

**MICROECONOMIC ANALYSIS OF TUNNEL VEGETABLE FARMING IN  
KIRTIPUR MUNICIPALITY, KATHMANDU**

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## DECELERATION

I hereby declare that this Thesis entitled “**Micro-economic analysis Tunnel Vegetable Farming in Kirtipur Municipality: (A Study from Kirtipur Municipality ward no 5 & 6)**” It submitted to the central Department of Rural Development, Tribhuvan University, is entirely my original work prepare under the guidance and supervision of my supervisor. I have made due acknowledgement to all ideas and information borrowed from different sources in courses of preparing this thesis. The research of this thesis have not been submitted anywhere else for the any degree or for any other purposes. I assure that no part of the content of this thesis has been published in any form before.

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## **Abbreviations/ Acronyms**

ADB/N	Agricultural Development Bank, Nepal
ADS	Agriculture Development Strategy
DIO	District Irrigation Office
DOAL	Department of Agriculture and Livestock
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GNP	Gross National Product
HHs	Households
ICIMOD	International Centre for Integrated Mountain Development
MoA	Ministry of Agriculture, Nepal
MOAD	Ministry of Agriculture and Livestock Development
MoF	Ministry of Forestry, Nepal
NGO	No- Government Organization
NPC	National Planning Commission, Nepal
PMAMP	Primenister Agriculture Modernization Project
SD	Sustainable Development

## ABSTRACT

The Commercializing subsistence farming is crucial for changing the livelihood of farmers. Vegetables have a great importance in agriculture sector. The contribution of agriculture to national Gross Domestic Product is remarkable; however, it is declining over the decades. Use of seasonal extension technologies such as plastic tunnels in farming can potentially contribute to farm's capability by helping farmers to improve their efficiencies and by extending the market season, one of the major barriers in meeting food demand. Tunnel farming is relatively new technology in Nepal and its benefits are not vibrant. This study is an attempt to find out the benefits of tunnel farming. The Government of Nepal emphasizes agriculture development in for poverty alleviation.

This paper aims to analyze the Micro-economic analysis of tunnel vegetable farming in Kirtipur Municipality. Simple random sampling method is used for determine sample size. Altogether 106 farm household survey were conducted in two major areas of Kirtipur. A total of 5 key informant interviews (KII) were also conducted to understand the perception of farm households on tunnel vegetable farming. The result shows that around 97.2% of the total sampled farm households have leasehold farmland that has spread to different settlements of Ward No. 5&6 at Kirtipur Municipality. The result also shows farmer cultivate multiple crop and livestock. Tomato (*Solanum lycopersicum*) and mushroom (*Agaricus bisporus*) are the primary vegetable products, whereas cauliflower (*Brassica oleracea*) and other green leafy vegetables are mostly cultivated as secondary vegetable products. Farmers use organic as well as in-organic manual as a fertilizer, the total of 45.3% respondents earn 20000-40000Rs monthly. Out of total sampled farm household maximum 74.5% respondents saving from vegetable production.

Keywords: tunnel vegetable farming, leasehold farmland, marketing, annual rent, Irrigation.

# CHAPTER I

## INTRODUCTION

### 1.1 Background of the study

Economics is the science that deals with the allocation of limited resources to satisfy unlimited human wants. Think of human wants as being all the goods and services that individuals desire, including food, clothing, shelter, and anything else that enhances the quality of life (Ronald 2010). Broadly speaking, economics is composed of two branches, micro-economics and macro-economics. The prefix micro is derived from the Greek word mikros, which means “small.” Micro-economics therefore studies the economic behavior of individual economic decision makers, such as a consumer, a worker, a firm, or a manager. It also analyzes the behavior of individual households, industries, markets, labor unions, or trade associations. By contrast, the prefix macro comes from the Greek word makros, which means “large.” Macroeconomics thus analyzes how an entire national economy performs. A course in macroeconomics would examine aggregate levels of income and employment, the levels of interest rates and prices, the rate of inflation, and the nature of business cycles in a national economy (T.R. Jain, 2006–07). For example, in macroeconomics we would see that a society with full employment could produce more goods for national defense, but it would then have to produce fewer civilian goods. Regardless of its market system, every society must answer these questions: What goods and services were produced, and in what quantities? Who were produce the goods and services, and how? Who were receive the goods and services?

Microeconomic analysis attempts to answer these questions by studying the behavior of individual economic units. By answering questions about how consumers and producers behave, microeconomics helps us understand the pieces that collectively make up a model of an entire economy. Microeconomic analysis also provides the foundation for examining the role of the government in the economy and the effects of government actions. Microeconomic tools are commonly used to address some of the most important issues in contemporary society (Humphrey, 1992).

The global population currently stands at 7.3 billion, expected to reach 8.5 billion by 2030 and 9.7 billion by 2050 (UN, 2015). Food security is a major challenge under this rapid growth of the human population. As a global population of 9 billion in the coming decades, it is often emphasized by the United Nations and the Food and Agriculture Organization (F

AO) that 70-100 percent more food is needed to feed humanity (Godfrey et al., 2010). The ability of agriculture to support growing population has been a concern for generations. With the rising demand for food all around the world, there have been various interventions and technological advancements from ploughing to harvesting of crops in agriculture. (Evenson & Gollin, 2003) discussed the impacts of green revolution from 1960 to 2000 in developing countries.

Growing out off-season crops in controlled atmosphere inside polythene tunnel is called Tunnel farming. If we talk about tunnel farming it is more than just intervention, we can say it is alternative to conventional agriculture and merges various agricultural interventions in it and provide superior and more efficient farming system. Specialty crop growers are using high tunnels to increase output yields and efficiency, prolong growing seasons and protect crops from extreme weather conditions. The tunnels are unheated, plastic-covered structures under which crops are planted directly into the soil, providing greater protection and control of the environment than open-field production. This study uses experiments at the field level to evaluate the production of tunnels. The results suggest that investment in tunnels can provide higher profits and better protection against adverse crop insurance risks (Belasco et.al 2016). Tunnel Vegetable farming has become important part of agriculture in the surrounding of cities (De Zeeuw, Van Veenhuizen, & Dubbeling, 2011). It has supported the livelihood of farmers through household subsistence farming to commercial scale (Van Veenhuizen & Danso, 2007). Vegetable farming in the surrounding of city areas has been increased due to continuous rural to urban migration (Bryld, 2003) This technique is more productive than traditional agriculture. Muhammad Shaukat, who introduced tunnel farming in 1995 he said this while speaking at a seminar titled “New Trends in Tunnel Farming.” The event was held at Muhammad Nawaz Sharif University of Agriculture (MNSUA). Tunnels may also be called hoop houses, high hoops, high tunnels or poly-tunnels. Tunnels are sometimes confused with greenhouses. The key difference is that tunnels are not heated and provide less climate control and are less expensive.

Extending the growing season by protecting plants from cold temperatures can drastically improve productivity in the early and late season. Tunnels are one way that has been shown to effectively and profitably extend the growing season for warm and cool season vegetables in certain climates (Wells and Loy, 1993). Crops grown out of season command a price premium when sold in direct markets (Foord, 2004). Tunnels look and

operate like greenhouses, but the temperature is maintained only by passive heating and cooling unlike standard greenhouses. The primary advantage of tunnel farming is profitability. Tunnels increase net returns per acre by protecting quality, increasing yields, and providing the opportunity to obtain off season price premiums.

It was found out that farmers using tunnel technology are more efficient as they possess higher technical, allocative and economic efficiencies compare to conventional farmers (Toba Tek Singh 2009).

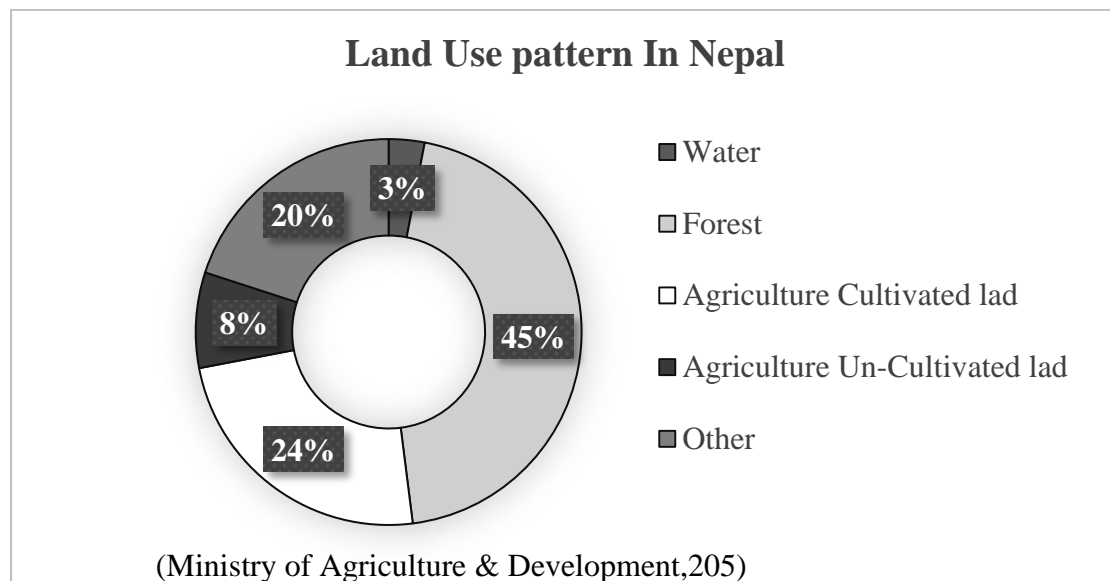


Figure 1: Agriculture Growth rate in last 12 year

Nepal is predominantly an agricultural country it consist one third of its GDP and employs approximately two thirds of the population. However, only about 20% of the total land in Nepal is arable and of which only 40% is irrigated with modern means of technology. The major portion of the arable land i.e. 60% is still rainfall whose productivity is dependent on the monsoonal activities. The variable monsoon, fragile-geology, agriculture-based economy, poorly ' use of modern means of technology and at the same time poor coping capacity have been contributing the poor production and productivity. Agriculture is the most important sector in Nepal's economy in terms of income generation, employment and food security. Rice, wheat and maize account for about 35% of agricultural GDP (AGDP) and other crops contribute 15% livestock 26%, horticulture 18% (.including fruits and vegetables) and fisheries 2% (NARC. 2010) and rest by the forests and other minor products. Rice is the main staple food in Nepal followed by wheat" The periodic approach



of development in Nepal has made a tremendous progress in reducing poverty in the last decade. The share of population below poverty line (with income less than 1\$/day) has dropped down from 42% in 1995/96 and to 16% in 2010/11 (CBS, 2011). However, population living under poverty line could still be estimated as approximately 55% if the basis of the international poverty line (US\$ 1.25/day) is calculated.

Vegetables have a great importance in agriculture sector. These crops share a great contribution to agriculture in national economy. There are many vegetables which can be grown in Nepalese climate and soil. Tunnel farming is a new technology for growing vegetables due to increase in population and small land for agricultural use. Government of Nepal is doing its effort to disseminate this technology among the farmers to enhance their vegetable production.

The vegetable sector has different opportunities and constraints like other agricultural sectors in Nepal even though it is a good source of income (Gurung et al., 2016). Identification of constraints and opportunities in tunnel vegetable farming is very crucial for the growth and development of the vegetable farming. Constraints indicate the hindering issues related to the vegetable farming and suggest the designing and implementation of appropriate interventions that address the constraints (Ruel and Levin, 2002). Vegetable production and marketing have growing contribution to the national GDP by generating employment opportunities and poverty reduction to some extent (Sapkota D and S.Pokhrel, 2010). Commercial vegetable farming has become an important asset of livelihood as it presumably support through food provision, income generation and employment (Bhatta & Doppler, 2010; Asongwe, Yerima, & Tening, 2014). Commercial vegetable farming can be a good method for poverty reduction in Nepal (Gurung et al., 2016)

Historically, agriculture was the main occupation of the people who exist in in Kirtipur (Maharjan, 2014). Recently, people residing in the peripheries of Kirtipur are engaged in commercial vegetable farming as their main source of earning. The numbers of commercial vegetable farming has regularly been increasing due to the proximity to market center and its production potentiality (Rai et al., 2019). Most of the commercial vegetable farmers are leaseholders, who have been migrated from different parts of the country (Rai et al., 2019). Some of the previous studies, including Phulara (2010) and Rai (2017) stated about the vegetable farming in Kirtipur area which showed that the

vegetable farming has positive impact on the livelihood and socio-economic condition of the farmer fulfilling the growing demand of local market and commercial scale. They concluded that farm households can take benefits from the vegetable farming by creating more opportunities and manage the constraints. In this context, this paper seeks to analyze the constraints and opportunities of commercial vegetable farming in Kirtipur.

Agriculture is the main economic activity in Nepal, and vegetable farming is one of the major agricultural practices of peri-urban farmers in Kathmandu Valley. Nepal is a developing country with an agricultural economy. Farming is the main economic activity, where two third of the total population are engaged in agriculture. Agriculture sector accounts 31% of gross domestic product (GDP) in Nepal. A high proportion of households in Nepal depend on agriculture for the generation of livelihood. As an important sector of the economy, vegetable production plays a significant role in determining the economic conditions for farmers (MoAD 2016–17.)

In Nepal, the economy is dominated by agriculture. In the late 1980s, it was the livelihood for more than 90 percent of the population, although only approximately 20 percent of the total land area was cultivable, it accounted for, on average, about 60 percent of the GDP and approximately 75 percent of exports. Since the formulation of the Fifth Five-Year Plan (1975–80), agriculture has been the highest priority because economic growth was dependent on both increasing the productivity of existing crops and diversifying the agricultural base for use as industrial inputs.

According to the World Bank, agriculture is the main source of food, income, and employment for the majority. It provides about 33% of the gross domestic product (GDP).Vegetable is one of the basic forms of livelihood of rural people to generate income. The current vegetable growing area in Nepal is 165,638 ha.The productivity of vegetables has increased from 8 metric tons mt/hectors to 10.85 mt/ha within 10 years. (MOA 2012)

## **1.2 Statement of the Problem**

Agricultural practices are inefficient in developing countries and with the use of such inefficient farming methods it is very hard to keep up with the growing demand of food (Thiam et al., 2001; Bakhsh et al. 2006; Khan & Saeed 2012; Iqbal et al., 2014). Agricultural interventions like plastic tunnel farming is very important to fulfill rising food demands, but before adopting any new technology it is very important to answer

“Whether new farming techniques are better than the old one?. This study is an effort to answer this question with the help of comparative efficiency analysis of conventional and tunnel farmers.

Tunnel vegetable farming is the main occupation of the majority of population in study area. The farmers of the study area rely heavily on vegetable for earning their livelihood. The development of agriculture depends on various aspects such as type of soil, relief, vegetation, climatic conditions, attitudes of different social groups of farmers to agriculture, use of irrigation, hybrid seeds, fertilizer, pesticides and insecticides, use of mechanical tools and implements, as well as proper scientific rotation of crops by which production be enhanced. The impact of these aspects of agriculture varies in different areas of the Kirtipur Municipality.

Much research works have so far not been done to study the different s social group variation in tunnel vegetable farming at a micro-level in the Kirtipur. So, for the adoption of appropriate planning strategies for agricultural development, an indepth study of the nter social group variation in respect of tunnel vegetable farming in the Kirtiprt is highly necessary.

Thus keeping these points in view, the researcher considers it important to undertake an analytical study of the socio-spatial variation of agricultural development in Kirtipur area from the microeconomic point of view.

### **1.3 Objectives**

- To analyze the economic condition of tunnel vegetable farmers.
- To analyze the livelihood status of farmer after involve in tunnel vegetable farming.
- To find out major problem faced by tunnel vegetable farmers.

### **1.4 Significance of the study**

This study is an addition in the restricted literature of efficiency analysis in agriculture of Nepal, as most of the efficiency related studies on agriculture is limited to conventional agriculture. Comparative analysis of tunnel and conventional farming on the basis of their efficiency analysis were help to figure out which farming system is more efficient and beneficial for farmers. Thus encourage farmers to adopt efficient agriculture technology,

may result in increase in the production of fruits and vegetables and also increase farmers' profit margins which would improve overall efficiency of agriculture in Nepal.

### **1.5 Delimitation of the study**

Due to the lack of sufficient time, financial constraints, the rigorous time schedule and researcher capacity the study were be limited in the following points

- This study were conducted in Kirtipur Municipality of Ward No. 5&6.
- The study was delimited to small size therefore the findings cannot be generalized as national indicator
- Only 106 household was selected on the basis of purposive and simple random sampling method.
- Primary data was collected from those farmer households who were directly involved in tunnel vegetable farming, therefore the results may not be generalized for other similar area.
- The study was based in Primary and secondary source of information. Primary data were collected through key informant interview and questionnaire survey method.

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

The study has been organized into five chapters. First chapter deals about the introduction, background of the study, statement of the problem, objectives of the study, significance of the study, limitation of the study and organization of the study. Second chapter is literature review; theoretical review, empirical review, and policy review. Chapter three is research methodology that involves research design, study area choice, nature and origin of information, data collection techniques, data processing, evaluation and presentation to complete the study. Chapter four is a part of the research that is at the core of the study. It included commercial vegetable farmers ' socio-economic backgrounds. Where, including household family size, composition of age & gender, ethnic group, employment, pattern of land holding, etc. Similarly, significant impact of vegetable farming has been identified on the livelihood and tunnel vegetable farming issues. The study is synthesized in chapter five, covering summaries and findings of the work with some effective suggestions for improving the welfare of farmers and future research work.

## **CHAPTER II**

### **REVIEW OF LITERATURE**

#### **2.1 Introduction**

Many studies have been proposed on tunnel farming and agricultural interventions in order to analyze their impact on food security and sustainable agriculture. In this review, focus were on how agricultural interventions specially tunnel farming can increase food production and have tried to answer the question “Whether tunnel farming is more efficient compare to conventional farming or not? With the help of previous studies. The review of literature is a critical evaluation, analysis and synthesis of existing knowledge relevant to our own research problem. It is useful to develop new ideas and analytical methods in research. Through the review of related literature, the researcher gains different kinds of information and experiences from the works of others. To conduct this research some relevant literatures have been reviewed which help researcher to address research issue systematically. For this research study, following relevant studies have been reviewed.

#### **2.2 Theoretical Review**

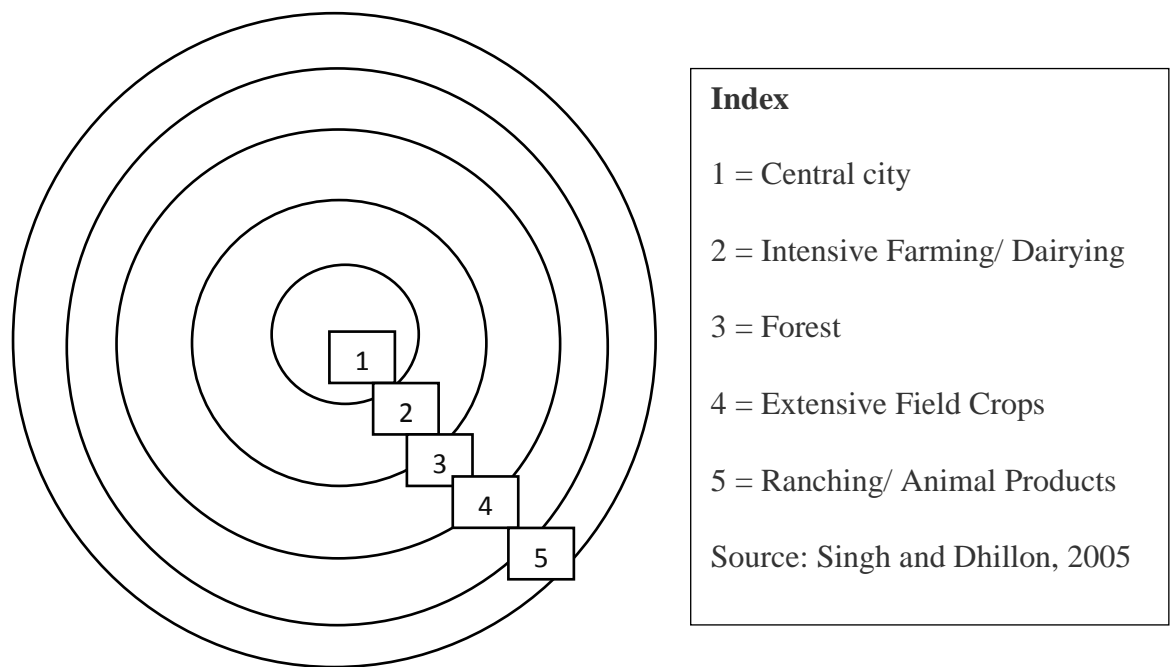
##### **2.1.1 Von Thunen - A Model of Agricultural Land Use**

The Von Thunen model of agricultural land use was created by farmer and amateur economist J.H. Von Thunen (1783-1850) Von Thunen's model was created before industrialization and is based on the following limiting assumptions:

The city is centrally located within a self-sufficient "isolated system" that has no external influences. An unoccupied wilderness surrounds the Isolated System (Hall, 1966). The state's land is completely flat and there are no rivers or mountains to break the ground. Soil quality and climate throughout the state are consistent. Farmers in the Isolated State carry their own goods directly to the central city via oxcart, across the land. Therefore, there are no roads. Farmers act to maximize profits (Chisholm 1962).

Von Thunen hypothesized in an isolated state with the above statements being true that a pattern of rings would develop around the city. The city is surrounded by four rings of agricultural production. Dairy and intensive farming take place in the cities nearest ring. Since vegetables, fruit, milk and other dairy products need to be quickly placed on the market, they would be produced near the city. In the second area, timber and firewood will be created for fuel and construction materials. Wood was a very necessary fuel for heating

and cooking prior to industrialization (and nuclear power). Wood is very heavy and hard to transport, so it's as close as possible to the city (Jasbir Singh and S.S. Dhillon, 2005).



The third area is made up of extensive crops such as bread grains. Because grains last longer than dairy products and are much lighter than oil, they can be located further from the city, reducing transportation costs.

Ranching is situated in the central city's final triangle. Animals can be brought up far away from the city because they are treated by themselves. Animals can go for sale or butcher to the central city.

#### Uses of Von Thunen's Model

- Von Thunen model useful generalizing agriculture patterns
  - Opens up discussion to merits and changes in agriculture
  - Displays connection of city and agricultural patterns
- Displays balance between land costs and transportation costs

Even though the Von Thunen model was created in a time before factories, highways, and even railroads, it is still an important model for the study of land use pattern. The Von Thunen model is an excellent illustration of the balance between land cost and transportation costs. As one gets closer to a city, the price of land increased. The farmers of the Isolated State balance the cost of transportation, land, and profit and produce the most cost-effective product for market (Abler et.al, 1971). Of course, in the real world,

things don't happen as they would in a model. However, this model still works in the sub-urban and peri-urban vegetable growing areas of developing countries like Nepal.

### 2.1.2 Schultz theory of transforming Traditional Agriculture:

Schultz (1964) Explains that most of the factors that influence production i.e. Thrift, attitude to work, industriousness etc. are not affected by the culture traits of a society. These are in-fact economic variable. People do not save for investment simply because the method of production does not give a high return. Again people do not work much because the return to labor is rather low. Accumulation of more capital or use of more labor are thus governed by economic factors and not by the cultural factor. Schultz described that the man who is bound traditional agriculture cannot produce much food no matter how rich land. Thrift and hard work are not enough to overcome the niggardliness of this type of agriculture. Traditional agriculture can transform into a relatively cheap source of economic growth. He tries to show what such transformations entails end what means are required to accomplish it efficiently. Whereas the past practices have to be discarded, on the one hand, new strategies have to be developed, on the other to meet the new situation arising out of risk and uncertainness involved in agriculture transformation (Alston and Pardey 2014). It is therefore not, not only significant to introduce new factors of production and reap richer harvest, but learning from experience, what risk and uncertainness are involve is also there. Schultz asserts that transformation of agriculture predominantly depends upon the availability and price of non-traditional (modern) agricultural inputs. He says that “The supplies of these factors in a very real sense hold key to such growth.” Producing and distributing these factors cheaply makes investment in agriculture profitable and farmer accept these modern inputs and learn how to best to use them. This also stimulates the saving and builds up institution to finance investment in agriculture (T.W. Schultz 1964).

#### **Schultz’s Suggestions for Transforming Traditional Agriculture:**

There are three ways of increasing production. These are as:

- (1) Make use of un-utilized resources
- (2) Optimally reallocate the resources so as to take the production on to the production frontier and
- (3) Change the nature of factors namely replace all or some of the old factor by new ones with higher output-input ratios.

Intentionally or otherwise, Schultz's ruled out the adoption of first two methods meant for increasing agricultural production. For instance, by his very definition of traditional agriculture, he has concluded that there is no factor of production lying unused in traditional agriculture. Land and labor and other capital assets are fully utilized in traditional agriculture (Hayami and Ruttan 1971).

In the same way he has concluded that resources in agriculture are always perfectly allocated. There is no misallocation of resources and therefore there is no possibility to increase production in a traditional agriculture, by further improving the resource allocation Hayami, Y., & Ruttan, V. W. (1970). So Schultz is left with only one way to increase production in a traditional agriculture i.e. by changing the nature of the factors of production. Before we talk about it in detail. It is necessary to discuss the approach to be followed for such adoption in Schultz's scheme of adopting new production factors (Schultz, 1961, p.2).

#### **Market Approach V/S Command Approach:**

According to Schultz, by market approach, no production factor should be imposed on farmers. Farmers should be left free to decide whether or not to use a particular production factor. Let them see the profitability of a given factor for themselves and decide on its adoption.

In other words, the adoption should be guided by market forces. In this case, the government's sole responsibility should be to ensure that the production factor is readily available and there is good publicity about it and that the necessary skills are properly developed for the use of new inputs. By the approach of order, Schultz means a scheme on which the government supplies farmers with a new variable output and which orders them to use it regardless of their profitability (Alston and Pardey, 2014).

Schultz prefers market approach to order approach, he feels that if the farmer willingly adopts a factor of growth, his acceptance will be widespread and enthusiastic. On the other hand forced adoption not only, in many cases, ignores the problems faced by the farmers at the local level, but also at times, spoils the skills and enthusiasm of the farmer, Schultz feels that the situation in a command approach can be compared to an absentee landlordism where the land lord knows nothing about the problems and difficulties of the actual cultivators but insists upon a good harvest (Pardey and Beddow 2013).



## **Process of Transformation:**

In a market approach, the actual use will ultimately be governed by supply and demand for the production factors. So Schultz discusses the factors affecting the supply and demand for such factors in detail. First of all, we can discuss the issues facing the supply of new factors and the suggestion that Schultz is making to overcome these problems (T.W. Schultz 1964).

### **A. Supply of New Factors**

According to Schultz three important steps are involved in the supply of new factors.

**These are:**

#### **1. Research and Development of new factors.**

According to Schultz, science and technology play a very important role in the transformation of traditional farming. Since the art of cultivation has been static for a long time in a traditional agriculture, it may not be possible to develop technologically superior production factors from within the country (Pardey et al. 2016).

So what he suggests is that these factors can be imported from some foreign country in the first instance and then this factor should be subjected to further scientific analysis so that it is finally adapted to the importing country's physical environments. This will be the least expensive way to develop a new production factor. Secondly, the benefits of a successful research are not going to accrue solely to the private person. Other members of the community will also benefit from this research. This may make the private person hesitate to take up the research work. On the other hand, the concept of benefit or profit is totally different for the government (Golan et al. 2002 and Herrendorf et al. 2013). It is rather very broad when compared with that of a private individual. The Govt. feels benefitted if any member of the society benefits from its actions (Alston 2002; Pardey et al. 2006).

#### **2. Distribution of inputs to the cultivators**

Following the development of new inputs and the perfection of technology for their mass production, a question arises: Who should produce and distribute these inputs? This question is answered by Schultz himself. No private person will take the risk of producing and distributing these inputs at the beginning when the new inputs are still untested by the farmers. There is a cost of entry into the market and this may be quite high in the beginning.

### **3. Extension of new knowledge.**

It is not enough for new information to be available. It is also necessary to develop the necessary skills for its use. This can be achieved by means of well-developed extension services. Even when new agricultural practices are to be introduced, extension services are essential (Schultz, 1964, p. 206).

Here again, Schultz believes that the cost of extension services is rather high and the government should therefore provide such services. Thus, overall, Schultz suggests that the Government is concerned with the supply of new inputs. It should take on the task of researching and developing new inputs, producing and distributing them and providing them with extensive education. However, at a later stage the government can offer the task of producing and distributing new inputs to private agencies (Balogh, 1964, p. 996).

#### **2.1.3 The Economics of Agrarian Change under Population Pressure:**

**Ester Boserup** (18 May 1910 – 24 September 1999) was a Danish and French economist. She studied economic and agricultural development, worked at the United Nations as well as other international organizations, Ester Boserup which posits that population change drives the intensity of agricultural production. Her position countered the Malthusian theory that agricultural methods determine population via limits on food supply. Her best-known book on this subject, *The Conditions of Agricultural Growth*, presents a "dynamic analysis embracing all types of primitive agriculture." (Boserup, E. 1965. p 13) A major point of her book is that "necessity is the mother of invention". Boserup argued that when population density is low enough to allow it, land tends to be used intermittently, with heavy reliance on fire to clear fields, and fallowing to restore fertility (often called slash and burn farming). Numerous studies have shown such methods to be favorable in total workload and also efficiency (Ruttan, 1968). In Boserup's theory, it is only when rising population density curtails the use of fallowing (and therefore the use of fire) that fields are moved towards annual cultivation. Contending with insufficiently fallowed and less fertile plots, covered with grass or bushes rather than the forest, mandates expanded efforts at fertilizing, field preparation, weed control, and irrigation. These changes often induce agricultural innovation, but increase marginal labor cost to the farmer as well. The higher the rural population density, the more hours the farmer must work for the same amount of produce. Therefore, workloads tend to rise while efficiency drops. This process of raising production at the cost of more work at lower efficiency is what Boserup describes as "agricultural intensification" (Boserup, 1965).

Ester Boserup's counter-Malthusian theory of growth of primitive agriculture is formalized in a continuous time framework that permits investigation of the long-run properties of such a closed economy. It is discovered that two asymmetric results are possible from any initial conditions (Boserup, 1981, page 3). The theory's implications are further extended to the now classic argument of Karl Polanyi about structural transformation as an economic system that makes the transition from feudalism to capitalism and to the claims of Walter Rodney about the origins of African underdevelopment Ester Boserup focuses on dynamic use of land. These are as follows.

(1) Forest-fallow cultivation. Under this system of land use, plots of land are cleared in the forests each year and sown or planted for a year or two, after which the land is left fallow for a number of years sufficient for the forest to regain the land. This means that the period of fallow must be at least some twenty to twenty-five years. The type of forest which grows up in territories which are regularly used for forest fallow is known as secondary forest, as distinguished from the primary or virgin forest, which was never cultivated or was left uncultivated for a century or more

(2) Bush-fallow cultivation. Under this system the fallow is much shorter, usually somewhere between six and ten years. No true forest can grow up in so short a period, but the land left fallow is gradually covered with bush and sometimes also with small trees. The periods of uninterrupted cultivation under bush-fallow systems varies considerably. It may be as short as one to two years (similar to conditions under forest fallow) and it may be as long as the fallow period, i.e. six to eight years. Many authors do not distinguish between forest and bush fallow systems, but group them together under the label of long-fallow cultivation, or shifting cultivation

(3) Short-fallow cultivation. The fallow lasts one year or a couple of years only. In such a short fallow period, nothing but wild grasses can invade the fallow, before the cultivator returns to the same plot or field. The system could therefore also be described as grass-fallow cultivation, but the term short fallow is to be preferred since under certain conditions land may lay fallow for very long periods without being invaded by anything but wild grasses. It is important, therefore, to distinguish between grass areas used in long-fallow systems and grass areas used in short-fallow rotations,

4) Annual cropping. This is usually not considered a fallow system, but may be classified as such, because the land is left uncultivated, usually for several months, between the

harvest of one crop and the planting of the next. This group is meant to include systems of annual rotation, in which one or more of the successive crops are sown grass or other produced fodder.

(5) Multi-cropping. This is the most intensive system of land use, since the same plot bears two or more successive crops every year. The planting of a new crop must therefore take place shortly after the harvesting of the preceding one and the fallow period is short or even negligible.

Under the pressure of increasing population, there has been a shift in recent decades from more extensive to more intensive systems of land use in virtually every part of the underdeveloped regions. In some parts of the world, cultivators under the forest-fallow system have been unable to find sufficient secondary forest. They have then had to re-cultivate areas not yet bearing fully grown forest. In this way, the forest has receded and been replaced by bush. Again, in regions of bush fallow the cultivators have changed to short-fallow systems or annual cropping and many short-fallow cultivators have changed to systems of annual cropping with or without irrigation. In the densely populated regions of the Far East, the growth of population during this century has caused a rapid spread of multi cropping.

#### **2.1.4 Sustainable livelihood Approach (UNDP)**

The sustainable livelihoods idea was first introduced by the Brundtland Commission on Environment and Development as a way of linking socioeconomic and ecological considerations in a cohesive, policy-relevant structure. The 1992 United Nations Conference on Environment and Development (UNCED) expanded the concept, especially in the context of Agenda 21, and advocated for the achievement of sustainable livelihoods as a broad goal for poverty eradication. It stated that sustainable livelihoods could serve as ‘an integrating factor that allows policies to address ‘development, sustainable resource management, and poverty eradication simultaneously’.

*A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term. Robert Chambers and Gordon Conway, 1992)*

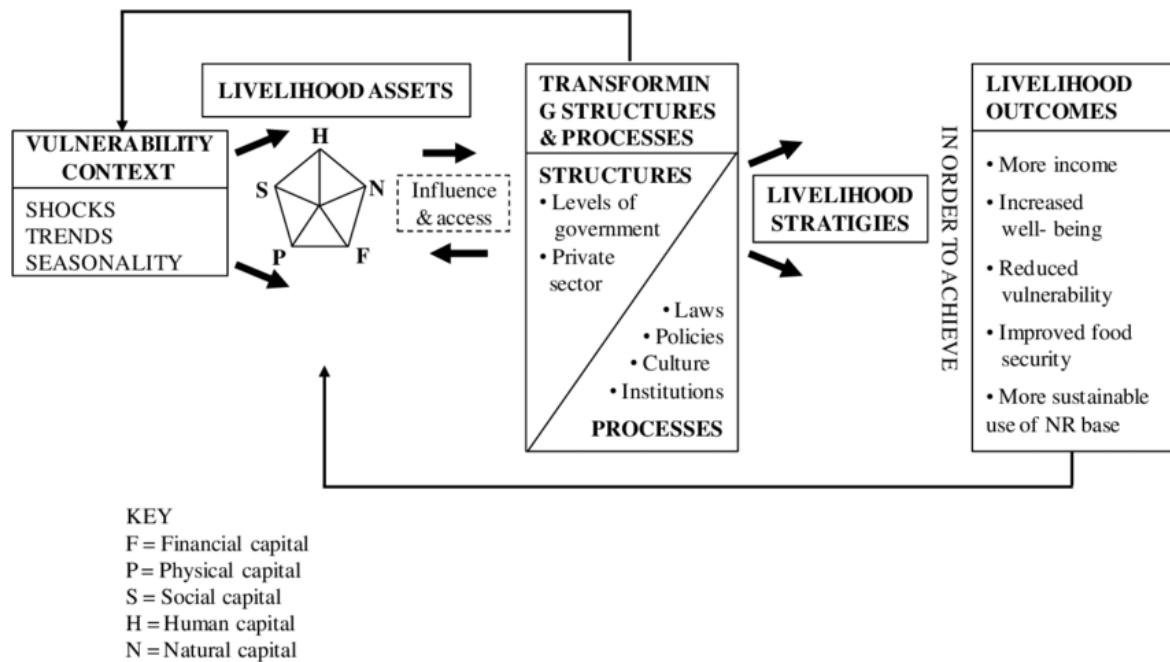


Figure 2: Sustainable livelihood Framework of UNDP

The sustainable livelihoods approach is a way of thinking about the objectives, scope, and priorities for development activities. It is based on evolving thinking about the way the poor and vulnerable live their lives and the importance of policies and institutions. It helps formulate development activities that are.

- People-centered
- Responsive and participatory
- Multilevel
- Conducted in partnership with the public and private sectors.

UNDP the SL approach serves primarily as a programming framework to devise a set of integrated support activities to improve the sustainability of livelihoods among poor and vulnerable groups by strengthening the resilience of their coping and adaptive strategies. Although this is in principle an open-ended process, certain emphasis is given to the introduction of improved technologies as well as social and economic investments. Krantz, L. (2001).

## 2.2 Empirical Review

### 2.2.1 International Context

Hessayan (1985) analyzed that commercial vegetables require adopting of cultivation methods and techniques for season adjustment of planting time. For instance, some summer vegetables can be planted in the hill pocket areas about two months earlier in cold winter season than the normal season of planting, which is possible by raising seedlings under polythene tunnels, where temperature is raised for seed germination of tomato,

brinjal, sweet pepper, beans and cucumber and harvested for consumption during winter season. Greenhouse farming technique is effective to avoid frost, excessive winter cold, and strong wind and raise temperature even during winter season. Plastic tunnel, polythene house and glasshouse are generally used as greenhouse farming techniques for controlling environment. It is reported that plastic film technology enables vegetable crops to mature 5 to 20 days earlier than normal, increases yield by 30 to 50 percent, increases output value by 40 to 50 percent and prolongs harvesting period of vegetables by 40-60 days. It has always positive effect on controlling diseases, insects, weeds, soil moisture etc.

S.A. Muhammad et.al 2015 Vegetables have a great importance in agriculture sector. These crops share a great contribution to agriculture in national economy. In Pakistan among 23.40 million hectare cropped area vegetables conclude 0.41 million hectares to produce 13.67 million tons of fresh produce annually, divided into vegetables 54% and fruits 46%. Pakistan export 150.2 million kg of vegetables and earned \$180.2 million in fiscal year 2011-12.

Sharma 1985 to ensure food and nutritional security for the growing population and to increase farmers' income, there is an urgent need to enhance resource use efficiency, reduce input costs and improve crop yields. According to the International Food Policy Research Institute, the world needs to double food production per unit area/day. This calls for an urgent need to identify potential alternative farming strategies to achieve long-term sustainable food production and food security.

Edward (2009) high tunnels are becoming an increasingly important production tool for vegetable, small fruit, and cut flower growers in many parts of the United States. They provide a protected environment relative to the open field, allowing for earlier or later production of many crops, and they typically improve yield and quality as well as disease and pest management. Producers, ranging from small-scale market gardens to larger scale farms, are using high tunnels of various forms to produce for early markets.

FAO (2013) during the last 20 years countries in the Mediterranean climate area have become increasingly competitive producers of greenhouse vegetables. During this time there has been a revolution in greenhouse production technology in terms of greenhouse design, type and quality of the plastic covering material, fertigation, mulch, use of high-yielding hybrids and cultivars, plant training and pruning techniques, integrated pest management, the use of pollinator insects, climate control, soil solarization etc. Only a few

years ago, a yield of 100 tons per hectare of tomato in a greenhouse was considered a good performance. Today, for growers in Mediterranean climate areas, a harvest of 300 tonnes per hectare is not unusual.

Saghir and Kousar (2015) Vegetables have a great importance in agriculture sector. These crops share a great contribution to agriculture in national economy. There are many vegetables which can be grown in Pakistani climate and soil. Tunnel farming is a new technology for growing vegetables due to increase in population and small land for agricultural use. Government of Punjab is doing its effort to disseminate this technology among the farmers to enhance their vegetable production.

Ghimire and Huang, (2015) Technological advances in agriculture seem to offer an opportunity to rural farmers to increase production and improve their livelihood sustainably. Adopting such technologies have contributed greatly toward the financial success of farmers through the efficient use of resources and scaling up the production at lower per unit cost. However, a majority of farmers in developing countries have not been able to adopt newly developed technologies because of their limited resources (cash, labor, time) and limited access to relevant information regarding the technology.

Mobushir Iqbal 2016 The agricultural sector is one of the largest sectors of Pakistan's economy, having the share of about 23.1% of the Gross Domestic Product (GDP) and provides employment to 45% of the total workforce of the country. More than 70% of Pakistani population directly or indirectly depends on agriculture for their existence. Agriculture sector of the country occupies a prime position in its economy (Govt. of Pak., 2010) by providing different employment opportunities Riasat et al., (2014)

Muhammad Asif 2016 Presently in Pakistan 0.69 million ha area is cultivated with vegetable with an annual production of 8.5 million tones. It is estimated that by 2030, the vegetable demand of the country would be around 25 million tones. To achieve this target, attention must be focused on the vertical expansion, strengthened with the boom of the technology instead of horizontal expansion just by increasing the crop area Government of Punjab has launched Punjab Irrigated Agriculture Productivity Improvement Project (PIPIP), which recommended the deployment of hi-tech drip irrigation system for precision farming to achieve vertical growth in crop production

FAO (2017) Greenhouse crop production is now a growing reality throughout the world with an estimated 405 000 ha of greenhouses spread throughout Europe, of which some 105 000 ha are located in the South Eastern European (SEE) countries. The degree of sophistication and the technologies applied depend on local climatic conditions and the

socio-economic environment. Jaime C Pinero 2018 based on the income criterion by the United States Department of Agriculture (USDA), more than 90% of farms in the United States are classified as small, with a gross cash farm income of \$250,000 or less. Missouri's agriculture similarly encompasses many small farms (USDA-NASS 2014). In terms of farm size, while average farm size in the United States is 442 acres, the average farm size in Missouri is 285 acres and 26% of all farms in the state are less than 50 acres in size (USDA-NASS 2014). Of the total number of Missouri farms (1241) that reported to produce and sell vegetables, melons, potatoes, and sweet potatoes, nearly half produce crops on less than 50 acres.

### **2.2.2 National Context**

NPC (2004) on average, over the 1990s, agricultural exports represented only 3.4% of agricultural gross domestic product, whereas total exports represented 10.31 % of the gross domestic product, an indication of relatively little trade orientation of Nepali agriculture. Similarly, agricultural imports were 7.7% of agricultural gross domestic product in the same period. It also indicates that agricultural exports are less than the imports. Nepal has introduced a policy of liberalization. However, to benefit from the changing policy environment and ensure high level of agricultural growth it needs to create a conducive environment for shifting of incentives to support production of non-traditional crops for export rather than supporting the production of commodities that are mainly for imports substitution.

USAID-NEPAL (2005) Nearly 75 %, 90% and 80 % of the off-season vegetables production was marketed by the producers and the rest consumed at household level in Baglung, Kaski and Palpa districts respectively whereas the farmers in Bharatpokhari, Kaski sold their total produce at Pokhara market, farmers from Hemja pocket sold only 95% of it. In Palpa, nearly half (49%) of the marketed volume was sold at the distant market of Butwal and about one-third (30.75%) was sold at collection center to the collectors, who in turn, supplied both to the domestic and export markets.

Shrestha (2007) evaluated particularly the pocket areas along the roads and surrounding of large cities such as Kathmandu urban region, Pokhara, etc. have got benefits from growing commercial vegetables, where there is high demand due to their hub centre of business, beaurocratic and tourism. Panchkhal (Kabhre), Tistung, Palung and Daman



(Makawanpur), Ranipauwa (Nuwakot), Basantpur, Hile and Sidhuwa (Dhankuta) and many pockets along the east-west highway are important locations where farmers have successfully grown commercial and-seasonal vegetables. In addition, many large Terai center and Indian border cities are also demanding center of seasonal vegetables.

UNDP (2008) contributed that 65% employment of the economically active population. The share of agriculture in GDP is about 38%; more than 80% of the rural population depends heavily on agriculture sector for their employment and about 65% of the total income of rural households comes from agriculture. As more than 80% rural population depending on agriculture and they are mostly fall below poverty line, poverty alleviation without agricultural development is not possible in Nepal. Realizing this fact, the government of Nepal has set a principal development objective of poverty reduction through agricultural development for the Tenth Plan (2002-2007). To achieve the objectives, APP has identified livestock, high value crops, agribusiness and forestry as its priority outputs. Commercialization of agriculture is essential for alleviating poverty in Nepal and it is realized that agriculture can only be commercialized by effective uses of information and communication technologies, giving the farmers a commercial orientation. Shah *et al.* (2004) has described According to the Horticultural Research Center, commercial vegetable system and production technologies for tomato, onion, cucumber, cabbage, cauliflowers etc. have been developed and recommended for farmers.

Joshi (2010) examined Agriculture plays a vital role in evolution of agrarian culture in Nepal from ancient times. It has always been a major sector of economy of the country from ancient time to date. The total area of land available for agricultural activities is estimated as 25, 98,970 ha. This is second biggest type of land use after forest in the country. Gross Domestic Product (GDP) of the nation contributed by the agricultural sector is NRS 1, 83,357 million in FY 2060/61. Agriculture sector was contributing 39% of GDP in 2060/061 reducing from 51.22% in 2042/043. This reduction was because of development of other non-agricultural sector of production of the country.

Pandey (2011) Weather variability comprising of intermittent drought, submergence, flood, intensive, hot and cold waves and irregular pattern of precipitation are considered as major parameters of changing climate having by and large adverse impacts in various aspects of agricultural system, its productivity and food security in different agro-

ecological zones of the country. In the late 1980s, it was the livelihood for more than 90 percent of the population, although only approximately 20 percent of the total land area was cultivable, it accounted for, on average, about 60 percent of the GDP and approximately 75 percent of exports.

FAO (2013) Vegetables are a required source of vitamins, proteins, essential nutrients and carbohydrates for a balanced diet. In the mid-hill region in Nepal, farmers are limited to grow seasonal vegetables and are dependent on marketing mechanism of demand and supply. Growing off-season vegetables and fruits means improving the diet and increasing the household income. In the absence of storage infrastructure and vegetable processing industries, off-season vegetable farming is the only viable option that can add value to the farmers' produce.

Ojha (2014), Agriculture and rural development are intrinsically interrelated elsewhere in the developing countries, especially true for a country like Nepal. It is claimed by the scholar that for Nepal, agriculture is and will remain a major contributor to the sustenance, employment and development of the poor as well as the better off sections of the population for a long time. (Even in Japan, which is now a well-known as an industrialized developed country, the number of people relying on agricultural sector did not reduce during long period between 1870 and 1940. Such number did not decline even until the 1960s, although non decline employment grew substantially by that time. In countries and areas such as Taiwan, Kenya, Thailand, Costarika, Columbia, and Punjab (India). It was the development of agricultural sector that chiefly led to economic growth and overall prosperity among the people.

Sharma (2015) Nepal is a mountainous country with plenty of natural beauties and an Agriculture-based economy with about 75% of the population being dependent upon agriculture. About 70% of the Nepali people are in the rural areas of the country where the main occupation is agriculture. A significant part of the population is dependent upon this sector, which remains a backbone of the country's economy, where as 36 percent GDP is covered by agriculture production. In this situation it cannot be taken for granted that the overall development of the country is possible without the development of this sector.

Adhikari (2015) Agriculture, which consisted of one-third of the global GDP in 2014, is pivotal for economic growth. According to the World Bank, agricultural growth can be

one of the powerful measures to streamline development, end absolute poverty and feed an estimated 10 billion people by 2050. It is four times successful in increasing household income of the poorest compared to other sectors. For LDCs, agriculture is vital for development.

Rai (2017) stated about the vegetable farming in Kirtipur area which showed that the vegetable farming has positive impact on the livelihood and socio-economic condition of the farmer fulfilling the growing demand of local market and commercial scale. They concluded that farm households can take benefits from the vegetable farming by creating more opportunities and manage the constraints. In this context, this paper seeks to analyze the constraints and opportunities of commercial vegetable farming in Kirtipur.

Chaudhary (2018) Nepal had exported paddy before 1975 but it is importing food grains beginning in 1980 (Mishra, 1987). Despite a large contribution of the agricultural sector in national GDP, agriculture growth rate seems to be fluctuating. Since the agriculture-growth is lower with respect to the population increment. The amount produced from agriculture is not satisfactory. The data of CBS 2011 reveals that 60 percent of farmers are unable to produce enough agricultural production in order to sustain their livelihood. Many western hill districts of the country have been facing food-deficit. Food and Agriculture Organization (FAO) has been working to ensure the food and nutrition security of farmers and herders (FAO, 2017). To cope with this, poor rural people mostly used to go to India in search of works in the off-farming season.

DOAL (2018) (Department of Agriculture and Livestock) Agriculture is Nepalese economy's biggest market. This provides 66% of the total population with job opportunities and contributes about 36% of GDP. Therefore, the growth of the agricultural sector is crucial to the national economy's success.

FAO 2018 Nepal is richly endowed with agro-biodiversity. Rice, maize, millet, wheat, barley and buckwheat are the major staple food crops. Similarly, oilseeds, potato, tobacco, sugarcane, jute and cotton are the important cash crops whereas lentil, gram, pigeon pea, blackgram, horsegram and soybean are the important pulse crops. Nepal is also famous for orthodox tea, large cardamom, turmeric and zinger too. Most Nepalese farmers grow diversified crops in order to hedge against erratic and uncertain weather and other unfavorable agronomic conditions.

UNDP (2019) A quick survey carried out by the Value Chain Development of Fruit and Vegetables Project under the Ministry of Agriculture and Livestock Development reveals that almost none of the 33 municipalities selected as having potential for fruit and vegetable production have any strategic plan for agriculture development. Few municipalities have developed their strategic plans, but agriculture sector has gained least attention. Which means the agriculture sector will continue to be left out in budget allocation.

### **2.3 Policy Review**

National Agriculture Policy, 2004 focuses on creating a rural development-led climate. Farmers are divided into two categories—small and large. Those who own less than 4 hectares of land are known as resource-poor farmers and government has managed to provide assistance to improve their productivity. The plan aims to achieve strong and sustainable economic growth by contributing to food security and poverty reduction through the process of commercial agriculture.

CBS (2011) Nepal's government conducts annual agricultural censuses. For the planning of agricultural action plans, agricultural research and policy perspectives, economists, farmers and environmentalists are consulted. Extensive research papers in agriculture have shown that the APP varies from previous plans by concentrating on a small number of priorities in order to produce. Historically, Nepal's agricultural research has harbored a misconception of what constitutes agricultural research. Research has been viewed to include genetic, physical and mechanical sciences in a limited context as they refer to plants and animals.

MOD (2014) The Agriculture Development Strategy (ADS) 2014 has the following vision: “A self-reliant, sustainable, competitive, and inclusive agricultural sector that drives economic growth and contributes to improved livelihoods and food and nutrition security.” In order to achieve its vision the ADS will accelerate agricultural sector growth through four strategic components related to governance, productivity, profitable commercialization, and competitiveness while promoting inclusiveness (both social and geographic), sustainability (both natural resources and economic), development of private sector and cooperative sector, and connectivity to market infrastructure (e.g agricultural roads, collection centers, packing houses, market centers), information infrastructure and

ICT, and power infrastructure (eg rural electrification, renewable and alternative energy sources). The acceleration of inclusive, sustainable, multi-sector, and connectivity-based growth is expected to result in increased food and nutrition security, poverty reduction, agricultural trade competitiveness, higher and more equitable income of rural households, and strengthened farmers' rights.

APP (2014) APP strategy is to accelerate the agricultural growth rate sufficiently to obtain strong multiplier effects on growth and employment, in both the agricultural and non-agricultural sectors. This growth would occur through technological change to be achieved through investment in research and extension. The APP aims for a broad-based participatory growth across regions and income classes and emphasizes sub-sectors particularly important to women.

The following six strategic thrusts are identified as essential to achieve APP objectives:

- A technology-based green revolution in agriculture which becomes the initial engine of accelerated growth;
- Accelerated agricultural growth which creates a demand-pull for the production of high value commodities in agriculture, as well as for non-agricultural commodities, with consequent large multiplier effects on other sectors of the economy;
- Broadly based high employment growth, which then becomes the mechanism for achieving societal objectives;
- Public policy and investment focus on a small number of priorities, building on past investment in human capital and physical and institutional infrastructure;
- A package approach to development, which would be different for the Terai, Hills and Mountains and would recognize the powerful complementation between public and private investment and priorities, and would ensure their co-ordination; and
- A regionally balanced and gender-balanced approach that explicitly ensures the participation of women and therefore achieves broad participation.

ADS (2015-2035) over the 20-year period 2015-2035, one possible scenario is for GDP/capita of Nepal to increase substantially and Nepal move towards middle income

country status. This scenario is consistent with the potential of the country and given an improvement in policies and institutions that will result in accelerated growth. During this movement towards middle income country status, Nepal will go through the process of agricultural transformation, a process whereby the economic structure of a society changes from one based on agriculture to one based on industry and services. Four lessons from the process of agricultural transformation are relevant to the formulation of ADS's vision. The lessons can be summarized as follows.

a) Total Factor Productivity (TFP) growth is the main source of future agricultural growth. TFP requires not only land, labor and capital, but also such things as technology, innovation, efficiency, human resource capacity, and governance. TFP growth contributed between 40% and 70% of agricultural output growth in Asia over the last 50 years 40 .

b) At early stage of development, agricultural growth is the main engine of poverty reduction because most of the poor are in rural areas. Lower inequality enhances the impact of growth on poverty reduction. c) Increasing urbanization presents challenges that traditional food systems are not well prepared for. Integration of smallholder farmers with modern value chains is a feasible response to these urbanization challenges.

d) As the economy moves closer to middle income status, the development of the rural nonfarm sector (including agro-food manufacturing, services, marketing and logistics), becomes increasingly important in closing the gap between rural and urban areas.

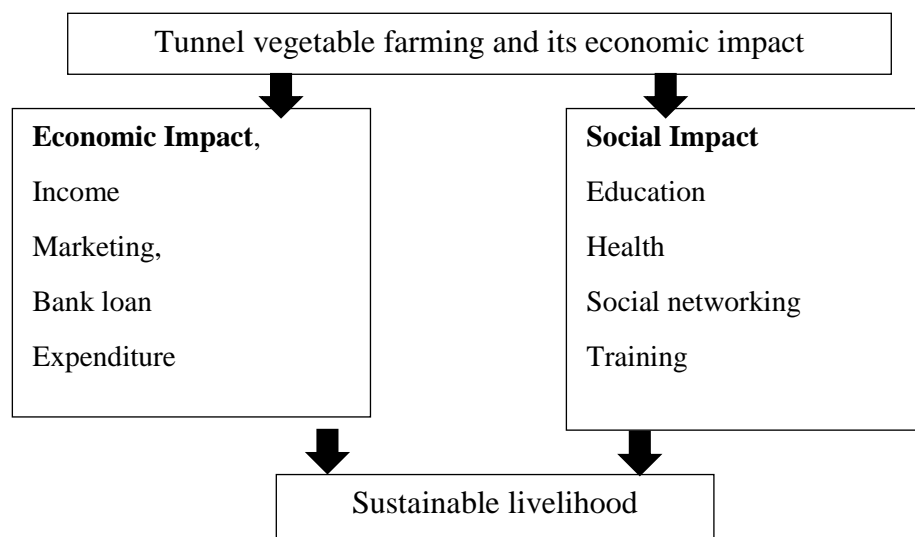
SDGS (2015) Sustainable development goals focus on food security and poverty eradication the goal no.2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture.

14<sup>th</sup> plan focus (PMAMP) "Prime Minister Agriculture Modernization Project" implemented under the Ministry of Agriculture and Livestock Development 2016 for the period of 10 years is in the line of motivation of right to food in the constitution of Nepal and promulgation of the long term strategy of agriculture sector "Agriculture Development Strategy-2015-35,' (ADS) with aiming to commercialize. Sustainable and self-reliant agriculture sector. This project is designed to expand the agricultural sector as the most profitable and commercialized sector through the development of specialized regions for major agriculture commodities by enhancing the competitiveness of agriculture

commodities through value addition chain. It aims in downing the trade deficit, slow growth in agriculture production as a result of labor deficit/labor drain, discouraging the fallowness of potential agriculture land. This project is designed to create employment opportunities for effective service delivery through functional coordination among the multi stakeholders directly and indirectly involved in the agricultural value chain. During first year of implementation, and industrial centers (Super zones) it was implemented in 7 specialized agriculture production in seven districts one from each province, 30 commercial agriculture production and processing centers (Zones) in 30 different districts, 150 commercial agriculture production centers (Block) across the country with 2 blocks in each districts and 2100 small agriculture production centers (Pockets)' across the country. In the current fiscal year (2074-2075) the project is being executed in 39 zones, 10 super-zones, 281 blocks and 3,34g pockets throughout the country. The project targets the number of super zones, zones, blocks and pockets will be 21,300, 1,500 and 10,000 respectively by the end of project.

#### 2.4 Conceptual Framework:

The main focus of study is to analyze Microeconomic analysis of tunnel vegetable farming through involving in tunnel vegetable farming and its impact to them. To fulfill this study is concentrated on the following variables, in short the conceptual framework of this study is as follow.



**Figure 3: Conceptual Framework**

## 2.5 Research Gap

The previous research cannot explain the microeconomic analysis, they only focus on commercial and subsistence farming but this research focus on tunnel farming and its microeconomic impact on livelihood of farmers and the main problem face by farmers, marketing channel, how price policy effect the farmers. Is tunnel farmer were getting training, Fertilizer, seed, farming tool, government subsidy, from governmental/Non-governmental agencies. Similarly, previous study can't explore about livelihood impact, economic condition, family expenditure, and family income of farmer. Likewise previous study can't justify impact of climate change on livelihood, microeconomic impact of tunnel farming. Based on above empirical review this study found following research or knowledge gaps that tried to address by this study.

**Table 1. Literature or Knowledge Gaps:**

<b>Categories</b>	<b>Focus</b>	<b>Gaps</b>
<b>Knowledge</b>	Tunnel farming as a source of income and employment	Sustainable farming practice soil conservation and development
<b>Methodology</b>	Explanatory, and qualitative method	Qualitative and Descriptive, source of data is primary and secondary.
<b>Relationship</b>	Farming, organic farming employment and environment conservation	Tunnel vegetable farming and sustainable livelihood
<b>Analytical</b>	Analysis among Environment conservation and changing technology, Agriculture and Nepalese economy	Tunnel vegetable farming and its impact on local people, sustainable livelihood i.e. income generating from tunnel vegetable farming Vocational training, investment cost and organic farming.
<b>Theoretical</b>	Schultz theory transformation of agriculture, Boserup's Dyanimic use of land and Von Thunen's urban land use model	Organic farming, Tunnel farming impact, social and economic.

(Developed by Researcher, 2020)



## **CHAPTER III: RESEARCH DESIGN AND METHODOLOGY**

This chapter explains the research design of this study which directs that how to proceed this study to achieve the targeted objectives. The methodology of the study was design in such away which includes the data collection, organization, analysis and finally presentation of outcomes. To simplify the analysis process systematical approach has been selected for presenting the study.

### **3.1 Research design**

The information was collected to achieve the objectives; data gathering has been conducted using the structured questionnaire. The study needs the sets of data from both primary and secondary sources. Different techniques including household's surveys were conducted for generating the data. Farm size of the farmers, location of the land holdings and type of farmers was considered the main focused area, as it shows differences during analysis. The location is a major factor influencing the irrigation performance. Farmers at heat region receiving more water on regular basis was privileged comparing to the farmers living at the tail regions means the farmers at the tail end are facing scarcity of water for irrigating their fields.

The descriptive and exploratory type requires quantitative and qualitative data of research were suit better while consider the topic under study. The sets of data and information collected from the primary sources of data, survey research method, and observation of participants were based for this study.

### **3.2 Introduction of the Study Area:**

The study was conducted in ward no.5&6, Kirtipur, Kathmandu, Nepal. The Ward No.5&6 of Kirtipur area is a village in Kathmandu District in the Bagmati Zone of central Nepal and part of Kirtipur Municipality. Kirtipur is situated at 27.67<sup>0</sup> North latitude and 85.28<sup>0</sup> East longitude and 1342 meters elevation above the sea level. It is a small city in Nepal. The climate of the area is mild and generally warm and temperate. In winter, there is much less rainfall and is dry. The average annual temperature in Kirtipur is 17.7<sup>0</sup>C. In the year, the average rainfall is 1479mm. Precipitation is the lowest in November, with an average of 7mm. With an average of 378mm, the most Precipitation falls in July.

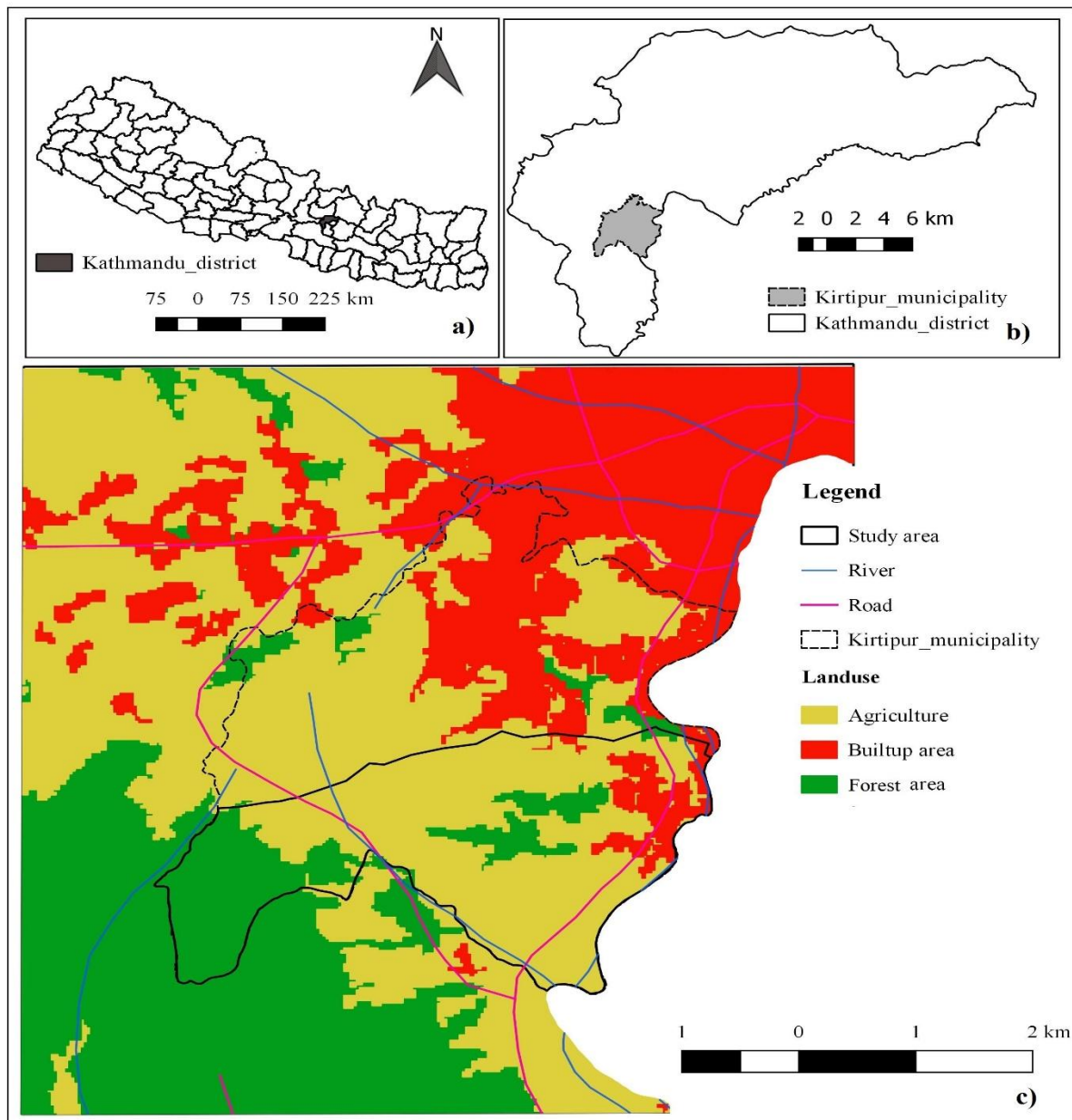


Figure 4: Map a) Nepal showing Kathmandu district, b) Kathmandu district showing Kirtipur municipalities, c) Landuse map of study area with Kirtipur municipalities.

### 3.3 Nature and sources of Data:

This research is descriptive and exploratory in nature. The research was based on primary source of information collected from the field. The secondary source of data also used in this report from DADO, RPPL and PPD publication, books, internets sources, journals, publications of related Ministry and organizations was also consulted. Besides this, own field observations, formal and informal discussion with community people.

### **3.3.1 Primary Data:**

Primary source of information was collected by interviewing with the selected participants, using structured questionnaire. Before starting the field works, the questionnaire was pre-tested to reduce the errors and verify the set questions in regards to the research objectives and issues of the research. The field observation information from the formal and informal discussion with facilitator, extension worker and community leader is another source of primary data.

### **3.3.2 Secondary Data:**

The secondary information was collected from the books, publications of Plant Protection Directorate and District Agriculture Development Office, Publications of different NGOs, related leaflets, magazines and grey documents of farmers' groups have been used. The literature available in the internet is another source of secondary data and other some relevant materials regarding Nepal.

## **3.4 Data Collection tools and techniques:**

Following techniques and tool were applied to collect data from the field.

### **3.4.1 Household Survey:**

The household survey has been conducted in order to collect qualitative and quantitative facts about socio-economic status of people living in the study area, income situation and the contribution of tunnel vegetable farming in upliftment. For that the researcher used household survey form as the tool.

### **3.4.2 Observation**

Certain information has been collected through observation method. Photographs of the area were taken to be important observed information was noted for study. Researcher observe vegetable farming activities such as, collection, selling goods, house pattern etc. and guess the situation of economic status. The researcher used observation checklist as the tool to observe vegetable farming in the study area.

### **3.4.3 Key informant interviews:**

Key informant interviews are qualitative in-depth interviews with people who know what is going on in the community. The purpose of key informant interviews is to collect information from a wide range of people including community leaders, professionals, or

residents who have first-hand knowledge about the community. These community experts, with their particular knowledge and understanding, can provide insight on the nature of problems and give recommendations for solutions.

Name	Designation	Date	Age
K.P Bhatta	Farmer	16 Nov 2019	46
G.M Maharjan	Farmer	16 Nov 2019	50
G.S Khatri	Farmer	16 Nov 2019	35
B Tamang	Farmer	16 Nov 2019	41
S Maharjan	Farmer	16 Nov 2019	38

**Filed Study, 2019**

### 3.5 Sampling Procedure:

The universe of the study is the people of Kirtipur Municipality Ward no 5&6 of Kathmandu district. The size of the Universe is the 144 households. For collecting the reliable data the random sampling method is applied. The households from different wards of Kirtipur municipality was selected randomly in order to conduct household survey. The respondents were selected from those who have been settled there for a long period and whose primary occupation is vegetable farming. Altogether 106 respondents from different households related randomly were taken be as sample size of the study.

#### 3.5.2 Population, Sample size

##### Sampling and Population

In the Kirtipur Municipality Ward No. 5& 6 there are 144 tunnel vegetable farmers, these are Universe of my study among them 106 are sample population( See in Appendix E) will be selected as a sample number that is generated with 95% confidence level 5% marginal error by using sample size determination formula (Krejcie & Morgan, 1970).

$$\text{Sample size (n)} = \frac{\chi^2 * N * (1-P)^2}{ME^2(N-1) + (\chi^2 * P * (1-P))}$$

Where,

n = required sample size

$\chi^2$  = Chi square for the specified confidence level at 1 degree of freedom (Value\* 3.841 for 5% confidence level with 1 degree of freedom)

N = Population size

ME = Desired Marginal error (expressed as a proportion)

P = Probability of success (0.5 value for unknown population)

Q= (1-P, i.e. 0.5 value for unknown population.

### **3.6 Data Analysis and tools used:**

The collected first-hand information is the main source of analysis of this research. Data analysis is a process of gathering, modelling, and transforming data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making. Data analysis has multiple facets and approaches, encompassing diverse techniques under a variety of names, in different business, science, and social science domains. The collected primary data was compiled in a systematic way into a master sheet and data was tabulated. The data was arranged and classified based on the related information and separated based on their nature. Both quantitative and qualitative approach of data analysis method have been applied and presented in the report. In some parts of the analysis, simple statistical tools like excel, SPSS, have been used as the frequency of the response was considered and presented in simple percentage, average, graphs, figures and comparative tables and the qualitative information is presented in descriptive way and analysis was interpreted into the findings.

## CHAPTER IV

### DATA ANALYSIS AND PRESENTATION

The data were processed by editing, classifying and tabulating. In this research descriptive as well as analytical methods were used to analyze the data and information. The simple statistical tools and techniques were used to present the information and data. Necessary tables, chart, diagrams were used whenever appropriate in the presentation of data. This chapter is focused on objectives of the study and divided on different sub topics. In this chapter researcher has tried to present the Socioeconomic aspect of vegetable farmer like age and sex composition, family size, income and expenditure, educational status, health status etc. Moreover livelihood aspect of the farmer has included in different topics. Generally major finding of the study has presented at the end of the chapter in bullets. Quantitative analysis is much more frequently pursued than qualitative.

#### 4.1 Socio-economic Condition of Vegetable Farmers

Socio-economic aspect is related with capability and awareness of the people of any area. In other word it is software part o the development which we can feel not to touch and see. Major social condition in this section includes age and sex composition, family size and household population, marital status; religion of respondents, caste/ethnic status, level of education, occupation etc., of the study area has given below:

##### 4.1.1 Respondents Permanent address

It explains respondent's origination where from they come to do the tunnel farming. In study area there are the farmer come from different origination the given table explains this.

**Table 1. Respondents Permanent address**

	Address	Frequency	Percent	Valid Percent	Cumulative Percent
	Province 1	6	5.5	5.7	5.7
	province 3	42	38.5	39.6	45.3
	Province 4	16	14.7	15.1	60.4
Valid	Province 5	15	13.8	14.2	74.5
	Province 6	14	12.8	13.2	87.7
	Province.7	13	11.9	12.3	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that the highest 39.6% respondents are from different district of province 3, lowest 5.7% from province 2, 15.1% from province 4, 14.2% from province 5 and 12.3% from province 7, 5.7% from province 1 and 13.2% from province 6.

#### 4.1.2 Age group of the Respondents:

Age determines the participation of the people in any work and so does in farming. The respondents were found as different age group. The age structure of respondents presented given below.

**Table 2:Age group of the respondents**

Age	Frequency	Percent	Valid Percent	Cumulative Percent
20-30	26	23.9	24.5	24.5
30-40	45	41.3	42.5	67.0
Valid 40-50	18	16.5	17.0	84.0
50-60	17	15.6	16.0	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table explains age group of respondents the highest 42.5% respondents belong to age group 30-40, lowest 16.0% respondents belongs to age group 50-60 and 17.0% respondents from age group 40-50 and 24.5 % respondents from age group 20-30.

#### 4.1.3 Respondents caste group

Caste group is a social phenomenon which distinguishes one person from one another on the basis of caste based variable. Different castes of respondents are involved in tunnel farming in the study area. The caste structure of the respondents on study area can be presented given below.

**Table 3. Respondents Caste group**

Caste	Frequency	Percent	Valid Percent	Cumulative Percent
Brahamin	27	24.8	25.5	25.5
Chhetri	47	43.1	44.3	69.8
Valid Janjati	28	25.7	26.4	96.2
Dalits	3	2.8	2.8	99.1
Madhesi	1	.9	.9	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows respondents caste group the highest 44.3% respondents was Chettri, lowest 2.8% respondents was Dalit, 25.5% respondents was Brahamin and 26.44% respondent was Janjati.

#### 4.1.4 Respondents sex group

Sex is a biological variable. Sex determines the certain characteristics of the people as men and women. In the cases of tunnel vegetable farming we can see the involvement of male and female in percent the sex composition of study area can be presented below.

**Table 4. Sex group of the respondents**

	Sex	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	71	65.1	67.0	67.0
	Female	35	32.1	33.0	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about involvement of sex group in tunnel farming the data shows that 67% Male and 33% female are involve in tunnel farming.

#### 4.1.5 Respondents Marital status

Marital status presents whether a person is single or married. It is also a variable that determines socio- economic structure of the respondents marital status of the respondents is given in the table below.

**Table 5. Respondents marital status**

	Status	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Married	97	89.0	91.5	91.5
	Unmarried	9	8.3	8.5	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that respondents marital status the highest 91.5% married respondents was involve in tunnel vegetable farming mainly from house hold level both male and female equally works in farming and lowest 8.5% unmarried respondents was involved in tunnel farming.

#### 4.1.6 Respondents Religion group

Religion is a social-cultural system of designated behaviors and practices, morals, worldviews, texts, sanctified places, prophecies, ethics, or organizations that relates



humanity to supernatural, transcendental, or spiritual elements. The survey from study area collect the following information about respondent's religion group.

**Table 6 Respondents Religion group**

Religion	Frequency	Percent	Valid Percent	Cumulative Percent
Hindu	93	87.7	87.7	87.7
Buddhist	10	9.4	9.4	97.2
Kirat	3	2.8	2.8	100.0
Total	106	100.0	100.0	

*(Field Survey, 2019)*

The above table shows that respondents religion group the 87.7% hindu farmer respondents was involved in tunnel farming was Buddhist. Lowest 2.8% respondents was Kirat and 9.4% respondents

#### **4.1.7: Respondents educational level**

Education plays key role to the developmental aspect of human life including farming. Educated people do better in agriculture than the uneducated. The educational status of selected respondents can be presented below.

**Table 7. Respondents educational level**

Level	Frequency	Percent	Valid Percent	Cumulative Percent
Primary	21	19.3	19.8	19.8
Lower secondary	15	13.8	14.2	34.0
Secondary	17	15.6	16.0	50.0
Higher education	31	28.4	29.2	79.2
Illiterate	22	20.2	20.8	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows that respondents educational level the heights 29.2% higher educated respondents was involved in tunnel farming, lowest 14.2% lower secondary level respondents, 16% respondents secondary level education and 20.8% Illiterate respondents was involved in tunnel vegetable farming.

#### 4.1.8: Respondents Subject specification

Subject specification is key in any occupation, the agriculture related subject ultimately help the farmer for better production and productivity of farming. The given table explains higher educational subject specification of respondents.

Table 8. **Respondents Subject specification**

Subject	Frequency	Percent	Valid Percent	Cumulative Percent
Management	5	4.6	14.3	14.3
Education	15	13.8	42.9	57.1
Arts	9	8.3	25.7	82.9
Valid Science	2	1.8	5.7	88.6
Health	2	1.8	5.7	94.3
Agriculture	2	1.8	5.7	100.0
Total	35	32.1	100.0	
Missing System	74	67.9		
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows that subject specification of respondents the 42.9% respondents study Education in their higher education, 5.7% studied science, 5.7% studied Agriculture, 5.7% Health and 14.3% respondents studied management and 25.7% respondents studied arts.

#### 4.1.9: family size of respondents

Family size refers to the number of family members in a family. It also determines socio-economic life of people. The survey of family size in the selected respondents in the study area is presented below.

Table 9. **family size of respondents**

Family Size	Frequency	Percent	Valid Percent	Cumulative Percent
1-3	24	21.8	22.6	22.6
Valid 4-8	72	65.5	67.9	90.6
9-12	10	9.1	9.4	100.0
Total	106	96.4	100.0	
Missing System	4	3.6		
Total	110	100.0		

*(Field Survey, 2019)*

The above table shows that family size of the respondents the heights 67.9% respondent have family size 4-8 member in family and lowest 9.4% respondents have 9-12 family member and 22.6% respondents have 1-3 family member.

#### 4.1.10: Respondents Number Scholl going children

School going children refers to the number of child goes school from respondent's household level. The survey of number of child goes from study area in respondents household level is presented below.

**Table 10. Respondents Number Scholl going children**

	Number	Frequency	Percent	Valid Percent	Cumulative Percent
	1	32	29.4	30.2	30.2
	2	52	47.7	49.1	79.2
Valid	3	7	6.4	6.6	85.8
	Not	15	13.8	14.2	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about school going children, the highest 49.1% respondents family have 2 school going children, lowest 6.6% respondents have 3 school going children and 30.1% respondents have 1 school going children.

#### 4.1.11: Types of School goes students

It says in which school students goes either government/Community, Private, or foreign study. The survey from study area found the following information shows in table.

**Table11.Types of School**

Type		Frequency	Percent	Valid Percent	Cumulative Percent
	Public	24	22.0	26.1	26.1
Valid	Private	57	52.3	62.0	88.0
	Foreign Study	11	10.1	12.0	100.0
	Total	92	84.4	100.0	
Missing	System	17	15.6		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about types of school going respondent child the highest 62.0% respondent's child goes in private school, lowest respondent's child study in foreign study, and the 26.1% respondent's child goes in public school.

#### 4.1.12 Involve Family member in farming.

It refers to the number of family member involved in tunnel farming. The survey from study area find the given information shows in table.

**Table 12. Involve Family member in farming.**

	Frequency	Percent	Valid Percent	Cumulative Percent
	2	66	60.6	62.3
	3	38	34.9	98.1
Valid	4	1	.9	99.1
	5	1	.9	100.0
	Total	106	97.2	100.0
Missing	System	3	2.8	
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows that information about the respondent's family member in tunnel vegetable farming the highest 62.3% respondents says their 2 family member involve in tunnel farming, lowest 0.9% respondents says 4 member from their family involve, 35.8% respondents says 3 member of their family involve in tunnel vegetable farming.

#### 4.2: Practice of tunnel vegetable Farming in the study Area

##### 4.2.1: Leasehold land by farmer:

The study area Kirtipur Municipality Ward No. 5& 6 of Kathmandu has a good practice of tunnel vegetable farming. In this area the residents of other district come to farming in leasehold land. It shows that most of the respondents taking >5 Ropani land. The given table shows that leasehold land status of farmer.

**Table 13. Leasehold land by farmer**

	Ropani	Frequency	Percent	Valid Percent	Cumulative Percent
	< 5 Ropani	45	41.3	42.5	42.5
	5-10 Ropani	26	23.9	24.5	67.0
	10-15Ropani	21	19.3	19.8	86.8
Valid	15-20 Ropani	7	6.4	6.6	93.4
	20-25 Ropani	4	3.7	3.8	97.2
	Own land	3	2.8	2.8	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about respondents lease land the highest 42.2% respondents have <5 Ropani,, and lowest 2.8% respondents have their own land, 24.5%

respondents taking 5-10 ropani lease land, 19.8% respondents taking 10-15 Ropani lease land, 6.6% respondents take 15-20 ropani lease land and 3.8% respondents take 20-25 Ropani lease land.

#### 4.2.2: Annual Rent of leasehold land

The annual rent of the lease land pay by farmer to the land hold man the given table shows that the annual rent of land in study area. The land is measured in Ropani.

**Table 14. Annual Rent of leasehold land**

	Rent in RS	Frequency	Percent	Valid Percent	Cumulative Percent
	< 50000	16	14.7	15.1	15.1
	50000-100000	57	52.3	53.8	68.9
Valid	>100000	30	27.5	28.3	97.2
	No Rent	3	2.8	2.8	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that annual rent of lease land the highest 53.8% respondents pay 50000-1000000 per year, and lowest 2.8% respondents have their own land so they are not paying rent of land, 28.3% respondents pay >100000 annual rent and 15.1% respondents are paying <50000 annually.

#### 4.2.3 Initial investment by respondents

It states the initial investment of respondents during tunnel farming. The survey from study area find the information of tunnel respondents how much money they invest the initial step. The following table explains it.

**Table 15. Initial investment by respondents.**

	Investment in RS	Frequency	Percent	Valid Percent	Cumulative Percent
	< 100000	5	4.6	4.7	4.7
	100000-400000	56	51.4	52.8	57.5
	400000-800000	28	25.7	26.4	84.0
Valid	800000-1200000	10	9.2	9.4	93.4
	120000-1600000	4	3.7	3.8	97.2
	> 1600000	3	2.8	2.8	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about initial investment of farmer in tunnel vegetable farming the highest 52.8% respondents invest 100000-400000, lowest 2.8% respondents invest >1600000, 26.4% respondents invest 400000-800000, 4.7% respondents invest <00000 and 9.4% respondents invest 800000-1200000Rs in initial stage in tunnel vegetable farming.

#### 4.2.4 Respondents Source of investment:

The respondents of study area borrowed money from different sources the given table shows the major source of investment of respondents of study area.

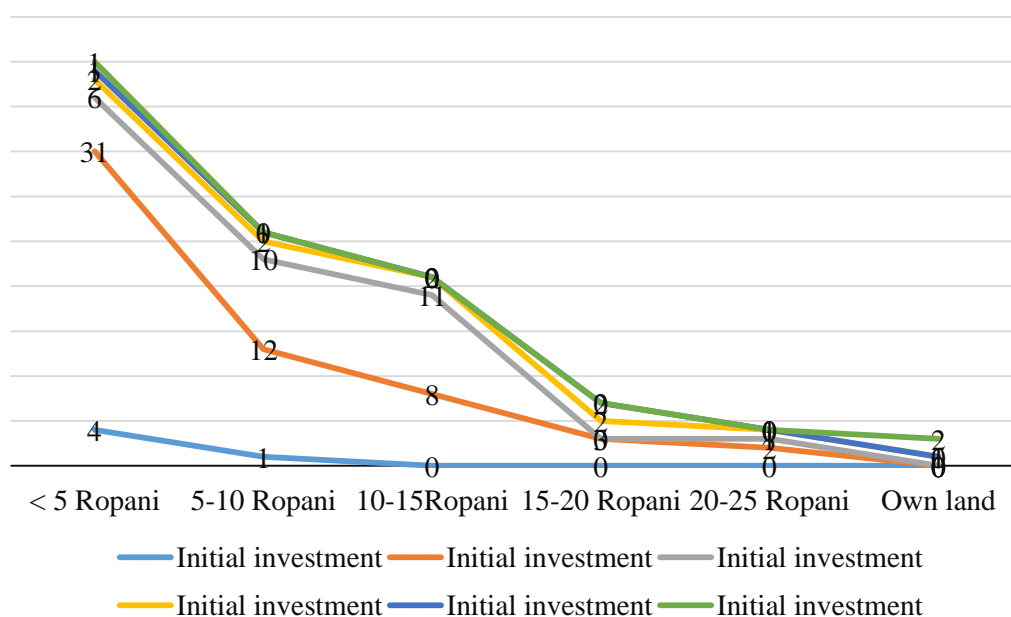
**Table 16. Source of investment**

Sources		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Personal Saving	60	55.0	56.6	56.6
	Borrowed From Relatives	20	18.3	18.9	75.5
	Cooperative loan	20	18.3	18.9	94.3
	Bank loan	6	5.5	5.7	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about source of investment of respondents the highest 56.6% respondents invest from their personal saving, lowest 5.7% respondents invest from Bank loan, 18.9% respondents have invest from cooperative and 18.9% respondents have invest burrowing from relatives.

Figure 5: *Relationship between leasehold land and initial investment*



The above figure shows relationship between leasehold land and their initial investment the respondent who take 5-10 Ropani lease land they invest according to their occupation minimum 1 lakh to maximum 16 lakh. According to one of my respondents (*G.M Maharjan, Saturday 16 Nov 2019[KII]*)".I start tunnel farming with small scale investment after few year I gradually increase invest in integrated farming".

#### 4.2.5: Respondents Participated in Capacity Building Training.

Training is important factor for doing any work. Training enhance farmer's knowledge and skill, the survey from study area find status of farmers training how many farmer get training.

**Table 18. Respondents Participated in Capacity Building Training.**

Response	Frequency	Percent	Valid Percent	Cumulative Percent
yes	40	36.7	37.7	37.7
No yet	49	45.0	46.2	84.0
On plan	17	15.6	16.0	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows that Respondents Participated In training, the highest farmer of this area is not involved any training, lowest 37.7% respondents involve in agriculture related different training and 16% respondents are planning to involved in training.

#### 4.2.6: Respondents involve in Types of Training

Training refers to farming specification of the respondents. Training helps to modify their farming practice. The survey from study area find the following data about respondents training types.

**Table 19. Respondents involve in Types of Training**

	Training	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	vegetable Farming	41	37.6	38.7	38.7
	Integrated farming	4	3.7	3.8	42.5
	Mushroom farming	6	5.5	5.7	48.1
	Floriculture	1	.9	.9	49.1
	Not involved in training	54	49.5	50.9	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
	Total	109	100.0		

*(Field Survey, 2019)*

The above table gives the information about respondents training type the highest 50.9% respondents have not involve in any training, the 38.6% respondents are involve in tunnel vegetable farming, 0.9% respondents are involve in floriculture, 5.7% involve in Mushroom farming and 3.8% respondents involve in integrated farming.

#### 4.2.7: Respondents Farming Specification

Farming specification refers to the major area of farming in which is respondents doing. The survey from study area find the following information about respondent's major farming that is presented given below.

**Table 20. Farming Specification**

	Specification	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Cabbage	8	7.3	7.5	7.5
	Cauliflower				
	Tomato	70	64.2	66.0	73.6
	Mushroom	16	14.7	15.1	88.7
	Floriculture	5	4.6	4.7	93.4
	Integrated farming	7	6.4	6.6	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
	Total	109	100.0		

*(Field Survey, 2019)*



The above table gives the information about farmer's farmer specification the highest 66.0% respondents have involved in tomato farming, lowest 4.7% respondents involve in floriculture, 6.6% respondents in integrated farming 15.1% respondents in Mushroom farming, and 7.5% respondents engaged in cabbage and cauliflower farming.

#### 4.2.8 Respondents Social status after farming

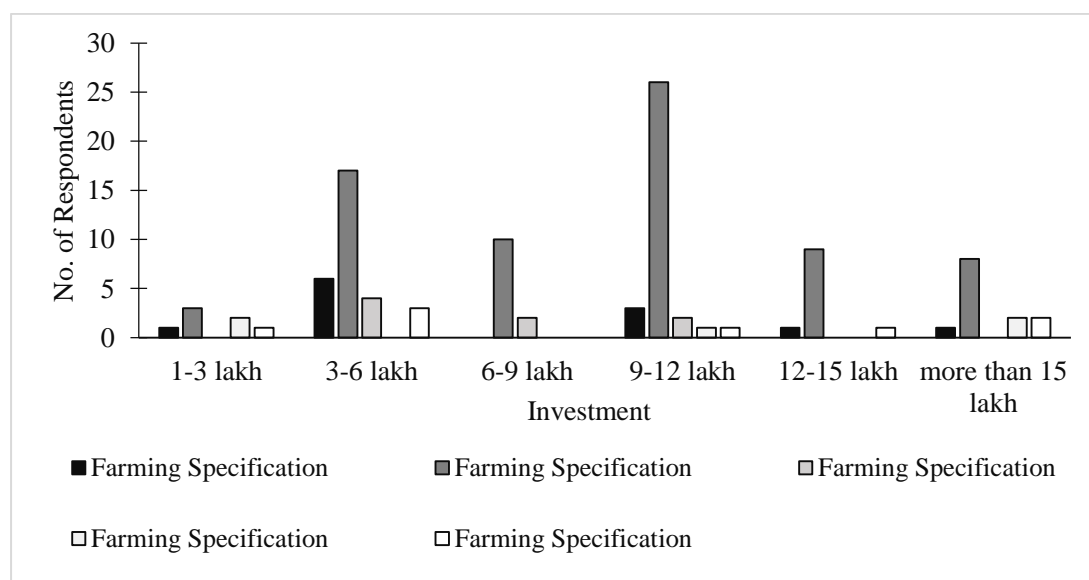
**Table 21. Social status after farming**

Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	68	62.4	64.2
	agree	21	19.3	84.0
	Neutral	5	4.6	88.7
	Disagree	12	11.0	100.0
	Total	106	97.2	100.0
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows that social status of respondents after tunnel farmer the highest 64.2% respondents strongly agree, after tunnel vegetable farming their social relationship increase, 19.8% respondents agree and 11.3% respondents are disagree.

**Figure 6: Relationship between Farming specification and initial investment.**



From this graph it would be conclude that the majority of respondents involve in tunnel farming with high (9-12 lakh) initial investment and minimum respondents invest in integrated farming. Majority of local farmer are involved in crop cultivation and other

farmer who comes from outside of valley they involved in vegetable farming that's why the numbers of vegetable farmer is less.

#### 4.2.9 Categories of profession of respondents

A profession is an occupation founded upon specialized manner he purpose of which is to supply disinterested objective counsel and service to others, for a direct and definite compensation. The survey from the study area find the following occupational status of respondents.

**Table 22. Categories of profession of respondents**

	Categories	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Small Farmer	19	17.4	17.9	17.9
	Commercial Farmer	85	78.0	80.2	98.1
	Role Model Farmer	1	.9	.9	99.1
	Leader of the farmer	1	.9	.9	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that the categories of respondent's profession there is 80.2% respondents are commercial farmer, 17.4% respondents are small farmer, 0.9% respondents are role model farmer and 0.9% are leader of the farmer.

**Table 23. Relationship of respondents with local farmer**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	85	78.0	80.2	80.2
	Agree	21	19.3	19.8	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that the perception of respondents perceptions on relationship with local farmer the highest 80.2% respondents are strongly agree their relation is good with

local farmers, and 19.8% respondents are agree they says their relation with local farmer is good.

**Table 23. Trend of commercial farming Increasing**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	80	73.4	75.5	75.5
	Agree	26	23.9	24.5	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that the information about trend of commercial farming the highest 75.5% respondents strongly agree the trend of tunnel vegetable farming increasing and 24.5% respondents agree.

#### **4.2.10. Respondents compost Prepare status**

Compost fertilize is the most important input in the farming it help to increase the production and productivity. It is organic in nature and not harmed for human health like chemical fertilizer. The survey from the study area find the following information about compost prepare and using respondents.

**Table 24. Respondents compost Prepare status**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	94	86.2	88.7	88.7
	No yet	10	9.2	9.4	98.1
	On plan	2	1.8	1.9	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that farmer's compost manual preparing status the highest 88.7% respondents says they prepare compost manual, lowest 1.9% respondents says they are on plan for preparing compost manual, and the 9.4% respondents says they are not prepare compost manual.

*"The farmer of this area involve in integrated farming many farmer also associated with Cow, Goat, Buffalo and chicken. The manure of this domestic animal is*

used as compost manure in tunnel farming. The majority of farmer used compost manure as vegetable fertilizer" (K.P Bhatta, Saturday 16 Nov 2019[KII]).

#### 4.2.11. Respondents Use pesticide

It is the most important factor for the production. Pesticide increase the crop production by kill the harmful pest of the crop. Most of the professional farmers are very much knowledgeable in the matter of vegetable production.

**Table 25. Respondents Use pesticide**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
	yes	96	88.1	90.6	90.6
Valid	No	10	9.2	9.4	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows respondents pesticide use status the highest 90.6% respondent's says they use pesticide and 9.4% respondents says they do not use pesticide.

#### 4.3: Contribution of vegetable farming in economy Generation:

Nepalese economy is based on agriculture 38% GDP is occupied by agriculture (CBS 2011). Among them vegetables covers 12% in GDP including Cash crops. Vegetable farming has contributed in a great extent for income generation of the farmers. The information about it is discussed in a given ways.

**Table 26. Respondents by monthly saving**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	79	72.5	74.5	74.5
Valid	No	27	24.8	25.5	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that respondent's monthly saving status the highest 74.5% respondents saving monthly and 25.5% respondents does not save monthly.

#### 4.3.1. Average monthly income of the respondents.

The income structure of the respondents is different due to various aspects. The general monthly income of the respondents is present in the given below.

**Table 27. Average monthly income of the respondents.**

Income	Frequency	Percent	Valid Percent	Cumulative Percent
<20000	29	26.6	27.4	27.4
20000-40000	48	44.0	45.3	72.6
40000-60000	19	17.4	17.9	90.6
>60000	10	9.2	9.4	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table gives the information about monthly income of the respondents the highest 45.3% respondents earn 20000-40000Rs monthly, the lowest 9.4% respondents earn >60000Rs monthly, 17.9% respondents earn 40000-60000Rs monthly and 27.4% respondents earn <20000 Rs monthly.

*"I am local farmer my permanent address is Kirtipur I involved in tunnel vegetable farming 14 year ago. I register my farm, I have only 2 Ropani land so I take other 7 Ropani land in rent. I Invest 1000000Rs in starting, in this time here 5-7 tunnel farmer, now days the number is increase. The market demand of vegetable in Kirtipur is good. I earn 25-30 lakh annually it is main source of my family income. From vegetable farming I give good education to my child. So I think vegetable farming is good scope in the city area because now days youth farmer are also involved in commercial farming" (G.M Maharjan Saturday 16 Nov 2019[KII]).*

#### 4.3.2 Annual Income of the respondents.

The farmer involved in tunnel vegetable farming owns several amount of money from their farm. The annual income of the respondents only from vegetable is reflected in the given table.

**Table 28. Annual Income of the respondents**

Income	Frequency	Percent	Valid Percent	Cumulative Percent
100000-300000	7	6.4	6.6	6.6
300000-600000	30	27.5	28.3	34.9
600000-900000	12	11.0	11.3	46.2
900000-1200000	33	30.3	31.1	77.4
1200000-1500000	11	10.1	10.4	87.7
>1500000	13	11.9	12.3	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table gives the information about annual income of the respondents the highest 31.1% respondents earning 9-12 lakh annually, and lowest 6.6% respondents earning 1-3 lakh annually, the 12.3% respondents earning more than 15 lakh annually, 28.3% respondents earning 3-6 lakh annually, and 10.4% respondents earning 12-15 lakh annually.

*"Kirtipur area is famous for tunnel vegetable farming but the government focus is less local government also do not focusing us, farmer are also suffer from price policy, last year 2 farmer leave farming because profit is less but input more" (G.S Khatari Saturday 16 Nov 2019[KII]).*

#### **4.3.3 Annual expenditure of the respondents.**

The expenditure structure of the respondents is different due to various aspects. The general annual expenditure of the respondents is presented in the table below.

**Table 29. Annual expenditure of the respondents**

	Expenditure	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	100000-200000	36	33.0	34.0	34.0
	300000-400000	65	59.6	61.3	95.3
	500000-800000	5	4.6	4.7	100.0
	Total	106	97.2	100.0	
Missing System		3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about annual expenditure of the farmer the highest 61.3% respondents expends 3-4 lakh annually, the lowest 4.7% respondents expends 5-8 lakh annually, and 34.0% respondents expends 1-2 lakh annually.

#### **4.3.4 Financial support from Governmental agencies.**

The farmer require support and aid in their farming. They are supported by government organization. The description of financial and technical support getting by government showing in following table.

**Table 30. Financial support from Governmental agencies**

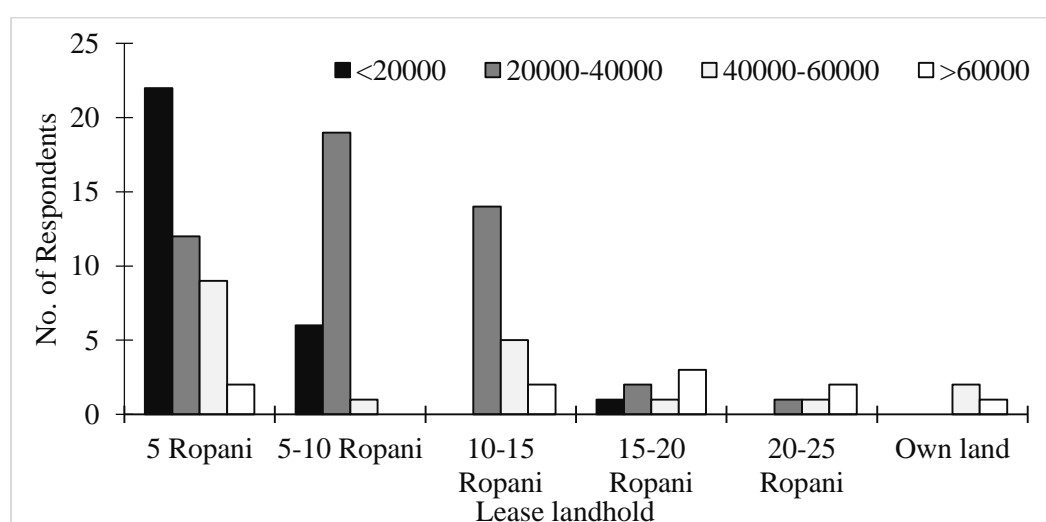
Support	Frequency	Percent	Valid Percent	Cumulative Percent
Subsidy	16	14.7	15.1	15.1
Soft loan	6	5.5	5.7	20.8
Valid Hard cash prize	1	.9	.9	21.7
Not yet	83	76.1	78.3	100.0
Total	106	97.2	100.0	
Missing System	3	2.8		
Total	109	100.0		

*(Field Survey, 2019)*

The above table shows that farmer get training from government agencies the highest 78.3% respondents says they are not get any training from governments, 15.1% respondents get subsidy from government, and 5.7% respondents says they get soft loan from government.

*"I get technical and financial support from government, also get visit opportunity. Government provide me Tractor and seed and other financial support. Here many farmer does not there farm so they does not get support from government. Many farmer are unaware about government support"* (G.M Maharjan, Saturday 16 Nov 2019[KII]).

**Figure 7: Relationship between leasehold and Monthly income**



The figure shows relationship between leasehold land and their monthly income the respondents who have their own land they earn above 60000 monthly and farmer who take 5 ropani lease

land they earn above 20000 monthly, according to this data the landlord are more profitable than leaseholder.

#### 4.3.5. Technical support by Governmental agencies.

Farmer require technical support for improving vegetable farming. These support is provided by government and non-governmental organizations. The survey from study area find the following information about technical assistance.

**Table 31. Technical support by Governmental agencies**

	Support	Frequency	Percent	Valid Percent	Cumulative Percent
	Training opportunity	13	11.9	12.3	12.3
	Exposure Visit	9	8.3	8.5	20.8
	Appreciation letter	2	1.8	1.9	22.6
Valid	farming tools	3	2.8	2.8	25.5
	All of the above	1	.9	.9	26.4
	No	78	71.6	73.6	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table give the information about farmer getting technical support from governmental agencies the highest 73.6% respondents says they do not get any technical support from governmental agencies, the 0.9% respondents get all of these support and 12.3% respondents get Training opportunity, 8.5% respondents says the get exposure visit, 1.8% respondents says they get appreciation letter, and 2.8% respondents get farming tool from governmental agencies.

#### 4.3.6: Economic status of respondents after farming.

It states economic earning from tunnel vegetable farming, is there farmers economic status increase after involve in tunnel vegetable farming. The survey from study area find the farmers perception about that.



**Table 33: Economic status of respondents after farming**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	69	63.3	65.1	65.1
	agree	28	25.7	26.4	91.5
	Neutral	4	3.7	3.8	95.3
	Disagree	5	4.6	4.7	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that the respondents economic status the highest 65.1% respondents are strongly agree their economic status is increase after farming,3.8% respondents are neutral, and 4.7% respondents are disagree.

*I am involve in tunnel farming 6 year ago, my permanent address is Nuwakot District, and We 5 members are in family. we husband and wife both are involved in vegetable farming my two son and one daughter are study in Boarding school in Kirtipur. Our annual income is 7-9 lakh. Work in tunnel vegetable farming is very hard but earning is satisfied. (B.Tamang Saturday 16 Nov 2019[KII]).*

#### **4.4 Farming and Marketing Related Variable.**

The Framing and Marketing process is an important factor. It includes the production and distribution of agricultural production. The detail of it is discussed in following sections.

##### **4.4.1 Problem face by farmers.**

The tunnel farmers face different types of problem in farming. In this study the researcher surveyed the types of the problems that the farmer face in their farming, the presentation of which is given problems related to marketing, policy, irrigation and so on. The major problem found in study area is given in the following table.

**Table 34.Problem facing by respondents**

	Problems	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Marketing	9	8.5	8.5	8.5
	Irrigation	15	14.2	14.2	22.6
	Fertilizer	14	13.2	13.2	35.8
	Price Fluctuation	68	64.2	64.2	100.0
	Total	106	100.0	100.0	

*(Field Survey, 2019)*

The above table shows that the different problem facing by respondents the highest 64.2% respondents says they are more suffer from price fluctuation, lowest 8.5% respondents says they facing marketing problem, 14.2% respondents says irrigation problem, and 13.2% respondents says they are facing problem of fertilizer.

*Here many problem associated with tunnel farming like irrigation, Seed, fertilizer, and some time harmful insect destroy the whole vegetable. We does not get any support from government. Farmer sell their product through middle men so we get less price of vegetable, if we sell our product directly in market then we get good price of vegetable (B.Tamang Saturday 16 Nov 2019[KII]).*

#### 4.4.2 Good marketing network.

Marketing is an essential factors in commercial farming. Good marketing network and stable price attract the the farmer in commercial farming. The survey study from study area find the respondents perceptions on good marketing network that is presented below.

**Table 35. Good marketing network**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	81	74.3	76.4	76.4
	agree	25	22.9	23.6	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows the respondents perceptions on marketing network the highest 76.4% respondent are strongly agree there is good marketing network and 23.6% are agree.

#### 4.4.3 Farmers Satisfied with price policy.

Price policy is another important factor in agriculture. Stable price policy motivated the farmer to do the commercial farming in effective way market and government policy affect the pricy policy. The survey find the respondents perceptions about price policy is presented below.

**Table 36. Farmers Satisfied with price policy**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	61	56.0	14.2	57.5
	agree	14	12.8	13.2	70.8
	Neutral	3	2.8	2.8	73.6
	Disagree	13	11.9	12.3	85.8
	Strongly disagree	15	13.8	57.5	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about respondents perception on price policy the highest 57.5% respondents says they are strongly disagree with price policy, the lowest 2.8% respondents are neutral with price policy, 13.2% respondents are agree and 14.2% respondents are strongly disagree.

#### 4.4.4 Family food sufficiency from own production

It refers to the availability of food from farmers own production. The survey from study area find the information about respondent's family food sufficiency. The given table presents the respondents family food sufficiency.

**Table 37. Family food sufficiency from own production**

	Time	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3-6 month	59	54.1	55.7	55.7
	6-9 month	42	38.5	39.6	95.3
	9-12 month	4	3.7	3.8	99.1
	Biological surplus	1	.9	.9	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows that the information about family food sufficiency from their own production the highest 55.7% respondents thy says their own production is for 3-6 month,

lowest 0.9% respondents have biological surplus, the 39.6% respondents say their own production is sufficient for 6-9 month and 3.8% respondents says their own food sufficient for 9-12 month.

#### 4.4.5 Nutrients Food Status of farmers

The process of providing or obtaining the food necessary for health and growth. For humans, a healthy diet includes preparation of food and storage methods that preserve nutrients from oxidation, heat or leaching, and that reduces risk of foodborne illnesses. The survey from study area find the information about respondent's perceptions about nutrients food is presented below.

**Table 38. Nutrients Food Status of farmers**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	75	68.8	70.8	70.8
	Agree	15	13.8	14.2	84.9
	Neutral	8	7.3	7.5	92.5
	Disagree	8	7.3	7.5	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table show that respondents perception nutritional food the highest 70.8% respondents strongly agree with this question, the lowest 7.5% respondents they are disagree with this question they have not nutrients food, 14.2% respondents say they are agree with this question and the 7.5 % respondents says they are disagree they have not nutrients food

#### 4.4.6 Quality life increase after farming

Quality life is an overarching term for the quality of the various domains in life. It is a standard level that consists of the expectations of an individual or society for a good life. The Survey from study area the respondents the following information about nutrients food.

**Table 39 Quality life increase after farming**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	71	65.1	67.0	67.0
	Agree	22	20.2	20.8	87.7
	Neutral	5	4.6	4.7	92.5
	Disagree	8	7.3	7.5	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table shows the information about after involve in commercial farming is farmer's life change the highest 67.0% respondents says they are strongly agree after involve in tunnel vegetable farming their living style upgraded, lowest 4.7% respondents are neutral, 7.5% respondents are disagree with this they say their life is not change, and 20.8% respondents are agree their living is upgrading after involve in tunnel vegetable farming.

*I involve in this sector about 7 year ago. I work in Israel 3 years as worker in agriculture sector during this time I learn and trained about agriculture when I return in Nepal I think Kirtipur area is good for commercial farming. In initial step I invest 200000Rs, now I am satisfied with my occupation now days I generate good income from tunnel farming. (S. Maharjan Saturday 16 Nov 2019[KII]).*

#### **4.4.7 Farming skill increase after tunnel farming.**

Skill is important factor for agriculture production. The respondents of tunnel vegetable farmer are more skillful after tunnel vegetable farming. Following table shows the respondents perceptions on training.

**Table 40. Farming skill increase after tunnel farming.**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	89	81.7	84.0	84.0
	Agree	17	15.6	16.0	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about respondents perception after tunnel farming is their farming skill increase the highest 84% respondents say they are strongly agree their farming skill is increases, and 16% respondents say they are agree.

#### 4.4.8 Confidence level of respondents increase after tunnel farming

This describes the confidence level of tunnel farmer is there the cooing capacity of farmer increase. The survey from study area find the respondent's perception presented below.

**Table 41 Confidence level of respondents increase after tunnel farming**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	91	83.5	85.8	85.8
	Agree	15	13.8	14.2	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about is their confidence level increase after involving in tunnel vegetable farming the highest 85.8% respondents say they are strongly agree after involving un tunnel vegetable farming their confidence level increases, and 14.2% respondents says they are agree.

#### 4.4.9 Earn more in Season or off-season

This explains the farmers of study area is earn more in season or off-season. The respondents from survey area gives the information about this either they earn more in season or off-season.

**Table 42. Earned more in Season or off-season**

	Response	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Season	54	49.5	50.9	50.9
	Off-season	52	47.7	49.1	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about in which season farmer earn more money the highest 50.9% respondents says they earn more in season of vegetable, but 49.1% respondents earn more in off-season of vegetable farming.

#### 4.4.10 Marketing process

Marketing is important factor in agriculture production. It describes the availability of marketing network in study area, the information is presented below.

**Table 43 Marketing process**

	Marketing	Frequency	Percent	Valid Percent	Cumulative Percent
	Self	68	62.4	64.2	64.2
	Middle man	17	15.6	16.0	80.2
Valid	Shopkeeper Come to collect	19	17.4	17.9	98.1
	Through collection center	2	1.8	1.9	100.0
	Total	106	97.2	100.0	
Missing	System	3	2.8		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about market process in study area the highest 64.2% respondents says they sell their production in market self, and lowest 1.9% respondents say they are sell through collection center, 17.9% respondents says Shopkeeper Come to collect their production and 16.0% respondents says they sell their product through middle man.

#### 4.4.11 Other Occupation of Respondents

Occupation refers to the main way of income of a family or a person. It states the other occupation behind agriculture in study area. The occupational status of the respondents is presented in the given table

**Table 43 Other occupation of respondents**

	Occupation	Frequency	Percent	Valid Percent	Cumulative Percent
	Local shop	5	4.6	4.8	4.8
	Government job	6	5.5	5.7	10.5
	Private job	9	8.3	8.6	19.0
Valid	Entrepreneurship	1	.9	1.0	20.0
	Remittance	6	5.5	5.7	25.7
	No other Job	78	71.6	74.3	100.0
	Total	105	96.3	100.0	
Missing	System	4	3.7		
Total		109	100.0		

*(Field Survey, 2019)*

The above table gives the information about farmer either they are involved in other occupation the highest 74.3% respondents says they have no other job they only involved in tunnel farming, and the lowest 1% respondents are Entrepreneur, 5.7% respondents family member are going foreign country, 8.6% respondents have private job, 5.7% respondents are also involve in government job, and 4.8% respondents are also involve in local shop.



## CHAPTER V

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Summary of Finding

This is the study on Micro-economic Study of Tunnel Vegetable farming in Kirtipur, Municipality at Kathmandu District. The study is focused on its three major objectives. After the systematic analysis and interpretation of collected data, this study came to in conclusion that there is a good practice of tunnel vegetable farming in Ward No. 5 and 6. The farmers of study area also give also give seasonal employment to youth. It is found that there is many youth are also involve in tunnel farmer, Most of them are higher educated, one youth farmer get master degree in economics. The most of the tunnel farmers are come from the surrounding area of province 3, highest 39.6% respondents are from different district of province 3, lowest 5.7% from province 2, 15.1% from province 4, 14.2% from province 5 and 12.3% from province 7, 5.7% from province 1 and 13.2% from province 6. The most of tunnel farmer do integrated farming the two tunnel are established in 1 Ropani land and the main vegetable are Tomato, Cabbage, Cauliflower, Radish, Coriander, Brainjal, Capsicum, Chilly, potato, Pumpkin, cucumber, and floriculture, etc. According to local people the practice of tunnel farming is increase year by year. The KII with local farmer says there is a good income from tunnel farming.

This study is also concludes that tunnel vegetable farming had contributed in a great extent for income generation of the farmers. The average of the farmers owned 25 to 50 thousands rupees monthly from their farming. The big tunnel farmer earn >60000Rs monthly. Farming tended them to sustain their life as well as to save few amount for future savings as well. The total of 74.3% a respondents only involve in tunnel farming they are not engage in other occupation and 25.7% respondents are also involve in other Governmental and private job, some of them are open their own local shop . The farmers of this area build an farmers group Mechi Mahakali collection center that is open in Hanuman Ghat Near to the Nayabajar and they bring their product self in evening time to sell.

The major Finding was listed below.

- 106 Respondents are selected for Research.
- The Farmers from different province involve in tunnel vegetable farming the highest 39.6% respondents are from different district of province 3, lowest 5.7%

from province 2, 15.1% from province 4, 14.2% from province 5 and 12.3% from province 7, 5.7% from province 1 and 13.2% from province 6.

- Highest 50.9% respondents have not involve in any training, the 38.6% respondents are involve in tunnel vegetable farming, 0.9% respondents are involve in floriculture, 5.7% involve in Mushroom farming and 3.8% respondents involve in integrated farming.
- The all total respondents from study area 67% Male and 33% female are involve in tunnel farming.
- The Educational status of tunnel farmers in study area was found that heights 29.2% higher educated respondents are involved in tunnel farming, lowest 14.2% lower secondary level respondents, 16% respondents secondary level education and 20.8% Illiterate respondents was involved in tunnel vegetable farming.
- The heights 67.9% respondent have family size 4-8 member in family and lowest 9.4% respondents have 9-12 family member and 22.6% respondents have 1-3 family member in study area.
- 42.2% respondents have <5 Ropani,, and lowest 2.8% respondents have their own land, 24.5% respondents taking 5-10 ropani lease land, 19.8% respondents taking 10-15 Ropani lease land,6.6% respondents take 15-20 ropani lease land and 3.8% respondents take 20-25 Ropani lease land.
- 53.8% respondents pay 50000-1000000 per year, and lowest 2.8% respondents have their own land so they are not paying rent of land, 28.3% respondents pay >100000 annual rent and 15.1% respondents are paying <50000 annually.
- Highest 56.6% respondents invest from their personal saving, lowest 5.7% respondents invest from Bank loan, 18.9% respondents have invest from cooperative and 18.9% respondents have invest burrowing from relatives.
- Highest 66.0% respondents have involved in tomato farming, lowest 4.7% respondents involve in floriculture, 6.6% respondents in integrated farming 15.1% respondents in Mushroom farming, and 7.5% respondents engaged in cabbage and cauliflower farming.
- 45.3% respondents earn 20000-40000Rs monthly, the lowest 9.4% respondents earn >60000Rs monthly, 17.9% respondents earn 40000-60000Rs monthly and 27.4% respondents earn <20000 Rs monthly.
- 31.1% respondents earning 9-12 lakh annually, and lowest 6.6% respondents earning 1-3 lakh annually, the 12.3% respondents earning more than 15 lakh

annually, 28.3% respondents earning 3-6 lakh annually, and 10.4% respondents earning 12-15 lakh annually.

- 61.3% respondents spends 3-4 lakh annually, the lowest 4.7% respondents spends 5-8 lakh annually, and 34.0% respondents spends 1-2 lakh annually.
- The 64.2% respondents says they are more suffer from price fluctuation, lowest 8.5% respondents says they facing marketing problem, 14.2% respondents says irrigation problem, and 13.2% respondents says they are facing problem of fertilizer.
- The highest 74.3% respondents says they have no other job they only involved in tunnel farming, and the lowest 1% respondents are Entrepreneur, 5.7% respondents family member are going foreign country, 8.6% respondents have private job, 5.7% respondents are also involve in government job, and 4.8% respondents are also involve in local shop.

## **5.2 Conclusion**

Tunnel vegetable farming is one of the main economic activities of the farmers in Kirtipur. Most of the farms are owned by migrant farmers as a leaseholder. The farmers have great attention due to the increasing urban demand, its profitability and accessibility of road and growing market demand. Commercial vegetable farming in Kirtipur has both opportunities and constraints in production and marketing phase. Tunnel vegetable farming has more opportunities than the constraints in Kirtipur area. Most of the constraints are related to the post- harvest process like marketing of vegetables where the frequent price fluctuation. Therefore, further steps on the basis of constraints and opportunities identified by this study could prove more effective in order to preserve commercial vegetable farming as an important agricultural sector in the study area. With proper management of marketing segment could greatly contribute for development of commercial vegetable sector. Furthermore, commercial vegetable farming could be a module of socio-economic development. So, further study could be focus to portray possible options to promote opportunities and overcome the existing constraints to retained commercial vegetable farming as a sustainable source for farm households in Kirtipur.

There have been various technological advancements in the field of agriculture like hybrid seeds, advance fertilizers, drip irrigation etc. But adopting just one or two such

technological improvements is not enough; there is a need for an alternative farming system which incorporates all latest technological interventions in it.

From last decade tunnel farming technology evolves as an alternative to conventional farming especially in the cultivation of vegetables and fruits. It integrates all the agriculture related technical interventions in it and most importantly provides farmer a control over heat and temperature of crops by which farmer can produce off-season vegetables and can earn more profit.

This study is an effort to provide evidence that farmers who are using tunnel technology for the production of vegetables are more efficient compare to conventional farmers.

### **5.3 Recommendations**

- Farmer should involve in training and skill development program, Make good relationship among farmer and adopt new way of production of technology and transform their traditional way of farming. Government should make effective program to attract skilled manpower who return from abroad, it helps to decrease labor shortage.
- The government has to make further policy research and developmental studies to cultivate the vegetable through the development of commercialized agriculture in study area. So, the farmers will have more opportunities and practices in vegetable farming.
- Local Governmental Institutions (Municipality/Rural Municipality) should also implement policies and programs for promoting sustainable vegetable farming towards market oriented organic production systems in coordination with concerned institutions. As a result of which, the local level developments become sustainable through constant farming.
- Government should be provided loan in zero percent for the construction of cold store though farmers can store their products and sell the product in off season. So that the farmers will have economic efficiency in their occupation.

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ANNEX I

QUESTIONNAIRE

**Microeconomic Analysis of Tunnel Vegetable Farming**

(A Study from Kirtipur, Municipality, ward No.5&6)

Dear respondent,

I would like to share that this is completely a thesis work and it does not carry any official record. You are requested to answer the question friendly and honestly. The importance of this study depends on your valuable answer. Your privacy will always be secured and information you provide does not effect on it. So, please answer the following questions on your knowledge and practice as far as possible.

Research Questionnaire:

**Name of Interviewer.....**

**Date:**

Name of Respondents .....

Cell Number.....

**A. Socio-Demographic Variable**

1. Permanent Address? District..... a) Migrated Fom.....

2. How old are you (age)? .....

3. Caste/ethnicity?

1. Bhramin,      2. Chhetri,      3. Janjati (Tamang, Newar)

4. Dalits,      5. Madhesi      6. Other

4. Religion:    1. Hindu      2. Budhhist    3. Muslim    4. Kirat      5. Other

5. What is your marital Status?

1. Married    2. Unmarried    3. Separated    4. Divorced

6. What is your formal educational status?

1. Primary, 2. Lower secondary, 3. Secondary, 4. Higher education, 5. Illiterate

7. What is your subject specification in higher education?

1. Management, 2. Education, 3. Arts, 4. Natural sciences, 5. Health  
6. Engineering, 7. JT/JTA, 8. Agriculture, 9. Forestry and animal science

8. Have you participated in any capacity and skill development trainings?

1. Yes 2. Not yet 3. On plan

9. What types of farming related training you have completed then?

1. Tunnel vegetal farming 2. Integrated pest management 3. Goat farming  
4. Mushroom cultivation 5. Bee keeping 6. Floriculture 7. Other

10. How many members are there in your family?

Female	Male	Total

11. Number of school going children?

Class	primary	Lower Secondary	Secondary	Higher education
Girls				
Boys				

12. If yes, in which school/college you are enrolling your children?

1. In public or community 2. In private

13. Subject specification of your children studying in higher education?

1. Management 2. Education 3. Arts 4. Natural sciences 5. Health  
6. Engineering 7. JT/JTA 8. Agriculture 9. Forestry and animal science

14. When did you involve in commercial farming?

Year	Month

**B. Economy Related Variable**

15. How much was your initial investment to start commercial farming?

NRs.....

16. Have you registered your farm?

1. Yes 2. No 3. On plan

17. How much lease hold land you have?

1. <5 Ropani 2. 5-10 Ropani 3. >10 Ropani 4. No leasehold land

18. What were the sources of that investment?

1. Personal saving 2. Borrowed from relatives 3. Cooperative loan  
4. Bank loan

19. What is your farming specification?

1. Major crop production 2. Livestock (meat purpose) 3. Poultry/duck 4. Fishery  
5. Tunnel vegetable farming 6. Mushroom cultivation 7. Floriculture 8. Sheri culture (bee keeping) 9. Integrated farming

20. Annual rent for lease hold land?

Nrs.....

21. How you sell your product in market?

1. Self 2. Through Midman 3. Shopkeeper come to collect 4. Through Collection center

22. Along with agriculture, what are the diversified occupational statuses of your family members?

1. Local shop
2. Government job
3. Private Job
4. Daily wages
5. Entrepreneurship
6. Remittance

23. What is the pocket identity of your village?

1. Cow milk
2. Goat meat
3. Green peas
4. Carrot
5. Cabbage
6. Potato
7. Local paddy
8. Mustard

24. What is the land holding status of your family?

1. <10 Ropani
2. 10-14 Ropani
3. 15-19 Ropani
4. 20-24 Ropani
5. >25 Ropani

25. Annual income of your family?

Sector	NRs
Agriculture	
Business	
Government job	
Private job	
Daily wage	
Entrepreneurship	
Remittance	

26. Annual expenditure of your family?

Particulars	NRs
Fooding	
Clothing	
Electronic Accessories	
Cosmetic	
Child education	
Visit/pilgrimage	
Cultural celebration	
Medicine	

27. How much was your recurring cost for different purpose?

Particulars	NRs.
Land	
Lease hold land	
Housing	
Gold	

28. How much is your average annual variable cost for commercial farming?

Particulars	NRs
Inputs/seeds	
Vitamin	
Fertilizer	
Pesticides	
Labor cost	
Transportation	
Fee for experts	

29. How much is your average monthly earning from commercial farming?

NRs.....

### C. Farming Related Variable

30. What types of technical support you got from government and non -government institutions?

1. Training opportunity
2. Exposure visit opportunity
3. Appreciation letter
4. Farming tools
- 5 All of above

31. What types of financial supports you got from government and non -government institutions?

1. Subsidy
2. Soft loan
3. Daily allowances
4. Hard cash prize

32. What is the status of family food sufficiency?

1. 3-6 months
2. 6-9 months
3. 9-12 months
4. Biological surplus

33. Family members are having varieties of nutrient food after commercial farming practices?

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

34. Quality of life of the family members have been improved due to commercial farming?

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

35. Farming skills of the farmers have been increasing due to practical knowledge

1. Strongly agree
2. Agree
3. Neutral
4. Disagree
5. Strongly disagree

36. Entrepreneurship skill also have been increasing due to involve in marketing

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

37. Self confidence level of the farmers also have been increased due to commercial farming

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

38. How many family members are involving in commercial farming?

Female	Male	Total

39. How full time employees are working in your farmland?

Female	Male	Total

40. How many seasonal employees are working in your farmland?

Female	Male	Total

41. Do you prepare compost fertilizer with farming purpose?

1. Yes 2. Not yet 3. On plan

42. Do you use pesticides in your farm?

1. Yes 2. No

43. How frequently do you use pesticides in your farm?

1. Twice in a year 2. Four times in a year 3. More than four times in a year

44. How many student and farmers visited your farm till date?

Students	
Local farmers	
Outsider farmers	
Researcher	
Bureaucrats	
Total	

45. What is the main problem for farmer here?

1. Marketing 2. Irrigation. 3. Fertilizer 4. Price fluctuation

46. More income generate farmer?

1. Season 2. Off-season

47. The trend of commercial farming is increasing annually around this municipality

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

48. There is mutual relationships among local farmers

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

49. Is there any agriculture collection center around your locality?

1. Yes 2. On plan

50. Farmers are satisfied with price policy of the local products.

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

51. There is a good networking of marketing system for supplying local products.

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

52. How do you categorize your profession?

1. Small farmer 2. Commercial farmer 3. Role model farmer 4. Leader of the farmers

53. Do you think that you are popular among the local farmers?

1. Yes 2. Not yet 3. Willing to become popular

54. What is the level of your farming practice?

1. Inorganic 2. Organic red 3. Organic yellow 4. Organic green

55. Social status and prestige have been increased after involving in commercial farming

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

56. Economic wellbeing of the family members have been increased after involving in commercial farming.

1. Strongly agree 2. Agree 3. Neutral 4. Disagree 5. Strongly disagree

**Respondents Signature**

.....

**Thank you for your better cooperation!**



## ANNEX II

### CHECKLIST FOR KII

#### Microeconomic Analysis of Tunnel Vegetable Farming

##### (A Study from Kirtipur, Municipality, ward No.5&6)

1. Why are you interested in Tunnel vegetable farming?
2. How much amount of money do you spend for buying vegetable seed in a year?
3. How much amount money you obtain in a year from vegetable farming?
4. Have you faced any problem in Tunnel vegetable farming in your farm? What are the major of yours?
5. Have you ever received any financial and technical support from the government and District Agriculture Office?
6. Do you have adequate knowledge of planting, cultivating, harvesting and using pesticides in vegetable farming?
7. Have you got an access of market in your locality to sell the vegetable product?
8. How does vegetable farming contribute in your income generator?

Thank you for your cooperation.

**ANNEX III**  
**PHOTOS**





