ROLE OF FARMER MANAGED IRRIGATION SYSTEM IN RURAL LIVELIHOOD: A CASE STUDY OF RANI JAMARA KULARIYA IRRIGATION PROJECT IN DURGAULI VDC OF KAILALI DISTRICT

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In

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Submitted by

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DECLARATION

I hereby declare that the thesis entitled *Role of Farmer Managed Irrigation System in Rural Livelihood : A Case Study of Rani Jamara Kulariya Irrigation Project in Durgauli VDC of Kailali District, Nepal* submitted to Central Department of Rural Development, Tribhuvan University is entirely my original work prepared under the guidance and supervision of my supervision. I have made due acknowledgements to all the ideas and information borrowed from different source in the course of preparing the thesis. The results of this thesis have not been presented or submitted anywhere else for the award of any degree of for any other purposes. I assure that no part of the content of this thesis has been published in any from before.

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LETTER OF RECOMMENDATION

This is to recommend that the thesis entitled *Role of Farmer Managed Irrigation System in Rural Livelihood : A Case Study of Rani Jamara Kulariya Irrigation Project in Durgauli VDC of Kailali District, Nepal* has been prepared by Pushkar Budha under my guidance and supervision in partial fulfillment of requirements of Master Degree of Arts in Rural Development. To the best of my knowledge, this thesis work has not been submitted for any degree in any institution.

I hereby forward this thesis to the evaluation committee for final evaluation and approval.

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APPROVAL LETTER

The thesis entitled *Role of Farmer Managed Irrigation System in Rural Livelihood : A Case Study of Rani Jamara Kulariya Irrigation Project in Durgauli VDC of Kailali District, Nepal* submitted by Mr. Pushkar Budha in partial fulfillment of the requirements for the Master's Degree (M.A.) in Rural Development has been approved by the evaluation committee.

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ABSTRACT

Irrigation plays a major role in the developing country like Nepal where almost 80% people are still dependent in agriculture to increase the production and in order to sustain the livelihood of the people. FMIS proves as the milestone for the economic growth of the people and to bring major transformation in the lives of the people. The share of FMIS in the irrigated agriculture is almost 70% in Nepal. To know about the balance water uses for sustaining livelihood and to relate in with available data, a study was carried out in Durgauli VDC of Kailali district. Rani Jamara Kulariya Irrigation Project has a great contribution in the complete transformation of the Durgauli VDC.

The main objectives of the study is to find out the role of former managed irrigation system in Rural Livelihood. The research tries to access the farmer managed irrigation system use of water for rural livelihood factors influencing participation for the effective management of water and the impact of irrigation management in the study area and what take change the irrigation project in rural livelihood.

Literature review was conducted through various sources such as previous studies report. Different articles about FMIS, previous thesis and internet to identify the gap. The research was conducted under descriptive and exploratory research design. Both primary and secondary information were collected during the course of study. Primary data were collected through structured questionnaire survey from the farmers. Key informant interview, field visit, observation and focus group discussion were also carried out while secondary data were collected from various published and unpublished information source i.e. relevant literatures, books, journals reports, annual reports and other official sources.

The farmers have observed the complete transformation in the livelihood of the people with 60 percent growth in investments, 30 percent growth in their savings 10 percent growth in access to education as the major economic changes, likewise 50 percent increased in the construction of road, 30 percent increase in the construction of houses, 10 percent increase in the construction of canals and 2 percent increase in the construction of agro processing centre an physical sectors. The level of production has increased by about 75 percent in the study area. With the availability of irrigation,

farmer in the area have started growing potatoes twice a year which has been the major source of the income.

Irrigation has major impact in the decision making of women which in 60 percent followed by 30 percent the development of self-help group and 10 percent conflict resolution. Irrigation has also played secondary role in the establishment of cooperative and has highly contributed in education of sector, physical infrastructure, economic growth and in the overall development of the study area. Farmer are actively participating in the effective management of water which helps of sustain the long terms of the project.

Thus, FMIS has a great significance for community development, enhancing opportunities to participate for farmers including women and small farmers in the mainstream of development which provides over all rural development.

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ACRONYMS/ABBREVIATIONS

ADB	Asian Development Bank
RJKIP	Rani Jamara Kulariya Irrigation Projects
AMIS	Agency Managed Irrigation System
APROSC	Agriculture Project Serviced Centre
CBS	Central Bureau of Statistics
CMIASP	Community Managed Irrigated Agriculture Sector Project
DOA	Department of Agriculture
DOLIDAR	Department of Local Infrastructure Development And Agricultural Roads
DOI	Department of Irrigation
DTW	Deep Tube Well
et al	and others (from Latin *et alii*)
etc	and so forth (from the Latin *et cetera*)
FMIS	Farmer Managed Irrigation System
GDP	Gross Domestic Product
GON	Government of Nepal
GWRDB	Ground Water Resources Development Board
ha	Hectare
HH	Household
HMG	His Majesty of Government
IDE	International Development Enterprises
ILC	Irrigation Line of Credit
IMC	Irrigation Management Committee
IMT	Institute of Management Technology
INPIM	International Network on Participatory Irrigation Management
ISP	Irrigation Sector Program
IWRP	Irrigation and Water Resource Management Project
MOLD	Ministry of Local Development

NARC	National Agriculture Research Council
NGOS	Non Government Organizations
NIIS	Nepal Irrigation Institutions and System Database
No.	Number
NPC	National Planning Commission
SAPPROS	Support Activities for Poor Producers of Nepal
S.N.	Symbol Number
STW	Shallow Tube Well
TU	Tribhuvan University
WUA	Water User's Association
WUG	Water User's Group
WECS	Water and Energy Commission Secretariat
%	Percentage

CHAPTER- ONE
INTRODUCTION

1.1 General Background

Nepal is a small underdeveloped Himalayan country with an area 1,47181 sq. km which accounts as 0.03 percent of land area 0f earth. The location of Nepal lies between 80 12” to 30 27” north longitude. The country has nearly 800 kilometers length and 160 kilometers breadth in its spatial extension mainly along the south slope of the Himalayas (Upadhya, 2006, p.12).

The Himalayas kingdom is between two big economic developed and most populous giant Asia countries India and China. China in the north and India in east, west and south with open border.

Nepal is predominantly hilly, rural and agricultural country. Its almost two third part is both hilly or mountains and rural as well. Almost 80% of its population are dependent in agriculture occupation which is mostly subsistence in nature.

However, in recent days people gradually seeking to change their pattern of traditional subsistence agriculture in few parts of eastern and central development region.

Nepal is primarily an agricultural country with about 26.6 million human populations out of which 83% population resides in rural area and 80% people are highly dependent on agriculture (CBS, 2011). Water is an important natural resources of Nepal. The immerse quantity of water available in the country and its potentiality to irrigate significant percentage of rural agriculture land provide us the better opportunity of overcoming the barriers of economic development in this beautiful Himalayan country. Agriculture is the main source of subsistence for most of the people in developing countries including Nepal. It contributes about 32% of GDP (CBS, 2014) and provide employment for more than two third of the population of the country. Thus farmer manage irrigation plays a vital role in agriculture based country like Nepal. The volume of agricultural production directly depends upon irrigation which directly affects the quality of life of rural people and GDP of the country. Thus irrigation development is need of people and for the poverty alleviation.

In Nepal, there is limited expansion of agricultural land to increase agriculture production. Therefore, the only alternative available for increasing the agricultural production is to increase productivity and cropping intensity by adopting suitable measures like increase in irrigated land, intensive use of available irrigation infrastructure, improvement in water management practices in farmer's participation in the irrigation systems. Farmer Managed Irrigation System (FMIS) have major contribution in providing irrigation facility in country. But due to various problems outside the central of the farmer the FIMS are losing their capacity.

Government of Nepal has initiated small Irrigation Special Program (SISP) with the view of supporting the existing small irrigation system and utilizing small source of water by making use of local technology and farmers contribution. Under this program financial support is provided by the government to maintain/rehabilitate and improves the existing small irrigation systems, to construct new small systems and to develop non-conventional irrigation systems (like drip, sprinkler etc.) where feasible.

Nepal's agricultural productivity has remained relatively stagnant over the past 20 years or more (NPC, 2007), with modest average annual increases of 1.8 percent in total cereal grain production (NPC, 2007). The potential for expanding areas being minimal, the only option left for improvement is the introduction of modern farming practices with the provision of irrigation facilities and their effective management

Nepal is famous for it's farmer participation manage irrigation system. At the beginning (FMIS) and existed on self-help basic. Those self-help groups locally name as *(Kulo banaune)* have established a mechanism according to the traditional of ownership, organization capabilities user's participations and mutual trust and accountability.

With this system irrigation development in Nepal remained in the hands of the local people for many years. At present two type of (FMIS) are seen in Nepal. They are:

- Traditional irrigation system managed by farmer
- Handed over irrigation system from government and NGOs to the farmers

Kailali districts lies in the lower terai region of Nepal in its far-western development region. Kailali district has many following rivers. Karnali is one of the long river of

Nepal. Where large amount of water follows in all season. Where farmer manage irrigation system is very famous in Chisapani. All farmer participant control the Karnali river and change the direction of water in (Rani, Jamara and Kularia) small river for irrigation which helps for more production, Fishery, horticulture. This helps in employment and poverty alleviation.

People participation in irrigation system is very important for getting positive result and making it sustainable. Therefore, it is must to involve local peoples participation in every state of irrigation development without whom it become difficult to achieve the sustainability of irrigation system.

Irrigation development and management in Nepal is probably as old as the rice terraces covered by the farmers. Until 1980's there was no formal recognition of the contribution of farmer's managed irrigation system (pradhan,2002). However, with the basic needs fulfillment program of the government during 1980's there been felt need for high rate of agriculture development which was not possible to development of irrigation. For this it is not possible to develop large infrastructure by the government for the desired rate of agriculture growth. Thus during 1980's government with different donor driven programs (e.g. irrigation line of credit –ILC, irrigation sector program-ISC) started to provide assistance to FMIS in the different parts of the country and hence increased the record of irrigated area (Pardhan,2002). Thus for the short period of time many of the FMIS came under the domain of irrigation Department. The feasible land area for irrigation in Nepal is 1.76 million hector. Out of the total irrigable land, around 60%has some kind of irrigation facility. However, less one- third irrigate land has year- round irrigation facility.

Only the limited percentage out of total land area of Nepal is suitable for irrigated agriculture. Irrigated agriculture holds great potentiality to meet the development challenges and key to increased agriculture production to feed the growing population of Nepal. Besides, increasing the agriculture production, irrigation helps promote Green Revolution, contributes for poverty alleviation and helps promote rural growth and food security among people. Dilapidated irrigation system affects on all these fonts of development issues. In order to meet these challenges. the important question is: how can irrigation sector be revitalized? It is, therefore, necessary to revitalize the irrigation sector to feed growing population, to ensure livelihood and poverty

alleviation and maximize the benefit of available natural resources like water to get more production from limited land availability (Pradhan, 1989a).

Irrigation helps to increase the production ratio of the farmers. It not only makes people life easy but also feasible to cultivate the crops as per their wish. The farmer needn't need to depend on rain water, so within a time limit hug quantity of products can be produced. His help to enhance the economic condition of the people by importing the produced goods to outside market paving a way for sustainable livelihood.

FMIS incorporate pluralistic democratic value and people's unified cultural heritage by means of their self-governing autonomy and egalitarian character. In day to day FMIS operations. these values and characteristics are expressed through the generation wind use of the social capital. The share of FMIS in the irrigated agriculture is almost 70% in Nepal. In the remaining areas, some systems are being transferred wholly to water users association (WUAs) for management, whereas some irrigation systems are being jointly managed by the governmental and WUAs (Shrestha, 2009).

There are about 16,000 FMIS and irrigate approximately 7,14,000 hectare of cultivated area or 67% of the total irrigable area of the country. Historically the government of Nepal perceived irrigation development as being the domain of the local concerns because of which farmers in disparate locations of the country organized themselves to construct, govern operate and maintain a large number of irrigation systems (Lam, 1998).

There are different agencies which influence the irrigation sector of Nepal. The National Planning Commission (NPC), Ministry of Irrigation (MOI), Ministry of Finance (MOF) and Water and Energy Commission Secretariat (WECS) are responsible for initiating appropriate policy on irrigation development in Nepal. Recently, the GON has shifted towards mega-irrigation projects and inter-basin water transfer projects as well. However, the micro-irrigation like non-conventional irrigation systems, small and medium irrigation systems also contribute to ensure food security. These policy making bodies have to take comprehensive approach incorporating all these resource (mega, medium and micro systems) to decide on the

investment, choice of appropriate technology, water right issue on different water sectors, allocation of water resources to different sectors keeping in view of integrated water resources management program, direction towards management types and governance modes etc.

Of the total agricultural land of Nepal only 1.8 million hectare of land is considered to have potential for irrigation. Of this, irrigation facilities have reached 1.252 million hectare (70.9%) land. Even in the areas with irrigation facilities, the facilities are often not available throughout the year (Economic Survey, 201-1-1-013).

1.2 Statement of the Problem

Due to population growth the demand of agriculture production is increasing day by day in the country. In this situation to meet the present need and fulfillment of people it is must to increase the agriculture production. And to do so irrigation plays an important role. Any irrigation system is beneficial to the farmers since it enhance agriculture production in their farms and contributes to the poverty alleviation and employment.

The discouraging economic growth of Nepal is characterized by low agricultural productivity against the rapid growth of population. Provision of food to people is perhaps Nepal's most serious problem and will continue to be so over the next two decades. In Nepal, the duration of monsoon is short. It start from June and last up to September. The country's participation record shows that is fluctuates highly with time and space. In this context, the surface irrigation is necessary for the cultivation of various crops like paddy, wheat, potato, etc. Nepal is facing the shortage of agricultural production to meet growing demand of food for the growing population. The growth rate of food production is only 1.4 percent per year, which is insufficient for growing demand. In order to increase the production of crops, it is necessary to improve present system of use of water for irrigation so as to sustain the livelihood of the people.

Also there is huge gap between the scientific studies in irrigation and sustainable livelihood. This study aims to bridge the gap. Nepal has about 600 rivers and the total length of them is about 4500 km. It is the second richest country in the world

possessing about 2.27% of the water resources. But lack of well knowledge, practice, experience, technology and methods, the water is not properly utilized as natural resource in Nepal (ABD, 1988).

Rani, Jamara, Kulariya Irrigation project posted by CMS Nepal on November 30, 2015 with a comment.

The Rani Jamara Kulariya Irrigation project (RJKIP) envisages irrigation about 20,3000 ha of land in Kailali district in the Far Western Development Region. The command area covers 8 V.D.C. and 1 municipality extending from the Karnali river in the East to Pathariya river in the west and forest boundry in the north to Nepal- India border in the South.

(RJKIP) plans to abstract water from the Karnali river near the village of Chisapani. Which is where the Karnali river emerges out of hills and enters into the alluvial plains. The intake is located just downstream of the East West highways bridge across the river. Around 500 m downstream of the bridge. The Karnali bifurcates into two channels, the geruwnom the left and the kauidiyala on the Right. The farmers in the Rani, Jamara, and Kulariya systems to divert irrigation flows from the Karnali into their canal system. Each year the farmer have been excavating a 3 km channel to guide the flow towards the west bank.

The government of Nepal intends to construct a new system to supply the three existing farmers managed irrigation system and extend irrigation to a new area about 7,000 ha to the north of the existing irrigation area.

The (RJKIP) was established in 2010 at Tikapur, Kailali to expenditure work of providing assured supply of irrigation water and rehabilitation of the existing system.

This (RJKIP) is a multipurpose project. Different type of benefits can be assessed from this irrigation project. For example: power benefit, irrigation benefit, navigational benefit, flood control benefit, tourism benefit and fish farming.

Research problem can be presented as follow:

- What is the current status of farmer managed irrigation system in the study area ?

- What are the factors influencing of farmers participation for an effective management of irrigation system ?
- What is the role of farmers managed irrigation system in livelihood improvement.

1.3 Objectives of the Study

The general objective of the study is to analyze the role of Farmer Managed Irrigation system in rural livelihood.

- To analyze the current situation of farmer managed irrigation system.
- To examine the socio-economic output of farmer managed irrigation system.
- To explore the problem and prospects of farmer managed irrigation system.

1.4 Significance of Study

Since, the study is completely concerned with the prospects of people's participation in irrigation management. So it gives the clear pictorial view of poverty alleviation outcome with the pros and cons of people's participation which will further enhance in various factor of rural development. People's participation in irrigation system water use for sustaining irrigation on field. The theory that supports the aim of this study is that the development of rural area can be achieved only through the infrastructure development and social empowerment followed by social mobilization. Thus the people's participation on a sustained basis helps in increasing farmer's household income and quality of life. It help to built a sense of ownership of a system among the people which will lead to the sustainable water irrigation system.

1.5 Assumptions and Limitation of the Study

The study was mainly confined to Durgauli VDC of Kailali District of Nepal. The study was very specific like that of case studies as the number of respondents interviewed in the study area represents only a portion of the total number so, the conclusion drawn from the study might not be conclusive. The sample selected was 40% of 200 household i.e. 80 household. As the study area was near to Kathmandu valley the total cost was effective. The time dimension was important limitation factor as the research was conducted for short period of time. The relevancy of the

information lies on the assumption that the respondents have given true information and the phenomenon was studied for the one time field visit and analysis was done accordingly.

1.6 Organization of the Study

The Chapter I is the introductory section, which includes the background of the study which sheds light on the Farmer Managed Irrigation System scenario, national overview on FMIS, statement of problem, objectives, significance of the study and assumptions and limitations of the study.

The Chapter II is the review of the literature concerned with the present study which includes review of concepts ad theories, review of previous studies, summary of the review and gaps in existing literature.

The Chapter III covers the details of the methodology adopted for the research. It includes research survey design, nature and sources of the data and methods of the data analysis.

The Chapter IV covers the setting of the study Area. It includes location and map of the study area.

The Chapter V presents the finding of the study. In this section the results are presented according to the specific objectives. Charts, graphs and diagrams are drawn to illustrate the result.

The Chapter VI is the discussion portion which includes mainly comparison of the results with previous studies where available. The results on each specific objective are thus discussed here. Some recommendations are also mentioned in this chapter.

CHAPTER -TWO
LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Concepts of FMIS

Until 1980's, there was no formal recognition of the contribution of farmer's managed irrigation system (Pradhan, 2002). However, with the basic needs fulfilment program of the government during 1980s, there was felt need for high rate of agricultural development which was not possible without the development of irrigation. For this it was not possible to develop large infrastructure by the government for the desired rate of agricultural growth. Thus during 1980s government with different donor driven programs (e.g., Irrigation Line of Credit-ILC, Irrigation Sector Program-ISP), started to provide assistance to FMIS in different parts of the country and hence increased the record of irrigated area (Pradhan, 2002). Thus for a short period of time many of the FMIS came under the domain of Irrigation Department.

Similarly during 1960s and 1970s huge investments was made for the construction of irrigation canals with the support of external agency and were managed by the government. Despite sophisticated engineering infrastructure and presence of highly educated staffs, the performance of these government managed irrigation system was poor (APROSC, 1978). In this context the devolution of responsibility for irrigation water resource management to local users 'organization has gained increasing importance in Nepal. Government of Nepal (GON) enacted Water Resource Act, 1992, Water Resource Regulation, 1993 and Irrigation Regulation 1999 which require registering the canal, though it is being managed traditionally by farmers. The right over the source and the canal can be protected only after the registration as the act established the ownership of water to state. GON has also adopted the policy of not only transferring irrigation systems to farmers but also creating a strong institution of farmers for the management of irrigation water (NPC, 2007).

In APP, providing reliable supply of irrigation water was prioritized as a prerequisite for enhancing agricultural production by reducing the risk of investing in the improved input packages. Accordingly, the Government prepared in 1997 a revised

irrigation policy and a long-term Irrigation Development Plan (IDP) to accelerate irrigation development, with the principles of (i) participatory and demand-driven investments; (ii) transfer of DOI- managed systems to water user associations (WUA) and (iii) full O&M cost recovery by beneficiaries. To assist the implementation of these initiatives, ADB has supported FMIS improvement through Second Irrigation Sector Project (SISP), management transfer of DOI systems, and groundwater irrigation development, mainly covering the two eastern regions, along with capacity development of DOI. The World Bank is assisting the package of similar interventions through Nepal Irrigation Sector Project (NISP), covering the three western regions, whereas the European Commission is also assisting the selected FMIS. Assistance to FIMS has drawn attention in view of their opportunities for enhancing productivity with relatively low cost, quick gestation period and adopting a participatory approach building on the existing local institutions that have operated and maintained the facilities over the long term (HMG, 2004).

The major challenge in the understanding of livelihoods, social protection and basic services in the post conflict Nepal is the perceived notion of linking these terms together than separate it. Hence, there is a need to understand, first of all, that livelihood, basic services and social protection are interlinked to each other. After understanding the needs of people and their way of livelihood, the social protection packages are to be formed so that the state can cover these groups of people based on their needs and nothing less or above that. From the government's side, there is a need to collaborate with the organisations involved with providing livelihood options to the people so as to monitor on their progress towards lives and also to create protection mechanisms for these people. There is a need for researches on the recorded data of what area was covered with the protection mechanisms and what groups of people have improved their livelihoods [including what type of livelihood option, what organisation provided it, and who is involved in monitoring (Upreti and K.C., 2012).

Livelihoods approaches offer, at least in principle, a way to link poverty, at the level of the community, to actions taken by higher-level policy and decision makers, as well as to economic factors. This is a shift in approach in that it involves communities in their own needs assessment towards a process of involving communities in a holistic analysis of their own way of living, assets and coping mechanisms, and of the

factors affecting their livelihood means and strategies. Livelihoods approaches also offer a way to judge poverty, relatively (not in absolute terms) against other members of the same community, while avoiding quantification. The sustainable Livelihood approach provides development practitioners with a coherent and flexible framework for programming, while also trying to establish micro-macro linkages. The approach has some practical tools and methods, such as guidance sheets, which describe how to use the Sustainable Livelihoods Framework, what information is needed and why, and how to go about obtain and analysing such information. It provides ingredients for the analysis of social, environmental, institutional, political, and policy issues, as well as options for livelihoods opportunities (Upreti and Muller-Boker, 2010).

The effect of the number of participants facing problems of creating and sustaining a self- governing organization is not yet clear. Although some scholars who have studied many- user governed forestry institutions have reported that success is more likely with smaller groups (Cernea, 1988). Others have found that smaller user groups are less able to undertake the level of monitoring needed to protect resources as moderately sized groups (Agrawal, 2002). Similarly, like size, the effects of heterogeneity on collective action are also problematic (see subsequent section). Groups can differ along various dimensions – cultural backgrounds, interests, and endowments (Baland and Platteau, 1996) – and each can operate differently. Since size and heterogeneity are not variables with a uniform effect on likelihood of selforganization. Ostrom (2001) suggests that instead of focusing on the variables themselves per se, studies should be directed towards determining how these variables affect other variables as they impact the cost-benefit calculus of those involved in negotiating and sustaining agreements.

Although recorded information on development of irrigation systems prior to 1950 is scanty we know that there are many small irrigation systems scattered all over Nepal which have been operating for more than a 100 years. The Nepal Irrigation Institutions and Systems Database (NIIS) indicates that there are 33 systems in the database that have their origins before 1900 and 13 of them including the “Raj Kulo” of Argali, Palpa have been in operation before 1800. Similarly, at least 6 systems in East Chitwan alone date back to over a hundred years. Reviewing these statistics against the base year 1950, one begins to observe evidence of the capabilities of

farmers to engage in fruitful collective action. 1950 is an important year in Nepalese history because it was only subsequent to this year that the state assumed an active role in the development activities concerning its citizens (Regmi, 2004).

Demographic forces are believed to be the primary reason that led to agricultural intensification techniques, irrigation being one of them. The manner in which the earlier systems were developed has a colourful and mixed history. Yoder (1986) cites the development of some of the earlier systems as having taken place through the individual initiatives of courtiers or soldiers after receiving land grants from the King. Invested with the powers of the state to draft tenants into constructing the systems in lieu of paying higher revenues the incentives were strong for constructing irrigation systems to boost productivity. Other driving forces have been "guthis" (land endowments), initiatives of local elite and royal directives. Although farmer-managed irrigation systems may have had its origins in "birta" (land grants awarded by the state) or "jagir" (temporary assignment of land by the state to compensate for services tendered) and the coercion of the state, there is evidence that some of them were built by farmers themselves (e.g. Cherlung Kulo of Palpa). There is also contemporary evidence to suggest that the vast majority of the irrigation systems have been self-governing.

From the very beginning, farmers were taking the responsibility for water acquisition, water allocation and distribution and overall management of the small irrigation canals on a continuous basis for increasing agricultural production in their fields. They were doing irrigation management utilizing their indigenous knowledge and skill. At the beginning farmer managed irrigation system (FMIS) had existed on self help basis. Those self-help groups, (locally named as Kulo Banaune) have established a mechanism according to the tradition of ownership, organizational capabilities, user's participation and mutual trust and accountability. With this system irrigation development in Nepal remained in the hands of the local people for many years. This tradition afterwards changed to or gave birth to FMIS scattered all over the country. Thus, the legal tradition and local administrative structures over a period of time have permitted FMIS in Nepal to operate without interference from an irrigation agency or other governmental administrative unit (Shrestha, 2009).

2.1.2 Farmer Managed Irrigation System

Irrigation development and management is undertaken by different agencies of the government and private sector in Nepal. The institutions that are contributing for irrigation development in Nepal are: (a) Department of Irrigation (DOI), (b) Department of Agriculture (DOA), (c) Ministry of Local Development (MOLD) through DOLIDAR (Department of Local Infrastructure Development and Agricultural Roads), (d) Ground Water Resources Development Board (GWRDB), (e) ADB/Nepal (f) farmers' community, and private sector organizations (e.g., NGOs such as International Development Enterprises (IDE), SAPPROS/Nepal (Support Activities for Poor Producers of Nepal), etc (Pradhan,2012).

Similarly, the educational and research institutes like agriculture and engineering colleges and the National Agriculture Research Council (NARC) are also important players to contribute for the better performance of irrigated agriculture. Among these different agencies involved in irrigation sector development, the DOI has a major share in promoting and managing the irrigation systems in Nepal. The DOI is involved in multi-facet aspects of irrigation development. Prominent among them are surface irrigation system of all sizes above 25 ha (small, medium and large), ground water development by shallow tube well (STW) and deep tube well (DTW), and lift irrigation systems (Pradhan, 2012).

Smallholder irrigation is a highly case-specific, potentially complex, dynamic socio-biophysical entity influenced by a considerable number of internal characteristics and external driving forces and factors, and is a driver of considerable change on downstream sectors and users. Have we recognized this special nature of irrigation within livelihoods, food and cash production, river basins and the environment? (Lankford, 2001).

Shrestha (2009) defined FMIS as a community based organization operating at grass-root level. It plays an important role in increasing agricultural production and productivity. It helps in increasing farmers' household income and quality of life. FMIS lays emphasis in institutional building of water users and provides them sense of ownership of the system. Local people's participation is very high in FMIS leading

to optimum utilization of water resources for production purpose and sustainable water management.

Basnet (2013) elaborated FMIS as the system practiced in Mountains, Hills, Valleys and the terai plains covering area ranging from 5-10 Ha to even > 10000 Ha which consist well organized and functional water user Association/Committees with hierarchical system mostly functioning as per indigenous traditional practices relying on rules crafted over years. It is highly suitable and effective operation and maintenance mechanism of irrigation system which consists participatory and consensus approach to decision making management that changes over on annual basis. It has very strong on defaulters and absentees. In some case irrigation institutions also function to address other social issues.

Roder (1965) indicated that irrigation projects have been successful in enabling farmers to obtain a certain amount of wealth, ... substantially more than dry land farmers, probably more than employees of white farmers, and comparable to levels enjoyed by urban workers. This suggests that farmers in irrigation schemes as long back as the 1930s were earning higher incomes than dry land farmers. The schemes helped in reducing the rural to urban migration by offering the rural population an alternative source of employment and income.

FMIS are owned and managed by the farmers themselves. At present, about 40% of food requirement of the country come from these irrigation systems. Hence, they have an important role for food security as well their contribution to the Nepalese economy. There have been many modes of intervention in the FMIS in Nepal (Ostrom, Lam et al 2011; ADB 2006; WB 2007). IWRMP and CMIASP have the objective to improve agriculture productivity of existing small and medium size FMIS suffering from low productivity and high poverty incidence and help enhance the livelihoods of the poor men and women. These objectives shall be translated by providing improved means for WUA empowerment, improving irrigation facilities, promoting agriculture extension, targeting livelihood enhancement to build human capital of the poor and strengthening policies, plans and institutions for more responsive service delivery (Pradhan, 2012).

Pradhan (2003) defined Farmer Managed Irrigation System as a mode of natural resource management in which there is participation of the member of the farming community in management decisions. A FMIS system comprises structure, methods and procedures for joint management and decision-making. In irrigation system managed by farmer's water is considered to be a community resource and it is water, which unifies farmer into a group that collectively makes decisions about for acquiring, distributing and applying water for agriculture. FMIS can promote polycentric mode of governance and in supporting equitable management of water. Uprety (2004) claimed that the irrigation system based upon the indigenous knowledge is successful. Therefore, the entire irrigation project must be based upon the assumption of putting the people first.

Coward (1979) in another context states that the operation of an irrigation system is a complex organizational enterprise that involves engineering and construction activities, the management of soil- water relationship, the allocation of water rights to groups and individuals, and other activities. While there are many tasks which must be organized to sustain the operation of an irrigation system, three are of fundamental importance: (i) the organization of Water allocation; (ii) physical maintenance activities; and (iii) conflict management.

The irrigation system activities could be divided into three categories: organizational management activities, physical system activities and water use activities. All of these activities are essential for productive and good irrigation management. However, the organizational management activities and physical system activities depend on the quality of organizational management activities (Uphoff, 1986). Kelly (1983) defined irrigation as more than an act of hydraulic engineering. It requires institutional arrangements for the constructions and maintenance of physical facilities and the procedures for the movement and distribution of water. It is economically important, politically significant as a source of power. And it is considerable social consequence because it defines pattern of cooperation and conflicts in irrigated agricultural region. Irrigation development and management in Nepal gives importance in farmers' 'active participation. Success or failure of all irrigation development programmes is determined by individual farmers and their actions, their initiative and innovativeness (Martin and Yoder, 1986). Baidya (1968) believed that irrigation is very important

activity which started in different ancient time and has been continued. He also stated that the relationship between crop productions has been positive and that irrigation can't be developed without enough capital, skill manpower and modern technology.

Stewart (1995) had tried to explain how irrigation shapes social and political life in relatively arid part of the world. According to him; the irrigation force is the strong force to shape the political system of a territory. Similarly, Scott (1985) showed how the irrigation system encourage or restrain the change in social relationship and institutions.

Water on the context of Nepal is the prime natural resources which are used for the promotion of agriculture. Its development is of great importance to us. Only 10% of total land is under irrigation facilities. We have natural resources, but we could not utilize them fully due to lack of money and technical difficulties (Sapkota, 1973).

Lamage Irrigation System, Syangja concluded that higher the intensity in irrigation, higher will be the cropping intensities and crop yields. Further, Irrigation Management Committee (IMC) has concluded that irrigation is an important constrains to improve agricultural productivity. IMC had also made an Impact Assessment of Sirsa-Dudara Irrigation System and summarized that proportion of land covered by rain fed crops reduced by 5% and that covered early paddy remarkable incensement in yield for all cereal crops (Sapkota, 1973).

In Nepal, the surface irrigation is the main system used in various parts of the country. Based on traditional methods of irrigation: Nepal has pipes, well and canal irrigation (Shrestha, 1987).

Thulotar Kulo is the most successful example of farmer constructed and farmer managed irrigation system in Nepal. It is located in ward no.4 of the Rupakot VDC in Tanahun, in the mid hills of western Nepal during a year long period 1997 and 1998. It was constructed by a group of farmers who manage and use the system as their common property, community; all farmers who are engaged in the management and use of Thulotar Kulo are defined as members of system and make up the Thulotar Kulo water users association (WUA). The executive committee of the Thulotar Kulo WUA is accountable to it general assembly, comprised of all meaning farmers of Thulotar Kulo (Poudel, 1996).

2.2 Empirical Review

ADB (1988) stated that some of the world's oldest irrigation system built; operated by farmers they exist in Nepal and have made a substantial contribution in the irrigation development of Nepal. ADB (2012) believed that participatory irrigation management may generate more benefits, perform better, or generate greater positive impacts than other approaches under certain conditions. Conditions vary across irrigation systems, such as land and water distribution structures, farmers' dependence on agriculture for household income, commitment of the leadership, support to newly created water organizations, and so on. Understanding these conditions in the various contexts and identifying key features of successful participatory irrigation management is essential to the success of future irrigation and drainage projects.

Participation is defined as a process through which stakeholder's influence and share control of development initiatives and of decisions and resources that affect them. Thus, participation requires more than just disseminating information and giving farmers government-specified roles in projects. Participation in irrigation management involves a larger role for farmers, water groups, and other stakeholders. It may range from offering information and opinions during consultations, to fully enabling farmers to act as principal decision makers in all or most project activities. There have been increasing efforts to use participation in various forms to improve the quality, effectiveness, and sustainability of irrigation systems. This makes it important to learn what has and has not been achieved in efforts to improve participation in irrigation management. This synthesis highlights lessons from evaluations of ADB-supported irrigation and drainage projects, with a focus on participatory irrigation management (ADB, 2012).

ADB (2012) also believed that participation enhances careful and appropriate planning. Stakeholders have to be involved as early as possible, rather than in a residual activity after physical facilities are completed. The expected outputs of each stakeholder should be clearly identified and linked to the outputs of other Stakeholders, which will facilitate participatory monitoring and meeting project targets. In the irrigation component of the Earthquake and Tsunami Emergency Support Project in Indonesia, joint walkthroughs and field inspections with the affected communities formed the basis for identification and selection of the main

rehabilitation and reconstruction options. The continuous involvement and participation of local communities resulted in agreement on scheme rehabilitation and reconstruction requirements. In addition, farmers' existing structures and traditional practices must be closely studied while designing irrigation facilities and projects should consider such practices as much as possible. The Rajapur Irrigation Rehabilitation Project in Nepal successfully demonstrated that farmers' participation can be easily solicited and augmented if the project and its components are planned and designed in response to farmers' needs.

Effective governance of Irrigation systems is crucial to Nepal because it is predominantly an agrarian economy dependent upon irrigated rice agriculture to feed a growing population. Agriculture contributes 40% to the GDP and provides employment to 80% of the labour force (Ministry of Finance, 1998). The Irrigation statistics of the nation further indicates that of the 2.621 million hectares of land cultivated nationally, only 853,030 hectares are serviced by some kind of irrigation system (Department of Irrigation, 1997). Farmer Managed Irrigation Systems (FMIS) contribute 75% towards the total irrigated area. There are 15,000 FMIS in the hills and 1700 systems in the Terai (Pradhan, 1988). Until the 1950s irrigation development nation-wide was a result of farmers' initiatives and investments in the construction and management of irrigation systems. These farmer initiated irrigation systems are referred to as FMIS. In the past a lot of investment was made on developing irrigation infrastructure by the government, however, the performance of these systems were reported to be unsatisfactory relative to the resources put into the sector (HMG/N National Planning Commission of Nepal, 1994). Failure to provide an assured supply of water, failure to reach water to farmers in the tail-end, and failure to achieve economies of scale in all spheres of construction, operation, and maintenance in the systems supplied by the Government were among the problems reported.

Systematic study comparing the performance of Agency managed systems (AMIS) to FMIS in Nepal (Lam, 1998) further showed that FMIS outperformed AMIS on most key parameters – agricultural yield, cropping intensities, ability to reach water to tail end. The farmers on the whole were able to overcome collective action problems but it cannot be assumed that the process is automatic. Although there are many key attributes of both resources as well as resource users that could interact in a multitude

of ways to influence collective action, salience of the potential joint benefit and the existence of a supportive political system are considered to be important variables conducive to promoting collective action.

While the potential of FMIS is substantial, not every FMIS operates at an optimum level of performance and not every FMIS is successful in self-organizing and self governing activities. It is important to understand why this occurs. Commons research indicates that the role of heterogeneity – unequal resource endowments, cultural differences etc. – in a commons outcome is not too well understood. Advancing our understanding in this direction can perhaps provide valuable inputs to designing intervention policies to support the irrigation sector in Nepal. The classification of Irrigation Systems in Nepal has been based on the topography of the terrain traversed by the rivers. Systems that tap into rivers whose gradients change rapidly as they flow downhill are called Hill Irrigation Systems, those that draw water from rivers that cut across valleys with gentle gradients are termed River-Valley Irrigation Systems, and those that draw water from relatively large rivers flowing across the flat Terai lands are called Terai Irrigation Systems (Pradhan, 1989). Although there are physical and institutional differences between these systems in terms of rate of change of gradient, idle canal length, efforts required at canal maintenance, farm types irrigated, the size of the command area, and rules governing resource mobilization & water allocation there are similarities too (Pradhan, 1989 and Ostrom, 1992).

Intake structures on systems in all classes are generally constructed from boulders, stones and brushwood located appropriately to ensure easy diversion of water; rights to water withdrawal are fairly well established within systems and water distribution among appropriators are governed by commonly understood sets of rules; and maintenance of physical structures, especially the intakes, during high floods require significant resource mobilization (Parajuli, 1999 and Ostrom 1992).

In addition to this, another way that Nepali irrigation systems have been classified is on the basis of how they are governed. Systems that are owned, developed and managed by farmers are known as Farmer Managed Irrigation Systems (FMIS) and those owned and governed by the State are referred to as Agency Managed Irrigation Systems (AMIS) (Pradhan, 1989). The Agency managed systems are further subdivided into three components - agency managed, jointly managed with farmers,

or farmer managed - to further distinguish ownership and control rights over the systems (Shukla & Sharma, 1997). The combination of these two classification methods results in 12 classes of irrigation systems. Thus, an irrigation system can be located either in the hills, river valleys, or in the terai and it can also be either farmer managed or agency managed. If managed by an agency then ownership and control can lie either entirely with the agency, or can be shared with farmers, or can also lie entirely with the farmers if the systems have been turned over to them. The irrigation systems studied for the purposes of this dissertation are mostly Hill based Farmer Managed Irrigation Systems.

The WUAs in Nepal and in many other countries, even to this date, are considered as non- entity. They are not considered as the social and organizational resource at the grass root level. It is equally important to consider the environment that allows them to undertake multifunction activities. On many occasions, WUAs are formed at the occasion of construction and rehabilitation/modernization of the irrigation systems. After rehabilitation, the importance of WUA gradually diminishes. The importance of WUA as viable socio-economic organization and their potential role in the development of irrigated agricultural system is yet to be recognized in Nepal and in many parts of the world (INPIM-Nepal, 2010).

Nepal has abundant water resources capable of irrigating 8 to 10 million hectares and providing 43,000 MW of hydropower. About 40 percent of the nation's 2.6 million ha of potentially irrigable lands are developed. Development of Nepal's rivers for irrigation is costly because of the large diversion structures needed to manage the annual floods, exacerbated by the large quantity of sediment these waters carry. Consequently, groundwater-based irrigation has proved to be an attractive option in the Terai for both the private and public sectors. Irrigation in Nepal is broadly categorized according to ownership and management (public versus private schemes), to location (Hills versus Terai), and to source of irrigation water supply (surface versus groundwater). Private irrigation schemes have long been developed and managed by private farmers, and are classified as Farmer- Managed Irrigation Systems (FMIS). The rest of the irrigation schemes are publicly developed and managed by the Department of Irrigation (DOI) assistance from the Government of India. To this day India makes expertise and finance available to Nepal in exchange

for water rights to the main rivers-which serve the large irrigation schemes in India. Even after construction of the Chandra Canal in 1928 and several later projects, the total irrigated area was still only about 25,000 ha in 1950 (World Bank, 2008).

World Bank (2008) also believed that more than two- thirds of total irrigation lies in the Terai, about a quarter in the Hills and less than five percent in the mountains. In the hills the mode is primarily gravity-fed traditional irrigation systems owned and managed by communities or farmers, while in the larger valleys many systems were developed with full or partial support of the government. Of the 1.06 million ha of irrigated land, government investment developed about quarter from scratch and a further quarter through upgrading community-owned schemes. The balance comprised 0.32 million ha developed by farmers alone; and 0.14 million ha developed with help from credits extended by the Nepal Agricultural Development Bank. One-quarter of all surface water-based irrigation is publicly-managed by DOI, the rest privately by farmers and fanner's groups. Similarly, government manages one-quarter of Nepal's 170,000 ha served by mechanized groundwater abstraction.

Similarly, the design of large-scale irrigation project was based on the Indian policy of spreading water relatively thinly over large areas to provide insurance against drought for wet-season (kharij) crops. Distribution systems of all government-financed projects were developed only partially in the expectation that farmers would build water distribution systems-in practice much of the potential command went undeveloped because farmers were unwilling or unable (for socioeconomic or technical reasons) to invest. As a result only 71 percent of public investment in command area development is utilized, and only 38 percent of that has year-round irrigation. More recently, government has helped finance the extension of distribution systems to the 50 ha level, as well as organizing water users' associations and providing agricultural support services. In addition, the dearth of agricultural inputs and fertilizer in particular explains in large part the slow growth of agricultural production and farmers' low productivity. This is part of the vicious circle by which low margins and insecure water supplies preclude collection of water user fees, jeopardizing adequate operation and maintenance and thus reducing water management efficiency. Uncertain or unreliable water supplies allied with low

margins heighten risk aversion and lower the perceived benefits of fertilizer and investments in improved agricultural management.

The governance of irrigation management is important. The centralized management system of irrigation systems has proven that it is not conducive for better water management, resource mobilization and agriculture production. There is a big debate going on whether bureaucracy or community should be managing irrigation systems. There are even debates going on stating neither state nor private sector but the community can better manage the irrigation systems (Ostrom, 1994). Therefore, revitalization of irrigation systems has to have multi-dimensional features to address resources (water), physical infrastructure (canal and other control structures) as well as placing the farmers in the driver's seat and creating appropriate governance procedures (irrigation institutions) (Ostrom, Lam et al, 2011). A central agency is necessary for planning, investment, monitoring, and evaluation of the sector in the larger context. At present, one feels the absence of such a central agency to oversee the overall irrigation sector encompassing all sizes, types and technologies as the national resource to ensure the food security.

The rate of expanding irrigated areas has slowed further in the last 5–6 years. During 2003–2006, the total area brought under irrigation was roughly 50,000 hectares (ha), equivalent to the new area brought under irrigation in 1999 alone. About 83% of irrigated land is not irrigated year-round, significantly reducing productivity by not allowing multiple crops in a year. Although the expansion in irrigated area increased in 2007 to about 27,000 ha, the rate of expansion remains very low, and, if it persists at the current level, Nepal will take about 40 years to irrigate the remaining 1.1 million ha of potentially irrigable land. The required investment could be as large as $3.3 billion at current prices roughly one third of Nepal's GDP in 2007/08 (ADB, DFID, ILO, 2009).

IMT (and in this case the intervention process in general) must hold out the promise of significant net improvement in life situations for a significant proportion of members and the irrigation system must be the central resource to creating an improvement in farmers' life situation (Shah et al, 2002). Lam (1998) in his study of irrigation systems in Nepal also does not find any relationship between the number of appropriators and his performance measures.

Pradhan (1989) notes that probably due to such a setting communities of irrigators have always been able to institute their own rules, bidhan (charters), schedules of operation, and sanctions without undue interference from an irrigation agency or other administrative units. The legal and local administrative structures over a period of time have permitted farmers to operate their systems independently. Despite the historical presence of a national judicial framework for irrigation, farmer managed irrigation systems have always retained an independent and self reliant character not through design but central neglect by the state.

Pandey (1978) has studied the Impact of Irrigation on Rural Development in India. He states that small size lad holding family is higher in the irrigated areas. In the irrigated land, a different variety of crops are being cultivated and employment, literacy, income are higher compared to the non-irrigated areas. For examples, there were 71.44 percent illiterates in the non-irrigated land. Only two types of crops (paddy and maize) are grown in the irrigated area. The use of chemical fertilizer has been increasing whereas the use of traditional manures has been declining.

A socio-economic Impact Evaluation Study in Janakpur APROSC (1988) noted the principal crops grown in the project area as paddy, wheat, oilseed, pulses and potato. The yield rate in the project area for paddy is strikingly higher than in the non-irrigated area. The yield rate for early paddy is 0.57 metric tons higher per hectare in the project area than the non-irrigated area. Similarly, the yield rate of normal paddy in the project area also exceeds that of the non-irrigated area by 0.79 metric tons per hectare. Since paddy is the most important crop grown in the area, it can be assumed that the income and standard of living of the farmers in the project area is higher than in the non project area. A little increase in the production of wheat has been found in the surface irrigation as compared to the non-irrigated area. In many areas as crop water available for irrigation is very low. This may be the factor responsible for such a marginal change. A slight increase is also observed in the production of oilseeds per hectare in the project area compared to the non-irrigated area which is recorded at 0.588mt/ha.

Studies on Nepalese case have confirmed the general hypothesis that irrigation is expected to have a positive effect on productivity, cropping intensity and input use.

Agriculture credit survey (1980) shows that crop yield, cropping intensity and input use on irrigated farms are consistently higher than that of the non-irrigated ones.

In the study on the Impact of Chitwan Irrigation Project Pageni (1982) said that crop production, cropping pattern and socio-economic activities have increased because of irrigation facilities. He further said that there is also a negative impact of irrigation, the pumping scheme lifted sand with water during the irrigation period and pumping tools had been adversely affected by sandy water. Due to this sandy soil, pumping schemes may not be durable for long time to supply water.

Mainali (1987) has studied the Impact of Irrigation on Rice Production in Nuwakot and summarized that irrigation project substantially increased the farm productivity and family income through farm diversification and utilization of farm resources. Farmers adopted recommended technology such as high yielding variety, modern farming practices, use of fertilizers and pesticides because of the availability of irrigation facilities.

The wide range of studies on indigenous knowledge and practice in the rural communities of Nepal has revealed their importance in irrigation development. FMIS resemble indigenous water resource management for subsistence of total people which involve operation, maintenance, allocation and distribution. Farmers make decision regarding the use and management of irrigation based on their indigenous knowledge and practice because irrigation is vital for both survival and culture. Gradually, the norms, values, routes and roles relating to irrigation management system have evolved in the mind of Nepalese people. The farmers have collectively and individually devised, decided upon, designed constructed, planned, implemented, maintained and improved indigenous system for the management of natural resource through many centuries (Upreti, 1989).

Lamsal (1989) has pointed out that the Vijayapur Canal Irrigation has a positive effect on agriculture. People are able to grow more food grains (rice, wheat, vegetable etc) after irrigation. The barren land is under cultivation. He added that the land value of that area has been increasing after the irrigation facility.

Dahal (1991) has studied the Rampur Irrigation Project in Chitwan District. He analyzed the impact of irrigation on variables such as cropping pattern, cropping

intensity and crop yield and found that the significant change before and after irrigation. Before irrigation project about 62 percent of the cultivated area was irrigated mostly in the monsoon season. The cropping intensity was 185, most of the cultivated land was covered by hardly bicultural and monoculture cropping pattern. Crop yield was low and also the cropping pattern was of self sufficient type. After the initiation of irrigation project 82 percent of the cultivated land had been irrigated. Therefore, the overall cropping intensity had been increased by 32 percent and cropping pattern had also been changed.

Parajuli (1991) has studied the Impact of Irrigation on Different Crops in Pokhara. The summary of his findings is as follows:-

After the irrigation facility the proportion of total irrigated land has increased and scale of production has also increased.

The cropping pattern has also been changing. People have adopted intensive agriculture and multiple cropping systems and farmers are more oriented towards cash crops.

The economic condition of households has also been improved by irrigation facilities. In 1983, the average household’s income was about Rs 776 per ropani while in 1989 it was Rs 1,438.

The traditional farmer-managed irrigation systems have succeeded in addressing social issues such as equity among the water appropriators. In other words, there is always an effort for putting people first in such systems and therefore, they have been sustainable for relatively long period of time. When there had been no focus on the people and other social issues under the modernization paradigm and overemphasis on the rational technology in 1950s and 1960s, the development interventions including in the irrigation sector could not be sustainable. It followed as a corollary that a group of social scientists, mainly sociologists and social anthropologists, began emphasizing on putting people first" in development projects in 1980s (Uprety, 2002).

Nepal hills have other such examples of successful Farmer Management of Irrigation. The relatively high performance of Farmer Management in South Asian hill irrigation schemes may be attributed to the tradition of collective self management of irrigation

that prevailed here for several hundred years. The Panchkanya System itself was originally built 115 years ago by the Tharu community, which also operated it as a Farmer-managed Irrigation System (FMIS) until the Department of Irrigation built a pucca head-works and took over its management (Tushaar Shah, Barbara van Koppen, Douglas Merrey, Marna de Lange and Madar Samad, 2002).

Access to reliable irrigation water can enable farmers to adopt new technologies and intensify cultivation, leading to increased productivity, overall higher production, and greater returns from farming. This, in turn, opens up new employment opportunities, both on-farm and off-farm, and can improve incomes, livelihoods, and the quality of life in rural areas. Overall, irrigation water, like land, can have an important income-generating function in agriculture specifically and in rural settings in general (Hussain & Hanjra, 2004).

CHAPTER- THREE
RESEARCH METHODOLOGY

3.1 Research Design

The research was conducted under descriptive and exploratory research design, it is because the characteristics intended to study quires how and in what respect the people's participation help in irrigation management on sustained basis? On the other hand, it was tended to analyze and discover degree of interdependence between various characteristics that were influenced by people's participation in irrigation system.

3.2 Nature and Sources of Data

To fulfil the objectives of study, both primary and secondary data were collected.

3.2.1 Primary Data

This study aimed to explore the outcomes of people's participation in balancing water uses for sustaining livelihood. Thus the primary data were collected from the irrigation user's households of the study area. In the due course of my study, primary data were collected with field visit and observation, focus group discussion, interview and questionnaire as per the convenience to aid to my study.

3.2.2 Secondary Data

Since, this research has been composed up of the base of description and analysis, secondary data was must. The various internal and external sources were used for acquiring the secondary data. The various sources consisted of Ministry of Irrigation, Central Bureau of Statistics, District Irrigation Office, Google, Bulletins/Reports, and NGOs/INGOs etc.

3.3 Universe, Sample and Sampling Procedure

Rani, Jamara and Kulariya Irrigation System (RJKIS) is one of the largest farmer-based irrigation system in the terai located in the Kailali district, it has a net cultivable are of approximately 14,300 ha of which about 11,00 ha are currently irrigated. This system is a cluster of three independent 'kulos' or branch canal systems, each with its

separate water intake from a bichannel of the main Karnali river. According to focus group interviews and discussions with key informants, Rani Kulo, was built by farmer in 1896, Jamara in 1960 and Kulariya 1972. At Present Rani has 18 branches, Kulariya 17 and Jamara 153. Each kulo has innumerable and an increasing number of branches and sub branches to irrigate the command area. This project commands 8 VDCs, and one municipality of Kailali district. It is extended from Baliya in North to Dhansingpur in South. The geographical co-ordinate of the project.

For this study universe in the people who engaged with Rani, Jamara, Kulariya Irrigation project of Durgauli VDC Kailali district. There are about 2829 household among them 2350 household are directly benefited from RJKIP. So, by the help of random sampling method choose two (4 and 5) wards in 40 household as sample to conduct this study.

3.4 Data Collection Methods and Tools

To collect reliable and authentic data various research methods and tools were used, based on the nature of the study. The following tools and techniques were adopted to obtain primary data and information. The structure/questionnaire, unstructured interviews and observation methods were applied to generate the primary data.

3.4.1 Household Survey (HH)

The household survey was used to collect data related to agricultural production such as water availability, cropping pattern, use of fertilizers, other inputs and crop yields. 40 household was surveyed. Two different types of questionnaire were developed for local people and key informants. To generate the accurate data structured questionnaire were carried out to draw the socio-economic information of the farmers, factors influencing participation for the effective management of water. For this purpose, the respondents were requested to fill up the questionnaire. In case of the respondents who couldn’t fill up the questionnaire, the questions were asked to the respondent and answers were filled up to collect the required information. Present scenario of the irrigation management, socio-economic, physical, educational and environmental impacts of irrigation management in the study area helped to visualize the impact of irrigation management. They are interviewed with the help of the questionnaire (See Annex II).

3.4.2 Key Informant Interview

The numbers of key informants were interacted to access the changes in the livelihood of people, factors influencing participation and impact of irrigation management. The interaction programs were conducted with the concerned officials & local people. Structured interviews were taken with local leader, chairperson, vice-chairperson, local experts, social mobilizer and water distributor to find out the reality of existing scenario of irrigation management. For this, interview schedule was prepared to obtain accurate and reliable information from the respondents. VDC officials, WUA person and members, health workers, volunteers and school teachers were the key informants. They are interviewed with the help of the key informants interview schedule (See Annex III).

3.4.3 Field Visit and Observation

The primary information was collected from the field through direct observation. Crosscheck of such information was carried out during the FGD and discussion with the key informants. The households using irrigation system selected as samples were visited and observed. The checklist was prepared to collect the required information while observing the irrigation scenario, livelihood status of the people and the various impacts of irrigation etc. (See Annex 1).

3.4.4 Focus Group Discussion

In order to obtain the information on the impact of irrigation systems on socioeconomic activities focus group discussion with the different group of people were organized. For this, VDC officials, social mobilizers, school teachers, WUA personnel and farmers were gathered. Focus group discussion was carried out in Durgauli VDC. There were 15 respondents were participated in the discussion (See Annex 5).

3.5 Data Analysis

The data obtained from the field survey were coded and categorized according to requirement. Then the coded data were converted into tables with numbers, average and percentage through computer office program as MS Word and MS Excel. Simple statistical tools like tables, graphs were used in presenting the data. They were categorized and analyzed according to the objective of the study.

All the information of household questionnaire collected from the field was edited and coded prior to entering it into computer. The data was entered into the computer using the data entry format developed into Microsoft Access software for easy data entry work. The validity of data entry work was assured by checking all the information of the randomly selected questionnaires. The data was analyzed through the computer using the data processing software. Simple statistical tools like average and percentage have been calculated for different groups, sub groups and irrigation schemes considering the nature of the study. The open-ended questions of the questionnaire have been coded manually and later it was processed through computer.

CHAPTER - FOUR
SETTING OF THE STUDY AREA

4.1 Description of Study Area

(a) Location

Rani Jamara Kulariya Irrigation project is situated in border of far western development region near the village of Chisapani 100 m. away from Karnali Bridge.

Figure 4.1 : Map of Nepal showing Kailali District

It covers an area 180 ha of Lamki Balaya municipality (ward no. 9) and Durgauli VDC (ward no. 1, 2, 3, 4 and 5 in Kailali district. It was initiated in the year 2066-09-05 and completed in 2074/075.

4.2 Durgauli VDC

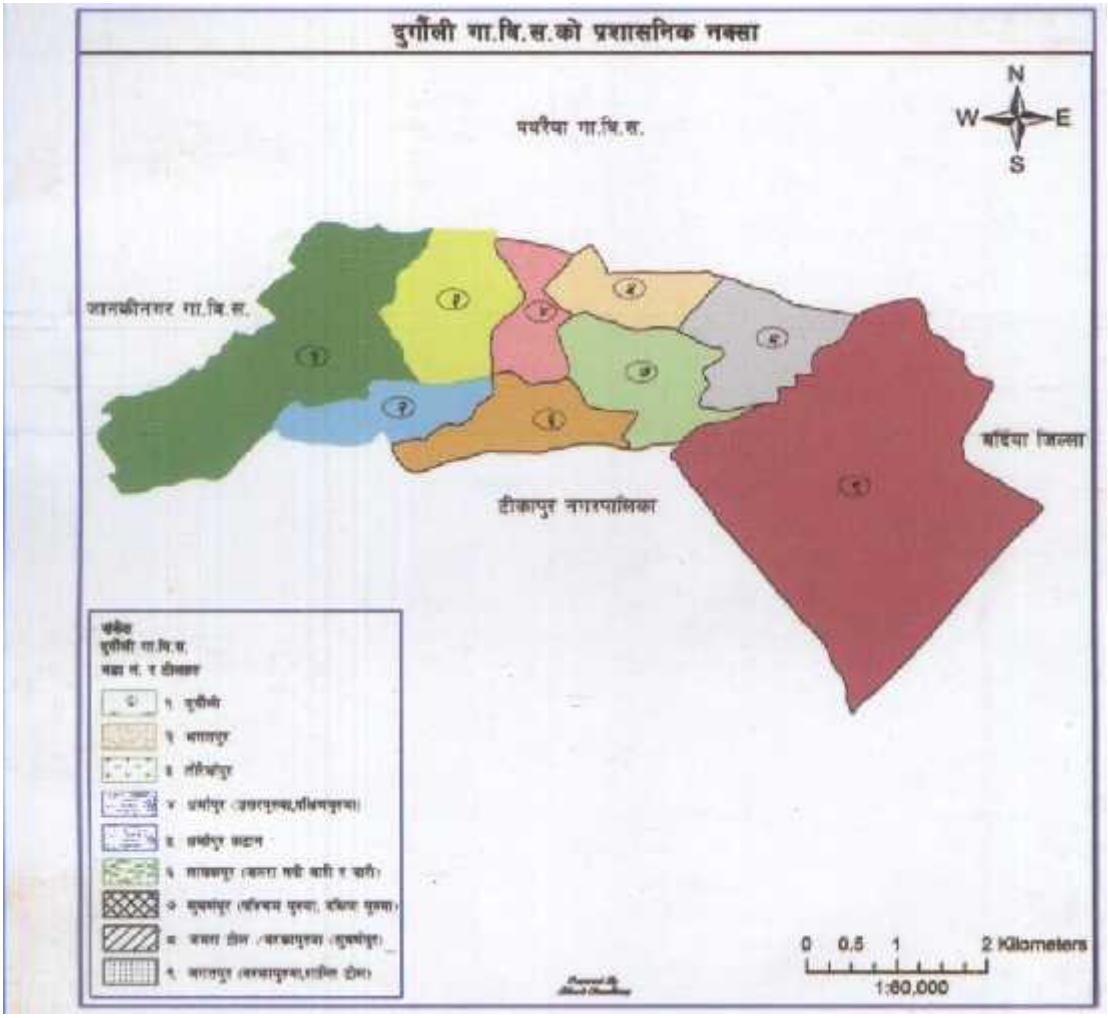
The site for social survey was conducted in Durgauli VDC of ward no. 4, 5 6 and 7. The VDC was named after the according to the profile of Duragali VDC 206. In ancient more powerful (Guruwa). Durga from has name it name be also Durgauli.

Map of Kailali District

Figure 4.2 : Map of Kalali district showing Durgauli VDC

Durgauli VDC covers an area of 5.2 sq. km. The total population of the VDC is 16966 (8420) female and (8546) males on 2014. The total households were 2829 as an census 2014 (CBS, 2014). The main ethnic composition in this area is Tharu the Chhetri and Brahmin. The studies are is very from the capital city, Kathmandu. The education ratio of male and female is satisfactory although the education level of women is considerably poor. The person in this area is mainly engaged in agriculture and animal husbandry. Some few peoples are involved in job business and services.

Map of Duargali VDC



Source : Durgauli VDC profile, 2071.

Figure 4.3 : Map of Duargali VDC

Mast of the land of Durgauli VDC land is the total and of Durgauli VDC is Terai.

4.3 Livelihood Status

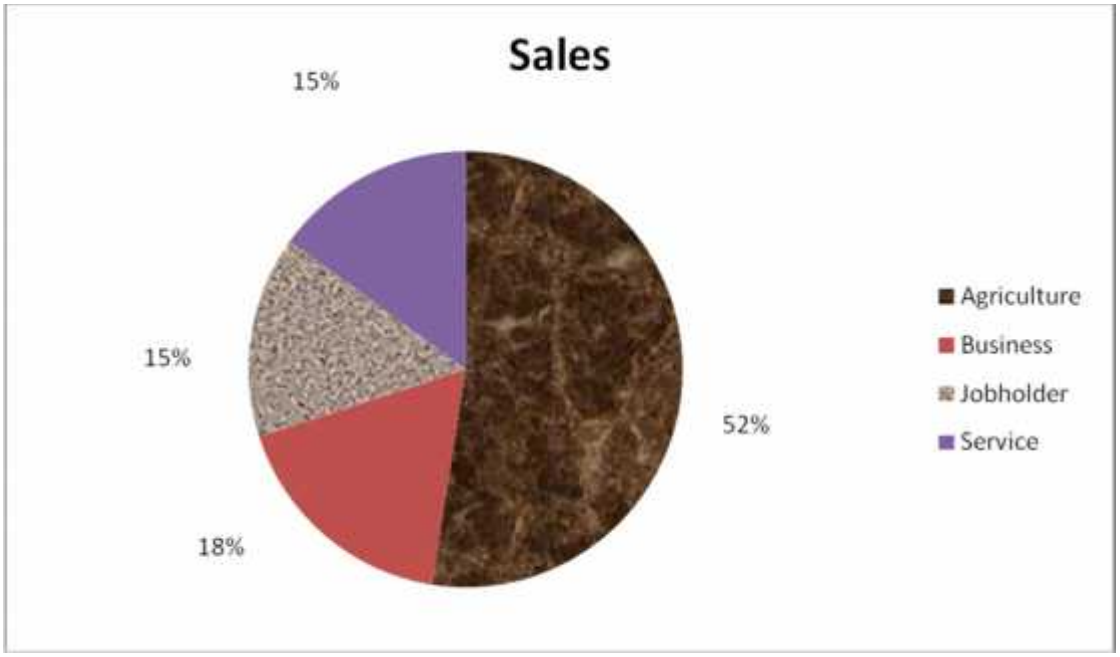
The local people predominantly depend on agriculture and livestock husbandry. The major occupation of the local respondents and the livelihood status in study area is represented by table 4% and figure 4 respectively.

Table 4.1 : Major Occupation of Local Respondents

S.N.	Major Occupation	No. of Respondent	Percentage
1.	Agriculture	21	52.5
2.	Business	7	17.5
3.	Jobholder	6	15
4.	Service	6	15
Total		40	100

Source : Field Survey 2016

Figure 4.4 : Livelihood Status In Study Area



The average family size of the household surveyed was 5.21% person per family. The family income source of the house hold was particularly agriculture which accounted 52.5% whereas business, job holders, service, contributed 17.5%, 15 percent and 15 percent respectively.

4.4 Livestock Herding

Cattle, buffaloes, goat and pig are the mainly livestock. From the survey 85 percent so the house hold were found to be rearing at least one kind of livestock and 15 percent of the household were not rearing single livestock of the total household 15 percent were rearing buffaloes and goat 20 percent were rearing goat only and 70 percent were rearing cattle goat and pig.

4.5 Climate

The climate pattern of the study area is mostly dominated by monsoon which occurs between June and September the weather is also relatively dry which clearly visualize the need of irrigation in this area for high production and incomes.

4.6 Population Size

The total no of house hold and the population of the study area are tabulated as follows.

Table 4.2 : Population settlement in Study Area

Name of VDC	Population			
	Male	Female	Total	Total Households
Durgauli	8546	8420	1966	2829

Sources : Field Survey, 2016

The population size in the study area is increasing with the improvement of the economic condition of the people due to the irrigation development. During the past few years, agriculture has been the chief source of income which is helping the local people to improve their live hood status.

CHAPTER- FIVE
DATA ANALYSIS AND INTERPRETATION

5.1 Current Situation of Rani, Jamara, Kulariya Irrigation Project

5.1.1 Background of the Project

Rani Jamara Kulariya Irrigation Project system which was established and managed by local community from 100 years ago in the largest irrigation system in far western Nepal. It is situated in Kailali district. This project is providing irrigation facility to 11,000 hectare land of Tikapur municipality and 8 neighbouring VDCs. Its source is eastern tributary (Jharahi) of Karnali and main stream system are Rani, Jamara and Kulariya. To operate these stream systems the farmers of the area have so dig long canals and make temporary dam every year. Every year the dam is swept, filled and damaged by the flood so, there is not good irrigation system here at present.

To solve the above mentioned problems and supply irrigation facilities all the year round, government of Nepal has been working in Rani Jamara Kulariya Irrigation Project (RJKIP) from 2066 BS by establishing its office in Tikapur. It is hoped that this project will upgrade the living standard of farmers related this irrigation system. it will have also positive impact in Nepalese economy.

At present, government of Nepal has given high priority and included it is national pride project. After completing this project, water users committees have responsibility to maintains and conduct this irrigation system.

5.1.2 Main Objectives of the Project

The main objectives of this project is to construct different structure to improve and modernize the present irrigation system and supply and extend irrigation facility in twelve month in 20,300 hectres lands.

The Rani, Jamara, Kulariya Irrigation Project was established in 2066-09-05 and this project completed in 2074/2075 in modern formed. Rani, Jamara Kulariya Irrigation Project located in Lamki Chua Munica Polity ward No. 1 (RJKIP) plans to abstract water from the Karnali river near the village of Chisapani which is where the Karnali

river emerges out of the hills and enters into the alluvial plain land. The intake is located just downstream of the east west highway bridge across the river.

5.1.3 Area Coverage

Rani Jamara and Kulariya are main streams of this irrigation system. Besides this projects has plan to make a new stream from northern side of east west highway which will be 14.7 km long. It will be in Lamki Chuha municipality and provided additional irrigation facilities to 600 hecters of land major inhabitants of this area are Tharus, Brahmins, Chheteries and Dalits. About 25,061 households and 160,611 people will be directly benefited from this project and many more people will be added of this after constructing new stream.

5.1.4 Water Users Associations and Social Mobilization

Rani Kulo water users associations Jamara Kulo water users association Kulariya Kulo water users association and major Karnali kulo water users association of this system were registered and are working from 2060, 2056, 2060 and 2056 BS respectively. The duration of there water users associations is 5 years having land in this irrigations system should become general member of these associations.

5.1.5 Funding Sources and Activities of the Project

Government of Nepal

i) Construct side intake link canal and to conserve intake of Karnali river.

ii) Construct 1.87 km barrel in different parts of (RJKIP) and setting basin and its different structures.

iii) Construct main canal of (RJKIP) 10.605 km feeder canal and hydro electricity home of 4.88 kw at Katase.

iv) Construct embankments in different parts of Karnali Mohana and Pathriya river to preserve irrigation area.

v) Construct needed office and residential buildings.

5.1.6 World Bank

For modernization of (RJKIP) scheme phase I world Bank, Government of Nepal and water users will invert 43 million dollar, 5 million dollar and 1 million dollar respectively. There are 4 components in this.

i) Scheme modernization 38.6 million US$.

ii) Strengthening water users association 2.2 million US$.

iii) Agricultural production support 2.9 million US$.

iv) Project management 4.3 million US$.

There was financing agreement between government of Nepal and world Bank and 1st Kartik 2068 B.S. In this aid 55% will be loan and 45% will be grant. There will be two phase of this project. It aims to make command area development in phase. (II)

5.1.7 Flow of Water

Rani Jamara Kulariya Irrigation Project System. The main source of water is Karnali river which was emerges out of the hill in all year. Its flow of water 100 quisek p/s.

5.1.8 Project Management

Project implementation office and contact office will be established in the Tikapur and Kathmandu respectively. Management information system and evaluation system will be developed and first phase activities and output will be recorded and report will be made. Nepal preparations and studies will be done to implement second phase programmes.

5.1.9 Project Operator and Water Distribution

Rani, Jamara, Kulariya, Irrigation Project. To maintain and to conduct sustainable running Rani Jamara Kulariya Project operator committee should be maded its operate the (RJKIP). It committee distribution the water in Three cannals in the whole year. According to Rules of consumers committee.

Water availability and system of payment. After the finishing of Rani Jamara Kulariya Irrigation Project. The availability of water should be available. In a

command area all 12 month. According to the rules of project minimums cost should be need to conduct the irrigation project.

5.2 Socio-economic Output

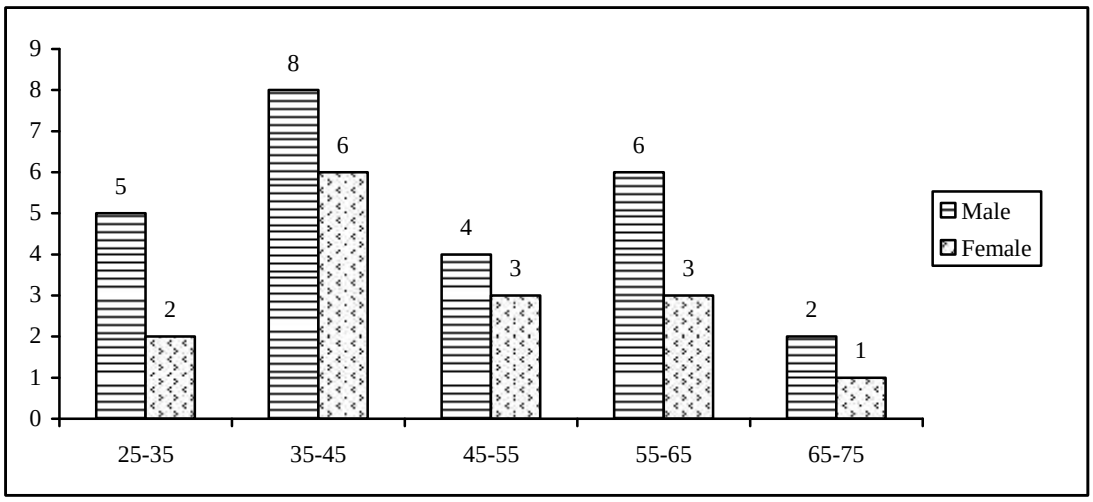
5.2.1 Profile of the Irrigation Project

Rani, Jamara, and Kulariya Irrigation Scheme (RJKIS) is one of the largest farmer-based irrigation system in the Tarai. Located in the Kailali district, it has a net cultivable area of approximately 14,300 ha of which about 11,000 ha are currently irrigated. The system is a cluster of three independent 'kulos' or branch canal systems, each with its separate water intake from a bi-channel of the makin Karnali river. According to focus group interviews and discussion swith key informants, Rani Kulo was built by farmers in 1896, Jamara in 1960 and Kulariya 1972. At present, Rani has 18 branches, Kulariya 17 and Jamara 153. Each Kulo has innumerable and an increasing number of branches and sub-branches to irrigate the command area. The three systems are owned, managed and operated by farmer communities with little input from government and external organizations. There exist close ties between the three kulo systems. All share a common source (located at some 120 meter south of Chisapani along the East West Highway) and users are required to annually contribute to source operation and maintenance.

5.2.2 Demographic and Socio-economic Information of Respondent

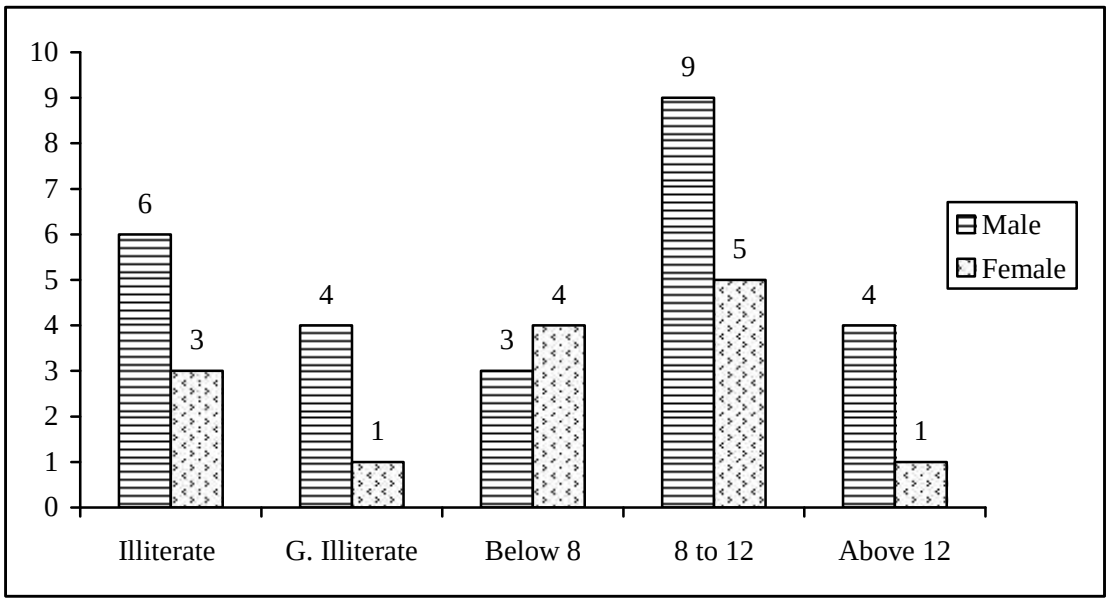
Altogether 40 local people were interviewed in the study area. The age distribution and educational qualification of the respondents are represented by the figure 5 and 6 respectively.

Figure 5.1 : Age Distribution of the Respondents



Source : Field Survey, 2016.

Figure 5.2 : Educational Qualification of Respondents



Source : Field Survey, 2016.

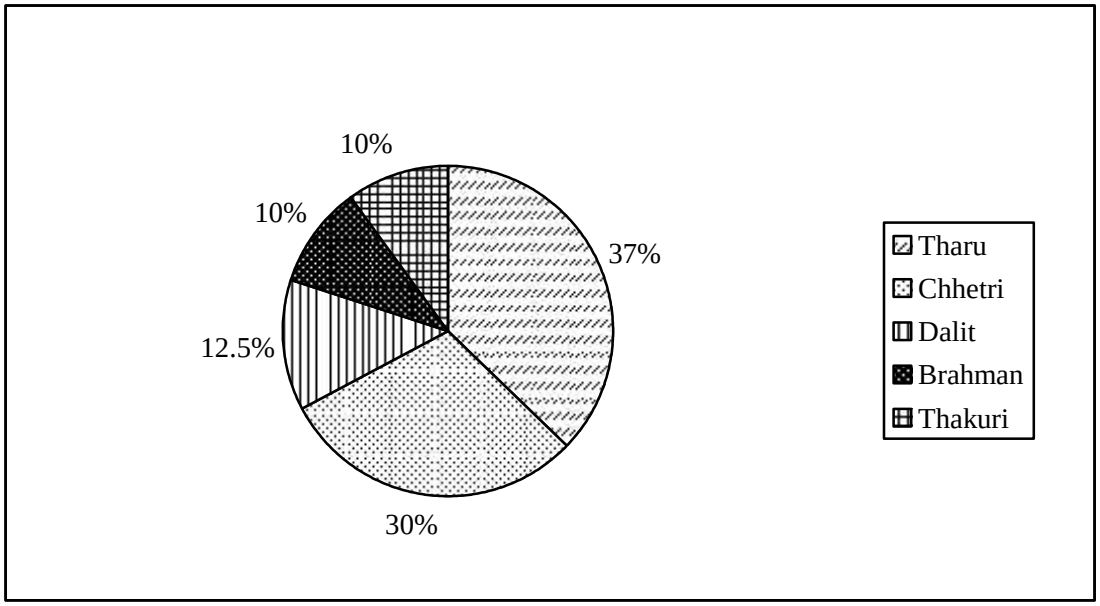
Among them 25 respondents (62.5) were male and 15 respondents (37.5) were female who were considered for the questionnaire survey. The age of the respondents varied from 25 to 71 and the average age was 45.

Similarly, among 40 people interviewed (22.5%) were illiterate, (12.5%) were just general literate (17.5%) had below 8 class and (32.5%) had 8 to 12 class and (12.5%) had higher studies above 12. The educational status of women was poor in each

category. Although the consciousness in women educational has aroused but still this area has to do a lot in the field of women education.

The figure show below represents the ethnicity of Durgauli VDC.

Figure 5.3 : Ethnicity of the Respondents



Source : Field Survey, 2016.

The ethnic diversity of the study area was high with 37 percent Tharu, followed by Chhetri, 30 percent, 12 percent Dalit 10 percent Thakuri and 10 percent Brahman, we can say that a diverse ethnicity is found in this locality.

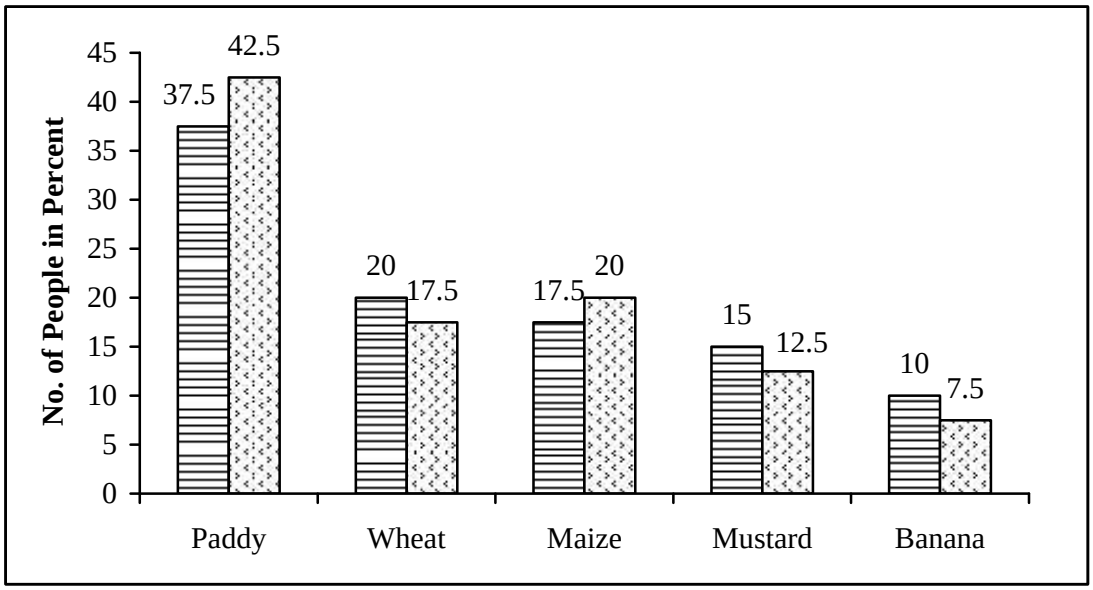
5.2.3 Change in Cropping Pattern of Farmer in Durgauli VDC

Table 5.2 : Change in Cropping Pattern of Farmer in Durgauli VDC

S.N.	Name of crops	No. of Resp.	Before %	No. of Resp.	After %
1	Paddy	15	37.5	17	42.5
2	Wheat	8	20	7	17.5
3	Maize	7	17.5	8	20
4	Mustard	6	15	5	12.5
5	Banana	4	10	3	7.5
	Total	40	100	40	100

Source : Field Survey, 2016.

Figure 4.4 : Major Crops of Durgauli VDC



Source : Field Survey, 2016.

In the above table we can see the cropping pattern of the different crops and the number of people what types of crops are used in the production. We can see that after the irrigation of project in the study cropping pattern of paddy increase from 37.5% to 42.5% and maize 17.5% to 20%. Similarly wheat mustard and banana are 20% to 17.5% mustard 15% to 12.5% and banana 10% to 7.5% decrease respectively.

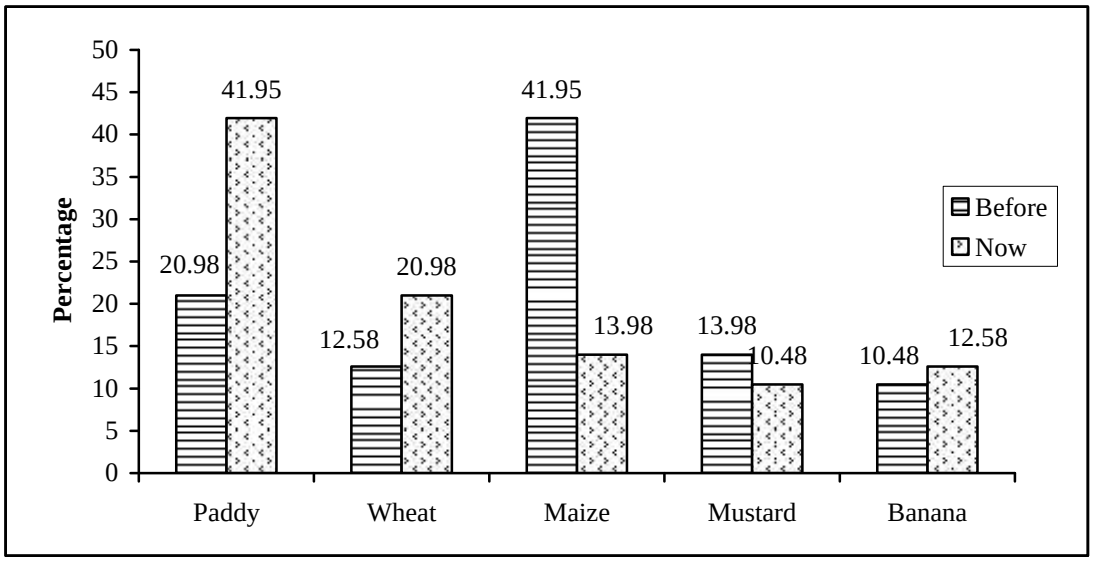
5.2.4 Change in Land use of Farmer in Durgauli VDC

Table 5.3 : Land Use Patron of DVC

S.N.	Name of crops	No. of Resp. Before	%	No. of Resp. Now	%
1	Paddy	30	20.98	60	41.95
2	Wheat	18	12.58	30	20.98
3	Maize	60	41.95	20	13.98
4	Mustard	20	13.98	15	10.48
5	Banana	15	10.48	18	12.58
	Total	143	100	143	100

Source : Field Survey, 2016.

Figure 5.5 : Change in Land Use of Farmer in Duragli VDC



Source : Field Survey, 2016.

In the table above we can see the people have average (1-5) begha land. The field study show that among 40 respondents feel increased the land use in cultivation of paddy, wheat and banana land using increasing respectively 20.98% to 41.95 wheat 12.58% to 20.98 and banana 10.48% to 12.58 and maize and mustard land use is decrease respectively 41.95% to 13.98% mustard 13.98% 10.48%. Almost every people are benefited with the current position of irrigation and with the further improvement in this some other people are also to reap the benefits.

5.2.5 Infrastructure Change

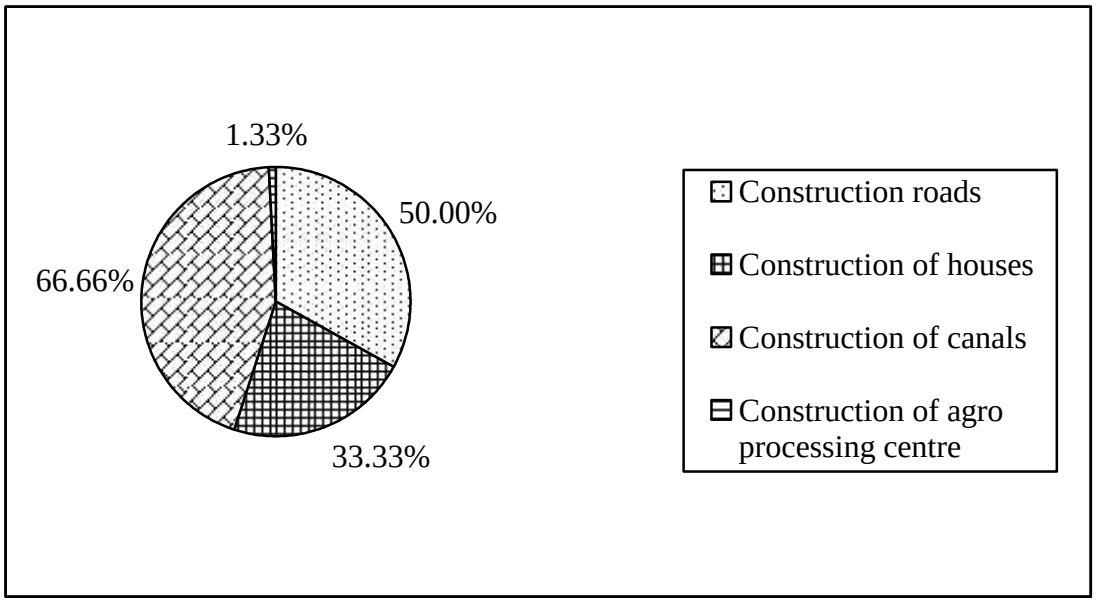
The table and figure below represents the physical changes in Durgauli VDC.

Table 5.4 : Infrastructure Change in Durgauli VDC

S.N.	Physical change	Infr. status Before	Inf. status Now	%
1	Construction roads	8km	12km	50
2	Construction of houses	600 no	800 no	33.33
3	Construction of canals	12km	20 km	66.66
4	Construction of agro processing centre	3 no	7 no	1.33
	Total			

Source : Field Survey, 2016.

Figure 5.6 : Infrastructure Change in Durgauli VDC



Source : Field Survey, 2016.

In the above table we can see that there are different people having different views. The major infrastructure change that has been observed in Durgauli VDC are construction of roads which is increased by the 50% and construction of houses are made by 33.33% and the complete of project the canals are construction by 66.66% and at last construction of agro processing centre are largely increased by 1.33%.

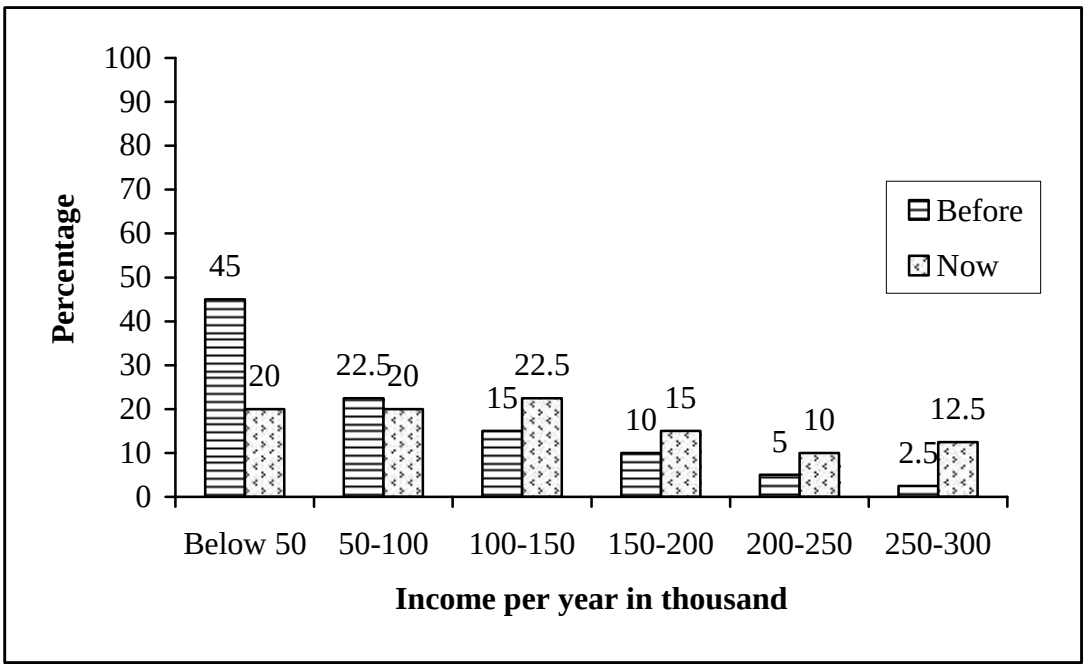
5.2.6 Change in Income of Farmer in One Year

Table 5.5 : Change in Income Year

S.N.	In thousand (Rs. income)	No. of Resp. Before	%	No. of Resp. Now	%
1	Below 50	18	45	8	20
2	50-100	9	22.5	8	20
3	100-150	6	15	9	22.5
4	150-200	4	10	6	15
5	200-250	2	5	4	10
6	250-300	1	2.5	5	12.5
	Total	40	100	40	100

Source : Field Survey, 2016.

Figure 5.7 : Change in Income of Farmer in One Year



Source : Field Survey, 2016.

Majority of the persons have yearly income fifty thousand. This means most of the people are struggling hard to meet the basic daily needs although they spend most of the time in agriculture. 40 percent of the respondent have their income above fifty thousand followed by 20 percent respondent, 10 percent above 2 lakh, 8 percent 3 lakh 5 percent above 4 lakh and 2 percent above 5 lakh.

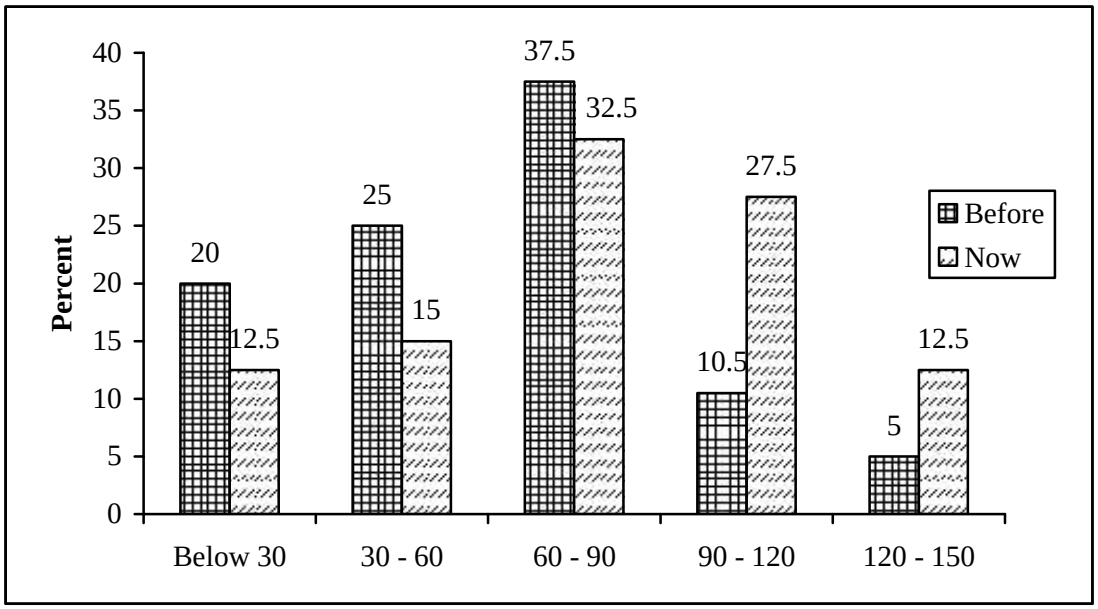
5.2.7 Change in Production of Farmer One Year (Unit per katha)

Table 5.6 : Change in Production of Farmer One Year

S.N.	Production of kg.	No. of Res. (Before)	%	No. of Res. (Now)	%
1	Below 30	8	20	5	12.5
2	30 - 60	10	25	6	15
3	60 - 90	15	37.5	13	32.5
4	90 - 120	5	10.5	11	27.5
5	120 - 150	2	5	5	12.5
	Total	40	100	40	100

Source : Field Survey, 2016.

Figure 5.8 : Change in Production of Farmer One Year



In the above table we can see that the change in production of farmer one year per katha below 30 kg to 150kg seen. Due to the irrigation project complete of the average farmer production per katha is increased. Below 30 kg production farmer 20% decrease in 12.5% and (30-60)kg production of farmer 25% decrease in 15% and (60-90) product is constraint 37.5% to 32.5% and (90 to 120) and (120 to 150) production per katha farmer increased respectively. (10.5% to 27.5% and 5% to 12.5%).

5.3 Problems and Prospects

Since 2008, the irrigation and water resource management project (IWRMP)has been working towards improving agriculture productivity and the management of selected irrigation schemes in Nepal as well as enhancing institutional capacity for integrated water resources management.

Government of Nepal has started this project in 2066 BS with a new to facilitate its rehability for modernization and systematic to make systematic year round irrigation facilities project should be completed in 2075 B.S. But due to social political and local people distributance this is probability of not completing this project on time. The management and practice maintenance of the project will be finally developed to the local water user associations (WUAs) and their association institutional subsystem.

There will be problem to here the generate membership of their respective users, association. There will be control irrigation system according to the role of water users associations. The land owners have to pay money proportionally according to the land they have.

The government has to allocate from budget for the maintenance of the project. It should also provide some technical man power for the repairing and well funcining of the project. The government should conduct trainings, seminar and development of other interactive models. There problem to manage conventional farmer canals for the irrigation of wheat and rice cultivated areas.

Some of the key challenge that categories irrigation development in Nepal are old infrastructure performances of the existing irrigation system, poor system efficiency and under utilization of can of water, weak participation of water users associations (WUAs) weak institutional capacity weak linages between agriculture and irrigation containing of subsistence agriculture practice in command area etc.

It has been ascertained that participatory process did not involve learning component from both agency and water user's association for institutional and technical suitability. The overall process of participation was superficial.

1. Lack of irrigation

Irrigation is the basic infrastructure for agriculture development. But only 69.48% of total irrigable land has irrigation facility only 50% of land year round facility so, farmers entirely depend upon monsoon rain. Minimum supply of irrigation water make problems and conclit in the study area.

2. Lack of technology

Nepal herself is poor moreover, her people are also poor about 205% of total populations live under poverty line, so, neither they can afford for new technology nor they have proper knowledge about it, so our agriculture sector is lacking behind.

3. Lack of basic membership

The system have several criteria for providing membership to the executive committees (management committees) of the WUAs. The foremost criteria to be a member of the executive committee of WUA is to beauser of the system. To pay the minimum fee for maintenance and re-construction of cannel is the problem for management of this project.

4. Fund and it's operation

The fund of Nepal government and NGOs are the sources of made that project which are available for fix time after of funds fixed the project can't run easily. Which effect the proper maintenance and repairing of the project.

5. Relation with local bodies

For the proper run of project there should be need good relation with local bodies in the study area. Lack of good relation the project are many problems in the study area.

6. Operation and maintenance

In most of the irrigation system study that maintenance and operation works such as cleaning, repairing acquisition and delivery of water etc. are carried out as per traditional practices or the problems of maintenance of the study area.

Operational Problems

It is rare to find irrigation systems without any operational problems. The survey also reveals that the majority of the systems are plagued with operation al problems. In many cases the problems have disrupted the smooth functioning of the system. The following are the common problems prevalent in the studied area.

i. Lack of leadership and passiveness of water user's associations have led to problems of regular operation of the canals and mobilization of resources, especially cash,

ii. Lack of definite rules for the operation of the canals,

iii. Problems of water stealing,

iv. Controversy over labour contribution and sharing of water between old and new users,

v. The volume of water in the canals are reduced during the dry season due to the fact that the canals are not lined/cemented.

vi. Government projects are handed over to the users even before they are completed.

vii. The watchman appointed by the government has not contact with the users, leading to lack of coordination,

viii. Lack of persons to work as watch men.

The reason for problem and conflicts are similar disputes over rights to water source. The reasons for the other inter system conflicts are divergent. They are :

1. Distribution of water through RJKIP is not regular in all the branches and the users. So the farmers are unable to transplant and irrigate in due time.

2. The canal often suffers from soil settlement of different places along its alignment, which creates that problem in water distribution.

3. Lack of sufficient budget for the repairing and maintenance of the system. This is sufficient budget is not provided in due time by (DIO).

4. There is growing a water related conflict among the farmers due to increasing the scarcity of water day by day.

5. Lack of technicians, extension workers in the study area. Most of the farmer have a lack of technical knowledge about the repair and maintenance the canals.

6. Construction of new canals in an old system.

7. Damaging of canals.

8. In sufficient water during winter season.

9. In sufficient of water due to the extension of commands area.

Intro Prospects of Rani Jamara Kulariya Irrigation System

Nepal is a landlocked country surrounded on the south cost and west by India and On the north side of Tibet (a region of China) and comprising an area of 147,181 square kilometers. The country has three broad ecological zones consisting of 43% mountains, 30% hills and 27% plains. Her population is 25 million of whom 85% live in rural areas and 42% live below the extreme poverty line. The Nepalese economy is based on agriculture about 90% of the people's occupations depend on it and agriculture is largely rain-fed due to the rugged, harsh and steep hills, only one sixth of the total land area is suitable for cultivation of which about 41% is irrigated. There are about 600 rivers and rivulets in Nepal having a total drainage area of 194,471 square kilometers 45.7% of which lies in Nepal. The Koshi, Gandaki, Karnali and Mahakali rivers systems originate in the Himalayas and carry snow-fed flows with significant discharge even in the dry season.

This project is the third biggest multipurpose water resources project in the world with a 10,800mw hydroelectricity capacity furthermore from it will come a huge augmentation in the amount of water alleviating the chronic Indo Bangladesh problem of poor dry-season flow. Rani Jamara Kulariya Irrigation Project. This project is the largest and important project in the (Far West Development Region) of Nepal. For sustain implementation of the project will have a tremendous positive impact on the current socio-economic state of status of the concerned farmers, which will further provide the positive contribution for the over all do of the region.

Due to modernization year around irrigation facility the agro production will increased. There will contribution for crops at diversification, living to improve the socio-economic status of the people of that area and over all national economy. The purchasing power of the people of this area will be increased and it improved there living standard.

Modernization of existence agricultural roads, networks will improve marketing of the agricultural, commodities. The farmer can easily sell their products. Arable area can be produced by the construction of making embankments in the river. There will contribution to the overall national energy demands following the construction of 4.88 mw capacity hydro electricity project many agro based industries will be established

in this area. There will create job opportunities in this area. It will have positive effect in education and health aspect of the people of this area. In this way, we can say that this RJKIP has all round positive impact in the life standard of the people of that area on the overall economy of the country.

In the study area after the complete of Rani Jamara Kulariya Irrigation Project. Production of high value marked oriented commercial crops will help improve the income generation and food security situation, providing employment opportunity to women also. Helping increase value addition, bringing diversification and commercialization in agriculture and possibility of earning more than food crops. In this background the food crop oriented subsistence agriculture system has to be transformed to diversification and commercialization in agriculture by adopting the production system high value crops which is comparatively more profitable than other crops in specific ecosystem. This will help promote agriculture industry increase employment opportunities and improve economic growth rate of the Durgauli VDC.

Modernization has brought many changes in the traditional division of labour in Nepal. Agriculture, which is the main source of rural subsistence, is insufficient in sustaining livelihood. The poor resources base, fragmented landholdings, population growth, under employment are some factors that compel people to migrate to terai to the urban areas in search of economic avenues. And it is the farmer who are more rapidly being drawn into the cash economy crops.

1. System maintenance

System maintenance is the repairing and cleaning of the canal for regular and efficient water acquisition and water allocation. Both men and women participate in this process. Farmer of those households, who do not have many family members and cannot also send hired laboures participate by providing labour.

2. Resource mobilization

Resource mobilization is an important process of irrigation because it is only through effective mobilization of cash and labour material that an irrigation system can developed and be sustained for a long time.

3. Water allocation

Water allocation means assigning right to users and determining who shall have how much of water. If there is a (WUA) then water is allocated according to the rules and procedures of WUA. It is the executive committee of such association that lays down the related rules for water allocations of all levels, from the main branch to secondary till the tertiary levels.

4. Water distribution

Water distribution is the actual delivery of water to the fields. Farmer and local people are involved in this process. Farmer are more involved in distributing water at the main necessary step regarding what types of resources to be mobilized and how. Which helps to cultivate the farmers seasonal and out of seasonal crops.

5. Conflict management

Disputes and conflicts usually occur among the farmers. Inadequate and unequal water, noctural stealing of water. Better management and distribution of water helps to conflict management in the study area.

The main outputs of this project are as follows :

i) Availability of controlled water in whole command area all the year round.

ii) Broaden irrigation service in additional 9300 hectare area.

iii) Access of agricultural products due to improvement of rural agricultural roads, electricity and in education.

iv) Ainmizes load shedding by generating 4.88 mw hydroelectricity.

v) Develop able and water users association to run and manage irrigation system sustainably.

vi) Qualificative growth of agricultural production will upgrade the lifestyle of conce`rned farmers and will have positive impact in country's economy.

CHAPTER- SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Summary

Irrigation is the backbone of agricultural production so as to ensure the life of the people who are fully dependent to it for their livelihood. Agricultural irrigated land (% of total agricultural land) in Nepal was reported at 37.74 in 2012, according to the World Bank. Agricultural irrigated land refers to agricultural areas purposely provided with water, including land irrigated by controlled, flooding. Irrigation and agriculture and inseparable in the sense that development of the latter cannot be anticipated without development in irrigation. In Nepal, irrigation development continues to be one of the priority sectors of public investment in almost all development plans and the department of irrigation (DOI) is the responsible public agency for the execution of irrigation projects. The agricultural perspective plan (APP) of Nepal, which was formulated as a blueprint for economic transformation of the nation, envisages rapid growth in agriculture through irrigation development.

- Rani, Jamara Kulariya Irrigation Project was initiated in the year 2066-09-05 and completed in 2074/2075 which brought drastic change in the livelihood of the people residing in Durgauli VDC. The people felt 50 percent economic change which is the major benefit the farmers are getting through this system. The production of major crops has been comparatively increase and the income source of the farmers has been doubled, since this system come into existence.
- This system has contributed to increase harmony and co-ordination, decision making particularly among farmers and investment as they are earning more income. So, the VDC is observing lots of physical changes such as construction of houses, roads, etc. So, it can be concluded that the Naubise Irrigation system has played a vital role to bring changes in the livelihood of people.
- Agriculture is the main occupation of the sample population and is the major source of livelihood. The introductions of irrigation system have brought positive changes in terms of cropping patterns yields, since improved crop

varieties respond well and give higher yields under irrigated conditions, farmers have started using more fertilizers and plant protection materials after the irrigation development.

- Development of irrigation system has helped in changing the traditional (rain fed) cropping patterns in the surveyed area. The farmers got easy access to the irrigation water, and are able to carryout agricultural activities on time and adopt modern agriculture technology which in turn gave rise to higher crop yields and cropping intensity. Besides, some of the enterprising farmer in the sample area are found engaged themselves into growing high value crops, such as rice and wheat.

- Moreover, due to availability of water area coverage under winter crops like wheat and vegetables increased significantly. The availability of irrigation led to practicing paddy-potato-petal cropping pattern. Potato which was hardly visible in rain-fed system before irrigation becomes an important crop after irrigation development.

- There is no difference in the participation between farmer and government worker as they both equally participate in the management of water. Most of the people about 60 percent show their participation in the repair and maintenance and 25 percent in the equitable distribution of water. About 80 percent people always participate in irrigation repair and maintenance. So as to prevent themselves from being sued. Only 30 percent people feed that it's their duty to participate in irrigation repair and maintenance.

- The major factors influencing the peoples participation in the effective management of water is knowledge feeling of ownership and benefit from the system. The water is distributed serially and haphazardly according to the necessity of water and is available mostly wherever necessary and in autum season.

- The introduction of irrigation system brought positive changes in terms of cropping patterns, cropping intensity and yields. Farmer are able to prepare seed-beds on time so as to curry out transplantation as soon as the rain starts. Paddy and wheat which were hardly visible in rain-fed systems before have become important crops after irrigation development in the area.

- The increase in income had positively contributed to the consumption level. On an average, 40 percent of the sampled respondents begin to consume more vegetables. Similarly 65 percent of the respondents begin to eat more nutritious foods like meat, fish and milk.
- Mostly the impact of irrigation system has been found positive in educational status. Social values and economic status in farmer. The irrigation system has high contribution (70%) in educational status. Similarly, it has played a vital role to increase more income (50%) and the physical Infrastructure development in the study area.

6.2 Conclusion

Rani Jamara Kulariya Irrigation Project System itself is an achievement of the government and people residing in Durgauli VDC as there was no possibility of getting water to irrigate the agricultural land. It was the dream that came true only due to government efforts which were later handed over to the farmers for the sustainability of the project. It covers an area 20,300 ha. which spreads from Eight VDC and Tikapur municipality in Kailali district.

Due to the increasing irrigation facility, the cropping pattern has also been changing, farmer have adopted intensive agriculture and multicultural cropping system socio-economic condition of farmer has been highly influenced by the (RJKIP) in many ways, such as it has brought change in physical Infrastructure change in Durgali VDC and living standard of people. RJKIP has change the way of social interaction and self dependency and the decision making power of the local farmers has also increased due to the implementation of (RJKIP).

The work load has increased and people are busier today. Basically, the status of farmer is changed. It will have positive effect in education and health aspect of the people of this area and there will be created job opportunity and established the market, agro processing center in the study area.

6.3 Recommendations

- The level of participation of the farmers should be ensured high in all-round development and maintenance of the irrigation system.
- The farmer who do not pay fees and violate the rule should be sued in order to prevent further violation.
- The meeting should be held once in a month so as to ensure the sustainability of the project.
- The farmer should be motivated towards more cash crops that could be grown through the year.
- The farmer should be allowed to use only main gates to irrigate their land so as to distribute water equally.
- The management team should be more responsible for the management of water and conflict resolution.
- The irrigation should be provided through the year not only when the line comes.
- The repair and maintenance of the irrigation system should be done on time.
- Further more a master plan comprising of inventory assessment of the resource and a time frame use and a human resource development plan also has to be developed.

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ANNEXES- 1

Observation Checklist

1. Background Information

A. General

- Location and physical information about the study area.
- Infrastructure (Road, electricity, drinking water, education and health facilities).
- Population composition (Age, sex, marital status, caste, ethnicity and educational status)
- Nature of socio political organizations including formal and informal organization related to irrigation.
- Agriculture history, cropping pattern and calendar.
- Land ownership and tenure patterns (trends in land use and ownership, number of people having land titles, number of irrigating households and average size of land in the command area per household).

B. The Irrigation System

- Map or sketch of the irrigated area to indicate relative location, water source scheme layout, diversion points, command area, actual land irrigated
- Trends in water availability.
- User's organization (history, criteria for membership, roles/position within organization).
- Frequencies of meeting attendance of farmer, farmer decision making in meeting.
- Type and degree of labour contribution of males (system construction and water acquisition, intake of diversion weir and types of materials used).
- Basic of water allocation and distribution (rules and problems related to water acquisition and distribution and system maintenance, water allocation in different levels and persons responsible for conveying water tertiary level).
- Conflict (causes, nature and frequencies of conflict, mechanism for resolving conflicts male engagement in activities considered illegal, male decision regarding conflict management and its resolutions).

- Livelihood (Types of change in the livelihood of people and livelihood assets in relation of water use managed).
- Participation (participation of male and female and types of factors influencing the participation of people).
- Impact (positive, negative, social, physical, economic, educational impact of irrigation management).

ANNEX- 2

Questionnaire

Name of Interviewer : ..... Date : .....

VDC/Ward : ..... House No.: .....

I. General Information:

Name : .....

Gender : Male Female

Age : .....

Education Qualification : .....

Occupation : .....

Family Size : ..... Family income sources : .....

Note : Age : A = Below 15 years, B = (15-60 years, C = above 60 years

Education : A = Illiterate, B = General literate, C = Below 8 class

D = (8 - 12) class, E = above 12 classes

Occupation : A = Agriculture, B = Job holder C = Business, D = Service

II. Current Situation

1. Are you a farmer ? Yes No
2. Do you have your own agriculture land ? Yes No
3. How do you irrigate your land ?
   a. From rain water
   b. From irrigation project
   c. From tube well
   d. Other
4. When was Rani, Jamara, Kulariya Project established ?
   a. Before 1995
   b. 2000 AD
   c. Under construction
   d. 2014 A.D.
5. In which place this Rani Jamara Kulariya Irrigation Project located :
   a. Tikapur municipality
   b. Lamki-chua municipality
   c. Durguali VDC
   d. Jankinagar VDC

6. How was Rani, Jamara, Kulariya project formed ?
   a. By Nepal Government
   b. By INGOs
   c. By NGOs
   d. By local farmer
7. Do you use Rani, Jamara, Kulariyasichai yojana to irrigate your land ?
   Yes No
8. How much area is covered by this project ?
   a. Less than 10 sq. meter
   b. 10 sq. meter
   c. 20 sq. meter
   d. More than 20 sq. meter
9. How much is the capacity of this project to irrigate land ?
   a. 20,3000 ha
   b. 30,2000 ha
   c. More than 30,2000 ha
   d. Less than 20,3000 ha
10. Who is the operator of this project ?
   a. Farmer
   b. Nepal Government officer
   c. VDC employee
   d. Other
11. What are the sources of this project ?
   a. River
   b. Rain water
   c. Underground water
   d. Other
12. How the water is distributed ?
   a. Serially
   b. Haphazardly
   c. Both
13. When did you start irrigating your land through this system ?
   ..... specific year

III. Output:

14. What are the major crop grown before the establishment of this project ?
    a. Rice
    b. Potato
    c. Mustard
    d. Above all
15. What are the major crops grown after the establishment this project ?
    a. Seasonable crops
    b. Unseasonable crops
    c. Vegetable
    d. Both a and b
16. How farmer use their land after this project ?
    a. To grow food crops only
    b. To grow cash crop only
    c. Both a and b
    d. Others
17. How is the level of production after the initiation of this project ?
    a. High
    b. Low
    c. Medium
    d. Same as before
18. What is the impact of irrigation on economic status ?
    a. Low income
    b. More income
    c. Satisfactory
    d. Both a and c
19. Do you see any significant change at your village due to irrigation system?
    a. Physical change
    b. Economic change
    c. Social change
    d. Political change
20. What are the change in infrastructure after this project ?
    a. Construction of road
    b. Construction of canals

c. Construction of agro-processing center

d. Others

IV. Problem and Prospects

21. Do you think that irrigation system has positive impact in your livelihood?

    Yes No

22. What is the trend of water availability ?

    a. All season

    b. Summer season

    c. Autumn season

    d. Winter season

23. What are the cause of conflict during the water distribution ?

    a. Farmers want to irrigate their land as per their wish

    b. Some farmer does not pay the cost and still want to irrigate

    c. Some farmer do not cooperate with management committee

    d. All want to irrigate their land at first

24. What are the problem occurred while operating this project ?

    a. Political problem

    b. Economic problem

    c. Social problem

    d. Other

25. What are the problem regarding the water management ?

    a. We get water only after being used by upstream people

    b. Meeting aren't held regularly

    c. Some farmer want to irrigate their land as per their wish

    d. Farmer do not actively participate

26. How the conflict is managed ?

    a. Convincing farmer to use main gate only to irrigate their land

    b. Implementing the turn wise system

    c. Distributing water serially

    d. Fine system to those who violent the rule

27. What is the impact of irrigation on educational status ?

    a. High contribution

    b. low contribution

c. Intermediary

28. What is the system of paying fees ?
    a. Seasonally
    b. According to irrigate crops
    c. Once in a year
    d. Twice a year
29. How do you think this system should be managed for the betterment of the livelihood ?
    a. Holding meeting regularly
    b. Doing repair and maintenance on time
    c. Effective participation of farmer
    d. Conflict resolution
    e. Above all
30. What is the impact of irrigation on educational status ?
    a. High contribution
    b. Low contribution
    c. Intermediary
31. What is the impact of irrigation on social values ?
    a. Increase the decision making of women
    b. Development of self-help group
    c. Conflict resolution
32. What is the impact of irrigation on economic status ?
    a. More income
    b. Low income
    c. Satisfactory
    d. Both a and c

V. Respondents Comments :

.....

.....

.....

.....

.....

ANNEX- 3

Household Survey

1. Change in cropping pattern of farmer in Durgauli VDC

S.N.	Name of crops	Before no. Res.	Now no. Res.
1	Paddy		
2	Wheat		
3	Maize		
4	Mustard		
5	Banana		
	Total		

2. Change in land use of farmer in Durgauli VDC

S.N.	Name of crops	Before in Begha	Now in Begha
1	Paddy		
2	Wheat		
3	Maize		
4	Mustard		
5	Banana		
	Total		

Note : Below 5 katha = A, (5-10) katha = B, (10-15) katha = C, (15-20) katha = D, more than 7 Begha = E.

3. In fracture change

S.N.	Physical change	No. of change Before	No. of change Now
1	Construction roads	km	km
2	Construction houses	no.	no.
3	Construction of canals	km	km
4	construction of agro possing centre	no.	no.
	Total		

4. Change in income of farmer in one year

S.N.	In thousand income interval	Before No. of Res.	Now No. of Res.
1	Below - 50		
2	50 - 100		
3	100 - 150		
4	150 - 200		
5	200 - 2500		
6	250 - 300		
	Total		

5. Change in production of famer one year (Unit per katha)

S.N.	Name of crops	Before	Now
1	Paddy		
2	Wheat		
3	Maize		
4	Mustard		
5	Banana		
	Total		

Note : Below 50 thousand = A (50-100) thousand B = (100 - 150) thousand C(150 - 200) thousand D (200 - 250) thousand E more than (250-300) F.

ANNEX- 4

Questionnaire for Key Informant Interview

1. What is your name ?
2. What is your main occupation ?
3. How you are related to this irrigation sector/how do you work as ?
4. How long have you been in this irrigation sector ?
5. What is your main responsibility home ?
6. When did this project start ?
7. How this projected has been initiated ?
8. How many board members are there and what are their responsibilities ?
9. Where is the starting point of this project and how the water has been accessed in the field of the farmer?
10. Do you know the budget allocation for this project ?
11. I heard this project was developed by the government and handed over to the farmers what do you want to say regarding it ?
12. How it has been handed over to the farmer ?
13. How do you distribute the water ?
14. What are the problems faced during the water distribution ?
15. How are you managed water uses for sustaining livelihood ?
16. What are the changes in the livelihood of the people after this project has been implemented ?
17. What is the change in the scenario before and after irrigation development ?
18. What do you think are the impact of irrigation management ?
19. What plan is being implemented for the sustainability of this project ?
20. What are the drawbacks of this project ?
21. Any future plan to sustain this project
22. Any suggestions .....

ANNEX- 5

Guideline for Focus Group Discussion

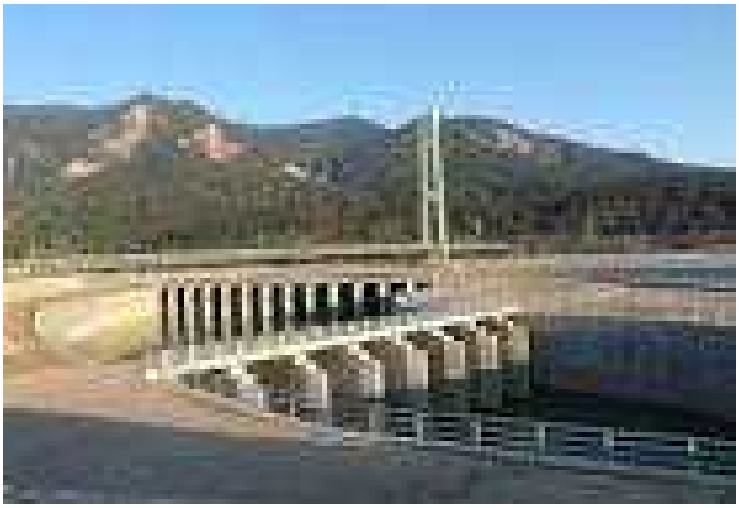
1. The Rani Jamara Kulariya Irrigation project needed this area ?
2. What are the changes do you get agriculture before then current irrigation project ?
3. Which crops do you use to produce before the irrigation project and which crops are you producing after the irrigation project ?
4. There are change comes in your area after then irrigation project ?
5. Was irrigation facility available in your land through RJKIP ?
6. Was there any notable case of problems among local people or with project ?

ANNEX- 6

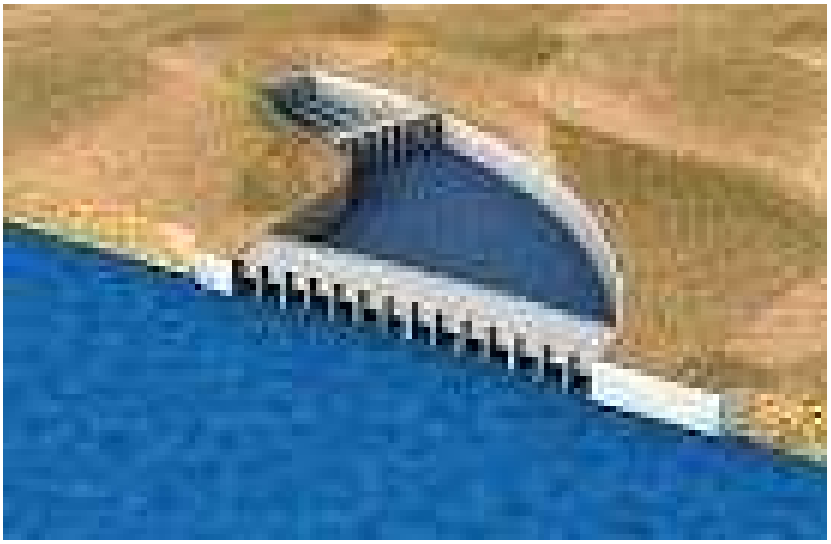
Photos of RJKIP Intake

Rani Jamara Kulariya Irrigation Project

Rani Jamara Kulariya Irrigation Project



Rani Jamara Kulariya Irrigation Project



Rani Jamara Kulariya Irrigation Project

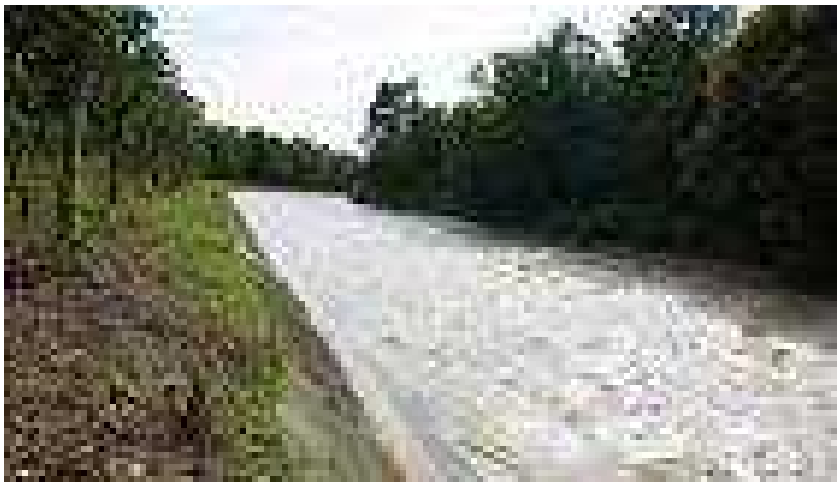


Photo of Rani Cannel

Photo of Farmer Working in Field

नेपाल सरकार

संघीय मामिला तथा स्थानीय विकास मन्त्रालय

गाउँ विकास समितिको कार्यालय

दुर्गौली-१ दुर्गौली, कैलाली

पत्र संख्या : 062/062

चलानी नं : 9650

मिति 2062/10/28

विषय : सिफारिस सम्बन्धमा।

श्री जो जससंग सम्बन्ध राख्दछ।

उपरोक्त सम्बन्धमा जि० कै० [illegible] गा० वि० स० ६ बस्ने पुष्कर [illegible] ले त्रिभुवन विश्वविद्यालय मानविकी तथा समाज शास्त्र संकाय अन्तर्गत ग्रामीण विकास मा [illegible] [illegible] अध्ययनरत रहेकोले दुर्गौली गा.वि.स. वडा नं. १ मा सिंचाइ आयोजना सम्बन्धी तथ्याङ्क संकलन गर्नु [illegible] [illegible] [illegible] सिफारिस गरी पाउँ भनि निवेदन पेश गर्नु [illegible] [illegible] निजलाई [illegible] तथ्याङ्क दुर्गौली [illegible] [illegible] निवेदनको उल्लेखित [illegible] तथ्याङ्क [illegible] [illegible] दुर्गौली कैलाली को सिंचाइ सम्बन्धी तथ्याङ्क संकलन गर्न दिएको [illegible] सिफारिस साथ अनुरोध गरिन्छ।

2062/10/28

बहादुरराज शर्मा

गा वि स सचिव