremendously soon after the completion of Canal irrigation many people irrigated there resulting in the emergence of settlement.

Parajuli (1991) studied "The impact study of Pokhara irrigation project"; he concludes that the cropping pattern has also been changing. People have adopted intensive agriculture and multiple cropping systems. Farmers are more oriented towards cash crops (especially vegetable farming) after complete the irrigation project and scale of production was also increased.

Bastola (1994) had studied on "The economic impact of irrigation in Rampur, Palpa". He concluded that the irrigation facility improved the agricultural system. The production of crops & productivity of land has been increased and cropping was also changed after irrigation facility in the study area.

In words of Panta and Jain (1997), in 'Agricultural Development in Nepal' the absence of proper irrigation facilities the farmers themselves have evolved and agricultural pattern to suit the monsoon period. However, in a pre-dominantly agricultural economy such as Nepal, effective development of irrigation is a pre-requisite for increased agricultural production. Extension of irrigation can bring about in general a substantial increase in agricultural production in the country and can serve as means for the diversification and intensification of agricultural production.

Pandey (1998) studied about the "Impact of irrigation of Rural Development". He found that small size landholding families are more in the irrigated areas than in the non-irrigated areas. In irrigated area, for example 71.44 percent people are affected by irrigation. They grow two crops with the advent of irrigation scheme.

Gautam (2000) studied an economic impact of Babai irrigation project at Bardiya district. According to his conclusion, Paddy production has increased by 80% and the cropping intensities change 1.4 times to 1.7 times increase in this area.

Bhattarai (2010) has studied on the topic "The Impact of Begnas Irrigation Project on its Command area of Lekhnath Municipality, Kaski". He found that the total production of crop is increased by 90.88 percent after the irrigation facility. The productivity of crops was increased after the irrigation facility. He also concluded that the cropping intensity has also changed between after and before irrigation facility. The cropping intensity has increased by 66.3 percent after the irrigation. The intensity of paddy production has also increased 85.7 percent and vegetable crops production has increased by 120 percent.

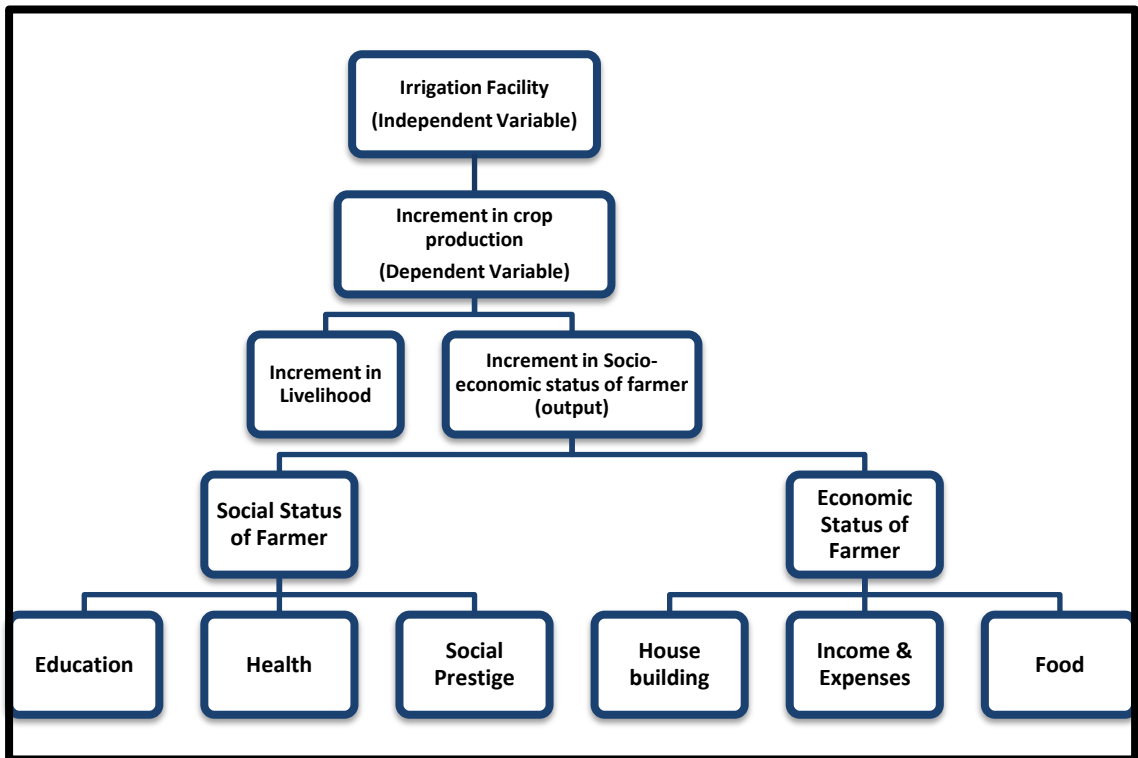
We know that irrigation facility plays an important role for the production of crops and it brings change in socio-economic status of the people. Economic condition of farmers can change by the growth of crop production.

Ratikhola irrigation project has also become the backbone for agricultural development in the command area. Researcher has intended to assure the socio-economic changes in the people of the Ratikhola irrigation command area.

## **2.5. Conceptual Framework**

The relevant literature researcher may clearly state that the new technology, modern inputs, irrigation facility, high yielding varieties play a vital role in the increment of crop production. The increase in the crop production has improved to some increase in saving. So, it brings change in the socio-economic status of farmers. It ultimately uplifts

their livelihood. Based on the relevant literature conceptual framework has been developed.



**Fig. 2.1: Conceptual Framework**

The figure 2.1 shows that irrigation facility is the independent variable because irrigation increases productivity. The crop production increment is the dependent variable because the growth of crop production is largely influenced by the irrigation facility. Lastly, the outcome of large amount of crop production has improved the socio-economic status of the farmers. In this study, researcher has selected only one variable via irrigation.

## **CHAPTER-III**

### **RESEARCH METHODOLOGY**

This chapter basically illustrates the research method adopted in carrying out this study. Primarily, this section of the study indicates the ground selection of the study site. Research designing, sampling procedures, Nature and sources of data, data collection tools and techniques (i.e. interview, schedule, observation and secondary information and data analysis) are formulated.

#### **3.1 Rationale for Selection of Study Site**

Economic impact of irrigation project in different phases plays crucial role in the overall irrigation scheme management. The irrigation scheme could not fulfill its targeted objectives until and unless the study of socio-economic impact and active participation of farmers. This research tries to access the socio-economic status of farmers in Tilahar. Moreover, it also evaluates the present status of Water Users' Association in the Ratikhola Irrigation Scheme.

The Project Scheme lies in the remote area. Most of the studies are conducted on the urban areas. But, such areas are always neglected. The status of real farmers is neglected in such remote area. So, it is necessary to access the farmers' participation in irrigation management in the area

#### **3.2. Research Design**

The study is of descriptive type. The exploratory research design is useful to explore the different aspects of the problem under study and descriptive design has implied to the description of crops production and economic impact has been studied as different variables.

#### **3.3 Nature and Sources of Data**

As per needed of the study, both primary and secondary data were collected but more priority was given over primary data. The primary data were both qualitative and quantitative. Priority is given to qualitative data, but some important quantitative data were collected by Observation, Questionnaire schedule, Focus Group Discussion (FGD) and key informant interview. All the informants were the main sources of primary data.

Secondary data were collected from INGO, Government office, library, they were published and unpublished sources.

### **3.4 Sampling Procedure**

The universe of this study was the total household of the catchments areas of this irrigation project. This irrigation project has covered 123 hectares land that lay in ward no 6, Tilahar of Modi Rural Municipality. The universe of this study consists of 244 households of the commands area. Among 244 households of the universe 150 households were selected as sampled by simple random sampling. From each sample household one of the head members was selected as a respondent of this study. Key-informants for this study were local leaders, some of the staff of this project, official members of district irrigation project in Parbat. Validity of the tools was ensured from careful planning of interview questions, observations and Focus Group Discussion.

### **3.5 Data Collection Tools and Techniques**

This research is mainly based on primary data; primary data has been collected by using following different of data collection tools:

#### **3.5.1 Interview**

Relevant questions were designed for interview. It was primarily filled by visiting door to door in the study area. Direct interview was taken to collect information for the study area with some key-informants such as; local leaders, local intellectuals, representatives of this project working in the office. This interview was totally unstructured for qualitative data. Generally, interview was conducted with the head of the family.

#### **3.5.2 Observation**

The researcher observed the study area. The actual conditions of respondents including water distribution system, cropping system, harvesting system, etc were observed. It was adopted to collect much more qualitative data and information about changing pattern of crop production and farmers.

### **3.5.3 Focus Group Discussion (FGD)**

Focus group discussion was performed in order to get much more data on economic impact by this irrigation project, the cropping pattern and the changing condition of farmers after or before irrigation. This discussion was conducted by him from the farmer groups' discussion. In this period, the water users group member involved in this process. Three Groups with 6 members in each group discussion who had presented their views about the effect of Ratikhola irrigation project.

### **3.5.4 Case Study**

Some case studies have been prepared by interviewing with farmers and recording their experiences before and after the irrigation project. In this research, two farmers' cases were studied about the change of their socio-economic status which is mentioned in data analysis.

### **3.6 Data Analysis Technique**

The data obtained both primary and secondary sources were analyzed by using descriptive statistics such as average percentage and some indices data were represented in terms of tables and diagram to support the explanation. The collected data were tabulated to meet the definite objectives. Collected data were analyzed both manually and with the help of Ms Excel and Ms Word.



**Case I (Improved the economic status):**

Hari Lamichhane is 52 years and has one son and three daughters. He is jobless and works with his wife as a farmer. This household has no other sources of income except cereals crop and vegetable farming. Before the Ratikhola irrigation Project, his family has used their land for millet, maize, wheat and a few for rice farming using rain water and guava as fruits. The land was dry, and lack of water even for drinking. They cultivated vegetable only for daily use.

They have 15 Ropani of land and out of these millet and maize were cultivated in 10 ropanies of land and in 5 ropanies of land rice was cultivated before the irrigation project. It was difficult to fulfill the daily needs of food and need to buy rice. As there was no source of income his family had debt from local rich person. Later, after the conduction of irrigation project, the family patter of his family completely changed. His family started to cultivate vegetable in 10 ropanies by applying modern technique. The production increased highly. By selling the vegetable his family earned 3 lakhs last year only. By collecting the money the couple managed the wedding ceremonies of their daughters where high dowry system still exists. They reported that “If we did not change the cropping pattern with the irrigation facility of the project, we would not be able to be here.” (Migrated to Kusma) because they had to sell their land for their daughter’s marriage ceremonies maintain and other ceremonies. Besides this, they now have money to manage clothing, medicine and schooling for their remaining children. Their living stander is increasing with the increase of economic status.

*Source; Field Survey, 2018*

**Case II (improved the social status of Dalit):**

A dalit landless farmer Lila BK of 38 years had married for 18 years as a second wife, when she got married. She has only one son aged fifteen and now studying in 9<sup>th</sup> grade. After 5 years of her marriage, her husband left her and lived with his 1<sup>st</sup> wife. But when he left her he didn't give her even a piece of land to work on and live on wage labor and selling others' vegetable was only means of livelihood for her before adopting this farming. As she didn't have her own land, she hadn't cultivated vegetable before. Somehow she obtained 3 Ropanies of land from her neighbor for potato cultivation. Land owner provided land for potato cultivation without sharing of crops or money because they would get more profit from cereal crops that grow after potato cultivation. Now, she also cultivates cauliflower, cabbage, radish, etc in leased land. Besides her own productions, she also sells vegetables and fruits grown by other farmers as a vender. She has earned a little more from working others' land during peak agricultural season as a wage laborer. She earns 100 to 150 thousand rupees annually. Last year, she earned about 150 thousand rupees from potato cultivation. She also made profit of about 80 thousand rupees for marketing cauliflower and potatoes produced by other families. With the saving of income from the sale of vegetables she has built a small cemented tin's house with 3 rooms and toilet bathroom facility. She spent 3 lakhs for the construction of this house. She also spent a lot for her son's treatment who has been suffering from kidney disease for 3 years. Besides there she now has the money to spend for clothing, medicine and schooling for her son. Being a disadvantaged caste, she has not got any training from any organization and she did not get a chance to any exposure visits organized by ward and farmers groups. But due to this farming now she has become a member of mothers' group.

*Source; Field Survey, 2018*

## CHAPTER-IV

### SOCIO-ECONOMIC AND NATURAL ENVIRONMENT OF THE STUDY AREA

Ratikhola irrigation project is located between 28<sup>0</sup>26' north latitude and 83<sup>0</sup>75' east longitude. This command area is situated at Parbat district in western development region of Nepal. It is a prominent site situated along the bank of Kali Gandaki River.

The average elevation range of the command area is 891 meters. The slope of the command area is about 5<sup>0</sup> to 10<sup>0</sup> (degree). It is tilted towards south. Land is suitable and fertile for crop cultivation. The command area falls on subtropical monsoon type of climate. Summer season is hot and wet. The temperature reaches up to 32 °C in this season. In winter season average temperature falls down to 8 °C. Rainfall begins from June and ends in October. During months of south east monsoon brings rainfall. About 90% of the total annual rainfall occurs in June to August. Perception amount is up to 1950 mm per amount and temperature from 26<sup>0</sup> C to 30 °C. The average temperature of winter season ranges from 8 °C to 14 °C and average rainfall ranges from 50 to 80 mm depending upon westerly breeze.

Winter months are fuggy and frosty in the morning and clear weather in day time and at night. Natural vegetation is deciduous types of forest in the command area. The dominant species of trees are Chilawane, Sal, Katus, and Bamboo. However, most of the forest has already been deforested and converted into agricultural land.

The distribution of soil type is different. About 60 percent soils are loamy soil and 40 percent are clayey loamy soil of reddish in color. It is found in the northern part of the study area and is less fertile than the soil of southern part.

#### 4.1 Socio-economic Profile

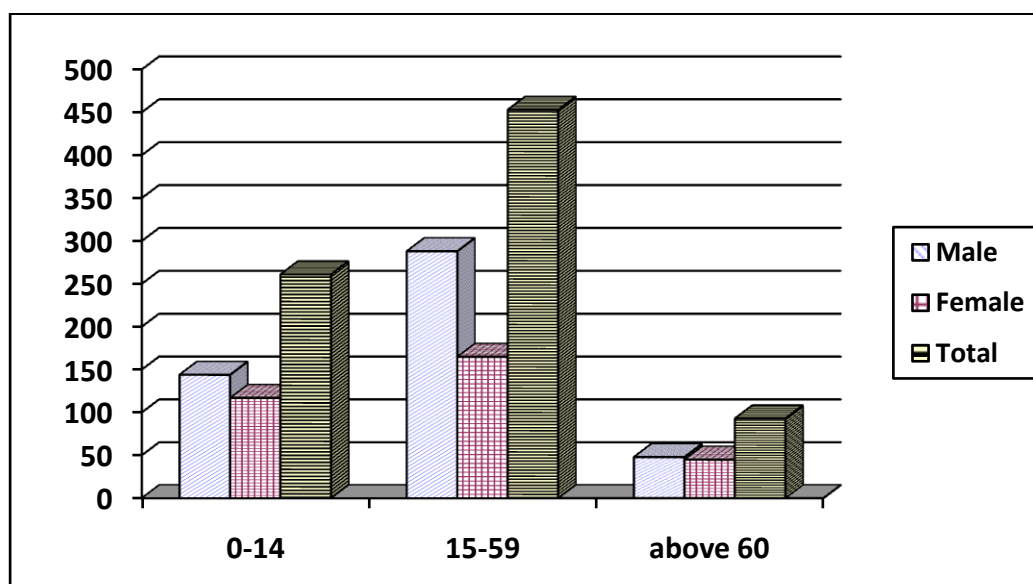
##### 4.1.1 Population Structure

The total population of the study area was 1456 and 807 as sampled out of which male was 59.48 percent and female was 40.52 percent. The dependent population was high. Children and above 60 aged people are of 43.87 percent. The male was a little bit high than female among 0-14 years and above 60 years of age group. This indicates that the female child birth rate was lower than male due to the concept of size of family.

**Table 4.1: Economically active and dependent population**

Age group	Male		Female		Total	
	Population	Percent	Population	Percent	Population	Percent
0-14 years	144	30	117	35.78	261	32.34
15-59	288	60	165	50.46	453	56.13
60 above	48	10	45	13.76	93	11.53
Total	480	100	327	100	807	100

*Sources: Field Survey,*



**Fig. 4.1: Economically active and dependent population**

*Sources: Field Survey, 2018*

Table 4.1 shows the economically active and dependent population of the study area. The percentage of working population is 56.13 and other 43.87 percent people are dependent.

From the above table, we know that there is a decreasing percentage of population in succeeding higher percentage and adult above 60 years is lower percentage.

### 4.1.2 Ethnic Composition

The society of the study area was heterogeneous. There is the representation of various ethnic groups. The following table shows that population of Kshetri (introduced with Lamichhane) is higher which is 40 percent of the total population. The caste system is going on changing. It is true that they are sharing with so-called lower caste group (Dalit) 12 percent; Brahman is 24 percent, Magar 8 percent, Newar 4 percent and others different castes are 12 percent of the total household's number.

**Table 4.2: Ethnic Composition of village**

Caste Group	household	Percent	Population	Percent
Chhetri	60	40	252	31.23
Brahman	36	24	225	27.90
Magar	12	8	57	7.06
Newar	6	4	33	4.08
Dalit	18	12	129	15.98
Others	18	12	111	13.75
Total	150	100	807	100

*Sources: Field Survey, 2018*

The table 4.2 shows that there is high ethnic diversity in the study area.

### 4.1.3 Academic status of the Respondents

In the study area literacy rate is 87 percent and illiterate population rate is 13%. Among them 90 percent male are literate and 10 percentages of them are illiterate in the total population. Female literate population is 84 percent and 16 percentage of female are illiterate.

**Table 4.3: Literacy status of sample household members by sex**

	Male		Female		Total	
	Population	Percent	Population	Percent	Population	Percent
Literate	431	90	275	84	706	87
Illiterate	49	10	52	16	101	13
Total	480	100	327	100	807	100

*Sources: Field Survey, 2018*

From the above table 4.3 shows that female literacy rate is lower than male literacy rate. It signifies that females are dominated in terms of education.

**Table 4.4: Academic status of literate population**

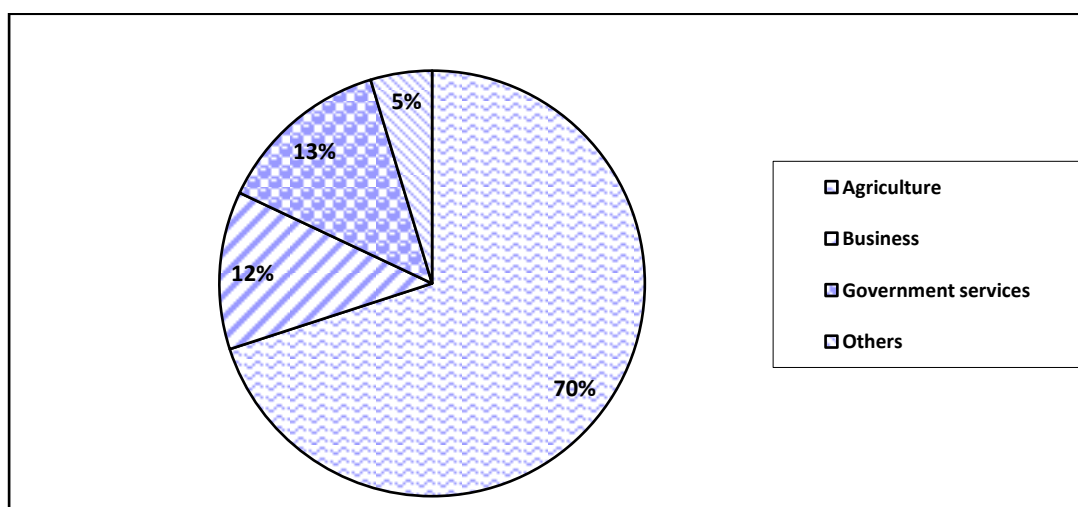
	Male		Female		Total	
	Populatio n	Percent	Populatio n	Percent	Populatio n	Percent
Below SLC	155	35.96	105	56	260	36.82
SLC	135	31.3	85	22.6	220	31.16
IA/+2	106	24.59	65	17.3	171	24.2
BA or above	35	8.1	20	4	55	7.7
Total	431	100	275	100	706	100

*Sources: Field Survey, 2018*

There is much difference between male and female below SLC level. In the SLC level, there is lower number of female population than male. Only 31.16 percentages of people are able to pass SLC. Out of them 31.3 percent are male and 22.6 percent are female. Out of total population, there is less percent i.e. 7.7 percent of people are B.A. or above. Among them 8.1 percent are male and only 4.00 percent are female.

#### 4.1.4 Occupational Structure

In the command area of the project 70.00 percent of the total population was engaged in agriculture. Only 30.00 percent people were employed in non-agricultural sectors, such as; business, government services and others.



**Fig. 4.2: Occupational Structure**

*Sources: Field Survey 2018*

Table 4.5 shows that highest proportion of population is involved in agriculture activities. Services, business and other occupations come under the second supportive position with 12 percent, 13 percent and 5 percent respectively.

#### 4.1.5 Cultivated land in own family

In the command area, the highest percent of respondent had their own land both irrigated and non-irrigated. Most of the people cultivated in own irrigated land and only 40 percent of population cultivated contract and others irrigated land to fulfill their crop scarcity.

**Table 4.5: Cultivated Land**

Types of land	Irrigated		Non-irrigated	
	respondent	Percent	respondent	Percent
Own land	130	86.67	135	90
Other land	12	8	10	6.67
Contract land	8	5.53	5	3.33
Total	150	100	150	100

*Source: Field Survey 2018*

Table 4.6 indicates that most of the population cultivated in own irrigated land and then only 8 percent of population cultivated others irrigated land to fulfill crop shortage. Few populations cultivated in contract irrigated land. Above table 4.6 also indicates that more population cultivated irrigated and non-irrigated land together. Among them highest population cultivated own non-irrigated land and only few population i.e. 6.67 percent does others non-irrigated land. 3.33% of them cultivate in contract non-irrigated land.

**CHAPTER-V**  
**IMPACT OF IRRIGATION PROJECT IN THE STUDY AREA**

**5.1 Cultivated Land before the Irrigation**

Before the irrigation project, the cultivated area was 79 hector. The soil of this area was productive and fruitful but due to the lack of irrigation the land had not been used properly. Single copping pattern was widespread.

**Table 5.1: Cultivated Area before Irrigation**

S.N	Crops	Cultivated area (in hector)	Percent
1	Paddy	43	54.43
2	Maize	9	11.39
3	Millet	8	10.13
4	Mustard	5	6.33
5	Wheat	9	11.39
6	Pulse	2	2.53
7	Vegetable	3	3.80
Total		79	100

*Source: Field Survey 2018*

The table 5.1 indicates that paddy was a dominant crop and produced in 54.43 percent of the total cultivated land before the irrigation facility. Maize and wheat were second crops and produced in 11.39 percent of total cultivated land. Millet was third crop and produced in 10.13 percent of the total land. Mustard was produced 6.33 percent. In the same way, vegetable was produced in 3.80 percent land and pulse was produced in 2.53 percent of total cultivated land.

**5.2 Production of Crops before Irrigation Facility**

Before construction of Ratikhola irrigation project, there was a lack of irrigation facilities and there was some small sources like temporary kulo, pipe and stream were used limitedly for irrigation in the agricultural fields. Some limited agricultural land had a seasonal irrigation facility. At that time, irrigation was available only in rainy season by temporary kulo, pipe and stream which start from outlet of land region. Subsistence



farming was the dominant economic activity of this area. This area is fertile and little bit plain region but due to the lack of proper irrigation facility, agriculture couldn't give sufficient production. Before the construction of the Ratikhola irrigation project, paddy, wheat, maize, millet, mustard, vegetable etc. were the main production of the study area. The proportion of the land was higher dry part. Paddy cultivation was limited in wet or swamp land area.

**Table 5.2: Crop production before the Irrigation**

S.N	Crops	Production in quintal (per hector)	Percent
1	Paddy	24	29.27
2	Maize	16	19.51
3	Millet	12	14.64
4	Mustard	4	4.88
5	Wheat	15	18.29
6	Pulse	11	13.41
7	Vegetable	-	-
Total		82	100

*Source: Field Survey 2018*

Table 5.2 shows that paddy was main food grain formed at study area. It was produced in 29.27 percent of the total food grain production. Second crop was maize which was produced in 19.51 percent of the total production. Wheat was the third crop which was grown in 18.29 percent. The production of mustard oilseeds and pulse was less. Paddy was grown in rainy season at the dry land. Before the construction of canal this area was dry or semi-dry and crop production was depending on monsoon rainfall. The monsoon rain was not reliable in time.

### **5.3 Productivity of Crops**

Due to the lack of irrigation facility, production of crops was not satisfactory before the irrigation project. The productivity of the crops was less and subsistence survival farming was prevailing in the study area before the construction of irrigation project. The productivity of crops has been given below:

**Table 5.3: Productivity of Crops before the irrigation**

S.N	Crops	Productivity
1	Paddy	36
2	Maize	32
3	Millet	13
4	Mustard	4
5	Wheat	14
6	Pulse	7
7	Vegetable	-

*Source: Field Survey 2018*

Table 5.3 shows the productivity of crops before the irrigation projects in the study area. The productivity of paddy was 36 quintal per hecter. In the same way, the wheat was produced 14 quintal per hecter. Maize was produced 32 quintal; millet was 13 quintal per hecter. Green vegetable was produced in a very small scale which is negligible. And other crops such as pulse and mustard were produced 11.9 quintal per hecter before the irrigation facility.

#### **5.4. Cultivated area before and after irrigation**

Changes in cultivated area after irrigation facility, the crop production area has also increased in the study area. It means that irrigation brought a drastic change in the production of agricultural products in the cultivated area. Table 5.4 shows the crops production area before and after irrigation project. According to this table, crop production has increased due to the irrigation facility.

**Table 5.4: Cultivated area before and after irrigation**

crops	Before Irrigation (in hector)	Percent	After Irrigation (in hector)	Percent	Change (in hector)	Change in percent
Paddy	43	54.43	81	62.60	+38	+88.37
Maize	9	11.39	15	13.01	+6	+66.66
Millet	8	10.13	2	1.63	-6	-75.00
Mustard	5	6.33	9	8.13	+4	+80.00
Wheat	9	11.39	4	4.06	-5	+55.55
Pulse	2	2.53	6	4.88	+4	+200.00
Vegetable	3	3.80	7	5.69	+4	+133.33
Total	79	100	123	100	+45	+493.36

*Source: Field Survey 2018*

After the irrigation 45 hector cultivated land was increased in the study area. Paddy production area has increased by 88.37 percent. Before the irrigation, paddy cultivation area was 43 hector and it has reached 81 hector after the irrigation. Maize production area has increased by 66.66 percent, mustard production areas has increased by 80.00 percent, vegetable and pulse production area has increased by 200.00, 133.33 percent respectively.

The construction of irrigation has brought drastic changes in the cultivated land. The dry lands are converted into irrigated land. There is proper facility of water supply now. After the irrigation facility, the amount of fallow and dry land has been converted into cultivated land after the irrigation facility.

Before the irrigation facility, crop production was totally depended upon the monsoon rain. So, the production and productivity of crops was low and people were not thinking about the increasing cultivated land. But, when irrigation facility has been provided by the Ratikhola irrigation project, the production of crops has also increased and people has changed the 45 hector fallow and meadow land into cultivated land. The increasing of cultivated land has automatically increased the crop production. The cultivated land has increased by 45 hector at the study area than before the construction of Ratikhola irrigation project. This became possible by bringing waste land under plough and expansion of irrigation facility to un-irrigated farm lands.

## 5.5 Production of Crops

Irrigation facility is available in the study area after construction of canal. Almost all land has been irrigated after the irrigation facility. Irrigation has brought a remarkable change in agricultural production in Gijyan. Paddy, Maize and Millet were grown in rainy season and wheat, mustard, vegetable, pulse were grown in winter season, vegetable was grown in limited area.

**Table 5.5: Production of different Crops after Irrigation Facility**

S.N	Crops	Production in quintal(per hector)	Percent
1	Paddy	42	36.21
2	Maize	24	20.69
3	Millet	4	3.45
4	Mustard	6	5.17
5	Wheat	21	18.10
6	Pulse	14	12.07
7	Vegetable	5	4.31
Total		116	100

*Source: Field Survey 2018*

Before the construction of this irrigation project, the total production of different crops was 82 quintal. But now total production of various crops is 116 quintal. Production of crop has increased by 41.46 percent after irrigation facility. Paddy cultivation has increased by 36.21 percent of the total crop production. Production of wheat was 18.10 percent of the total production. The production of maize and millet is decreasing after the irrigation facility. It is because maize and millet land is converted into paddy land after the irrigation facility. Pulse and vegetable accounts are produced 16.38 percent after the irrigation facility.

## 5.6 Changes in Crops Production

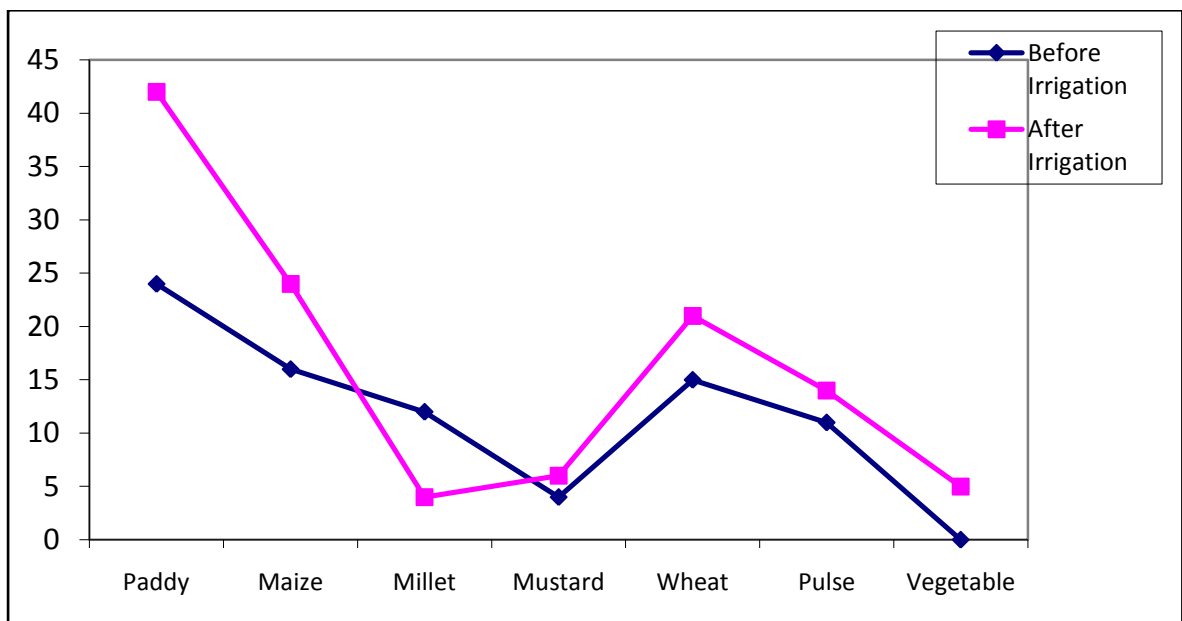
After the development of irrigation, it has increased the production of crops than before. It is due to the increase of irrigation facility in a cultivated land.

The data indicates that the production of crops has increased with the increase of irrigation facility in the study area.

**Table 5.6: Production of Crops before and after Irrigation**

Crops	Production in quintal(per hector) before Irrigation	Percent	Production in quintal(per hector) after Irrigation	Percent
Paddy	24	29.27	42	36.21
Maize	16	19.51	24	20.69
Millet	12	14.64	4	3.45
Mustard	4	4.88	6	5.17
Wheat	15	18.29	21	18.10
Pulse	11	13.41	14	12.07
Vegetable	-	-	5	4.31
Total	82	100	116	100

*Source: Field Survey 2018*



**Fig. 5.1: Production of Crops before and after Irrigation**

Table 5.6 shows the comparative crops production in the study area. The production of paddy has increased by 75 percent after the irrigation facility, production of wheat is increasing after the irrigation and it is increased by 37.5 percent. Likewise, the production of maize has increased by 50 percent. Vegetable production has increased by 5 times than before the project, mustard has increased by 50 percent, and pulse has increased by 16.67 percent. But millet production is decreasing by 66.67 percent. Because of after irrigation facility, all millet land is being converted into paddy land.

### 5.7 Productivity of Crops after Irrigation Facility

The productivity of crops also increased after the irrigation facility. Due to the irrigation facility per hector, production of crops has increased after the canal in this area.

**Table 5.7: Productivity of Crops after Irrigation**

S.N	Crops	Production in quintal(per hector)
1	Paddy	48
2	Maize	42
3	Millet	13
4	Mustard	8
5	Wheat	28
6	Pulse	16
7	Vegetable	60

*Source: Field Survey 2018*

Table 5.7 shows the productivity of crops after the irrigation facility at Gijyan in Tilahar. The productivity of paddy is 48 quintal per hector; wheat production is 28 quintal per hector. The productivity of maize has increased after the irrigation facility but the productivity of maize has increased i.e. 42 quintal per hector. The productivity of millet is the same as before because the irrigation doesn't affect the production of millet. The productivity of mustard has increased by 8 quintal per hector and pulse has been 16 quintal per hector. In the same way, the productivity of vegetable is 60 quintal per hector after the irrigation facility. The productivity of crops has increased after the irrigation facility in the study area.

### 5.8 Changes in Agricultural Productivity

It is true that the irrigation has increased the production of crops. It made possible to grow crops by using modern technology in the production such as the local farmer have adopted high yielding varieties of seeds, chemical fertilizers, modern tools and insecticides by which they are able to increase per the yield of crops.

**Table 5.8: Productivity of Crops before and after Irrigation (in quintal)**

Crops	Production (per hector) before irrigation	Production (per hector) after irrigation	Absolute increase (in quintal)	Increased percent
Paddy	36	48	12	33.33
Maize	32	42	10	31.25
Millet	13	13	0	0
Mustard	4	8	4	100
Wheat	14	28	14	100
Pulse	7	16	9	128.57
Vegetable	few amount	60	60	Many times
Total	106	215		

*Source: Field Survey 2018*

From the table 5.8, we know that the productivity of crops has also increased after irrigation facility. Productivity of paddy was 36 quintal per hector before irrigation facility, but after the irrigation facility, productivity of paddy per hector has increased by 33.33 percent and the production is 48 quintal per hector. The productivity of maize has increased by 31.25 percent; wheat per hector has increased by 100 percent after irrigation. The productivity of vegetable has increased by many times. Mustard has increased by 100 percent and pulse has increased by 128.57 percent after the construction of irrigation project. But the productivity of millet consists of same as before. It is true that the construction of irrigation doesn't affect the production of millet. Except millet, the productivity of all crops has been increased after the irrigation facility due to the available of proper irrigation of crops.

## **5.9 Cropping Pattern**

### **5.9.1 Cropping Pattern before the Irrigation Project**

Before the construction of Ratikhola irrigation project agricultural activities were fully dependent upon monsoon rainfall in this area. There was no any source of irrigation. During that period there was diversification in the cropping pattern. Various types of crops were produced such as paddy, maize, millet, wheat, mustard and vegetable. Paddy and maize were grown in summer season. Wheat, mustard, pulse and vegetable were grown in winter season and dry season.

**Table 5.9: Cropping pattern before irrigation**

Area	Summer crop	Winter crop
Wet land	Paddy	Wheat, Mustard, Pulse
Dry land	Maize, Millet	Mustard, Pulse, Sugarcane

*Source: Field Survey 2018*

From the above table 5.9, we can see that paddy was grown in wet land during the summer season and cultivated in July. Maize was grown in both wet land and dry land during the summer season but mostly grown in dry land. Millet was produced in summer season on wet land. Mustard was grown in dry and wet land and vegetables were produced in wet land during the winter season.

### **5.9.2 Changes cropping pattern after the irrigation project**

Irrigation has brought a remarkable change in cropping pattern. People used to grow various types of crops in dry land before the irrigation facility. At present, cultivated land is irrigated in the study area. Due to this irrigation facility, people are also growing varied crops.

**Table 5.10: Cropping pattern after irrigation**

Area	Summer crop	Winter crop
Wet land	Paddy	Wheat, Mustard, Pulse
Dry land	Paddy, Maize and Millet	Mustard, Pulse, Sugarcane, vegetable, wheat

*Source: Field Survey 2018*

Cropping pattern has changed after the irrigation facility. After the construction of irrigation canal, paddy is produced both in dry and wet land during the rainy season. Beside paddy, maize and millet are also grown in some of the dry land but paddy is grown more than other in dry land. Similarly, wheat is also grown in both wet and dry land during the winter season.

### **5.9.3 Changes in cropping pattern after the irrigation project**

After the irrigation facility, there is change in cropping pattern. Before the irrigation, paddy was produced in dry land during rainy season. Before the construction of irrigation canal, wheat was produced only on wet land. But after the irrigation, wheat, mustard and vegetable occupies in dry land in winter season. People are practicing to



grow different types of vegetable at dry land. Before the irrigation substance, type of farming was adopted by the people. But at present, people are slowly changing the agriculture system and adopting the commercial type of farming.

#### 5.9.4 Changes in livelihood of people after the irrigation.

After the irrigation project, the lifestyle of people has changed drastically. The rate of poverty decreased rapidly which has made such a positive impact. The quality of life of those people is far better than before. They are using high quality food, clothing, shelter and education. Even their psychological condition is improving day by day.

**Table 5.11: Major cereals before and after the project**

S.N.	Cereals	Before Irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1	Rice	10	6.7	35	23.3
2	Roasted maize	45	30	35	23.3
3	Dhindo (Millet, Maize, Buckwheat item)	55	36.7	25	16.7
4	Bread	20	13.3	35	23.3
5	Aato (Maize item)	20	13.3	20	13.4
Total:		150	100	150	100

*Sources: Field Survey, 2018*

From the above table we can note that before the irrigation project, only 6.7% household took rice as major food item. It had already increased to 23.3%. Similarly, other food item percentage too has changed due to the project. Dhindo was major food in most of the houses. But now all food is almost equally consumed.

**Table 5.12: Major vegetables before and after the project**

S.N.	Vegetable	Before Irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1	Dried vegetable	20	13.3	20	13.4
2	Potato	45	30	35	23.3
3	Gundruk (Spinach item)	55	36.7	25	16.7
4	Green vegetables	10	6.7	35	23.3
5	Pulses	20	13.3	35	23.3
Total:		150	100	150	100

*Sources: Field Survey, 2018*

From the above table we can note that before the irrigation project, only 6.7% household took green vegetable mostly. It had already increased to 23.3%. Similarly, other food item percentage too has changed due to the project. Gundruk was major vegetable in most of the houses. But now all types of vegetables are almost equally consumed.

**Table 5.13: Extra foods before and after the project**

S.N.	food	Before Irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1	Milk and Milk items	13	8.7	50	33.3
2	Meat and Meat items	17	11.3	40	26.7
3	Fruits	15	10	60	40
4	Fish item	7	4.7	35	23.3

*Sources: Field Survey, 2018*

Milk is an excellent food. Due to poverty before the irrigation project, 91.3% people didn't consume milk and milk items normally. But now only, 66.7% people don't consume it. Same is the case regarding meat items, fish items and fruits.

**Table 5.14: Major clothes before and after the project**

S.N.	Cloth item	Before irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1.	Daura Suruwal	55	36.7	25	16.7
2.	Suit	10	6.7	35	23.3
3.	Guniyo Choli	45	30	35	23.3
4.	Readymade Garments	10	6.7	35	23.3
5.	Kamij Kachhad	20	13.3	20	13.4

*Sources: Field Survey, 2018*

Before the project about 36.7% people used to wear Daura Surual. Very less i.e. 6.7% wore Suit and Readymade Garments. It has changed due to low poverty and development due to the project.

**Table 5.15: Major housings before and after the project**

S.N.	Housing	Before irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1.	Thatched roofed	55	36.7	25	16.7
2.	Slate roofed	45	30	35	23.3
3.	Tin roofed	10	6.7	35	23.3
4.	Cemented	15	10	45	30
5.	Hut	25	16.6	10	6.7
Total:		150	100	150	100

*Sources: Field Survey, 2018*

Above tabulation shows that most people used to live in thatched roofed house before but now many of them have cemented house. The number of slate roofed, tinned and hut too have decreased.

**Table 5.16: Educational investment before and after the project**

S.N.	Educational Investment per year	Before irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1.	0-20,000	68	45.3	17	11.3
2.	20,000-50,000	41	27.3	19	12.7
3.	50,000-75,000	21	14	55	36.7
4.	75,000-100,000	16	10.7	49	32.7
5.	100,000 and above	4	2.7	10	6.7
Total		150	100	150	100

*Sources: Field Survey, 2018*

We can read that before, people used to invest less on education due to poverty. Later due to irrigation facility, lifestyle changed. And the educational investment increased.

**Table 5.17: Psychological Condition before and after the project**

S.N.	Psychological Condition	Before irrigation		After Irrigation	
		Total	Percentage	Total	Percentage
1	Satisfied	50	33.3	72	48
2	Highly Satisfied	30	20	57	38
3	Depressed	60	40	10	6.7
4	Not Satisfied	70	46.7	11	7.3
Total:		150	100	150	100

*Sources: Field Survey, 2018*

As people had low income, their lifestyle was miserable. So, many of them were fed up with their life. Some were even depressed. Just 20% of people were highly satisfied. But now the condition has changed.

### 5.9.5 Cropping Calendar

**Table 5.18: Cropping Calendar**

Crop	Time
Paddy	May-November
Wheat	November-March
Maize	March- July
Millet	June-November
Mustard	October-February
Winter Vegetable	September-February
Summer Vegetable	February-September

*Source: Field Survey 2018*

From the table 5.11, we can see that double cropping system is practiced in the study area. During the four months period February – June; the cultivated land of the command area remain unplanted. This may be because irrigation water is not sufficiently available during this period. Cropping pattern and cropping intensity is generally dieted by water availability. After the irrigation facility, people at the study area are adopting double cropping system. Irrigation facility is very helpful for the practice of triple copping system in the study area after the regular supply of water from irrigation canal.

### 5.10 Use of Chemical Fertilizer

Comparative data at the chemical fertilizer per hector at Ratikhola irrigation project command area for different crops before and after irrigation facility is presented in below table 5.12. Use of chemical fertilizer has increased after the irrigation facility. The increase of chemical fertilizer has also helped to increase the production of crops.

**Table 5.19: Use of Chemical Fertilizer before and after Irrigation (per hectore)**

Crops	User of chemical fertilizer before irrigation (in Kg)	User of chemical fertilizer after irrigation (in Kg)	Changes in percentage
Paddy	60	120	100.00
Wheat	50	90	80.00
Maize	15	30	100.00
Millet	5	10	100.00
Mustard	12	30	150.00
Pulse	3	10	233.33
Vegetable	35	100	185.72

*Source: Field Survey 2018*

Table 5.12 shows that the use of chemical fertilizer has increased after the irrigation facility. Before the irrigation facility, use of chemical fertilizer was very low. Only 60 Kg per hectore chemical fertilizer was used for paddy production and it has increased by 100 percent and reached 120 Kg per hectore. Before irrigation 50 Kg per hectore fertilizer was used for wheat production which has increased by 80 percent and reached 90 Kg per hectore after the irrigation. Likewise, for the production of pulse and mustard, low amount of chemical fertilizer was used before the irrigation facility. But after the irrigation facility it has increased by 133.33 percent and 150 percent respectively. Only 5 Kg in millet and 15 Kg in maize were used before irrigation, which were increased by 100/100 percent and reached 10 Kg and 30 Kg in millet and maize respectively. For the production of vegetable, only 35 Kg per hectore chemical fertilizer was used before irrigation. It has increased by 185.72 percent and reached 100 kg per hectore after the irrigation facility.

### **5.11 Changes in the occupational structure**

Irrigation is not only essential for crop production but it has also changed the status of society and its people. Irrigation has influenced the occupational structure of society after the irrigation facility. There is low density of population on agricultural sector because higher production does the higher saving. People invest their money in other activities. Due to the irrigation facility, people can grow higher amount of crop.

In the study area, 70% populations are engaged in agriculture and more land is used for cultivation. The living standard of people has increased than before. The

production of crops on this area has increased and food surplus of people has changed after the irrigation facility.

In the study area, 12 percent of total population is engaged in business, 13.33 percent are in service and 4.67 percent are engaged in other different occupations.

In this area, the living standard of people has increased due to the higher amount of crop production, which has affected on the occupational structure of people. Increasing crop production means increasing the source of income of people. The main income source of people of this area is agricultural production. We already know that the crop production of the study area has increased after irrigation facilities. People have invested their saving money in different activities, which helps them for improving their economic conditions.

### 5.12 Food Grain Sufficiency

Most of the respondents have sufficient food grain and some respondents do not have sufficient food grain in 2017.

**Table 5.20: Food Grain Sufficiency**

Sufficiency	Number	Percent
Yes	93	62.00
No	57	38.00
Total	150.00	100.00

*Source: Field Survey 2018*

Table 5.13 indicates that food grain is sufficient in last year for 62 percent respondents. But only 38 percent of respondents of the study area food grain are not sufficient last year. Most of the respondents i.e. 38 percent have food dearth only for 3 months, but sufficient for 9 months. It shows that crop and vegetable is not sufficient for their utility.

### 5. 13 Income from agricultural product

Agricultural production has invested vital role for the farmers. Ratikhola irrigation project has increased agricultural production and their annual income after the irrigation facility. Income from agricultural product in irrigation command area is given below.

**Table 5.21: Income from agricultural product**

Income/year	Number	Percent
Below 50,000	75	50.00
50,000-100,000	66	44.00
100,000- 150,000	6	4.00
Above 150,000	3	2.00
Total	150	100.00

*Source: Field Survey 2018*

Table 5.14 indicate that highest percent or 50 percent of respondents sell their agricultural product below Rs. 50,000 and followed by Rs. 50,000-100,000 i.e. 44 percent. Only 4 percent of respondents earn Rs. 100,000-150,000 by selling their vegetable product and crop production. Among of them very little i.e. 2 percent earn above Rs. 1, 50,000

#### **5.14 Expenses of people in the study area,**

Irrigation has played an important role in increasing the production as well as expenses of people. People has increased their expenses in the command area Such as; food, clothes, fuel, health and education, cultural functions and others that is given below in table 5.15.

**Table 5.22: Expenses of people**

Items	Number	Percent
Food	150	100.00
clothes	150	100.00
Fuel	108	72.00
Health and education	150	100.00
Festival	150	100.00
Entertainment	135	90.00
Other	150	100.00

*Source: Field Survey 2018*

Table 5.15 indicates that 100 percent of respondents spend their income on food, cloths, festival, health and education. Among them 72 percent of respondents use up their income on fuel which is lower than others expenditure. Only 90 percent of them use their income on entertainment. Others mean donation, social works, transportation cost, unexpected expenses, etc. So, 100 percent respondents spend on such previous title.



### 5.15 Expenses rate in agriculture sectors

An efficiency of irrigation related to agriculture production depends upon the management of input used in agriculture sectors such as; human labor, fertilizer, seeds and others. Small farms are managed more effectively and increase efficiency in production in comparison to large and medium size farm. Ratikhola irrigation command area use different crops in relation to land-holding categories are presented below:

**Table 5.23: Expenses rate in Labor**

Expenditure (Rs.)/year	Number	percent
0-25000	87	58.00
25000-50000	42	28.00
50000-75000	21	14.00
Total	150	100.00

*Source: Field Survey 2018*

Table 5.16 shows the last year expenditure rate on labor of the study area. Highest percent i.e. 58 of respondents spend Rs. 0-25,000 on labor last year and followed by Rs. 25,000-50,000 that is 28 percent. Very few of them spend Rs. 50,000-75,000 on labor.

**Table 5.24: Expenses rate in Agricultural sector**

Expenditure (Rs.)/year	Fertilizer		Seeds		Other	
	Number	percent	Number	percent	Number	percent
0-10,000	72	48.00	150	100.00	150	100.00
10,000-20,000	57	38.00	-	-	-	-
20,000-30,000	21	14.00	-	-	-	-
Total	150	100.00	150	100.00	150	100.00

*Source: Field Survey 2018*

Above table indicates the expenses rate in Agricultural Sector. It shows that most of the respondents i.e. 48 are spent Rs. 0-10,000 on fertilizer and than 38 percent of respondents spent Rs. 10,000-20,000 on it. Only 14 percent of respondents spent Rs. 20,000-30,000 on fertilizer.

And 100 percent of respondents spent Rs. 0-10,000 to buy seeds. Nobody spent more than Rs. 10,000 to buy seeds. Others means to buy tools, transportation cost,

communication cost, food and drink cost for labor, unexpected cost, etc. so that 100 percent respondents spent less than Rs. 10,000 for others things.

### 5.16 Problems of the Irrigation Project

Table 5.18 shows the problem faced by people in Modi-6, Tilahar from Ratikhola irrigation project.

**Table 5.25: Problems of Ratikhola Irrigation**

Problems	Number	Percent
Lack of continuous irrigation	120	80.00
Capacity of canal is not sufficient	105	70.00
Branch canal is not constructed	45	30.00
The volume water is not sufficient	120	80.00
Water is not equally distributed by irrigation project	111	74.00
Others	84	56.00

*Source: Field Survey 2018*

Table 5.18 shows the different problems faced from irrigation project. Highest percent as well as equal percent i.e. 80 of respondents had faced lack of continuous irrigation and the water volume of water is not sufficient from Ratikhola irrigation. And followed by water was not equally distributed by irrigation project that is 74 percent. Among them 70 percent of respondents had faced the problem of capacity of canal is not sufficient. Very few respondents had faced problem from branch canal because branch canal is not constructed according to requirement. Only 56 percent had faced other problems such as lack of regular monitoring of irrigation after starting, lack of co-operation, lack of maintenance, lack of group discussion about irrigation etc.

## CHAPTER - VI

### SUMMARY FINDINGS AND CONCLUSION

#### 6.1 Summary and Findings

Irrigation facility is the most important phenomenon in the sense of crop production. It plays an important role for the production of crops and it brings change in socio-economic status of the people. Economic condition of the farmers can change by the growth of crop production.

Ratikhola irrigation project has also become the backbone for agricultural development in the command area. The present research is primarily concerned with the "*The economic impact of Ratikhola irrigation project*". The study had the general objective of studying to find out the socio-economic impact of Ratikhola irrigation project whereas, following were the specific objectives of the research: to study an economic impact of Ratikhola irrigation project, to examine the existing crop production before and after irrigation project and to access the changes in the cropping pattern after the irrigation project.

The study is mainly focused on the impact of Ratikhola irrigation project. The study is explorative and descriptive in the nature. Modi Rural Municipality-6, Tilahar is selected for this study purpose. The universe of this study has been consisted of 244 households of the command area. Among them 150 households has been selected as sample by the simple random sampling method.

The data were gathered from both primary and secondary sources. The nature of data is qualitative as well as quantitative. Household survey, observation, interview schedule, key-informant interview were the data collection techniques used for the study. The key informants of this study are local leaders, staffs of this project, official members of district irrigation project in Parbat and one of the head members of 150 households.

There is 123 hectares land utilization for the food grain, vegetable crops, oilseeds etc. Modi Rural Municipality-6, Tilahar has only one irrigation project, which is occupied 123 hectares land irrigated. The total area of irrigated land of this Rural Municipality is covered by Ratikhola irrigation project. About 244 households and 1456 populations are living in the Ratikhola irrigation command area. This project can be

improved by developing agriculture system and can be uplifted by changing livelihoods of the farmers.

Ratikhola command area has 43.87 percent people are dependent the age of under 14 & over 60 years, 56.13 percent respondent are found on the age of 15-59. The literacy rate is 87 percent out of the total respondent, which is lower. Among them 90 percent male are literate and 84 percent female are literate. Female literacy rate is lower than male literacy rate. In the study area 70 percent population is engaged in agriculture. Only 30 percent people are employed in non agricultural activities such as business, service and other functions.

Before the irrigation project, the cultivated area was 79 hectares and single cropping system is prevailed. Vegetable crops have 3.80 percent before the irrigation project. Only 10 percent agricultural land has seasonal irrigation facility. In rainy season by temporary "Kulo" which start from outlet of wetland area. Before the project, there are many means of irrigation such as pipe, kulo, stream and others.

Paddy accounted for 29.27 percent of the total food grain production and the share of maize and millet production is 19.51 and 14.64 percent respectively in the total production. The productivity of crops was very low before the construction of irrigation project.

After the irrigation, 45 hectare cultivated land was increased in the study area. Paddy production area has increased by 88.37 percent. Before the irrigation, paddy cultivation area was 43 hectare and it has reached 81 hectare after the irrigation. Maize production area has increased by 66.66 percent, mustard production areas has increased by 80.00 percent, vegetable and pulse production area has increased by 200, 133.33 percent respectively.

The total production of crop has increased by 41.46 percent after the irrigation facility. However most of the millet field people have replaced the area under maize to paddy cultivation.

After the construction of irrigation channel, paddy used to produce both in dry and wet land. After the irrigation facility, people are adopting double and triple cropping system in the study area. Chemical fertilizers have 100 percent increased after the irrigation in the study area. For vegetable production 185.72 percent chemical fertilizer has increased after the irrigation facility. However, the use of chemical fertilizer has increased after the irrigation facility.

Before the irrigation project, farmers used to cultivate millet, maize and wheat mostly but less rice and little vegetable only for their daily use. But now, after irrigation facility they changed their cropping pattern growing varied crops like paddy, wheat and various types of vegetables and fruits. There was less production of crops before irrigation which was not even sufficient for their use and they couldn't produce for selling. Hence, their economic status was poor. They couldn't invest for education, health etc. Their living stander was very low.

At present, with the change of cropping pattern highly increased the production of various crops; farming is commercialized so that they are able to earn money. Their economic status is highly increased which made their living stander good. They can invest their money in education, health, social ceremony, food, clothes, entertainment etc.

Economic status is an important and determining component of social change and development. Positive changes in economy, health, education and farmer's position/status are often regarded as the hallmarks of social development of the country, Therefore, the study aimed to explore the farmer's access to income generated by commercial vegetable farming. Less income and less access to income meant that they had very little choices in what they wanted such as meals, clothes, decisions etc. lack of adequate income means less access to health, education, and the perpetual domination of farmers in the society. In general commercial vegetable has helped raise farmer's status in the society through their social and economic empowerment components. It was revealed that before adoption of this farming, the majority of farmer in the study site did not have any income source and used to work as unpaid family labor. Only some farmers used to sell some cereal crops to local people if it was surplus.

But now, due to Ratikhola irrigation facility farmers have access to financial resources. More importantly, access to financial resources can have substantial positive impact on food security and household nutrition, especially for women and children nutrition. The trend of vegetable consumption increased among the farmers after adopting this occupation. With the help of vegetable production, not only these farmers have become financially strong but also are able to secure their own and family's nutritional intakes. The awareness among farmers about saving was found increased in the study site. They further said proudly that previously they had to take loans to celebrate ceremonies (such as marriage), festivals and households need. Now, they have money at any time and have got rid of taking loans to fulfill their family needs. Due to

this irrigation project, the crop production of farmers highly increased with the change of cropping pattern. This increased the status of farmers.

Likewise, the project has brought a remarkable change in the livelihood pattern and quality of life of farmers. With that the satisfaction rate of the farmers of the study area has increased drastically. We can note that this project has done a lot in the field.

## **6.2 Conclusion**

Irrigation facility is the most important for crop production in agriculture sector. Almost 74 percent people of Nepal are engaged in agriculture. The main occupation of Nepalese people is agriculture. But agriculture is dependent on irrigation. The study area is based on Modi Rural Municipality-6, Tilahar. The total population of this area is 269 out of which 59.47 percent are male and 40.53 percent female. In the study area 70 percent population is engaged in agriculture. Only 30 percent people are employed in non agricultural activities such as business, service and other functions. To conclude, sufficient branch canal to all people is the burning issue. Due to lack of branch canal all people were unable to take equal benefit from the irrigation. Water in Ratikhola River is insufficient in winter to provide irrigation facility for the command area. So the production is very low in winter. Institutional development is not well maintained due to ignorance at repairing and maintaining the canal. Lack of co-ordination of water user association and water user group, people participation and operation and management of allocation and distribution of water brought conflict for water issue. The farming technology is very poor due to the lack of technical services and modern well equipment for agriculture activities such as lack of quality seeds, harvesting machine. There is lack of agricultural market to sell the agricultural production on the reasonable price. In fact the government should bring new policies to enhance the people who are actively involved in agricultural sectors. In conclusion, however farmers have replaced an area under millet and maize.

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## Appendix -I

### Questionnaire used for data collection

#### ***Ratikhola Irrigation Project***

This survey is conducted within Canal command area in Modi Rural Municipality-6, Tilahar, Parbat for the partial fulfillment of MA in Anthropology.

Questionnaire No.....

Date: .....

1. The head of the family name.....

2. No. of family: Male ( ) Female ( ) Total ( )

Age	0-14	15-29	30-44	45-59	60 above
Male					
Female					

3. Number of family members according to literacy (7 years & above)

	Illiterate	only literate	8 pass	SLC pass	IA	BA or +
Male						
Female						

4. Major occupation of the family members. (15 years & above)

S.N	Occupation	No. of persons		Total
		Male	Female	
1	Agriculture			
2	Business			
3	Service			
4	Industry			
5	Others			

5. Who are the original castes of this area?

.....

6. Annual income source.

(a) Agriculture (b) industry (c) wages

(d) Business (e) service (f) others

7. How much cultivated land owned by your family? (In Ropani)

Types of land	Own land	Other land	Contract	Total
Irrigated				
Non-irrigated				
Total				

8. How much cultivated land owned before the Ratikhola irrigation project?

Ans..... Ropani

9. Was there irrigation facility in your land before irrigation project?

Yes ( ) No ( )

10. If irrigation facility was provided, how much land was irrigated?

Ans..... Ropani

11. What was the means of irrigation?

Pipe ( ) Canal ( ), River/Stream ( ),  
Other ( )

12. Changed in factor that you have after the irrigation project.

(a) Economic factor

(b) Social factor

(c) Political factor

(d) Educational factor

(e) All

13. If changed in all factors, what was the cause?

(a) Achievement of irrigation facilities

(b) Awareness of people about the irrigation and its proper utilization.

(c) Utilization of fertilizer

(d) Improvement the economic as well as social status of farmers

14. Achievement after the construction of Ratikhola irrigation project.

(a) Decrease in crop production

(b) Increase in crop production

(c) Constant in crop production

15. If increase in crop production what are the causes?

(a) Achievement of irrigation facilities

(b) Utilization of improved seeds.

(c) Utilization of higher quality of labor.

(d) Increase in cultivated land.

(e) Purchase the new land by farmer.

(f) Utilization of fertilizer

16. If decrease in crop production. What are the causes?

(a) Irregular water supply in all season.

(b) Canal has damaged in time to time.

(c) Unequally distributed of water

(d) Other

17. Agriculture production before and after the Ratikhola irrigation project.

Crops	Before irrigation	After irrigation
Paddy		
wheat		
maize		
mustard		
pulse		
vegetable (kg)		
others		

18. Use of fertilizer to produce the agriculture crops.

Crops	Before irrigation		After irrigation	
	Area in (Ropani)	Chemical, fertilizer (kg)	Area in Ropani	Chemical fertilizer (kg)
Paddy				
wheat				
maize				
pulse				
vegetable				
others				

19. Food grain sufficiency at last year.

	paddy	maize	wheat	pulse	vegetable	other
Sufficient						
dearth						

20. If you have dearth, how long did the food dearth.

..... Month.

21. Selling price of surplus food (per quintal or muri)

Crop	paddy	maize	wheat	pulses	vegetable	other
Price Rs.						

22. How much expenditure for your family last year? (A part from agriculture)

Heading	food	cloth	fuel	Health & education	festival	entertainment	other
expenditure Rs.							

23. Expenditure in agriculture per Ropani at last year (Rs.)

Crop →	paddy	wheat	maize	pulse	vegetable	other	total
labor							
fertilizer							
seeds							
others							
total							

24. If you have saving the money, where you invest your money or goods?

- (a) To buy land      (b) to gain in interest  
 (c) To business      (d) to keep in bank      (e) to buy ornament  
 (f) To lend money      (g) others

25. Annual cropping pattern

Winter crops	Area Ropani	Production in quintal	Summer crops	Area Ropani	Production in quintal
After Irrigation					

26. Problems related with Ratikhola irrigation.

- a) Lack of regular irrigation.
- b) Capacity of canal has not sufficient.
- c) Branch canal has not constructed.
- d) The volume water has not sufficient.
- e) Water was not equally distributed by irrigation project.
- f) Others.

27. Problem related with the agriculture sector

- a) Chemical fertilizer, seeds, agriculture tools have not use.
- b) JT and JTA service are not facilitated.
- c) Chemical fertilizer, seeds and agriculture foods have not been sufficiently provided.
- d) Lack of irrigation
- e) Lack of capital and labor
- f) Lack of agriculture market
- g) Others.

28. Have you any comments and suggestion to Ratikhola irrigation project.

.....

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.....

.....

***Thank you***

## **Appendix -II**

### **Members involved in Focus Group discussion (FGD)**

#### Group A

- Chandra Bahadur Chhetri (leader)
- Lal Bahadur B.K.
- Nirmala K.C.
- Krishna Pariyar
- Anita Lamichhane
- Sabita Malla

#### Group B

- Nandalal Subedi
- Shanti K.C.
- Maya Rana
- Kamal Pariyar
- Arjun Shrestha
- Ramkrishna Sharma

#### Group C

- Laxmi Devi Lamichhane
- Bal Bahadur Rana
- Prem K.C.
- Kamala Sharma
- Bimal Nepali
- Kopila Sunar

## Appendix-III

### Modi Rural Municipality-6 Ward Committee

- Bimal Mani Lamichhane : Chairperson
- Lakshya Bahadur K.C. : Member
- Sushila K.C. : Member (Ladies)
- Kamala Sarki : Member (Dalit)
- Nandalal Subedi : Member

### Ratikhola Canal Consumer Committee

- Lakshya Bahadur K.C. : President
- Sita Thapa : Vice President
- Sunita Timilsina : Secretary
- Krishna Bahadur Hamal : Treasurer
- Vishnu Prasad Sharma : Vice Secretary
- Dayanath Nepali : Member
- Foolmati Chhetri : Member
- Nira Pariyar : Member
- Sushmita Rana Magar : Member
- Maya Hamal : Teacher
- Ram Singh Sarki : Old age
- Ramlal Rana : Member