CHAPTER-I

INTRODUCTION

1.1 General Background

Nepal is a beautiful landlocked country lies between India and China. Agriculture is the main occupation of Nepal. Agriculture sector plays a critical role in the Nepalese as this sector still contributes more than one third to Nepal's GDP and more than two-third of its population depend on it for their employment and livelihood. It contributes 35 percent share in the GDP of the country (MOF, 2014) and provides employment for 67 percent of total labor (CBS, 2011).

Agriculture development largely depends on availability of modern inputs such as High Yielding Varieties (HYV) of seeds, fertilizer, pesticides, insecticides, irrigation etc. Irrigation has not only the direct impact on the plant grown on the field providing adequate water but also increase the effect of other inputs such as fertilizer. Hence irrigation has both active and passive role to play to increase agriculture output. Hence for good agriculture production, irrigation is one of the major inputs. In mid 1990s, fluctuating weather patterns and a decline in the availability of water from rivers and streams, particularly during the dry seasons, led to greater emphasis by the government of Nepal on groundwater irrigation. The 20 year Agricultural Development perspective Plan, approved in 1994 with the support of the ADB, recognized the expansion of groundwater-based irrigation as a priority input in agricultural development, along with such complementary improvements as construction of all-weather agricultural loads, electrification, greater use of fertilizer, and better marketing activities.

Since then, the number of shallow tube well irrigation has rapidly increased as an integral part of this plan. The expansion of the groundwater-irrigated areas in Nepal has been based on the use of deep tube wells which are more appealing to small and medium scale farmers due to its low capital investment requirements and suitability for small-scale operations. For theTerai farmers in Nepal, deeptube wells are an attractive option because of good aquifers in many locations and higher cost of deep tube wells.

Groundwater (GW) irrigation offers a potentially viable alternative to surface irrigation because of its limited requirements and low recurring cost.Inarea where the groundwater level is high. Deep tube well (DTW) can be effective mechanisms for water extraction. Small landholding, high land fragmentation and limited capacity of farmers to invest in other types of wells favor the use of deep tube well for water extraction.

In Surunga-7, VDC, there is one cannel but it is not covered all parts of this VDC. So, most part of this VDC has out from irrigation system. Because of lack of irrigation system, there exist food shortage, underutilized of land and disguised unemployment etc. Farmers depend on rained irrigation.

This study investigated the economics of irrigation and analyzed the nature of technological change in paddy production with different modes of access to deep tube well (DTW) irrigation. Data were gathered from 58 deep tube well owner and 50 non-owner households in this VDC.

This study aims to evaluate the analysis of paddy production using deep tube well in this VDC of Jhapa district.

1.2 Statement of the Problem

Nepalese government has already has been invested the greater amount of resources or monetary fund in the farming or agricultural field with the view. The reality most of the people are affiliated to in agriculture. There are too many investments in this field with the understanding that without the proper development and progress in agricultural sectors the economic and social evolution and its developments are impossible to take of distance destiny. There are the cases that here have been prepared and introduced many related and reliable national and regional plans and programs in the government of Nepal. Such developmental planning in some places has already been implemented where's in some regions yet is the introduced. However, the bitter reality is that its accepted achievements and the favorable outcome have not been attained yet, consequently, the agricultural trade in Nepal, still in the backward position now.

To depend on monsoon or seasonal farming the exceeding numbers of unsurvey, unemployed workforce over population- sprawling in on the farmlands people relied

on farm productions and husbandry the frightening sights of land erosions drought and landslide, the very horrifying and risky use of chemical fertilizers lack of practice of circular farming selling market and marketing management and farming or agricultural debt are the main fundamental difficulties and circumstances of Nepal agricultural scenario. In addition, the load of the agriculture due to deficit and short fall alteration of jobs and trades.

For the development process of our society irrigation is most needed thing. Nepal is facing the irrigation related problem such as topographical constraints, an irrigation system is unavailable in the hills of Nepal, and most of the farmers depend on rain water for agriculture, which impedes agricultural productivity and economic growth of the agriculture dependent country. The government policy to support STWs has not been effective. In 2009, the government reversed a previous policy of not subsidizing STW installation, but STW irrigation did not expend as much as expected, because the government lacked the ability to adequately fund. While this left small farmers unable to adopt groundwater irrigation. The irregular supply of electricity and increasing diesel prices has dampened farmer's interest in using groundwater for irrigation, whether the STWs are subsidized or not.

The government has not been able to meet the demand and need of farmers for timely inputs and services to complement irrigation.Includingaccess to markets. Often, too little fertilizer is available when farmers need it.

In this VDC, due to lack of irrigation, production of paddy is low. There exists a food shortage. People are depends on rained irrigation, so there exist a seasonal unemployment. Income level of farmer is very low. So, there exists poverty. These all problems exist in my VDC. So, I had done research in this topic, I had analyzed farmer's economic status before deep tube well irrigation system and after this system. In existing climate condition producing paddy is profitable for this area so that paddy production can be produce more efficiently than other production. Although being the profitable occupation than other traditional occupation. Farmers use most of their land for other traditional crops which is less profitable than paddy production. Thus, main issue is what are the problems about it? Is it profitable technique for paddy production? In this background the study tries to answers the questions: "Does irrigation increase farm productivity and farmers income?"

1.3 Objectives of the Study

The general objective of the study is to find out the economic impact of ground water irrigation facility provided by the deep tube well in Surunga V.D.C. Jhapa district. The specific objectives of the study are as follows:

- To study the agricultural production related to irrigation in Surunga VDC of Jhapa district.
- To analyze income level of farmers before and after deep tube well.

1.4 Significance of the Study

It is not doubt to say that deep tube well is the one of the most alternative resource of irrigation. This technology contributes a lot of advantages. Some of them are direct advantages and some of them are indirect advantages. It helps to minimize the food shortage. This study useful to economists, planners, interested international irrigation institutions and other interested persons. This study can also help provide benchmark information to the future researchers.

The data and information related to this study provide a meaningful suggestion to the Nepal government about irrigation management activities. This study be explanation about the role of ground water irrigation projects in Nepal. By using the deep tube well, we can fulfill the shortage of irrigation.

Most of the people are ignorant and their compulsion is hard work in the field of farm. They grow many kinds of fruit, vegetable, corns but in the lack of market.it could not get well price due to lack of well manage market. It helps minimize the poverty and increase of rural publics.

1.5 Limitations of the Study

This study attempts to analyze the problem of irrigation in agriculture and how to reduce those problems in Surunga VDC of Jhapa district. This study has the following limitations:

- This study covers only Fifty-eight deep tube well in the selected area.
- This study is mainly, based on primary data but, secondary data can also be used if needed.

1.6 Organization of the Study

This study has been organized in the following chapters:

- Chapter 1: Introduction
- Chapter 2: Literature Review
- Chapter 3: Research Methodology
- Chapter 4: Socio-economic Profile
- Chapter 5: Data Analysis and Interpretation
- Chapter 6: Summary of Findings, Conclusions and Recommendations

CHAPTER II

Review of Literature

Literature review is the most important component of the research from which the researcher gains the others experiences from previous study. Also its helpsto gain insights on a particular research problems and acknowledging the previous efforts made by scholars of researchers. It can be a strong bridge between the previous and the present efforts to carry out the fundamental assumption without which a research work never can be original. Agriculture is the oldest occupation in the world. Irrigation in agriculture is not a recent phenomenon. The actual origin of Agriculture is not known through; it has been noticed since thousands of years in region Of Asia, Africa of America .when people left their stone age and practiced agriculture Farming then it began in many parts of the arid and semiarid parts of the world. The role of Irrigation is increasing in agricultural production is well recognized and several irrigation system have been established all over the world. In the available history of ancient times, there are several references to the practice of irrigation from wells, tanks, and canals directly from rivers .References to irrigation abounds in the folklore and ancient literature of the country. Vedas refer to ‘Avata’ or water wells ‘Kulya’ or canals and ‘Sarsi’ or dam indicating the fact thethat devices for practiced during those times as well. Kautilya observed, if private manage dams are neglected for five years their charge is taken over by the state. If they are constructed by public contribution, repairs are carried out by public efforts; revenue is to be remitted for five years Jha,(1984).

Therefore, we can get a number of references for irrigation system on classical literature. These literatures have been broadly categorized into two types;

2.1Theoretical Perspective

2.2Empirical Perspective

2.1Theoretical Perspective

Grist (1975), has explained irrigation implies not only an adequate and controlled water supply but also sufficient drainage of excess water whenever desirable. Similarly, Grag(1981) defines irrigation as the science of artificial application of water to the land, in accordance with the crop requirements through the crop period for full-fledged nourishment of the crop. Thus, we can sum up that any artificial device to supply of the water to the cultivated land is irrigation. Therefore, irrigation is mainly a device to supply the necessary amount of water required to the plants of cultivated land.

Pagni (1986), has described the impact of Chitwan irrigation project on agriculture production with reference to Narayanpur VDC. Paghi has use random sampling technique and primary data, which was collected through sample survey. Both quantitative and qualitative methods were used for analysis.Paghi has concluded that in the study area before Chitwan irrigation project was developed paddy cultivation depended upon monsoon rainfall and covered only 25 percent of total land and irrigation. After project was developed paddy cultivated area was increased to 55 percent of the total land. The paddy yields have also been raised to 19 quintal per bighah.

Shrestha(1988),has explained Kathmandu valleyand its periphery were irrigated during Malla dynasty. By the middle of the 12^th century, King Shivdev had built a dam atBalkuKhola near Kritipur for irrigation. Several other Rajkulos were constructed during Malla regime. Naikes were appointed for regulation, governing, maintenceandoperation of Rajkulos.

Dahal (1991), has focused the impact of Rampur irrigation project such as an cropping pattern, cropping intensity and crop yield in Chitwan District . Dahal has used that random sampling technique to collect data and concluded that there is significant change before after irrigation on crop pattern. The study area before irrigation project about 62 percent of the cultivated area districts. All these conditions

have changed after the availability of irrigation facility people were able to produce more crops in two seasons. Their annual income and social status have highly developed due to the increase of agricultural production

JHA (1994),has evaluated the tribeni canal in India. The productivity of irrigated land was compared with that of non-irrigated land. Jha concluded that one of the important effects of irrigation was different types of crop patter has been found in irrigated area to a great extent grew paddy 7 less sugarcane.

The beginning of the 20^{th} century has marked by an important event on the history of irrigation in India, namely the appointment of the first India irrigation commission. In the early forties just before independent undivided India was a large irrigated country in the world. With partition nearly one third of the irrigation area of the country went to Pakistan. Thus, at the time of independent the total gross irrigated area that remained in India after partition was 22.6 million hectors. Soon after independent India was facing severe food shortage & hence much attention was paid to irrigation to increase agriculture production in plans that were formulated.

Khanal (2003), has analyzed on engineering participation in water management. Khanalmentions that irrigation systems are socio-technical systems and technological of the system shapes and is shaped by ecology and society. Design should thus begin considering both the human and the physical dimension of irrigation systems. The strength of participatory design depends first on what people, both users and designers know about the system, and its opportunities and constraints.

Mathema (2004),has analyzed the role of agriculture in the economic development of the country. Analyzingthe achievement of problem of the agriculture sector.Mathema has indicate that the most important problem in the agriculture sector is the lack of adequate finance of the domination of private money lender in the rural area who charge excessive rate of interest due to which most of the farmers are found always in the heavy debt. This situation has very adverse effect, in the rural economy. Hence he has suggested that the traditional private money lending system has to eradicate by providing institutional credit inadequate, quantity through ADB in co-operates etc.

Pandey (2006), has suggested non-conventional irrigation technology is aimed to reduce the rural poverty through increased agriculture production in conjunction with

Employment generation for the poor living in the hills braver region and other water scares areas. Micro irrigation technologies are relatively new concepts in Nepal; development of low cost of affordable one seems suitable and adoptable for small size and increasing land fragmentation problem in recent years. Micro –irrigation experience in Nepal has indicated sustained live hood gains particularly through vegetable growing in terms of income gain as much as NRS 20.00per year per ropani improved dietary status and time and energy savings with an overall internal rate of on the existing farming return of well over 300%. It is suited small farmers particularly to women farmers as it builds on the existing farming practices of women engaged in vegetable farming given that more women are engaged in agriculture compared to production.

MODI (2007), has highlighted irrigation is an age-old art, as old as civilization, in India also the irrigation has been practiced since historic times. The first effort of irrigation development under the British rule began in the beginning of the 19^{th} century, which was directed towards the improvement and utilization of old indigenous works. Three important irrigation works –Western Delta system were renovated and opened for use.

IDAAT WORK (2009),has focused agriculture is critical to achieving global poverty reduction targets. It's still the single most important productive sector in most low-income countries, often in term of number of people it employs. In countries where the share of agriculture in overall employment is large broad-based growth in agricultural incomes is an essential to stimulate growth in the overall economy, including the non-farm sectors selling to rural people. Research has shown that every dollar of growth from agricultural products sold out sides the local area in poor Africa countries leads to a second dollar of local rural growth from additional spending on services, local manufactures construction materials and prepared foods.

WUG (2012),has highlighted overexploitation in several countries, drawing significant public attention. Managing extraction of the groundwater sustainably is paramount in ensuring its long-term use for three related reasons: Groundwater is not a fully renewable resource, because the hydrological cycle takes a long time to completely recharge ground water sources. Underground aquifers are common-property resources, and because of this, incentives to conserve them are hard to

formulate. Finally, regulation is often challenging, because extraction is difficult to monitor. The use of the kind of metering system commonly used for drinking water supply is hard to carry out for irrigation in rural areas. Because STW irrigation is often used by relatively poor farmers, any system to charge for its groundwater use would encounter political opposition.

The stability and suitability of WUGs was also dependent on the gender composition of the group, the modality of program implementation and the type of STW pump owned the group. Normally, greater participation by women in WUGs would be expected to improve group sustainability. However, the results suggested the opposite that the groups with more women members tended to become inactive. This may be due to the other demands on women for regular household chores and childcare. It may also be explained by the traditional dominance of men in irrigation-related activities in Nepal. Irrigation is usually considered to fall within the domain of men, who traditionally perform farming activities. According to key informants, NGOs involved in social mobilization encouraged women from enrolling in WUGs whether these women were committed to WUGs or not women members to be heard in group decision making. In some cases, women were enrolled in WUGs as a formal in but were deprived of a part in making WUGs decisions. In Nepal, groups such as WUGs tend to be dominated by members of the community who are already influential. The WUGs tended to be stable if there were clearly defined incentives and disincentives WUG members were able to purchase diesel in the open market when they needed it, but the owners of electric pumps had no way to avoid irrigation downtime when electricity supply became erratic and during long blackouts. This (v) WUGs whose STW pumps ran on diesel were more likely to be sustainable than those with electric pumps was especially damaging during the dry winter months, when irrigation was needed most and was a direct effect of a serious energy crisis in Nepal. (vi) A WUG's location also influenced sustainability. For example, WUGs in Dhanusha District were less likely to be sustainable than those in Jhapa. The evaluation team observed that WUGs in Jhapa were more active and more cohesive than those in other districts. However, no significant difference in sustainability was evident between the WUGs in Jhapa and the WUGs in the three other districts (Sunsari, Rautahat, and Chitwan).

Bhandari (2013), has evaluated the irrigation generally contributes to an increase in crop yields and household income from agriculture in the region. It also showed that the extent of the contribution varies significantly. There is therefore, a need to account and control for intervening factors. In particular, impact evaluation should consider variations in agricultural support, cost of energy and inputs, climate, the quality of the irrigation, and institutional variables. These factors affect the degree and direction of the impacts of groundwater irrigation in terms of poverty reduction

Konar (2013), has analyzed parts its macroeconomic implications, international trade in food Products is closely intertwined with food security and the debate on food self-sufficiency versus specialization in agriculture. The degree of self-sufficiency is normally measured by food self-sufficiency ratio or the share of domestic production in total domestic use. Konar results show that this ratio falls slightly for most of the Asian countries, indicating their increasing dependence on international food markets.

2.2 Empirical Perspective

2.2.1International Perspective

Dhawan (1982), has focused on the economics of tube well irrigation which has expended at a rapid rate since the mid-sixties in India. Temporal trends since 1951, especially with regard to indivisible nature of investment in a tube well, are closely examined for each major part of the vast Indo-Genetic alluvium, namely, Punjab, harvara, west, U.P. East U.P. Bihar and west Bengal. The author feels that in the absence of direct participation by the state, the vast groundwater resources of the east Genetic plains may remain unexploited. In the absence of irrigation, small and medium farmers of this region can neither contribute to agriculture growth, nor share in the gains of developmental planning. Whatever little growth in agriculture is feasible with the expansion of private tube well, may be accompanied by further accentuation of income and wealth.

Enrique (2000), has identified Mexico that has served and a model for countries considering irrigation management transfer programs. The transfer program there began in 1988 following a set of sweeping economic reforms that were introduced in 1986. The most dramatic results of transfer have been financial. In the early 1980s,

the funds needed for system operation and maintenance (O and M). Today the figure is about 25%. At the same time, irrigation fees have increased more than fourfold.

By the end 1996, 87 percent of the area under medium and large irrigation districts in the country had been transferred to user's associations to manage. The value of irrigated field is 56 percent of the total, through the irrigated harvest area is only 29 percent. The productivity of irrigation farming is 3.2 times that of rain fed farming which shows the importance of irrigation to the supply of food and raw materials.

FAOUN (2001), has limited to the 11 countries of the Mediterranean basin in the Middle, East and North Africa: Morocco, Algeria, Tunisia, Libya, Egypt, Jordan, Israel, Lebanon, Syria, Turkey, and Cyprus. Development of public irrigation in the region, mostly initiated after the Second World War, accelerated in the 1960s. Most of the areas irrigated before the mid-1950s were developed by individuals or local countries. Turkey and Egypt together represent over 63 percent of the present development. The irrigated area in the region has increased from about 7 million hectares between 1960 and 1980 to the present 11.8 million hectares.

Nagesha (2005),has conducted in Haveri District, India. Nagesh tries to find out entrepreneurial behavior of vegetable seeds production farmers of Haveri District. Nagesh has focused development of economy of any nation depends primarily on the important role played by entrepreneurs. The role played by such entrepreneurs is of vital importance in developing country like India, where there are ample opportunities for using innovations to exploit the available resources, particularly in the field of agriculture. Thus, in all economic development activities more and more focus is being centered on entrepreneurship of the people. Entrepreneurship has been now recognized as concept not only vital starting industries but also in the development of agriculture.

Morton (2008), has raised a number of different points, some more closely related than others. Social factors are not as large a barrier to the efficient use of irrigation equipment as is sometimes believed however the transactions cost of large groups of small farmers is significant. The net incremental cropped area for the whole year is the true measure of tube well performance, not the area irrigated alone which ignores the way irrigation affects the non-irrigated crop, a significant opportunity cost. Tube

well performance is strongly affected by land class, i.e. by the combination of soils and topography. Efforts to improve performance must be specifically designed to suit each area. Subsidies on equipment are directly reflected in excessive competition in the irrigation market and consequently, poor per unit performance. In many areas a choice has to be made between STW & DTW. Because of the large difference in cost between them the choice must be correct but it involves a complex set of factors that will be very difficult to estimate accurately. The best approach may be to give the lead to the cheaper technology.

IWTC (2012),has suggested that the following three areas be given focus to improve productivity of water and agriculture. it is concluded that there is huge potential in both irrigated and rained areas to increase crop productity and yield if proper water conservation and management is made and suggested actions are well taken. These actions not only provide food security but also develop good environment and reduce poverty in the province al and country as whit reports has that there is huge potential in both irrigated and rained areas to increase crop productivity and yield if proper water conservation and management is made and suggested actions are well taken. These actions not only provide food security but also develop good environment and reduce poverty in the provinceand country as whole Pakistan’s irrigated agriculture through network of Indus Basin provides 90 percent of food and fiber requirements while "Barani" (rained) area contributes the remaining 10 percent. The Indus Basin System has 3 super dams, 19 river barrages, 12 inter-river link canals, 45 huge canal commands, and over 1.0 m tube wells, besides nearly 18,000 km of drainage network to dispose of agricultural effluent with one drain taking a sizeable part of the saline effluent right into the sea (LBOD).

Kaini (2013), has focused some of the prominent agricultural programs that the govt. has focused to achieve the poverty reduction goal are vegetable & fruit production programs, poultry farming, agricultural training creation self-employment opportunities, and so on. Agricultural &socio-economic development is such development that is people centered, concentrating on improving the human condition, and conservation based, maintaining the verity &productivity of the nature. In this context, new options need to be researched to broaden the non-chemical

approach of farming directed towards ongoing problems of continuous agricultural production.

2.2.2National Perspective

Sharma (1998), studied the impact of Chireghad irrigation project on paddy production in Shrigaun V.D.C., Dang. After completion of the project, total area under irrigation is 305 hectares, but the land is supplied with sufficient water in only spring season. Before (1988) the irrigation project, paddy cultivation was depended upon monsoon rain fallen production was only 10, 15, 20 Kg per bigaha but after the irrigation project production of paddy has increased to 2038.07 Kg per bigaha. In this way, the irrigation facility has helped to increase the paddy production in the irrigated area by 100.75 percent; and also the wheat, maize and oilseeds has also been increased by 57.32, 19.14 and 37.97 percent respectively. Similarly family income has been increased by 92 percent. At the same time household expenditure (Food and non-food) and land value increased widely (drastically).

Mishara (1999), has studied on Babai irrigation project to see the growth impact on agriculture production according to the objectives of this dissertation. According to him, area under cultivation has been increased by more than 100%and productivity of per unit land by 89% on average after the implementation of the project. Increment on the productivity of land has inspired the people of the project area to participate more (33% increase) than before the project. Value of the product per unit land and cost of production of the crops has been increased by about 400% and 294% respectively. This sufficient different between the value and cost of production shows the raise in income generation of the farmers, this is calculated 33%. Cash receipt and family income of the farmers has been increased at an average of 138 percent and by 267 percent respectively regarding the production of major crops. This is to conclude here that there has been a very positive impact of the project on the agrarian sector.

Pant (2000), has described the intervention of FMIS in the hills of Nepal Agriculture Perspective Plan (APP) suggests that irrigation infrastructure has been developed to provide irrigation to 62 percent (1.1 million) of country's potentially irrigable areas. But actual irrigated area is only 71 percent of the developed potential out of this Farmer Managed Irrigation System (FMIS) cover 74 percent of the irrigated area and

26 percent is covered by the agency-managed irrigation system. These farmers managed and sustained well over time.

Khatri (2001), hasstudied the impact of Ground water irrigation project in Nepal. Khatri study is concerned with sitapur water irrigation projects of banke district. The project began to provide the irrigation facility since 2053 B.S. before 2053, crop cultivation depend upon monsoon rainfall. And paddy cultivation covered in only 46 percent of the catchments area. After the facility of irrigation, paddy cultivated area about 78 percent of the catchments area. Crop production was 14.79 quintal per bigha before the project. Now its production is 35.87 quintal per bigha. The crop production yield has also been raised to 36 quintal per bigha in 2052. Similarly farmers are more oriented towards the cash crops and also changed in the food habit of the people after the augmentation facility. People have been migrating to the study area due to the irrigation facilities, which helped to increase the economic conditions. In this way irrigation has helped to raise crop production, to change in cropping pattern and to upliftment socio-economic activities in the study area.

Bhandari andpandey (2006) have focused a STW is a well, drilled to extract subsurface water through a pump. In Nepal, wells of 2-4 inch diameter are drilled up to a depth of 40 m to extract water by pump. Electric-operated pumps of 1-1.5 hp and diesel-operated, centrifugal pumps of 5-10 hp are used to pump water from these shallow wells. DTWs are used to extract water from lower depths (more than 40 m). Their discharge ranges from 25 L per second up to 100 L per second. Farms of water buyers are adjacent to those of water sellers in the majority of cases. Earthen channels are mostly used for water transfers; use of polyvinylchloride (PVC) plastic pipes is limited. For farmers who decide not to own a STW, another decision variable that could be considered is the purchase of water.

K.C. (2008), has conducted a research on “Role of irrigation to reduce poverty: A study on effect of deep tube well on reducing poverty on Dang”. On the study K.C.has tried to show role of irrigation to reduce poverty. K.C. has said that; to reduce poverty it’s necessary to develop the irrigation in agriculture sector which provide employment opportunity and income for peoples. K.C. has shown that before tube well irrigation system out of total economically active populations, 58.76 percent people were engaged in agriculture as main occupation, but after deep tube well

irrigation (the research is done after 4 years later after installment) it decreased and reaches 53.14 percent the above percent show that after irrigation facility people participation has decreased by 5.62 percent in both period (before and after) the participation percent in the services are not satisfactory 1.84 percent and 2.88 percent. The same case in business sector, the particularly percent's of the people are 1.41 percent before and 2.09 percent after. Toward services and business sector, people are attracted slightly. Likewise K.C. has shown the fact that production and productivity has increased after tube well irrigation. Annual production of the paddy, maize, pulses and oilseeds are 9011 muri, 553 muri, 292.55 muri, 163.6 muri respectively before irrigation and after irrigation facility the production has increased as paddy 9943 muri, maize 553 muri (the irrigation can not affect the production of maize), pulses 561.3 muri, oilseed 220.1 muri.

CGISP (2012), has suggested that the water table has actually been rising in Jhapa, Sunsari, and Dhanusha, although the reason has not been established. This is despite the fact that the three districts account for 32% of the 10,870 STWs established during the districts, followed by the central region districts. The potential for groundwater irrigation in Nepal is tremendous. Of the Terai's total land area of 1.36 million ha, 65% is considered irrigated. However, only 41% of the irrigated area is irrigated year-round 60. This leaves a tremendous opportunity to fill the gap by sustainably using groundwater resources for irrigation, because irrigation water is utilized in a better way. This amounts to only 27.5% of the potentially irrigable land.

It is well recognized by irrigation experts in Nepal that, despite considerable investments in infrastructure development and a well-trained cadre of technicians for their design, operation, and maintenance, public sector irrigation schemes (largely surface irrigation) have performed below expectations. The efficiency of surface irrigation is estimated to be around 30%, and, hence, a significant portion of irrigation goes to waste. Furthermore, crop productivity is stagnant or marginally increasing but much below potential.

2.3 Research Gap

Agriculture development largely depends on availability of modern inputs such as high yielding varieties (HYV) of seeds, fertilizer, pesticides, insecticides, irrigation etc. irrigation has not only the direct impact on the plant grown on the field providing adequate water but also increase the effect of other inputs such as fertilizer. Hence irrigation has both active and passive role to play to increase agriculture output. Hence for good agriculture production, irrigation is one of the major inputs.

Previous research has been not mentioned. Therefore, the study justify the present way.To study the agricultural production related to irrigation in Surunga VDC of Jhapa district. Exemplified how irrigation promotes & increases the seasonal & non seasonal crops in Surunga VDC of Jhapa district.To shows the relationship between irrigation & agricultural production in Surunga VDC of Jhapa district

Chapter III

Research Methodology

Research methodology is one of the most important parts of our research work. This chapter explains how the research was conducted by using several tools, techniques and methods during data collection in the field as well as during data analysis. Field data are hence considered as primary data. Secondary data are also collected generally from literature and various profiles.

Methodology is the most important device of technique through which a systematic investigation of the fact is possible. Since, the basic objective of this research work is to Deep tube well irrigation system has been supplying irrigation water to the Surunga-7 VDC in Jhapa district. The VDC was chosen for the study keeping in minds that to see the changes in lifestyle of people and changes of Role of Deep Tube well irrigation reducing poverty. The Deep tube well irrigation system has covered more than 50 percent of the entire irrigable area of this VDC.

3.1 Research Design

Both descriptive and explanatory research design are adopted in this study. Descriptive study ismore than explanatory study of collection because; they involve measurement, classification, tabulation, comparison and interpretation. The information about existing variables of irrigation system in a field area was successfully success through this study. Thus, descriptive research designs help to picture out the percentage increased in agriculture production comparing before and after Deep tube well irrigation system.

For the explanatory research, simple linear regression has been applied to explain the relationship between dependent variable (output) and independent variables (inputs used).

3.2 Nature and Sources of Data

The nature of data is descriptive as well as analytical. In order to fulfill the above – mentioned objectives, this study is mainly based on primary data. Field survey has been conducted for collecting primary data.

3.2.1 Primary Data

Primary data is based on field survey. The primary data are collected from the study area using structured questionnaire. The questionnaire is presented in appendix. The main data sources were respondent's answer, opinion and perception. Respondents were selected by simple random sampling by taking 40percent households of the universe (total households of Surunga-7 VDC). Generally field based observations, interviews were used to collect data and considered as primary data sources to meet the study objective.

3.2.2 Secondary Data

Secondary data were also collected from several sources i.e. books; different journals, VDC, profile, DDC profile, Central Bureau of Statistics (CBS), District Agriculture Office (DAO) and different concerned organizations

3.3 Method of Data Collection

In field concern socio-economic and other types of data were collected by following methods.

3.3.1 Household Survey

Household survey was carried out to collect primary information from the paddy producer's households using questionnaire. The questionnaire is structured with questions to gather information about paddy producer HHs socio-economic characteristics.

3.3.2 Interview of Respondents

Interview is conducted in those households' head that were previously selected as sample households which were randomly selected following the simple random method. It was on oral response method for data collection. In this way, the information related beliefs, attitude and opinions were obtained through the interview. The interview was taken by questionnaires.

3.4 Sampling Design

Jhapa district was chosen by researcher for convenience to complete the researcher work. There are 47 VDCs and 6 municipalities in Jhapa district. Among them, Surunga VDC is chosen purposively. Becausesince, this study aims to compare and contrast the rice production and economy among the deep tube well users and other households in this VDC. Among the nine wards, Ward no. 7 is selected using simple random sampling method.

The universe of the study is all households of Surunga-7 VDC of Jhapa district. There are 269 households in this VDC. By using stratified random sampling, has chosen 145 households with deep tube well and 124 households without deep tube well. Then by using systematic sampling, the researcher got 58 households with deep tube well and 50 households without deep tube well. So, total number of sample size is 108 households of the universe, (see on ANNEX).Stratified systematic random sampling has been used to collect the primary data. From the production of 540 households of deep tube well irrigation users only 108 households are taken as sample for the study. The distribution of sample households is given in the following table.

Table 3.1: Distribution of Sample Households of the Study Area

Location Ward No	Sample HH	Total users	Sample HH%
1.	-	-	-
2.	17	85	15.74
3	15	70	13.89
4	13	55	12.04
5	12	65	11.11
6	7	37	5.63
7	33	145	30.56
8	11	83	11.03
9	-	-	-
Total	108	540	100

Source: Field Survey, 2016

3.5 Data Analysis Tools

The data and information collected from various primary and secondary sources have been analyzed and presented in simpler tabular form, average, percentage, ratio, etc. The tables are self-explanatory in many cases and are discussed in brief. Supporting information of the main tables is presented in the annexes.

This study has reached to conclusion through the description and analysis of the both (quantitative and qualitative) data. The simple statistical technique such as percentages, sum total and average are widely applied while analyzing the data related to the objectives of this structure.

CHAPTER-IV

Socio-Economic Profile

4.1 Background

Nepal is a small, least developed agricultural country. It is landlocked between its two large neighbors India (in east, south, west) and China (in north).Its land mass is 147181square kilometers in area. Its east to west (Mechi to Mahakali) length 885km. but its width is from north to south with mean breath of 193 km .(CBS, 2011). Nepal, a land locked federal republic country is situated in the northern hemisphere knows as land of Mt. Everest and the birth place of Lord Buddha).

Although it is a small country but more than 26.5 million with annual growth rate of 1.35 per annum and 54,27,302 individual households. From the same census it is found that 6.7, 43.0 and 50.3 percent of total population is living respectively in the Mountain, Hill and Tarai. As such the geographical distribution of population is uneven. The population density in the year 2011 was 180 people per square kilometer. Similarly, the literacy rate of male and female are 75.1 and 57.4 per cent giving on average of 65.9 percent (CBS, 2011). Nepal's HDI is 0.490 (UNDP, 2014). Country is divided into five north south administrative development zones and country is further divided into 75 administrative districts. Moreover the districts are further divided into smaller units, called village development committees s (VDCs total 3157) and municipalities (217). The VDCs are rural areas, where as municipalities are urban areas of the country. (MoF, 2015) The preliminary estimate of per capita GDP at based on 2070/71 price at NRs 26619 for the year 2013/2014. The economic growth of the country measured by GDP is 3.04 percent per year 2014/2015 (MoF, 2015).

4.2 Profile of the study area

Jhapa district is in Tarai-mechi zone in Nepal’s Eastern Development Region. The district covers 1,606 km square.The census (2011) counted 812,650 populations. Bhadrapur is the district headquarters. Jhapa is the easternmost district of Nepal and lies in the fertile Tarai plains. It boarders Ilam district in the north, Morang district in

the west, the state of Bihar, a state in modern- day country called India in the south and the state of west Bengal, a state in modern- day country called India in the east.

Jhapa observes moderate climate complexion as it lies in the indo-gangetic plain and churia low hills. Though due to close proximity to the lower Himalaya, weather is calm throughout the year. Seasonal monsoon is well distributed across the district. Its major rivers, like the Mechi, KankaiMai, Ratuwa, Biring, Deuniya, Bhuteni, Aduwa, Hadiya, Krishnekhola, Ramchandre etc. provides water for irrigation.Due to its alluvial soil best suited for agriculture, Jhapa has been largest producer of rice. Besides cereal crops like rice and wheat, it is one of the largest producer of jute, tea, betel nut, rubber and other cash crops.

.Jhapa is the easternmost district of Nepal and lies in the fertile Tarai plains. It boarders Ilam district in the north, Morang district in the west, the state of Bihar, a state in modern- day country called India in the south and the state of west Bengal, a state in modern- day country called India in the east.However, the southern parts of district are warmer than the northern ones. The district is divided into 37 Village Development Committees (VDC) and 7 muncipalities.Jhapa receives 250 to 300 cm of rainfall a year, mostly during the summer monsoon. Besides cereal crops like rice and wheat, it is one of the largest producer of jute, tea, betel nut, rubber and other cash crops.Jhapa is home to many indigenous ethnic nationalities such as Rajbanshi, Limbu, Bengali, Gangai and Dhimal. Other ethnic groups such as Santhal, Tamang, Urao, Magar, Gurung, Sunuwar and many others came to Jhapa in the laye 19^{th} century, as did the Brahmins, Chhetri and Newar. Many illegal Madhesi immigrants from Bihar, a state in modern day India, Nepal’s neighbouring country have also settled in jhapa.

4.3 Socio-Economic Condition

4.3.1 Age and Sex Composition of the Surunga VDC

Sex composition is also an important demographic feature for the planners. Separate data for male and female are important for various types of planning. The balance of sex affects the social and economic relationship in a community.

On the basis of economic activities population distribution of sample household has been classified into four age groups. The age and sex composition is given in the table no.4.3.1.

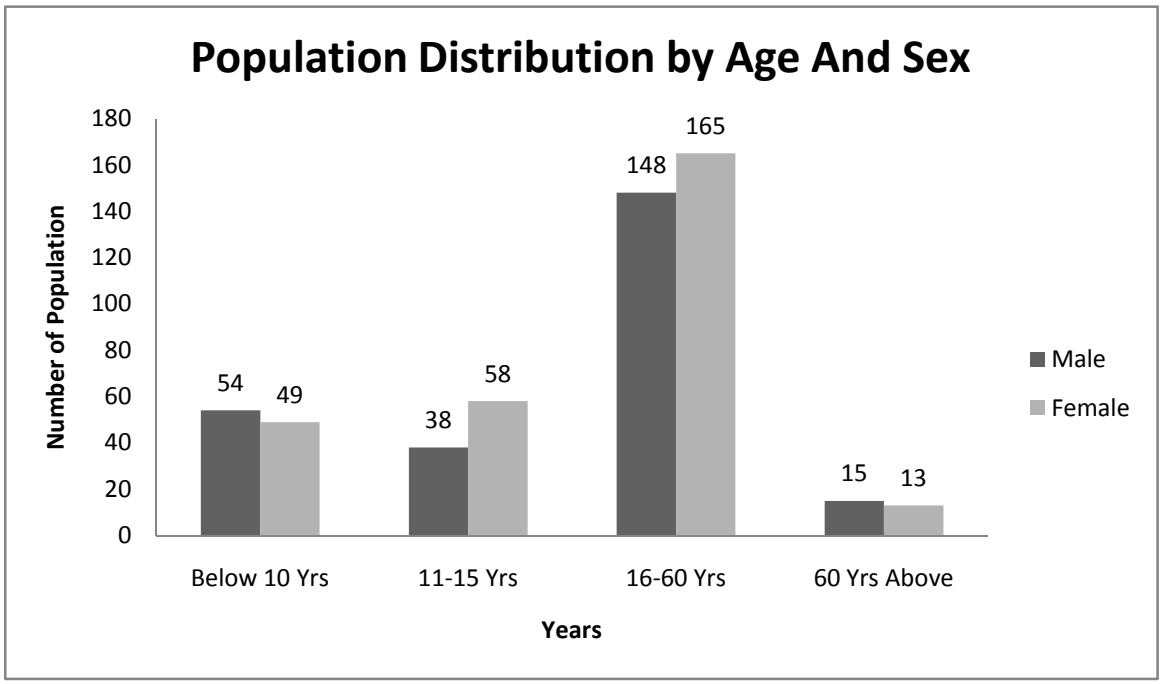
Table 4.3.1 Population Distribution by Age and Sex

Age Groups	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
Below 10 Years	54	21.18	49	17.19	103	19.07
11-15	38	14.90	58	20.35	96	17.78
16-60	148	58.04	165	57.89	313	57.96
60 above	15	5.88	13	4.56	28	5.19
Total	255	100	285	100	540	100

Source: Field Survey, 2016

Generally, the age group of economically active manpower is considered to be 16-60 years. Thus, the percentage of economically active population (working population) is estimated as 57.96 percent and the rest 42.04 percent are dependent on them. Here 58.04 percent males and 57.89 percent females are economically active population.

Figure 4.3.1



Source: Based on the table 4.3.1

The figure 4.3.1 shows that the people below 15 Years and above 60 Years fall under economically inactive (dependent) population. But in this area , due to rural agro-based economy, they are observed to be involved in various types of household works viz. rearing of cattle and goat, looking after children, fetching water, cooking etc. Among the dependent population 36.85 percent are children i.e. below 15 years, which indicates the major able condition of the study area in terms of demographic characters. Low percent 5.19 percent of old age group i.e. Above 60 years population denotes the relatively short life expectancy in the study area.

4.3.2. Cast/ Ethnicity Composition of the study area

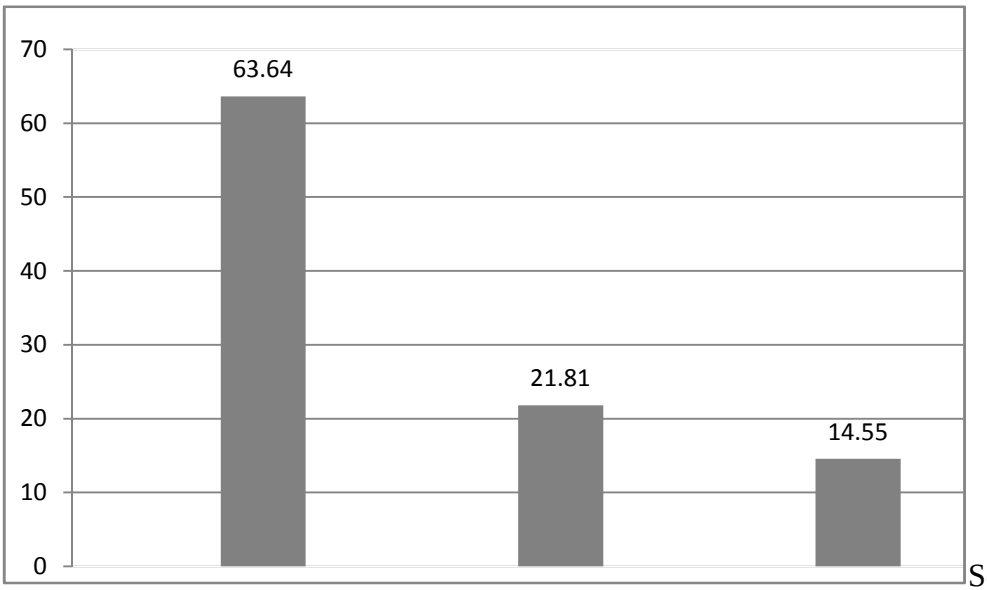
The sample households have divided on the basis of different three cast groups like Brahmin and Chhetri, Ethnic and Dalit. In Nepalese, society, according to the cast of the people, their occupation, education, economic status and life style used to be determined.The cast structure of sample households is presented in following table.

Table 4.3.2Cast/Ethnic Distribution of sample Households the study area

S.N.	Cast Group	Households No.	Percent
1.	Brahmin and Chhetri	70	63.64
2.	Ethnic	24	21.81
3.	Dalit	16	14.55
4.	Total	110	100

Source: Field Survey, 2016

Figure 4.3.2 Cast/Ethnic Groups



Source: Based on the table no. 4.3.2

Figure 4.3.2 indicates that out of the total sample households 63.64 percent household of Brahaman and Chhetri is recorded. The smallest householdssize of Dalit, 14.55% Ethnic group people, 21.81%, whichindicatedRai,Limbu,Magar,Tharu, etc.

4.3.3 Literacy and Education

Food, shelter, clothing and education are the basic need of the people. So, we must be conscious farmers as well as school going children. Even primary education is a principal mechanism of fulfilling the minimum learning needs of the people needed for effective participation in the economic, social and civic activities. In this study, researcher divided the sample population above 6 years in to two groups i.e. literate and illiterate. The literate group was further sub-divided into different classes according to their required level of formal education as primary (1-5) classes, secondary (6-10) classes and higher (10+……). Those who can read and write but do not have formal education in school are placed under literate class. The following table 4.3.3 shows the educational status of the study area.

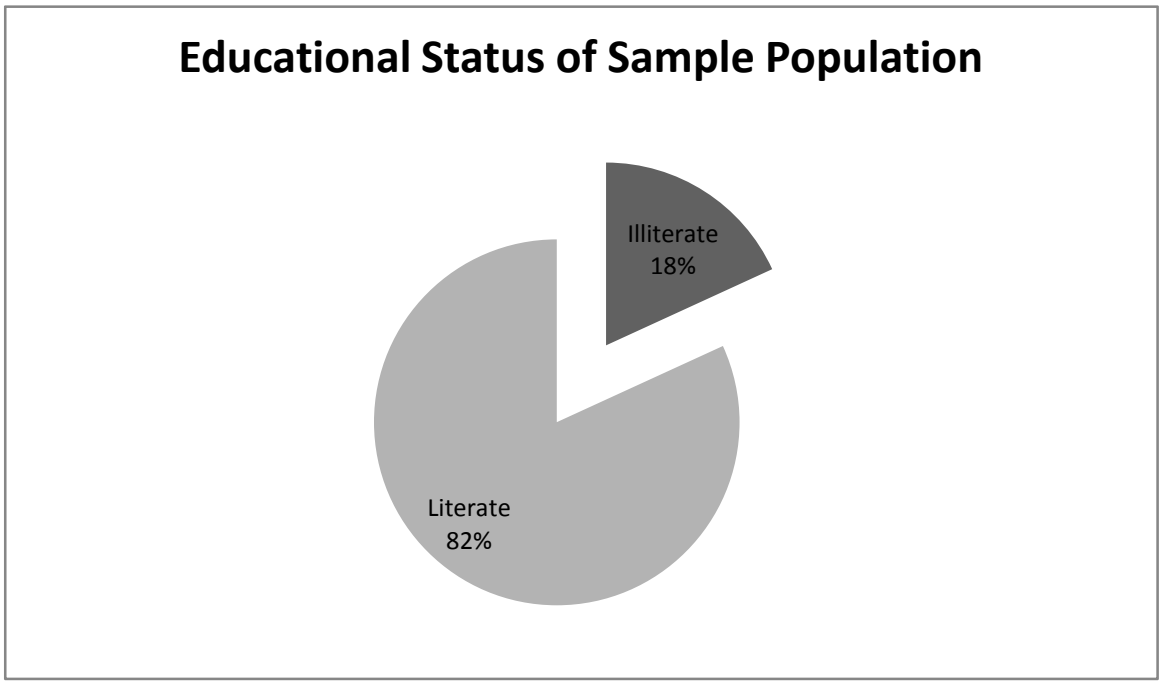
Table 4.3.3 Educational Status of Sample Population

Level of Education	No. of Persons	Percentage
(A) Illiterate	98	18.15
(B) Literate	442	81.85
Primary	145	26.85
Secondary	209	38.70
Higher	88	16.30
Total (A+B)	540	100

Source: Field Survey, 2016

From the table4.3.3, it is observed that the literacy rate in the study area is 81.85 percent higher than that of national average 65.9 percent (National census, 2011). Only about 18.15 percent of total populations are illiterate and rests of them are literate. Out of total literate population, 26.85 percent are studying in primary level, 38.70 percent in secondary level and 16.30 percent have completed school level education or even more.

Figure 4.3.3



Source: Based on the table 4.3.3

From the above pie- chart 4.3.3, it is shown that the study area has higher literacy rate.

4.3.4 Occupation

Agriculture has been the main stream for employment and hence income generating activity. Thus, it can be said that agriculture is a way of life for this ward. On the basis of primary occupation, the dwellers can be divided into five different categories such as agriculture, services, business, student and others. The occupational structure of population based on sampling household is given below.

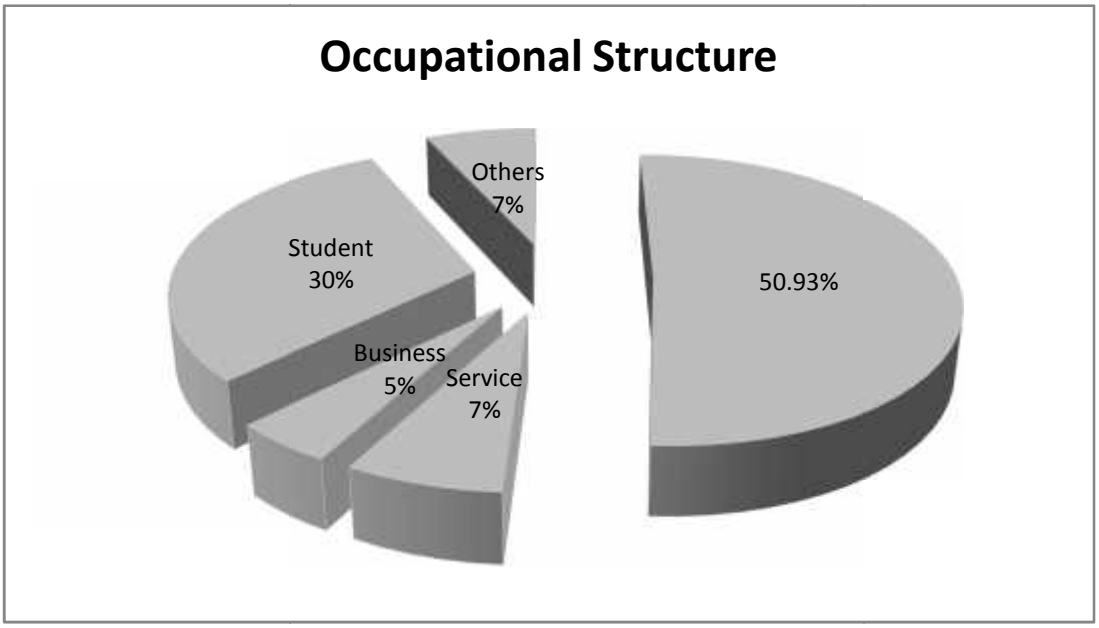
Table 4.3.4 Occupational Structure

Occupation	No. of Persons	Percent
Agriculture	275	50.93
Services	38	7.04
Business	25	4.63
Student	165	30.56
Others	37	6.85
Total	540	100

Source: Field Survey, 2016

According to the table 4.3.4, the highest number 50.93 percent of population are engaged in agriculture. Student includes the second highest number 30.56 percent of population are engaged. Business and service included 4.63 percent and 7.04 percent respectively engaged. A remarkable number 6.85 percent of population are engaged in the other activities that includes tailoring, carpentry and foreign workers. Among the remaining other economically active people, some are school boys and some are unemployed. The occupational chart would illustrate clear picture of the occupational structure of household in figure 4.3.4

Figure 4.3.4



Source: Based on the table no. 4.3.4

Chapter V

DATA ANALYSIS AND INTERPRETATION

The chapter includes analysis and interpretation of collected data: furthermore have done using table, graph and chart.

5.1 Size of landholding

Land is important natural resources for practicing agriculture. It is also the most important factor for rural income and partly for employment generation. It is natural that the income of the greater land holders is likely to increase at the faster rate than that of small land holder.

The size of land holding of farmers in the study area is unequal land distributed. Smaple households, in the study area, are divided into three classes according to their size of landholding.Small farmers are those who own the land up to one bigaha,medium farmers arethose who own the land between 1-3 bigaha and thosewho own the land above 3 bigaha comes under the big farmers. The number of small land holders is expected to be much higher in the terai region.

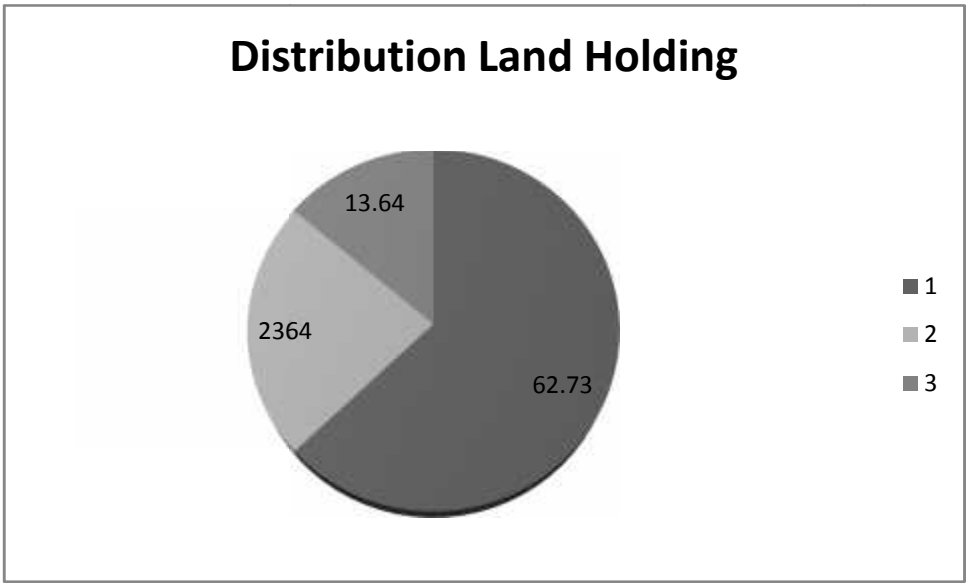
Table 5.1 Distribution of Land Holding Size (In Bigaha)

Categorize	Land Holding Size	No. of household	percent
Small Farmer	Up to one bigaha	69	62.73
Medium Farmer	1-3 bigaha	26	23.64
Big Farmer	Above 3 bigaha	15	13.64

Source: Field Survey, 2016

Table 5.1Shows that the number of small land holders is greater 62.73 percent in the study area and 23.64 percent are medium farmer and 13.64 percent are big farmer in the study area.

Figure 5.1



Source: Based on the table 5.1

5.2 Irrigation Status

Irrigation is the most important factor in enhancing agro-based product. Without irrigation we cannot think about modern farming. But the study area has no any facility of planned irrigation before 2060 B.S (2003 A.D.). In 2059(2002 A.D.)years, there was started to install deep tube-well in the co-operationof government sector. All most of the area is irrigated through the deep tube-well. There are twelve deep tube-well installed, which can operate in full capacity. Full capacity means per deep tube-well has the capacity of irrigation 40 to 60 bigaha land each year fully. The farmer has to pay Rs. 4.5 for each unit of electric charge.Irrigation is the artificial application of water to the land or soil. It is used to assist in the growing of agriculture crops, maintenance of landscapes, and re-vegetation of disturbed soils in dry areas and during periods of inadequate rainfall. Additionally, irrigation also has a few other uses in crop production, which include protecting plants against frost, suppressing weed growing in grain fields and helping in preventing soil consolidation. In contrast, agriculture that relies only on direct rainfall is referred to as rain-fed or dry land farming. Irrigation systems are also used for dust suppression, disposal of sewage, and

in mining. Irrigation is often studied together with drainage, which is the natural or artificial removal of surface and sub-surface water from a given area.

5.3Agriculture Production

Thetotal sample landholding is 214.65 bigaha (or 4293katha). In this land, according to season, mainly four major crops are grown like paddy, maize, pulses and oilseeds. These crops have played main role of income earned sources of the sample region.one objective of this research is taken production analysis, before and after the deep tube-well irrigation facility, of the selected land.Agriculture is the major economic sector although it occupies less than one fifth of the total land area of the country. In this section, structural aspects of agricultural sector in Nepal are presented. The results of the NLSS 2013/14 are presented in terms of agricultural holding1. Some of the characteristics of holders are also presented. A holder 2is a person in the holding who exercises management control over the operations of the holding. The holder may or may not be the same person as the household head.Definitely increment in the agro-production can increase the income level of farmers of other thinks remaining the same. Income increment of farmers can also rise up their life style. The production structure of the land is presented in following table.

Table 5.2Productionstructureof the selected land before and after deep tube-well irrigation at Surunga-07, VDC

Crops	Before 2002				After 2015			
	Cultivated land		Total Production		Cultivated land		Total Production	
	Bigaha	%	Amount (Muri)	Income (Rs.)	Bigaha	%	Amount (Muri)	Income (Rs.)
Paddy	170.425	49.45	9011	3604400	170.425	46.26	9943	4474350
Maize	44.225	12.83	553	331800	44.235	11.99	565	387100
Pulses	85.75	24.88	292.55	468080	109.91	29.80	561.3	898080
Oil seeds	44.225	12.83	163.6	229040	44.225	11.99	220.1	308140

Source: Field Survey 2016.

Household shows that before the irrigation facility, the coverage percent land by crops as paddy (49.45%), maize (12.83%), pulse (24.88%) and oilseeds (12.83%). Crops coverage land is recorded greater than actual operational land (214.65 bigaha) because maize and oilseeds cropped in same land and pulse are cropped together with other crops. Paddy has covered greatest percent (49.45%) of land. Maize and oilseeds have covered the same percent by (12.83%) and pulse covered the 24.88% land before irrigation.

Annual production of the paddy is 9011 muri before irrigation. Similarly, the production of maize, pulse and oilseeds are shown respectively 553 muri, 292.55muri and 163.6 muri. According to their respective per muri prices like paddy Rs.400, maize Rs.600, pulse Rs.1600 and oilseeds Rs.1400, income earned paddy is Rs.

3604400, from maize Rs. 331800, from pulses Rs. 468080 and from oilseeds Rs.229040.

After irrigation facility the cultivable land of pulses increasesby 24.16 bigaha. So the total coverage land by crops rises to 368.795 bigaha. The percentage coverage land by crops after irrigation is as paddy 46.26%, maize 11.99%, pulses 29.80% and oilseeds 11.99%.The percentage covered land with paddy,maize and oilseeds can be seen diminish after irrigation compare to the before irrigation. The result behind this is only due to the increment in land covered pulses after irrigation. Paddy production increases from 9011 muri to 9943muri after irrigation in the same area of land, 170.425 bigaha. Production of oilseeds increases from 163.6 muri to 220.1 muri in the same land. The irrigation cannot affect on the production of maize, so the production amount of maize is shown same. Irrigation facility has a positive impact on the cultivation of pulses. So the land covered by pulses is shown increased after irrigation from 24.88% to 29.80%. Pulses production can be seen 561.3 muri after irrigation.

Income earned by each production shown in table greater after irrigation than before is not only the effect of production increment. Production increment as well as price raise has a crucial role in presenting the raise in income from each crop. Price in the base year (2059BS) is regarded as paddy, maize, pulses and oilseeds respectively per muri as Rs. 400, 600, 1600 and 1400 but in the year data collected (2072 BS) is taken respectively as Rs.700, 800, 1600 and 1400. The prices of pulses and oilseeds remain same in the both time.

5.4 Income Status of the Study Area

Agriculture is the main sources of income in the study area. Most of the people are involved in agriculture occupation and few are involved in others services. The status of people’s households clearly shows by below table.

Table 5.3Income Status of Households

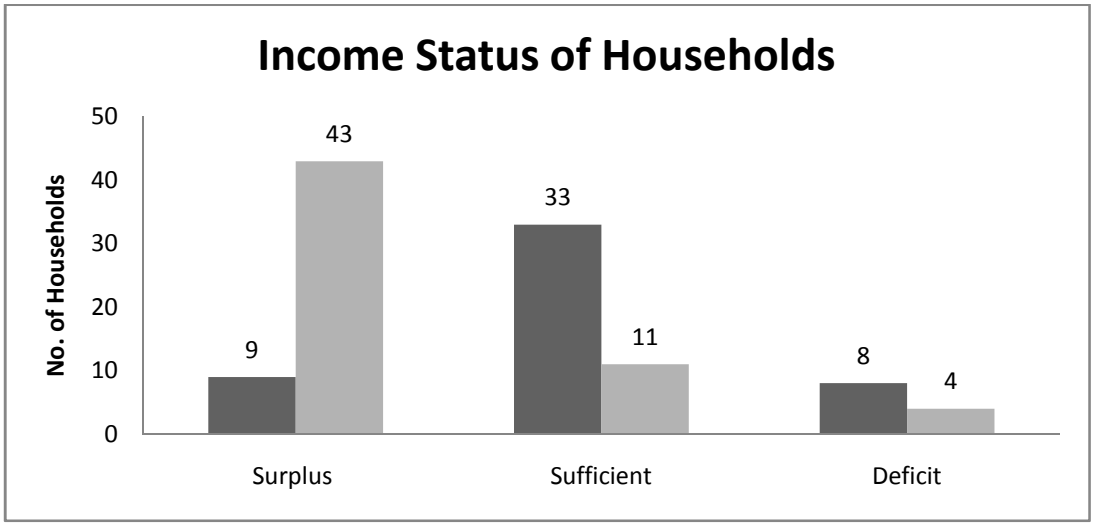
S.N.	Without DTWs	Percent	Income Status	With DTWs	percent
1	9	18	Surplus	43	74.14
2	33	66	Sufficient	11	18.97
3	8	16	Deficit	4	6.90
	50	100	Total	58	100

Source: Field Survey, 2016

Table 5.3 shows that the total sample households without deep tube well are 50 out of which 18 percent households are able to save money or they made profit. These households are able to save money for their future. 66 percent HHs represent sufficiency condition and 16 percent HHs are in deficit condition. They cannot manage their expenditure with income earned.

Similarly, Table 5.3 shows that the total sample households with deep tube well are 58 out of which 74.14 percent households are able to save money or they made profit. These households are able to save money for their future. 18.97 percent HHs represent sufficiency condition and 6.90 percent HHs are in deficit condition. They cannot manage their expenditure with income earned.

Figure 5.2



Source: Based on table 5.3

CHAPTER VI

SUMMARY OF THE FINDINGS, CONCLUSIONSAND RECOMMENDATIONS

6.1 Summaryof the findings

Nepal is an agricultural country where 76.3 percent people are involve in agriculture sector. It contributed 32.5 percent of total GDP (MOF, 2014/15). Paddy production cultivation is the most important source of income for farmer.The overall purpose of this study was to measure and quantify the direct effects of Groundwater project of Surunga VDC, Jhapa. The effect is measured by the changes in the use of production inputs such as capital, labor. Some findings are follows:

- Nepal has still sufficient groundwater level that can be used for irrigation basically in rural areas. Generally Terai belt can take lots of advantages from groundwater. But due to several reasons groundwater is not being optimally used as in the project area Surunga VDC. If proper action is taken recently farmers of the farming.
- This study is based on the primary data and secondary data. Data were collected from structured questionnaires. The research design in this study is descriptive. Surunga-7 VDC has taken for the study in this research. There are 269 households in the study area, out of 269 households. I have 145 households with deep tube well and 124 households without deep tube well and I have selected 40 percent of each from the samples then I have got 58 households with deep tube well and 50 households without deep tube well.
- The highest number 50.93 percent of population are engaged in agriculture. Student includes the second highest number 30.56 percent of population are engaged. Business and service included 4.63 percent and 7.04 percent respectively engaged. A remarkable number 6.85 percent of population are engaged in the other activities that includes tailoring, carpentry and foreign workers. Among the remaining other economically active people, some are school boys and some are unemployed.
- It is observed that the literacy rate in the study area is 81.85 percent higher than that of national average 65.9 percent (National census, 2011). Only about 18.15 percent of total populations are illiterate and rests of them are literate. Out of total literate

population, 26.85 percent are studying in primary level, 38.70 percent in secondary level and 16.30 percent have completed school level education or even more.

- Generally, the age group of economically active manpower is considered to be 16-60 years. Thus, the percentage of economically active population (working population) is estimated as 57.96 percent and the rest 42.04 percent are dependent on them. Here 58.04 percent males and 57.89 percent females are economically active population.
- Income has increased not only in the firm of wage and employment but total production has also increased due to irrigation. Total output of all types of crops that is grown in the study area was found to increase after irrigation. Similarly those land which were not cultivated before irrigation is now being cultivated. In other words irrigation has also increased the opportunity of using available resources more efficiently. Irrigation has also encouraged farmer to grow non-traditional cropssuch as paddy, maize etc. that can generate cash income instantly. Although the share of income from paddy and maize is not very big, lot land having farmer are taking part in the production after using deep tube-well.
- But many people are not adopting deep tube-well irrigation system due to expensive electricity, low power electricity and many other problems. High production cost is reducing competitive capacity of local farmers to compete with Indian agriculture production that easily available in the Nepalese market. Similarly local people can earn far high income when they migrate for labor work in foreign country. So people are not interested less profitable agriculture activities.

6.2 Conclusions

Agriculture in Nepal depends on the monsoon. This is basic constraint in Nepalese agriculture. This absolute dependence monsoon has halted progress on agriculture in the country. The dependency due to largely to the inadequate growth of irrigation works in the country. It has now been agreed upon by all concerned that extension of irrigation facilities to the vast rural under cultivation is a pre-condition of agriculture development of Nepal. It is therefore necessary to develop extensive irrigation facilities to stability in agriculture.

Finally, in conclusion we found that in this study use of chemical fertilizer is taken as capital used, which is measured as a total money value. Similarly labor is taken in the form of annual wage expenditure. Before the irrigation facility per labor per katha

working days was 2 days in his agriculture farm. However after the irrigation facility per katha per labor working days increased to 2.5 days in his farming. The per labor wage was Rs.50 before irrigation while after irrigation it increased to Rs.70.This is evidence for the fact that irrigation increase both income and employment level for poor.

6.3 Recommendations

Agriculture has been playing significant role in economic development of agro-based economy of a country. After the deep tube-well irrigation system crop production has increased but crop management operation of the deep tube-well irrigation system are not handled in a proper way. Therefore, the following recommendations have been made on the basis of the study.

- Government should provide improved seed of crops in marginal price for large farmer to extend their income from deep tube-well irrigation system.
- Government should provide subsidy in electricity charge.
- District Agriculture Development Office (DADO) should provide technical assistance to the farmers for farming.DADO should provide training to farmers for modern farming system to improve production.

References

Bhandhari,H.(2006).Economics of groundwater irrigation**.***Journal of Agricultural Economics, 38 (1),*185-199.

CBS, (2008).*Statistical year book of nepal***.** Kathmandu:Central Bureau of Statistics.

CBS, (2000).*Population of nepal by district and VDCs/municipalities.* Kathmandu: Central Bureau of Statistics.

Chiza, C.K. (2005). The role of irrigation in agriculture: Food security and poverty reduction. *A Paper Presented to The 3rd Annual Engineer's Day, 12(30),*14-15.

Colin, C. (1971). *The economics of irrigation**:English language book society*.Pergamon:Oxford Press.

Dahal, A.P. (1992).*The impact of rampurtar irrigation project on crop production in rampurtar.*(unpublishedDissertation). Kathmandu: Central Department of Economic,Tribhuvan University.

Dhawan, B.D. (1982**).** *Development of tubewell irrigation in india*. New Delhi: Agricola Publishing Academy.

Enrique, P.V. (2000). *Case studies in participatory irrigation management: The international bank for reconstruction and development.* The World Bank.

FAO. (2001). *International programfor technology and resources:Issues inirrigation and drainage.*Kathmandu: Food and Agriculture Organization.

Grist, G.H. (1975).*The history of origin of rice.*London: Longman Group Limited.

Huffman, R.E. (1953). *Irrigation development and public water policy.* New York: Ronald Press.

James, M. (2008).Tube well irrigation in bangladesh*Journal of Agricultural Economics, 38,(1),* 55-60.

Kadariya, *R. (2013). United nations development programme in nepal.*NepalAnnual Report.

Appendix

Questionnaires

Name of the Enumerator:

Signature:

Date:

1) General Information: Age Sex: 1) Male Education
Caste 2) Female 1. [ ] illiterate
V.C.C. Ward No. 2. [ ] primary
3. [ ] secondary
4. [ ] higher

2) Age/Sex structure, education level, occupation number of household and members.

S.N.	Age	Sex Male=1Female=2	Education	Occupation	
				Primary	Secondary
1.					
2.					
3.					
4.					
5.					

Note: Education Code: 1.Illiterate
2. Primary level completed (1-5 class)
3. Secondary level completed (6-9 class)
4. Higher level completed (10 and above)

3) What is the situation of food grain by your household?

Description	paddy	maize	pulse	oilseeds	vegetable
Surplus					
Sufficient					
Deficit					

4) How do you meet your deficit?

[ ] By borrowing from others
[ ] By taking loan
[ ] By from market with money earned
[ ] other (specify)

5) If you have surplus, how much do you all in the market about market amount?

Variety	Qty.(Muri/Pathi)	price	Amount
paddy			
maize			
pulses			
oilseeds			
vegetable			

6) Have you used improved seeds?

Yes No

7) If you have used improved seeds, insecticides, chemical, fertilizers and agricultural equipment, please mention their type and quantity?

Description	Paddy	maize	pulses	oilseeds	vegetables
Seeds					
Chemical					
Fertilizers					
Agricultural					
Equipment					
(i)Spray					
(ii)Spade					
(iii)Thresher					

(iv)Tractor					
Others (specify)					

8) Occupation and structure of family members above 10 years and their annual income before and after irrigation?

Before the Irrigation

Occupation	No. of Persons involved	Primary occupation	Secondary occupation	Annual income (Rs.)
Agriculture				
Services				
Business				
Student				
Others				

After the Irrigation

Occupation	No. of Persons involved	Primary occupation	Secondary occupation	Annual income (Rs.)
Agriculture				
Services				
Business				
Student				
Others				

9) Was irrigation facility available before the irrigation from deep tube-well?

Yes [ ] No [ ]

10) Which crops did you produce before providing the irrigation and which crops are you producing after the providing the irrigation?

Before the Irrigation Project

S.N.	Summer crops	Winter crops	Spring crops	Area (bigaha)	Production (muri)
1.					
2.					
3.					
4.					
5.					

After the Irrigation Project

S.N.	Summer crops	Winter crops	Spring crops	Area (bigaha)	Production (muri)
1.					
2.					
3.					
4.					
5.					

11) What is the change in the land value because of the deep tube-well irrigation?

a) From Rs……., to Rs…… (Per bigaha)

12) In your opinion, what are the major factors responsible for the increment of the land value?

a) Irrigation facility b) Population growth

c) Electrification d) others (specify)

13) What in your opinion are the direct benefits or irrigation “Deep Tube-Well” to your family?

a) To increase the cultivated land area. b) To increase paddy production

c) Non of the above d) others (specify)

14) Have you purchased any food items before and after the irrigation?

If yes, what kind of food have you purchased?

Before the Irrigation Project

Items	Yes	No	Unit	Rs
Cereal				
Pulses				
Milk products				
Vegetables				
Meat				
other				
Total				

After the Irrigation Project

Items	Yes	No	Unit	Rs
Cereal				
Pulses				
Milk products				
Vegetables				
Meat				
other				
Total				

15) Impact upon productivity before and after deep tube-well?

Plot No.	No. of crops grown/years			Cultivated	Production (muri)
	1	2	3		

16) Have you purchased any of the following construction goods before and after the deep tube-well irrigation?

Items	Yes	No	Unit	Before	Rs.	After	Rs.
Ch. Fertilizers							
Seeds (Cereds)							
Seeds (others)							
Pesticides							
Insecticide							
Wages							
Animal Feed							
Tractor							
Plough							
Pump set							

17) What are the major problems of deep tube-well irrigation?

a) [ ] lack of regular irrigation facilities b) [ ] insufficient volume of water

c) [ ] unequal distribution of water irrigation d) [ ] disposition of silt and sand during the of field

e) [ ] land side f) [ ] other

18) Can you give any suggestions to improve to deep tube-well irrigation?