Exploring the Innovation in Agriculture of Developing Country

(A case Study of Nepalese Cardamom)

MASTER THESIS

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Abstract

Most of the developed countries achieving their economic growth by exploring the innovation in the various sector. This research paper is focused on exploring innovation in the agriculture sector of Nepal. The NSI framework is analysed to enhance the quality of large cardamom. Furthermore, qualitative research method is conducted where data is collected from the primary and secondary sources.

Moreover, the findings of the research study show that Nepal has the huge possibilities to improve the economy of the country through exporting the large cardamom in to international market. Similarly, it helps to boost the living standard of Nepalese farmer. However, the quality of large cardamom should increase up to the market standard. Therefore, the requirement of improved technology, advance skills and knowledge, and research and development are highly needed in large cardamom sector. Additionally, regularity in the function of governmental and public institution, farmer friendly policy formulation, development of basic infrastructure, establishment of ICT, universities-farmer collaboration, and overall practice of good governance is highly recommended to promote innovation in Nepalese cardamom sector.

Key words: Innovation, NSI, Developing country, Nepal, Agriculture sector, Large cardamom

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List of Abbreviations

APPARI	Asia-Pacific Association of Agricultural Research Institution
BIMSTEC	The Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation
CPI	Corruption Perception Index
FNCCI	Federation of Nepalese Chamber of Commerce
GDP	Gross Domestic Product
ICT	Information Communication Technology
IFAD	International Fund for Agriculture Development
ITC	International Trade Centre
LDC	Less Developed Country
MASL	Meter Above Sea Level
MoAD	Ministry of Agriculture Development
MoC	Ministry of Commerce
NGOs	Non-Government Organizations
NSCDP	Nepal Spice Crop Development Program
NTC	Nepal Telecom
OECD	Organization for Economic Co-operation and Development
SPS	Sanitary and Phytosanitary
TBT	Technical Barrier to Trade
TEPC	Trade and Export Promotion Centre
USAID	United States Agency for International Development
VDC	Village Development Committee

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

List of Tables

List of Figures

1. Introduction

In a contemporary world, the innovation is becoming a key driver for the economic growth of any nation. Most of the developed countries, at least 50 percent of economic growth attainable form their innovation capacity. Many developed countries, including United States, Germany, Denmark, Finland, Norway, Singapore, Japan are ranked as a top performer in terms of their capacity for innovation (Parkey, 2012). At the other side of the world, most of the developing countries are struggling for economic and technological development due to less practice of innovation process. Moreover, most of the developing countries facing the difficulties in terms of institutional structure, lack of scientific and technological activities and linkage among the units of the organization (Kayal, 2008). Therefore, the concept of NSI could be one of the best options for the development. Because, NSI encompass the holistic view of innovation that mainly focused on the interaction of the actors involved in the innovation process and analysis of how institutional, social and political factor has shaped that interactions (Schrempf et al. 2013).

Although, the background of NSI relate with the developed economies, the application of NSI in developing country can bring the development because each country has the different ability for the creation and adoption of innovation and aptitude to bring the technological change from the existing skills and capabilities. This perfect example developing countries who applied the NSI successfully are South Korea, Taiwan, Brazil, Singapore etc. where they were foster the innovation by choosing the different model of innovation such as; catching-up process, strong network structure, effective role of states and so on (Kayal, 2008).

Furthermore, this thesis is focused on exploring the NSI in Nepal in fact agriculture sector of Nepal. Because Nepal's economy is highly based on agriculture where this sector contributing almost one third in GDP contribution and above 78 percent of household producing for their home consumption (Nepal et al 2014). Moreover, the export commodities of Nepal in the international trade are also agricultural products or related to agriculture such as; Jute sacks, Juice, Ginger, Herbs, Cardamom, Fruits, Paper and so on. However, the value of export commodities is less than import commodities which were negative 23.5 percent in 2013/14 (Paudel, 2016). Additionally, Nepal's most of the

agricultural production dominated by normal cereal crops like Maze, Paddy, Wheat which is accounted for more than 80 percent of total area used for agricultural cultivation. Similarly, most of the crops were produced for the food sufficiency purpose (Nepal et al. 2014). In another hand, Nepal has good possibilities in production of cash crops which are known as high value crops such as; Ginger, Sugar cane, Tea, Large cardamom, Fruits and so on. Furthermore, this research study is about one of the cash crop and that is large cardamom.

Moreover, the large cardamom is one of the major crops in Nepal which contributing about 7% share in the export trade of agricultural commodity (Kc and Upreti, 2017). Moreover, large cardamom is known as a cash crop because it is a high value crop among other cereal crops that normally farming in Nepal. In fiscal year 2014/15 the crop was highly valued with NRS 2,700 per KG (MoAD, 2015) which comes approx. 27 US Dollar per Kg in today's price (source:www.xe.com). But the price of the large cardamom started to fall during the period of 2015/16 by almost 50% than the previous year and traded below NRS 1,350 per Kg. (Kathmandu Post, 2016) and it was decreased more and reached NRS 875 per Kg in April 2017 (Gautam, 2017). The president of FLCEN, Nirmal Bhattarai explain that combination of low quality of products, global fall of demand and impact of demonetisation in India are the reason for decreasing price of Nepalese large cardamom (Gautam, 2017). This matter of fact motivated to the researcher to conduct this research study in the field of large cardamom sector in Nepal. While the idea was presented, it was also considered by course coordinator and supervisor during the meetings and approved for the further process and Nepalese large cardamom sector was made as a case for the research study.

1.1 Problem Formulation

As we explained earlier, the agriculture sector has a huge impact on the economy of Nepal as well as in lives of Nepalese people. All facts that mentioned above indicates the dependency of agriculture in Nepal but along with that it indicates towards the problem that agriculture sector which is not performing well. One of the reasons behind the negative in trade of agriculture commodities is that farming system of Nepal is more focused in traditional way and due to limited technology availability, lack of advance skill and knowledge, lack of basic infrastructure development and more than lack of right and implementable policies towards the agriculture hindering this sector to grow. Furthermore, most of the Nepalese farmer lives in rural area and those are poor and vulnerable and

suffering from lack of basic needs, basic infrastructure, services and essential goods and commodities (Paudel, 2016). According to recent data of Trade economies Nepal's over 25 percent of total population is lying under the line of poverty and about 48 percent of total population's average earning is $2 per day is (https://tradingeconomics.com/). Therefore, the development of agriculture and especially development in large cardamom farming has the strength to maintain the increasing trade deficit of Nepal similarly enhancing the economy of Nepalese people. Thus, the concentration from of all the governmental institution, public officials, rules, regulation and policies, universities, agricultural research centre, agricultural facilitator need to be paid for the development of Nepalese agriculture sector especially in large cardamom sector. The concept of NSI and understanding of NSI in developing countries and how innovation system in agriculture can be explored in Nepal to enhance the quality and quantity of large cardamom. Since the price of cardamom is related to the quality, it is assumed that high quality of large cardamom gets the high price. Therefore, the research question towards the enhancing the quality of large cardamom. Therefore, the research question is formulated as:

1.2 Research Question

"How NSI in developing country can enhance the quality of agriculture commodity? A case study of Nepalese large cardamom sector".

1.3 Purpose of the study

The objectives of using the NSI framework to understand the NSI concept theoretically and analysing the linkage in the agriculture sector of Nepal for the production and quality development of large cardamom. It helps to the farmer of large cardamom to identify various actors and components of innovation system which could be beneficial to them to enhance quality and quantity of large cardamom. Consequently, it will support to increase the price of large cardamom. NIS also suggested innovation process that comes through interaction between different components of SI that may help famer to brings various innovation such as product, process and technological in cardamom farming. The finding of the thesis provides a clear situation of Nepal's large cardamom sector, barriers and opportunities in this sector. Moreover, how farmers can benefit from the use of NSI in agriculture field specially in large cardamom farming is the main agenda of this thesis.

1.4 Structure of Thesis

This Thesis is organized in to seven chapters. The introduction is the first part of the study which shows the dynamics of Nepalese agriculture and the relevance of choosing specific study area for the research. Moreover, it also gives an idea regarding the problem which was the departure point for conducting this study and problem formulation lead towards the research question. Furthermore, the second chapter is all about the methodology that researcher finds suitable to accomplish this thesis. Where, researcher's beliefs towards the reality drives him to choose specific research methods and data collection procedure.

The concept of NSI, AIS and good governance are incorporated in the third chapter of the thesis which is a literature review. It provides the clear understanding of dynamics and application of theories and its relevance in the context of the research subject. Moreover, the fourth chapter follows case presentation along with different data, fact and information about Nepalese cardamom including its history, current scenario, trade flow, functions and involved actor in cardamom farming. Furthermore, the fifth part is focused on the analysis of the fact that researcher found during this research. Here, researcher analysis the data what he collected through the secondary and primary sources. Moreover, this part presents an actual scenario in real life context which provides the area for discussion that follows in the sixth chapter of the thesis. Moreover, the seventh part of the research is about the conclusion and recommendation for further research while other researchers conducting the research in this specific field.

2. Methodology

This chapter embraces the various methodological tool that used to accomplish this research paper. Such as; Research strategies, Research method, forms of data collection, reliability and validity, limitation and more. Additionally, this chapter also explained the research paradigm which leads the researcher to the how and why the specific methodology has been followed to accomplish this research study.

2.1 Research Paradigm: Qualitative

The research paradigm described as a how the researcher's set of *basic beliefs* deals with the first principle and how he acquires the knowledge to solve the problem that he understood and want to be addressed (Guba and Lincoln, 1994). It set the connection between researcher's views on the world and right methodological approach which researcher need to select (Denzin & Lincon, 2008). Moreover, research paradigm based on four set of beliefs (Ontology) and they are, - *Positivism, Constructivism, Post-positivism* and *Critical theory et al* and the researcher's used best tool (epistemology) and methodological approach according to which view of social reality he assumed (Guba and Lincoln, 1994).

The mostly used example of research paradigms is 'Quantitative research' and 'Qualitative research' (Denscombe, 2010). This research study is followed by qualitative research paradigm. Where researcher motivated by specific philosophy and that is *constructivism*. The *constructivism* explains the multiple reality and suggested for the human interaction to discover and interpret. Therefore, from the constructionist viewpoint the reality is based on subjective which can influence the perceptions of surrounding people. Moreover, to construct the accurate meaning the reality researcher should have interpreted which can be done by the dialectical methodology (Crotty, 1998). The researcher assumes the multiple reality in cardamom sector apart from the price decreasing. Therefore, the research study directed through case study strategy, qualitative research method, observation, interviews to conduct this research.

2.2 Research Purpose: Exploratory

The purpose of research is categorized in to three types, and they are – exploratory, descriptive and explanatory. However, the researcher may have one or multiple research purpose on based on nature and objectives of the research study (Sounder et al. 2009).

Furthermore, while using the case study research strategy to accomplish the research, the researcher gain depth understanding about the context which accrued the new insight inside him which may encourage him to change his direction on the base of the result. In this situation exploratory research provides flexibility for the researcher to change the direction and explore the experiences (Sounders et al. 2009). Here, flexibility in research doesn't mean that research without direction but it means that, the research focus is changing as the research progress. It's becoming narrower compare to its initial phase where the focus was broad (Adams and Schvanveldt, 1991). Moreover, the exploratory purpose of research can be beneficial for researcher while nature of the problem is unknown because it explores new information and new visions thorough the various sources such as; literature review, interview with the individual, focus group or with expert, brain storming session and so on (Sounders et al. 2009).

Explanatory is another type of research purpose, which basically used to show and describe the relationship between variables. Moreover, it is useful to get the answer of *'Why'* question which leads to the reason or cause and mostly quantitative data are required to test statically that help researcher to establish the reliability and validity in terms of the relationship of variables (Saunders et al. 2009).

The descriptive research purpose mostly taken as a part of explanatory research purpose and sometimes consider as an extension or exploratory research purpose. However, it is referred to "*portray an accurate profile of a phenomenon, an event or a person*" (Robson, 2002, p.59). It is demanding the clear picture of the phenomena before conducting the data collection procedure. Moreover, the researcher should be able to conclude the research from the data that he is describing. It enhances the ability of researcher in terms of data evaluation and ideas creation. Additionally, descriptive research objective used to explain the behaviour, opinion, or attitude of people or the group towards the subject matter of research (Saunders et al. 2009).

The exploratory research purpose finds more suitable to conduct this research paper rather than other two research purpose. Because, the Nepalese cardamom sector is rarely being researched and the problem faced by the farmers is hardly addressed by the previous researchers. Additionally, the reason for price falling in cardamom taken as a low quality of production. But why the farmer is producing the low grade of products while their livelihood is depending on its farming? this question keeps the place of doubt regarding the problem that farmers are facing. Therefore, there is a chance of exploring the unknown problem which need to deeply understand by the researcher and that facilitate him to discover the new insight in the research. Moreover, this research purpose also provides the flexibility to modify the direction of the research according to new information that collected during the research process. Additionally, it allows the researcher to involve in real life of farmer where he can experience various new information which helps to lead him towards the reality.

2.3 Research Strategy: Case Study

The research strategy refers to the plan, idea or action to lead the research study. it provided useful guidelines such as; planning monitoring and executing the research study. In another hand, the researcher also should be focused while selecting the research strategy because research strategy should help for the data collection process (Johannesson and Perjons, 2014). Moreover, the research strategy and research question are inter-related to each other because research strategy guided through the research question, where it is important for the researcher to choose the suitable strategy that could help to get the answer of the research question. Additionally, research strategy helps to the researcher to the extent his/ her existing knowledge within available time and resources (Sounders et al. 2009). Furthermore, Yin, (2009) has described different strategies like, *Experiment, Survey, History, Case Study and Archival Analysis*, which are presented in below table.

Strategy	Form of research Question	Requires Control Of Behavioral Events	Focuses on Contemporary Events
Experiment	how,why?	yes	yes
Survey	who,what,where how many, how much?	no	yes
Archival analysis	who,what,where, how many, how much?	no	yes/no
History	how,why?	no	no
Case study	how,why?	no	yes

Figure 1: Different types of research strategy

Source: Yin, 2009, P8

Among the above presented research strategies, the **Case Study** research strategy going to consider for this research paper. Because, the case study research strategy allows to the researcher to gain a deep understanding of the context where the research and research process is undertaken. Moreover, it provides the answer to the research question that formed in '*how'* and '*why*' so researcher able to explore existing theory in a new context (Sounders et al. 2009). In this research study, the Nepalese cardamom sector is taken as a case where researcher analysing the usefulness of NSI concept to enhance the quality of large cardamom. This research strategy supports the researcher for a comprehensive understanding of large cardamom sector. It helps to get the analytical view on the feasibility of NSI concept to increase the quality of large cardamom. Furthermore, Robson defined the case study as "*a strategy for doing research which involves an empirical investigation of a particular contemporary phenomenon within its real- life context using multiple sources of evidence*" (Robson, 2002, p. 178). This definition also offers suitability of case study strategy because in this research different information and data collected from the secondary and primary sources are going to use to analysis either NSI concept is helpful or not to increase the quality of large cardamom in Nepal.

Furthermore, The nature of the case is categorized in to five types and they are - the critical case; the unique case; the revelatory case; the representative or typical case; and the longitudinal case (Bryman & Bell, 2015). The subject of this research is unique therefore it is based on the single case study. The large cardamom is a not a common agriculture commodity like other agriculture commodities which has a good contribution in Nepalese economy. And recently the price is falling in cardamom therefore it could be interesting and important to conduct the research in this area. And very few research conducted in this field, therefore, **Single Case Study** strategy finds more appropriate in this research paper because this case is unique and complex as like Sounders et al. (2009) explained, the case study research strategy is more useful when the case is extreme and unique.

2.4 Research Method: Qualitative

The Research method is all about the procedure of data collection which should be organized, systematic and focused along with all the essential information that specifically used to answer the research question. The research method is categorized in to two parts – Qualitative and Quantitative research method and researcher choose the specific research method on the base of research problem and purpose. (Ghauri and Grønhaug, 2005).

Qualitative research method carries the broad perceptive of research which embraces the wide range of techniques and philosophies that used for the data collection. Such as; in depth interviews, focus group interviews, literature, observation, life stories and so on (Hennink et al. 2010). Moreover, it explained in detail about people's behaviour, experiences, attitude and belief and collects the data in a text form which provides a brief understanding of the specific context where the problem is identified (Altinay and Paraskevas, 2015). This type of research especially, executed when researcher personally, curious about that specific subject and never had a *valid* reason for entering (Tracy, 2013). However, the researcher should be open minded, ability to listen to people's story, flexible and sensitive. Because researcher is the one who interprets the phenomena of the research study in terms of what peoples mean to say (Hennink et al. 2010). Moreover, qualitative research method is rich and holistic which is suitable to achieve the variety of research goal as well as it is supportive to establish the relationship with another research method (Tracy, 2013).

The fundamental difference between qualitative and quantitative research is that, qualitative research believing in generating or building the theory where quantitative research mostly focus on theory testing (Bryan and Bell, 2015). Therefore, those research

studies which are studying based on quantitative research method, scientifically investigated to explore the relationship between the variables. Hence, the range of statistical tools and techniques are used to analyse that relationship of the variable (Walliman, 2005).

Furthermore, **qualitative research method** is going to use to conduct this research study. Because of this study is based on the context of agriculture of Nepal where cardamom farming took as a case. To deeply understand the reason behind the falling quality of cardamom, its necessary to understand the farming procedure, farming methods, problems faced by the farmer and its effect on their livelihood. Therefore, the researcher should be calm and focused while interacting with the farmer. There are various techniques of data collection in qualitative research which are going to disused in following page, however researcher should be capable to interpret the people's experiences, story, behaviour, and the perception in a right and sensitive manner to reach the depth of the problem. Moreover, researcher never visited the cardamom farming therefore his curiosity leads towards the research subject and encourage to conduct this research study. Moreover, the chosen concept of literature is very much advance for the Nepalese context, even more challenging to apply in agriculture sector of Nepal, therefore it is interesting to look forward how it will interact to the reality of research subject. Thus, this research allows to the researcher to generate the new theory based on the finding of the research.

2.5 Data collection: Primary, Secondary

The data collection procedure is an essential job for the researcher to perform because collected information or data should meet the objectives of the research study. The data collection process can be done through the two methods and they are – Primary data collection and Secondary data collection (Krishnaswami and Satyaprasad, 2010). The researcher can used either one or both method for collection of data, however the important fact is, the collected data or information should be helpful to find the answer of the research question. Though, the usefulness of the collected data depends on how researcher present that in analysis part of the research study which can be done thorough qualitative and quantitative method (Kothari, 2004). Furthermore, this research study carries both data collection method which is described below.

2.5.1 Primary data collection

The data which are fresh and collecting for the first time for the specific research study is known as primary data and that process of data collection is called primary data collection (Kothari, 2004). There are various techniques for collecting the primary data and they are – In-depth and group interviews, observation, questionnaires, Survey, experimentation, mailing, stimulation (Krishnaswami and Satyaprasad, 2010). This type of data having the essence of originality and it contributing to enhancing the existing knowledge of researcher and supporting him for theory building, and designing the research. Moreover, primary data clarifies the purpose of the research study and collected information helps to solve the problem (Hox and Boeije, 2005).

2.5.2 Secondary data collection

Furthermore, the data which are already collected by someone else for their own purpose and interest is known as secondary data. Generally, these types of data are collected by the various reputed institutions, government departments, universities, professional organizations and individual researcher and can be found in different journals, books, articles, websites, database, newspaper, government publication and so on (Saunders et al. 2009). Moreover, most of the secondary datasets cover the quantitative nature of data which provide the extra-empirical support to the researcher. Additionally, the process of secondary data collection is cheap and easily accessible than primary data, hence it saves the time and money of the researcher but available data are out of the control of researcher and may not fulfil the exact desire of the researcher (Krishnaswami and Satyaprasad, 2010).

Moreover, both **primary** and **secondary** source of data is used to conduct this research study. The data were collected from the secondary sources such as; journal, annual reports of the ministry which collected from the official website, articles, books, google scholar, newspaper, research report, online library etc. Additionally, the researcher used the Participation observation and Semi-structured interview as a source of primary data. Basically, in participation observation researcher is fully participating in the lives and activities of the people, member or group of the community or organization. The researcher will gain the experience in this data collection process not only by purely observing but also being in their shoes (Saunders et al. 2012). Moreover, the researcher used participation observation while doing fieldwork, where fieldwork means actively looking, informally interviewing, memorizing, making field notes and patiently observing.

Under the participation observation, researcher actively participating and learning from the activities which provide the guidelines to the interviewer for an interview (Kawulich, 2005).

Furthermore, semi-structured interview conducted through several themes and some key questions which helps to explore and defines the specific area. It provides space for interviewer to peruse his idea and explain more in details (Gill et al, 2008). However, the researcher should have the clear mindset regarding the subject that he wants to explore. Moreover, the conversesation between interviewee and interviewer should cover the scenario, event, behaviour or beliefs that relevance to research topic (Saunders et al. 2012).

The Taplejung district which situated in Eastern part of Nepal is chosen for the observation and interview purpose. This district is contributing to a larger production of the cardamom compare to other district and (See section 4.3.1). Most of the large cardamom, cultivating in the high elevation and the farmer who is involved in cardamom farming lives in high elevation area which is rural and underdeveloped. Here, in this research, the researcher chose *Ankhub* VDC which is one of the rural villages of Taplejung district where almost all household's livelihood based on large cardamom farming only. The researcher spent a week for this purpose where overall 3 days spent in travelling. Moreover, the researcher fully participated in the observation by involving in farmer lives, behaviour, perspective, and experiences about large cardamom farming which provides him with a deep understanding of the real-life context of the research problem. The participation observation took two days where the first day was observed on harvesting field of the large cardamom. The researcher noted down some of the pre-harvesting activity which farmer is already done. Furthermore, the primary data collection procedure take a place in the second week of October 2017, so that researcher got the opportunity to observe the harvesting process livelily. Similarly, the second day of observation is more focused into the post-harvesting activities. The researcher visited all the place of the village to understand the post-harvesting activities such as; segregation, drying grading and storing. The detail about the activities that researcher done in of participation observation presented in Appendix 2.

Furthermore, the Third and fourth days spent into the semi-structured interview. The researcher established a good interview guide (Appendix 1, section 9.1) to cover all the area of the problem. The researcher interviewed with 10 farmers from the village who are involving in cardamom farming since more than 10 years. The summary of the research

interview presented in appendix 1, section 9.2. During the study the researcher found that large cardamom farmers are out of the focus from the governmental and other public institutions in terms of development and innovation. The economy of the larger population from this area depending on large cardamom farming and this sector has huge possibilities to support the economy of the nation.

2.6 Validity and Reliability

The validity and reliability concept was developed to help the researcher for less chance of getting the wrong answer which increases the level of creditability and trustworthiness of research study (Saunders et al. 2009). This research study followed the qualitative research method where phenomena of problem viewed through the broad perspective of the real-life context. However, the qualitative research study often questioning in terms of creditability and trustworthiness due to research finding and interpretation of data therefore the validity in qualitative research refer to increased the accuracy and truthfulness in findings of the research study (Brink, 1993). By keeping these things in mind, this research study's validity has been obtained by use of cited documents from the reliable sources. Additionally, the researcher conducted a semi-structured interview with farmers from the related field. Furthermore, the suggestion got from the supervisor during supervision of this thesis also support to keep the work on the track.

Furthermore, reliability defined as "*the extent to which your data collection techniques or analysis procedures will yield consistent findings*" (Saunders et al. (2009, p:157). In another word, the reliability of qualitative research can be obtained through the consistency, repeatability and *stability* of research and accuracy of the researcher in the direction of information and data collection process (Brink, 1995). Moreover, reliability of the qualitative research is more focused on generating the new understating. It means the good qualitative research should understand the situation where other would be puzzling or confusing (Golafshani, 2003). This research is more focused on subjectivity rather than statistical and empirical calculation where researcher covered people's experience, their beliefs and attitude, culture and their perspective about the context of research. Moreover, the methodology of this research described simply manner, thus other researcher finds easy to understand and follow the procedure if they find interesting.

2.7 Limitation

This research study aims to address the problem regarding quality declination in large cardamom of Nepal. The data collected through the primary and secondary sources where primary data were collected by the participant observation and semi-structured interviews. The first limitation of this study is time constraint and timing of data collection, because the data were collected in the second week of October which is a harvesting season of cardamom. The researcher got opportunities to see lively harvesting function of cardamom but fewer farmers were available for an interview due to busy season. Therefore, the interview conducted with 10 farmers only. Although, researcher actively participated in observation and got formal and informal talk with individual people and group during the farm visit. In another hand, September and October are the festival moth in Nepal therefore most of the government's institution and offices of facilitators were closed, so the researcher could not talk with them and understand their view regarding on problem of the research study. Moreover, an economic limitation of researcher also remains in this research study. Consequently, the researcher could not visit more places of cardamom farming. Therefore, it may influence the finding of this research study. However, the researcher has asked the farmer if they know about something new in other places regarding cardamom sector.

Furthermore, another limitation was the use of relevant theories. The literature used in this research is rarely used before in Nepalese agriculture context therefore, there is a chance of misleading while analysing the collected data. Moreover, due to the time and pages limitation the researcher could not use some other theories such as global value chain, agriculture entrepreneurship, women participation in agriculture and so on and I'm sure there are more theories which do not come in my consideration. Moreover, secondary data which are available in Nepalese context, they were not well cited therefore many data are unable to include which could be helpful to give the better understanding of research study.

3. Literature Review

This chapter includes the literature review of the research, where various literatures are presented to enlighten the relevance with the research subject. The NSI, ASI and Good governance are the core concept where this chapter is focused.

3.1 System of Innovation (SI)

The National System of Innovation (NSI) concept has been developed as an application of System on Innovation (SI) at the national level. However, various authors were described the SI according to their field of research. A century ago, Austrian-American theorist Joseph Schumpeter developed the innovation concept as a driving force of economic development that brings continuous conversion in social, institutional and economic structure. This concept of innovation became the base for many other kinds of literature at present scenario. Such as; innovation as a "new combination" of existing knowledge and resources; various types of innovation into product, process, market and organizational structure. (Fagerberg et al. 2012). Moreover, Kline and Rosenberg (2010) explained that innovation should bring the changes for lifetime which should totally change the economic significance of that thing where the innovation has been done. It could be a first invention or successive improvement on that invention. But the important fact is that improvement should be more important economically rather than original form. The core subject of Schumpeter's innovation is knowledge and resources where Kline and Rosenberg were more focused on economic transformation. Furthermore, innovation is not a certain thing that comes and goes it is a process that continuously running which is quite an uncertain process. Therefore, the process of innovation is taken as an exercise of management which determined the innovation within the firm (Kline & Rosenberg, 2010). Hence, the innovative firm always needs to find new and better way of doing things which is implementable. This newness could be a form of new product new way production or a new way of doing economic activities (www.innoresource.org).

Furthermore, the term *'System of Innovation'* (SI) is a combination of two words "Innovation" and "System" where above we already defined about innovation. Moreover,

another term “System” referred to various firm and non-firm entities. Here firm denotes the different suppliers, customers and competitors where non-firm entities described as a different university, school, ministries and government. Hence, System of Innovation (SI) known as a collaboration or interactive process between the various organization (i.e. firms and non-firm entities) and institutions for creating and commercializing the new knowledge. However, institutions are referred to various rules, law norms and practices that shaped the behaviour of organization (Edquist, 1997). Overall, the system of innovation is more focused on the interaction between individual institutions, firms and universities for collective knowledge creation and use. It also embraces the broader perspective framework of innovation where the government have a major role in formulation and implementation of policies and these policies shaped the institutions however these institutions have important impact on innovation. Therefore, innovation system is all about interaction between individual institutions, governments and organization where these all are working for creation and diffusion of knowledge with help of technologies (Gu et al. 2005). Furthermore, Bergek et al. (2008) put some analytical view on SI framework. They argued that SI framework focused on synchronized and interactive process between system’s components but it is silent on whether the system should be completely developed or it could be emerging with weak interaction. Similarly, the interaction between components could be unplanned and unintentional compare to intended. Moreover, the actors are not directed by any components of the system therefore, it is not necessary for actors to share same goal and function within the system but even they do they are not forced to work together deliberately toward it (Bergek et al. 2008).

The study of innovation system can be analyzed through various conceptual dimensions. And they are – National System of Innovation (NSI), Regional System of Innovation (RIS), Sectorial System of Innovation (SSI) and Technological System of Innovation (TSI) (Chang and Chain, 2004). Among these frameworks, the NSI framework has been taken to conduct this research paper. Because, NSI framework analysed various components of system innovation (such as; input/output system, organizations and institutions, industries and firms, various actors, R&D activities, government agencies and policies) as a component of single national system and interact between these components looking as a combined form (Carlsson et al. 2002). This research paper focused on upgrading possibilities of quality in large cardamom sector of Nepal through National System of Innovation. The objectives behind the using the NSI framework to understand the NSI concept theoretically and analysing the linkage in the agriculture sector of Nepal for the

production and quality development of large cardamom. It helps to the farmer of large cardamom to identify various actors and components of innovation system which interaction could be beneficial to them to enhance quality and quantity of large cardamom. NIS also suggested innovation process that comes through interaction between different components of SI that may help farmers to brings various innovation such as product, process and technology in cardamom farming.

3.2 The National System of Innovation (NSI)

The NSI concept appeared first time in 1982 while Freeman was working on a paper for OECD but published in 1985 by Lundvall booklet named *User-Producer Interaction*. The basic components and stimulation for innovation concept have been found by many scholars before eighties. However, coining and shaping of the earliest version done by Freeman and IKE group in Aalborg at the beginning of eighties (Lundvall, 2007). According to Lundvall definition National System of Innovation is all about interaction between producer and user, technology development and the relationship between system's components that produce, diffuse and use the new knowledge. This new knowledge must be economically useful and located within the nation-state. (Bartels & Koira, 2014).

Additionally, in innovation, wider set of player and institutions are coming together in its process where collective entrepreneurship is taken one step further to bring the networking between firms along with knowledge institutions. Moreover, while 'National' comes together with 'Innovation System' then nation-state functioned at the national level including economic analysis. In this analysis, economic growth comparison and wealth of nation are taken into high consideration. However, economic analysis can be diverse in different countries in terms of institutional support on innovation and learning process which are considered as an important factor in Lundvall's literature. Additionally, his strong focus is to see how knowledge progresses through the process of learning and innovation (Lundvall, 2007). Moreover, NSI approach also carries the essence of research and development (R&D) intensity and organization which are an important factor for innovation activities. R&D activities are primarily linked with a various research institution and private sector and required continuous investment for generation of innovation. However, it required technological initiative and role of multinational firms that brings the strong network through the globalization (Adeoti, 2002).

Furthermore, NSI differentiates between the countries in terms of their organized and sustainable development and circulation of technological innovation in their national

economies. Where, their quantity of innovation is not only measurable but also their methods of innovation adaptation were considering in their sectoral composition. Therefore, it is important to analyze that how NSI work in terms of mechanism that generates the innovation whhich leads to technological change along with its social and institutional adaptation, interaction between producer and user and firm's competencies and routines. Because these are some major elements that playing the effective role in the use of innovation system at the national level (Chang and Chen, 2004). Moreover, following table no 1 shows the different definition of NSI presented by various authors.

Definitions of NSI

'*The Network of institutions in the public – and private sectors whose activities and interaction initiate, import and diffuse new technologies'* (Freeman. 1987).
'*The elements and relationship which interact in the production, diffusion and use of new, and economically useful knowledge…. and are either located within or rooted inside the borders of a nation-state'* (Lundvall, 1992).
'*The national system of innovation is constituted by the institution and economic structures affecting the rate and direction of technological change in the society'* (Edquist and Lundvall, 1993).
'*A national system of innovation is the system of interacting private and public firms (either large and small), universities, and government agencies aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social and financial, in as much as the goal of the interaction is the development, protection, financing or regulation of new science and technology'* (Niosi et al. 1993)

Table 1: Different definitions of NSI

Source: Lundvall et al. 2011, p5

Above-mentioned table 1 shows the different concept of NSI developed in a different period. It also shows that the concept of NSI has been keeping developing times to time. Freeman introduces the concept by defining that NSI is the network of private and public sector and their activities where Lundvall added the elements of knowledge that produced, diffused and used inside the nation. Furthermore, Edquist and Lundvall add another element in NSI and that is a technological change in society which comes through NSI. Moreover, Niosi and his colleague presented the broad definition of NSI which embraces the multiple elements. Such as; Universities, governments role, interaction between

different firms, universities and government agencies and linkage to the new science and technology development (Lundvall et al. 2011). Furthermore, there is some major theoretical dimension of NSI which is presented in next section.

3.3 Major elements of NSI concept

Seeing through the above mentioned various definition of NSI presented by different authors we conclude that there are some major elements in NSI where the concept of NSI is standing. Following section of a paper presented some of the major elements of NSI and their role in NSI.

a. Institutional network – is one of the important elements of NSI which indicates both public and private organization of nation and their network. The relationship, cooperation and interaction among these networks create, diffuse and use the new knowledge which is important for the innovation process. similarly, the institutional network provides great support for research and development and their policies and regulation influence in direction of innovation. Various public and private firms, universities, research centres, the and government are some key institutions of NSI (Lundvall, 2010).

b. Learning and Knowledge – are two major elements of NSI, where learning is focusing on the process of getting knowledge. There are two assumptions of getting knowledge and that is '*learning by doing*' and '*learning by using*' (Godin, 2009). Moreover, aspects of knowledge in NSI is more than information that includes tacit elements which are embodied with actors, routines of the organization, the relationship between firms and people. Creation, diffusion and use of new knowledge determine the performance of innovation within a nation or state (Johnson et al. 2004).

c. Financial system – is one of the key element of the innovation process. As Schumpeter mentioned earlier that innovation strategy and process strongly linked with R&D system, its resources and competencies of organization and financial system of a nation determine its continuing. Therefore, the financial system of the capability of the nation is important regarding the national system of innovation (Lundvall, 2016).

d. Education and Training – are also important elements of NSI that determining the performance and capability of innovation. Moreover, it focusses on investment in quality education, investment in skilled worker and registration in science and engineering. The difference in capability of innovation between countries is due to differences in formal and informal education and training system of that nation or state. However, these elements are

missing in an early stage, the important is radically increasing in contemporary NSI (Lundvall, 2010).

Furthermore, the NSI concept has been emerged looking thorough into advanced economies and it is grown in developed countries where creation and adoption of innovation and skills and capabilities brought the technological change. But developing countries are suffered from the limited access to science and technological activities, lack of institutional structure and less linkage between organizational units. Therefore, the perspective of NSI should be different in developing countries. NSI in developing countries can view as a how they can participate into global economy? In fact, developing countries can grab the opportunity in terms of obtaining knowledge and technology, supplying goods to global market or else benefited by latecomer (Parkey, 2012). Mostly, the broad concept of NSI has been used for developing countries where catching up strategies has been taken into consideration (Kayal, 2008). Moreover, the following section of the paper presents the understanding of NSI in developing countries.

3.4 Understanding of NSI in Developing Countries

Basically, innovation process accomplishes with specific inputs such as R&D activities, accumulation of exemplified and non-exemplified technological capabilities and interaction among firms and institutions. Moreover, innovation process should be focused to certain output which mostly known as new or modified products. Therefore, innovation is not ending by itself or through innovators, it is considering as a continuous process which could be improved with better performance (Chudnovsky et al. 2006). As mentioned previously NSI comes along with economy analysis differ from country to country as per their institutional support on innovation and learning process. Furthermore, the concept of *linkage* is an important factor when it comes NSI in underdeveloped countries (Arocena & Sutz, 2005). Authors explained that linkage is true inductors of innovation which also known as 'innovative circuits' and NSI can be enhanced by analysis of those circuits in terms of how and why they appear, how they succeed and multiply and disappear. Development measured by analysis of profit that comes from those circuits. Moreover, these innovative circuits play a vital role to firms or team's competence to elaborate a knowledge-intensive solution and solution for those specific problems which lies in small surface countries which usually not available in the international technological market. Consequently, those problems may persuade innovation and learning process with strong national dimension (Arocena & Sutz, 2005).

Furthermore, Lundvall (2009) presented *the narrow and broad definition of innovation system* for a better understanding of NSI in the context of developing countries. As Lundvall explained, the narrow approach to NIS mapping various indicators of nation's specialization of innovation performance, R&D efforts, science and technological organization. Whereas, analysis of broader perspective to NIS analysed the social institutions, market condition, education and communication development, financial system and these elements creating the big impact on learning and competence building (Lundvall et al. 2009). Consequently, in a narrow perspective, the performance of innovation is measured by the patents and innovation surveys. Whereas, board viewpoint of NIS focused on both major and minor innovation, various sector and different types economic activities along with low-tech sector. This perspective principally includes all aspects of interactive learning process where the performance of innovation measured through new technology and diffusion of new knowledge (Gregersen & Johnson, 2005).

Moreover, authors explained that study of NIS in the context of developing countries is more understandable through the concept of DUI and STI. The STI modes of innovation basically refer to the typical lab related activities such as; *experimentation, formalization and codification of the identified knowledge* (Lundvall et al. 2009) where DUI concept of innovation of innovation considering on learning on the job process and in this process, employees were challenged by different changes that occur through various problem. DUI concept is closely linked with border definition of NIS that focused on learning by interaction which comes through structure and external customer's interaction. In the context of developing countries, border approach to innovation is more suitable compared to narrow approach. Because the narrow approach is more related to science and technology innovation process where boarder approach provides more knowledge, particularly tacit and local both through doing, using and interacting (Lundvall et al. 2009).

Moreover, in this project, the border approach is going to consider because research field of this thesis is Cardamom sector of Nepal and Nepal is one of developing country which has a very limited resource in science and technology field and economy of the country more relies on agriculture compared to industry and service sector. Following section of the paper presents a scenario in developing countries in terms of linkage of NSI in various elements of the innovation process.

3.4.1 Linking the NSI with technological capabilities

The development and distribution of new knowledge playing the key role in the formulation and implementation of government's policies for the innovation process, and the interaction between institutions create, diffuse and use the new knowledge which defines the new technologies. Therefore, institutions, new knowledge and technologies are the interconnected elements of NSI (Metcalfe, 1995). The notion of the NSI is '*interactive learning*' and it develops the accumulated knowledge. The effective use of knowledge help for the use, adapt and change the existing technology and this ability is all about technological capability. Moreover, the central point is the ability to produce, diffuse and use the technical knowledge is known as technological capabilities. The main issue in developing countries regarding technological innovation is the capabilities of technology because Lundvall's broad definition of innovation is not only considering the commercial invention but also focusing on the capability of adoption and improvement of existing innovation (Adeoti, 2002).

3.4.2 Linking the NSI with policies

The policies are the reflection of the awareness of governance towards the innovation, where innovation policies are formulated to address the problems of the innovation system. Some of the problems in developing countries in terms of innovation process described as a low ability to produce, diffuse and use of new knowledge, less interactive learning process, lack of R&D etc. Therefore, policies of the nation should be encouraging the innovation process. There are various policies which are formulated by the government of nation such as; educational policies, technological policies, social policies, R&D policies, FDI policies and so on. The policies should play an important role towards the increasing innovation capacity, enhancing technological capabilities and building the competence of the nation. Moreover, the policy framework helps to enhance the structural and technological transformation in developing countries that motivating towards the economic development (Casadella and Uzunidis, 2017).

3.4.3 Linking the NSI with economic development

The application of NSI in developing countries is not similar with developed countries. Therefore, the broad approach of NSI seen as a better understanding for developing countries. The NSI concept regarding economic development in less developed countries more focuses on how NSI relates to economic welfare, sustainable development and role of government in commodifying knowledge. Moreover, innovation in the product is highly

considering compared to innovation in the process. In another hand, innovation in low and medium technological sector is more focused rather than innovation in the high technological sector. Therefore, borrowing and adopting technologies is highly consider compare to development of new technology (Lundvall, 2017).

3.5 Agriculture in Developing Countries

Agriculture is the backbone for the economy of developing countries and agricultural activities becoming the basic economic activities of developing countries. About three – a quarter of employment generation comes from agriculture in such developing countries where 35 to 40 percent of GDP contributing by agriculture sector (Maskey, 1997). Even though, Agriculture playing a major role in the poverty reduction and increasing growth of the developing countries, the production and production yield was not much satisfactory since a couple of decades. The reason behind it is that most of the developing countries still focusing on traditional based technologies and poor public-sector programs. Less use of improved technologies (Such as; advance fertilizers, improved seeds and cropping methods) makes these countries to face the same problem over long time (Aker, 2011). Therefore, requirements of innovation in agriculture is high in such countries. Because, innovation in agriculture brings the new knowledge through interaction between various research institutes, organization and farmers, it helps to formulate new policies for regularity bodies and moreover, innovation brings the development and diffusion of new technology that helps to grow the agriculture of developing countries (Agwu et al. 2008).

Furthermore, Nepal is one of the developing countries which economy is highly based on agriculture. About 65.6 percent of the population engaged in agriculture and about 32.6 percent of GDP contribution comes from the agriculture sector. However, the rapid growth in agriculture sector required for the development of the country, the growth in agriculture is not satisfactory which was indicated during this period by 4.7 percent only. Apart from its geographical limitation, Nepalese agriculture sector has suffered for many difficulties. For an instance; low investment in agriculture, the poor linkage between technology generation and diffusion, lack of skilled human resources, heavy reduction on natural resources, poor infrastructure development, less subsidy on agricultural inputs and overall lack of concrete policies for agriculture sector (Paudel, 2016).

3.5.1 Challenges of agriculture in developing countries

As mentioned before, agriculture providing the major contribution to the economy of developing countries, but at the same time challenges of this sector also remain high in such developing countries. Most of the farmer or producer from these countries suffering from lack of institutional and infrastructural support, less availability of resources, insufficient investment capital, modern technologies and skilled labour or manpower. Additionally, lack of advance ICT instruments, easy access to the transportation facility, global networks and effective government's policies are also some major problems that farmer or producers of developing country facing (Trienekens, 2011). These problems leading to some major challenges for agriculture sector of developing countries which are described in the following section.

a. Deforestation and Land degradation

These two problems became the major challenges for developing countries since a couple of decades. Deforestation affecting badly to the water resources, soil and biodiversity which leads toward the environmental degradation and economic declining. Increasing population, the demand for firewood, unplanned smart city policies are some major issues causing the deforestation in those less developed countries. Similarly, deforestation creating the land degradation which diminish the agricultural productivity which is also another challenge for developing countries. Asia and Africa together accounted for 43 percent of total land where 70 percent of world's total population is living. Therefore, population pressure and land insufficiency becoming the major causes of land degradation. Additionally, a country like Nepal has suffering from extra pressure in marginal land due to the source of food, fuel and fodder requirements (Regmi and Weber, 2000).

b. Productivity Declination

Most of the countries from Asia like Nepal, Bangladesh and other countries from Africa are facing the problem of productivity declination since decades or more than that. Highly, dependent livelihood in agriculture, lack of good government policies, lack of technical policies against the natural disaster, environmental depletion are some major issues that leading the productivity declination in the agriculture sector of developing countries. Additionally, global climate change also one of the major reason for product declining (Regmi and Weber, 2000).

c. Lack of Market access

Most of the developing countries suffering from the easy access to the market. Basically, technological capabilities of producers, strong infrastructure, bargaining power and knowledge of the market are some key factors that facilitating to the producers of developing countries to the easy market access which is not seen as satisfactory level (Trienekens, 2011). Moreover, other hand landlocked countries like Nepal having some extra challenges due to geographical conditions. Apart from these, tariff barriers, subsidise policies, trade knowledge and policies are some major factors that hindering easy access to the local and global market (Adhikari and Adhikari, 2005).

3.6 Application of Innovation in Agriculture

In above, we present the different perspective of innovation system and national innovation system in regard to developing countries. we explained that innovation system playing the vital role in overall development of country especially in developing countries which can be analyzed through NSI. Moreover, the scenario of agriculture and various challenges faced by developing countries also taken as a part of the study. Furthermore, this section of the paper explains the application of NSI in the agriculture sector of developing countries. The framework of Agriculture innovation system(AIS) has been taken to emphasise more on the purpose of the study.

AIS is one of the dimensions of innovation system so that it is beneficial for developing countries to analyze the importance of innovation system in agriculture sector for the improvement because most of the developing countries are highly depended on agriculture in terms of source of employment, contribution to GDP, export commodities to the foreign countries and so on. But the scenario of agriculture development in those countries is not that much satisfactory. As we mentioned above numerous constraints (Unskilled labour, weak infrastructure, lack of institutions, lack of appropriate policies) creating an unfavourable environment in agriculture and consequently it hinders to bring the various investment (Private, foreign) in this sector along with manufacturing and service industries (Moise et al. 2013).

Furthermore, the demand for agriculture product is growing aggressively and it is expected to grow in the future corresponding to the growing population of the world. Therefore, innovation is only workable option to meet the increasing production demand and to introduce the varieties of crops through the efficient and productive use of

resources. Moreover, the role of innovation in managing natural resources and agriculture sector is essential. Innovation brings advances in science, technology and engineering, useful for agriculture and natural resources, helps to leapfrog in genetic technologies and through innovation an entire system can be created around agriculture sector. Through an effective innovation system in agriculture, a conducive environment can be created that promotes interactions between government, farmers, educational institutes, the private sector and the society (Andersen et al. 2015).

Therefore, the objectives of this research paper to create a bridge between various elements of innovation system and agriculture sector of Nepal particularly in large cardamom sector through the NIS framework. As we earlier mentioned broad approach of NIS will be more suitable to analysis the overall agriculture sector and create linkage to the innovation system. This framework clearly indicates the major role of different actors and structure of agriculture (such as; farmer, suppliers, inputs, infrastructure, market) in the innovation system. Moreover, NIS framework also focused on the integration of different organization such as; research, training and educational institutes, farmers and association of farmers, NGO and private organization, policy and regulatory bodies and so on. It creates coalitions between public and private sectors, builds the relationship between various actors and market institutions. Therefore, it will be helpful for the overall development of agriculture sector. consequently, it will help for poverty reduction and economic development of the country (Agwu et al. 2008).

3.6.1 Agriculture Innovation System (AIS) Framework

Since last decades, there has been various concept developed to analyze the application of innovation system in the agriculture sector. Such as; NARS (National Agriculture Research System), AKIS (Agriculture Knowledge and Information System), and AIS (Agriculture Innovation System). The technological and economic strategies have moved from NARS to AKIS and nowadays more concern in AIS. Basically, the concept of AIS emerged from the concept of NSI as a sectorial unit of analysis (Agwu et al. 2008). Moreover, the importance of innovation system in agriculture can be studied through AIS concept because it is more focused on the linkage between research, education and implementation of technology change (Speilman, 2005). It includes different activities and process in agriculture that linked with generation, production, distribution and use of new knowledge in terms of technological, institutional, organizational and managerial context. The study of innovation system can be beneficial for creating the favourable environment in agriculture

system that promotes the interaction among government, farmers, educational institutes, private sector and society (Juma, 2015).

Furthermore, it is important to identify a framework which can embrace the various indicators that can be used to analyze the inputs, process and outputs of the innovation. Following figure no. 2 represents the AIS framework that captures the fundamental elements of the national system of innovation. Additionally, it shows the linkage between its components, the relationship between institutions and policies which creating the overall environment for innovation.

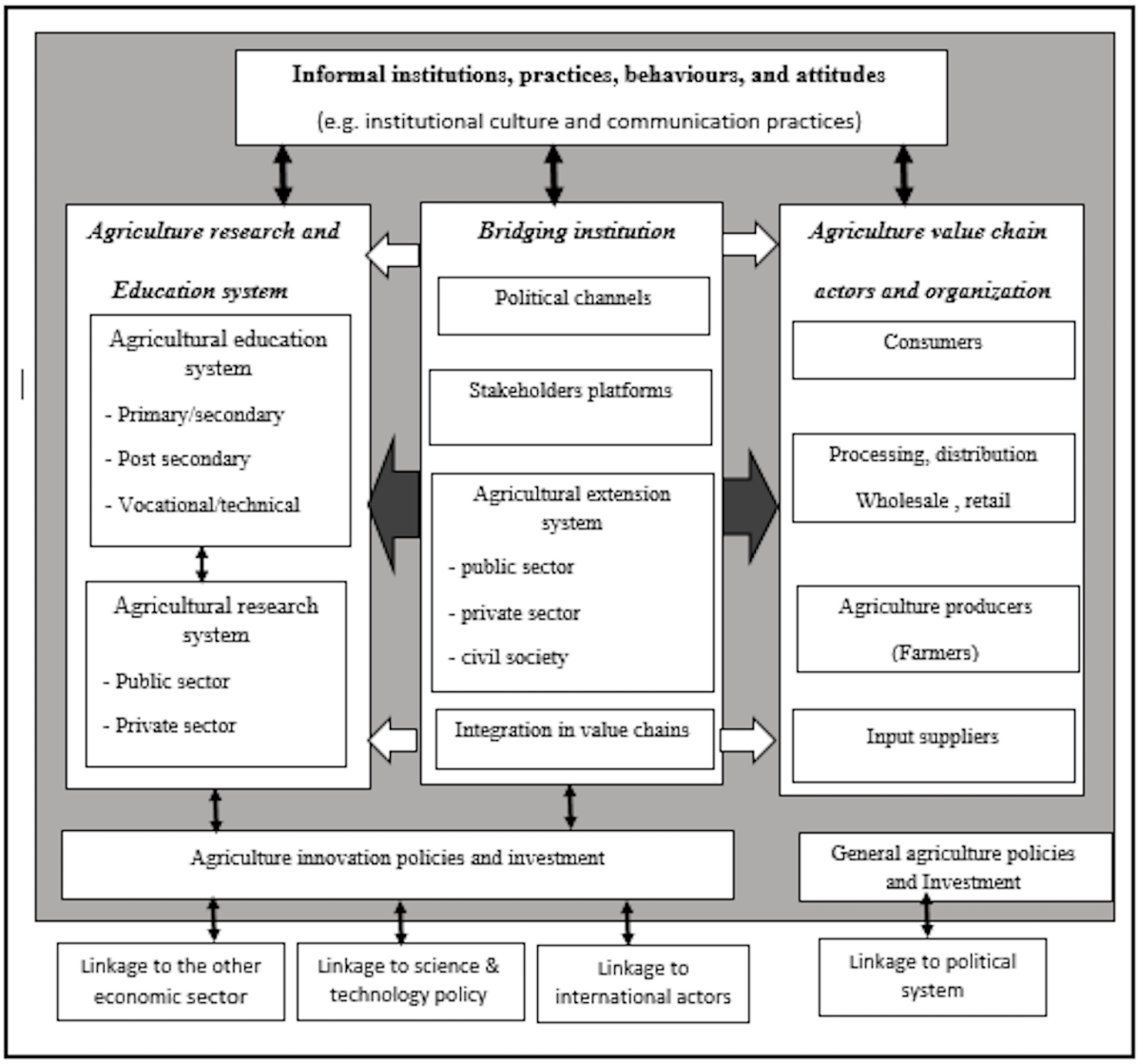

Figure 2: Framework of agriculture Innovation system

Source: Spielman & Brinar, 2008, p6

As we mentioned earlier, agricultural innovation system (AIS) can be analyzed as a sector of NSI. Therefore, above-presented figure 2 contains the fundamental elements of NSI that

is combined with the agricultural system. The figure shows that different form of the institution (political channels, private & public stakeholders) associating between the source of knowledge (education & research system) and actors and organization such as; consumer, retailer, producer etc. Different education and training system of nation generating different types of knowledge (codified or tacit) where institutions are playing a key role to transfer this knowledge to the various actor of agriculture. Institutions are setting the various norms, rules, practices, behaviours and cultural attributes of society that interact the various sector or organization of nation. Moreover, the presented framework also embraces various policies (general & agriculture) of a nation that determining the structure of institutions, education and knowledge system which are key drivers of the innovation system. However, these policies relate to various other sectors (such as; economic sector, international actor, political system) which are beyond the border of innovation system (Spielman and Brinar, 2008).

Furthermore, presented AIS framework is relevant to understand the role of innovation system in agriculture of developing country like Nepal. The quality of the agricultural commodity can be enhanced using modern technologies which comes from the diffusion and use of knowledge. In most of the developing country, the interactive learning process is the prime source of knowledge due to lack of science-based learning. Therefore, the interaction between the institution, actors and knowledge expertise can produce, diffuse and use of knowledge which is important for developing country. Moreover, problem based learning (PBL) which providing by educational and research institution such as; universities and information communication technology (ICT) are some of key factors that helps to enhance the capabilities of farmers and related actors to the agriculture, consequently, which is one of the determining factor to bring the investment in agriculture of developing countries (Lundvall, 2009).

Additionally, in developing-country case, it is also important to study the process of social and technological change in agriculture and how the concept of technology transfer from advance to developing economies playing the vital role for a change. Moreover, various policies within the nation also encouraging for the process of innovation (Spielman, 2005). Therefore, analysing the role of policies that formulated by the government, and other private and public stakeholders is also the part of this research paper. Following section of the paper presents the role of universities and research centre, the role of information communication technology (ICT), the role of policies are some factors which can motivate

the innovation process that would be beneficial for agriculture development in developing countries.

3.6.2 Role of Universities in agriculture innovation

The Universities and research centre playing the important role in innovation process through knowledge and learning process. The comprehensive study of the role of universities in innovation system is ongoing for more than two decades back where universities have been identified as scientific knowledge provider through its resource base people, skill and knowledge, research and research-related activities. The advance knowledge enhances the capacity of the institution and its actors which encourage for innovation (Gunasekara, 2006). Furthermore, universities courses have always been a source of knowledge and research of students also producing the knowledge. similarly, a training program conducted by universities also source of technological knowledge which is the major inputs for the development of any sector such as; agriculture and industry. Moreover, universities providing an environment for the fostering of knowledge flow, technology transfer, development of human capital, infrastructure development and improvement of existing industry that would be helpful for creation of a favourable environment in the agriculture sector (Youtie and Shapira, 2008).

3.6.3 Role of ICT in agriculture innovation

Most of the developing countries lacking the proper information system due to lack of communication technology. Because the information system should deliver the useful information to the consumer or user of the system. Consequently, various actors (such as; farmers, traders, producers, users) of the agriculture sector and other actors like managers, knowledge producers, R&D department from organizational sector suffering on obtaining, repossessing, processing and spreading the various types of information. The reliability and validity of the information are basically depending on the quality and usefulness of the inputs (data or massage) which that information carry and it is important for the policymaker to formulate the required policy (Omekwu, 2003). Therefore, Calestous Juma explained about the usefulness of some of the innovation platforms in agriculture innovation which came from the scientific and technical research of the developing countries, and they are; biotechnology, nanotechnology, information communication technology (ICT) and geographic information system (GIS) (Juma, 2015).

Furthermore, the impact of these technologies already seen in some of the developing countries. For an example in 2002 farmers from the China and India were benefited by

94% and 66% respectively in cotton farming by using of biotechnology (Qaim, 2005). Moreover, in the period of 1984 to 1990 China could grow their rice production about 40% through the technology adoption (Ghimire, 2012). Therefore, diffusion of technological knowledge helps the developing countries to bring the innovation in agriculture that could enhance the productivity of agriculture (Huang and Rozelle, 1996). Additionally, the application of ICT should impact very diversely to the society for the development process which comes through dynamic institutionalisation and application of electronic technologies. It helps to provide the strong flow of information that transfers among local communities, responsible institution for information, knowledge and skill transfer and policymakers (Turpin and Ghimire, 2012).

3.6.4 Role of Policies in agriculture innovation

As previously discussed, most of the developing countries suffering from the population pressures, consequently the pressure on land also increasing which leading towards the deforestation and land degradation. Therefore, agriculture productivity also rapidly diminishing in such developing countries and to enhance the productivity, the level of inputs also need to be increased. The inputs level can be increased through advance fertilizer system, improved agriculture technology and scientific way of farming which comes through the advance learning process. It creates an environment for the generation, adoption and transfer of the technologies. Therefore, various policies (such as; education policy, technology policy, agriculture policy, investment policy etc.) need to be formulated and implemented from the government side. Moreover, these policies should be linked to upgrading productivity which comes through *technological change* (biotechnology, modified crops), economic inducements policy (tax off, subsidies) and rules and regulation (law & order, injunction) that encourage the innovation on agriculture (Andersen et al. 2015).

Furthermore, agricultural innovation policies and other national development policies should be coordinate with each other. While AIP (Agriculture innovation policy) is implemented to building the country's capacity to innovate in the agricultural sector, other policies must be focused on promoting the regional innovation through attracting the investment to small-scale entrepreneurs, developing ICT for diffusion of knowledge and developing basic infrastructure. Then only AIP can work efficiently towards the development of formal national agricultural research and innovation. Additionally, the

legislative body of the nation should be prescribed various law, order and regulation for the actual implementation and enforcement of those policies (Spielman and Brinar, 2008).

Nepal is one of the agriculturally based country which livelihood and most of the employment depended on the agriculture sector. Nepal's most of the trade and import-export commodities are related to agriculture. As per the data, the agro-trade balance recorded negative 30.8 percent during 2013/14, which could be balanced by exporting the varieties and high volume of agricultural commodities. Therefore, national agriculture policies should have focused on the development of agro-based industries. In another hand, effective investment policies also required to increase the investment in agricultural R&D. The recent data of APPARI shows that Nepal invested only 42.4 million US dollar in 2015, where Sri Lanka, Bangladesh and Pakistan invested 83.1, 177.5, and 278.5 million US dollar respectively in the agricultural sector for the R&D purpose. Similarly, functional and implementable policies are required to emphasize on vocational training for the rural youth so they can bring the innovation in their localities through their knowledge and skills. Moreover, national agriculture policy can bring innovation by competence building which comes through strong linkage between universities and research institutes, production and diffusion of technology and development of skilled human resources (Paudel, 2016).

As we mentioned previously, to implement the innovation policies effectively, the other policies of the nation should coordinate with each other to achieve the overall development of society. Therefore, while analysing the application of NSI and AIS in developing country to enhance the productivity of agriculture sector it is beneficial to analysis the governance system of that country. Here, governance system indicating the practices of the government towards the development, willingness for innovation, transparency, accountability and enlightened policies. Where every institution of government should actively participate in the public affair and perform according to rule of law (IFAD, 1999). Therefore, following section of the paper describing the concept of 'Good governance' and how its related to fostering innovation in the agriculture sector, especially in case of Nepal.

3.7 Good governance

The concept of 'Good governance' was introduced by World bank after the crisis of governance in Sub-Saharan Africa in 1989, where World bank identified that development of developing countries required the good public management. Furthermore, this concept was adopted by world bank to emphasized on the role participatory governance to transform the aid into poverty reduction mechanism (Waheduzzaman, 2010). Here, the

term ‘Governance’ is not similar to the government, neither it is a single actor of the system. it is defined as ‘*a process whereby societies or organizations make their important decision, determine whom they involve in the process and how they render*’ (Graham et al. 2003, p.1). Moreover, World bank argued that overall development of the country is linked with good governance and that is a combining form of open, predictable and progressive policy along with transparent bureaucracy with a professional attitude and accountable executive body of government (IFAD, 1999). Additionally, IFAD has emphasized on various elements of good governance which are explained below in table 2.

Accountability – is one of the major elements of good governance for that all the body of the government.
Transparency & information access – the good governance concept provides right for the information to the different market players. Moreover, all the activities and information should be transparent.
The legal framework for development – the legal system of good governance should provide stability and predictability which are the key factors to create the economic environment.

Table 2: Major elements of good governance

Source: IFAD, 1999, p. 2

Furthermore, most of the countries in the world especially developing countries are considering the good governance concept due to practices of bad governance, where bad governance of the country is described as corruption, lack of human rights, lack of transparency and accountability in government actions and moreover ineffective legal framework. Additionally, bad governance hindering people on the right of information access, equal participation in society and increasing corruptions that diminishing the rule of law (IFAD, 1999). The following section explains one of the major challenges of good governance and that is corruption.

3.7.1 Corruption

Corruption is one the supporting factor for bad governance and most of the countries taking it seriously because this is affecting the development of the country. Generally, the corruption is defined as; ‘*miss use of power for private gain’* (Morse, 2006). Which encourage the person for the consumption of public goods and resources for the personal benefit. Therefore, it affects the wider distribution of public goods, led towards the imbalance of the development priorities, and affecting the social and political stability.

Consequently, it will affect the overall development of the country (Morse, 2006). Moreover, most of the developing countries are facing the problem of corruption. Recent data of Transparency International show that out of 176 countries participated in the survey in 2016, more than 120 countries are in below average (scored less than 50), where score 100 is free of corruption and 0 is most corrupted. Most of the less scorer countries are developing countries and belongs to Sub-Saharan Africa, Asia Pacific, North Africa, Central Asia and some of from Europe region (Transparency International, 2016).

Even though, corruption identified in most of the developing countries, but those countries are not facing the similar types of corruption. Generally, three types of corruption are identified and they are; Political, Bureaucratic and Electoral corruption. Additionally, there are many forms of corruption that have been in practice and they are; Bribery, Fraud, Favouritism and Nepotism, Extortion, Unlawful gratuity and so on (Otusanya, 2011).

3.7.2 Role of good governance in Innovation System

The good governance concept focused on equal participation and involvement of people through the collaboration of various actors like government, the private sector, a representative from different field and citizens. The collaboration process among these actors develops the equal participation of people enhance accountability and transparency of government which helpful for the economic development of the country (Waheduzzaman, 2010). In another hand, an accountable and transparent government able to focus on development priorities for the innovation support. Moreover, it can formulate different innovation policies along with technology development projects which could be helpful to enhance the innovation system. Moreover, good governance emphasizing on continuous collaboration among the key actors which encourage government towards the rethinking of strategic policies that could motivate the innovation process (Wallin, 2016).

Furthermore, good governance can promote the higher education by formulating the different policies for the development of government or private universities where government universities are funded and regulated and controlled by the government of the country. Mostly in Europe, governments promoting the higher education where in developing countries private sector are dominating the system of higher education. Furthermore, good governance facilitating to higher universities to make decision and action accordingly (Nurunnabi and Nurunnabi, 2016).

Additionally, good governance also can play the major role to bring the investment by facilitating different private organization for the business purpose. PPP (Public-Private-Partnership) agreement is one of the example taken by the Sabry, (2015) to clarify the benefit of collaboration between government and private organizations. He explained that under the PPP agreement, the government is helping the private business firm to create the business environments by formulating a various rule, regulation and policies where private firms are investing in infrastructural service development. Moreover, private business firms investing in R&D for the better result in business which creates an environment for innovation and other side quality of government and body of government should be a guarantee for the infrastructure allocation contracts, investment security and institutional support (Sabry, 2015).

Furthermore, innovation process required continues learning which comes from the knowledge and that knowledge can be generated through higher education or research and development. And policies and strategies are fostering the establishment of universities and private organization. Additionally, international business firms can bring the technology for their business purpose which also would be a great learning to the local employers. But the end of the day, these all are shaped by the government's action and policies Which need to be accountable and transparent.

4. Agriculture of Nepal

This chapter of thesis embraces the overall situation of Nepalese agriculture sector. However, the content of the chapter is more focused on large cardamom sector and related activities. It includes various data and information related to large cardamom which provides the brief understanding of this sector.

4.1 Overview of agriculture system in Nepal

Nepal is one of the developing country situated in South Asia. It is a landlocked country which is surrounded by two economically emerging giant India and China. The country is 22 times smaller than India and 54 times smaller than China in a size which is approximately in a rectangular shape with the length of 650 Km and width is about 200 Km. Moreover, Nepal is geographically divided into three parts and they are called; Himalayan region, Mountain region and Terai region. The climate diversity of Nepal is unique which is different from one region to another region. The Terai region (above sea level 300- 1000 m) is hot, where the climate of Mountain region (above sea level 2600-4200 m) is pleasant and cool and above sea level 4200 m is a Himalayan region where we can find cold and alpine climate (Paudel, 2016).

Furthermore, the livelihood of Nepalese people is staying in agriculture and crop farming, livestock farming is the major activity of Nepalese farmer. About 65.6% of the population is engaged in farming and agriculture sector of Nepal contributing around 32.61% in annual GDP (MOAD, 2013/14). Moreover, the agriculture system of Nepal is mainly dominated by family farming where about 78% of farm holders producing for home consumption and around 80% of the land is used to grow cereal crops such as Paddy (40%), Maize (20%) and Wheat (17%). Apart from these Tobacco, Tea, sugarcane, Cardamom, Ginger, Oilseeds, Jute are some of the agricultural commodities that Nepalese farmer is producing. Even though, about 66% of labour force is employed in this sector, the growth rate of this sector is not much satisfying which was recorded 4.7 % in the period of 2013/14. The traditional way of farming and priority were given to production for common crops is the main reason for less growth rate in this sector (Nepal et al. 2014).

4.2 Nepal towards the agriculture innovation

Since, earlier in the 1990s, the concept of globalization, market liberalisation and privatisation emerged in Nepal, the movement of changes has been seen in agriculture research and technology system. Since then various institutions such as; NGOs, CBOs, NARC was actively involved in agricultural technology development and promotion. This involvement encourages the institutional R&D, partner/client relationship and national and international sources of funding in the science and technology system (Gauchan et al. 2003). Furthermore, Nepal is in the just crawl situation in terms of agriculture innovation and development. There are high possibilities for growth and poverty alleviation of Nepalese farmer through agricultural innovation and development but challenge for Nepalese farmer also as it is. Geographical difficulties (out of total land 15% covered by Himalayas and 68% covered by mountains) with different weather condition in different regions, unrest political changes since 2/3 decades and high competition with the products of two giant neighbour India and China are some of the major challenges that Nepalese farmer is facing from long time (Paudel, 2016). Therefore, the importance of agricultural innovation system highly considered for the product development as well as the development of country's economy. There are some agricultural innovation practices has been done which is mostly focused on a system of farming and technological development in agriculture of Nepal.

Furthermore, Nepalese agriculture sector playing a major role for poverty reduction and economy development of the country. However, the productivity of cereal crops is in decreasing order. The share of cereal crops is in gross crop output went down from 76% to 69% and it is a more decreasing trend. Therefore, the focus of Nepalese farmer shifted from cereal crops cultivation to cash crops cultivation which is grown through the process of agricultural escalation in the Mountain and the Himalayan region. Various vegetables, sugarcane, Tea, Tobacco, various spices, are considered as a cash crop in Nepal which has high monetary value in the market (Nepal et al. 2014).

The following section of research paper provides the brief study of one of the cash crops **Large Cardamom** which is farming in mostly high altitude. Moreover, following section incorporates the situation of large cardamom farming, major functions and involved actors, production, global market and trade flow, problems and development practices in large cardamom sector.

4.3 Large cardamom Farming in Nepal

From the prehistoric times, Nepal has been well known as a land of spices. More than 20 spices are growing in Nepal, where Asia account for 70 spices and 109 spices have been growing globally. It has been seen over the years that fast-growing food industries in the world largely depend on spices as a test and flavour market. Therefore, spices demand growth is estimated by around 3.19 percent and it is an increasing trend (Chaudhary & Vista, 2015). Furthermore, large cardamom is known as Black Gold, Queen of Spices and 'Alaichi' in Nepali which basically related to the Botanical family called *Zingiberaceae*. In worldwide it is also called Black Cardamom or Nepalese Cardamom which is the third most expensive spice in the world after Saffron and Vanilla which is inherent to the Nepal, India, Pakistan and Bhutan (MoAD report, 2015).

In Nepal, large cardamom was introduced during the 19th century in Ilam district by Nepali labourers who work is Sikkim, India. It is started to become commercial cultivation in Nepal since 1953 and slowly became new livelihood option for Nepalese farmers. At present scenario, it is a high-value cash crops which market demand is increasing day by day nationally and internationally. It is second highest agriculture export commodities after lentils (29.6%) which accounts 7 % of total agriculture export (Kc & Upreti, 2017). Furthermore, most of the large cardamom only harvesting in the eastern Himalayan countries therefore Nepal, northern part of India (Sikkim and Darjeeling) and Bhutan is only major producer of large cardamom. Therefore, total production of large cardamom across the world projected from these three countries where Nepal account for 52 percent, followed by India 37 percent and Bhutan 11 percent (Singh & Pothula, 2013). A recent report shows that Nepal produced around 5,763 MT of large cardamom which worth around USD 23.6 million (MoAD, 2015). Moreover, at present time large cardamom growing into 41 districts out of 75 districts of Nepal, where more than 67,000 household directly involves in its farming. Most of the eastern regions of the country produced large cardamom which comes about 84 percent of total production. Ilam, Taplejung and Panchthar are the major producers of the large cardamom (Kc and Upreti, 2017).

Furthermore, there are 16 cultivars of large cardamom identified in the world. Whereas, eight varieties being planted and grown in Nepal. Basically, they are differentiated according to a height above sea level where they were harvested. Such as; Nepal Ramshai (1500-2000 MASL), Golshai (1200-1600 MASL), Saunae (700-2000 MASL), Chibeshai (700-1000 MASL), Dammershai (700-1200 MASL), Kayntidar (700-1000 MASL),

Salakpure (1500-2000 MASL) and Jirmale (600-1200 MASL) (Chaudhary & Vista, 2015). Large cardamom as a spice mainly used for flavouring food and drinks. In South Asia, especially in the Nepalese and Indian kitchen it is mostly used. It is used in Indian traditional sweets and tea and in both countries mostly used in Garam Masala for curries. Large cardamom has unique, strong taste with an intensely sweet-smelling resinous fragrance. It also has coolness like mint. Therefore, sometimes it is smoked and its seeds are chewed and used as a mouth refresher. In some of the Nordic countries large cardamom used in baking. For an example in Finland, Finnish people used it to prepare sweet bread called *Pulla* or Scandinavian bread *Julekake*. In the middle east, large cardamom powder used in sweet dishes, coffee and tea (MoAD, 2015).

4.3.1 Production trend of Large Cardamom

In 1964, the government of Nepal took imitative to help farmers for the cultivation of large cardamom. Hence, government launch a new policy to grant a loan to the farmer through Agriculture Development Bank (ADB). Moreover, in 1976 government brought 400,000 sample of improved large cardamom from Sikkim to develop varieties in the production which is distributed to the farmers of Ilam, Panchthar and Taplejung (Bimali, 2014). In the early stage, production of large cardamom started into 19 ha land by the Ministry of Agriculture, to use mostly as a large cardamom plant nursery. Currently in Nepal, over 14875 ha land is being used for the large cardamom harvesting which generating more than 6,000 tons annually (ITC, 2017). Following presented table 3 shows the last 10 years t production of large cardamom and area that used for cultivation.

Total production of large cardamom in last 10 years

Year	Production Area (ha)	Production (tons)
2003/04	11220	5983
2004/05	11347	6086
2005/06	11498	6647
2006/07	11712	6950
2007/08	12015	7087
2008/09	11849	7037
2009/10	11766	5232
2010/11	12584	5517
2011/12	11665	6026
2012/13	11434	5753

Table 3: production of large cardamom

Source: Chaudhary & Vista 2015, p: 2

Above mentioned table 3 shows that production of large cardamom is increasing trend till 2007to 2009. But after that it is declining. This may be due to biotic factors and production declining in major districts (Taplejung, Ilam, Panchthar) which accumulating more than 3 quarter of total production. In Nepal, large cardamom production is 500kg/ha which below average yield whereas in India producing 2000kg/ha (Chaudhary & Vista, 2015). However, the area for cardamom production increasing trend where recent report shows that about 14875ha being used (KC & Upreti, 2017).

Production of Large Cardamom by Region and Districts

Regions	**Total Districts**	**Major Districts**	**Area (ha.) 2013**	**Productions (MT) 2013**
Eastern	12	Taplejung, Panchthar, Ilam, Sankhuwasava	13,696	5,398
Central	8	None	533	174
Western	10	None	317	127
Mid-Western	7	None	119	41
Far Western	4	None	22	13
Total	**41**	**-**	**14,686**	**5,753**

Table 4: Production by Regions and Districts

Source: KC & Upreti, 2017 p3

Above presented table no 4 shows the production of large cardamom by region and districts and area used for cultivation. It shows that most of the production is generated from the only Eastern region where Taplejung, Panchthar, Ilam and Sankhuwasabha are major districts. Basically, cardamom farming is imported firstly in these places and these areas are most suitable for cardamom farming. About 25,000 households are engaged from this place and about 93 percent of the land is used in these places out of total area used for cardamom farming in Nepal (Kc and Upreti, 2017).

4.3.2 World market of large cardamom

Mostly large cardamom is demanding spice in cooking due to its exclusive taste and strong flavour. Apart from taste and flavour, large cardamom also known for medicinal benefits. It's oil which is extracted from its seeds mostly used for aromatherapy treatment.

Moreover, its oil also used to make hair shiny (MoAD, 2015, p8). There are some other medicinal benefits which get through large cardamom. Such as;

a. *Gastro-Intestinal Health,*
b. *Cardiovascular Health,*
c. *Respiratory Health,*
d. *Urinary Health,*
e. *Large Cardamom is full of antioxidants, Vitamin C and essential mineral potassium and so on.*

Furthermore, due to its amazing benefits the demand of the large cardamom in the world is in increasing trend. As per the ITC report 2014, 114 countries had imported large cardamom from the world market. Among them, only 10 countries which had an important involvement in import is presented below.

S.N.	**Countries**	**Total Value in 2014 ('000'USD)**
1	Saudi Arabia	100173
2	United Arab Emirates	78556
3	India	34090
4	Bangladesh	15753
5	Singapore	10033
6	Egypt	9767
7	Pakistan	9349
8	Vietnam	9317
9	Kuwait	9313
10	United State of America	7887
	Total	**284,238**

Table 5: Top 10 importer of Large Cardamom

Source: MoAD, 2015, p10

According to presented table 5, Saudi Arabia is the highest importer of large cardamom which equivalent around 35.24 percent of import value among top 10 countries. Moreover, the report shows that total import value of large cardamom in the world is around USD 349,640 thousand where top 10 countries account for around 81.29 percent (MoAD, 2015).

Among top 10 countries, top three countries are Saudi Arabia, UAE and India and they account for 28.65%, 22.47% and 9.75% respectively into total world import of large cardamom. Furthermore, in the following section it is presented top 10 countries which exporting the large cardamom into the world market.

S.N.	Exporter countries	Total Value in 2014 ('000'USD)
1	Guatemala	240319
2	India	58007
3	Nepal	23554
4	Singapore	10059
5	Indonesia	10036
6	Netherlands	2705
7	United Arab Emirates	2316
8	United Kingdom	2205
9	Germany	1002
10	Colombia	989
	Total	**351192**

Table 6: Top 10 exporter of Large Cardamom

Source: MoAD, 2015, p12

Above presented table 6 shows top 10 exporters of large cardamom into the world market. According to MoAD report, (2015) total export of large cardamom worth around USD 356,494 thousand in the world market. Whereas, about 98.51 percent value of total export comes from these top 10 countries. Above mentioned exporter countries are involving in the export of large cardamom it does not mean that all these countries produce the large cardamom. As previously mentioned large cardamom harvesting especially in eastern Himalayan areas and it generally requires cool, moist soil, humid under a shaded area and its performance are better if the cultivation land is in 700-2100-meter elevation range above sea level (NSCDP, 2009).

4.3.3 Nepalese Cardamom's Market and Trade

The government of Nepal highly prioritized to the large cardamom as an export potential crop that has high value but volume is low. It is a climate sensitive crop therefore export

quantity is generally depending on the production inside the country. In 2013/14 country exported about 4,914 tons of large cardamom which vale was NRS (Nepalese Rupees) 4,270,372 thousand which equivalent approx. USD 4.27 Million. The production was decreased by 3.85 percent compared to previous year 2012/13, however the value is increased by 9.84 percent compared to year 2012/13 (TEPC, 2015). Moreover, the market of Nepalese cardamom totally depends on Indian market because 90 percent of the production exported to India via Britamod port of the Jhapa district (Maharjan, 2014). Additionally, a small proportion of the production exported to other countries such as Germany, China, Singapore, Bangladesh and so on (MoAD, 2015). Following table no. 7 presented a trading scenario of Nepal's large cardamom into world market during a period of 5 years (2009- 2013).

Trading of Large cardamom in Nepal

Unit: USD '000'

Buyers	Exported in 2009	Exported in 2010	Exported in 2011	Exported in 2012	Exported in 2013	Tariff
India	16957	20331	30460	45646	19190	0%
Bangladesh	21	0	0	0	0	23.75%
Canada	0	0	0	14	0	0%
China	0	0	4	3	0	0%
Pakistan	321	53	0	0	0	5.00%
Singapore	0	25	0	0	0	0%
UAE	83	92	95	111	0	0%
Ukraine	0	0	111	0	0	0%
UK	0	0	76	0	0	0%
World	**17382**	**20500**	**30746**	**45774**	**19190**	

Table 7: Major Byer of Nepalese Cardamom

Source: MoAD, 2015 p: 16

Above presented table 7 shows that during 2009 to 2013 most of the large cardamom being sent to India only. In 2009, the total value of large cardamom exported to the world India accounts for 97.55% which gradually increased and reached 100% in 2013. There is only 2% of produced large cardamom consumed for domestic purpose and 98% were exported outside of the country. Even though, it has an exciting market in other countries like UAE, Pakistan, Ukraine, the UK which also providing 0% tariff to Nepal, the market diversification of large cardamom is unsatisfactory. The reason behind it quite unclear but some of the research says India provides effective demand, fair market competitiveness, less trade barriers, high market access or ease of doing business for large cardamom which is prime determining factor for any commodities trading between countries (MoAD, 2015).

4.3.4 Major functions in Cardamom farming

a. Plantation

Large cardamom is a shade loving plant. It requires hill shade or sparse shade condition to grow nicely. Its cultivation can be done between 600 – 2000 MASL. Large cardamom plants grow better in temperature between 10 – 22º C and require 2000 – 4000 mm annual rainfall. Moreover, large cardamom can't grow under direct exposure to sun therefore, land for the plantation should be in shade (Pratap et al. 2014). The plant of large cardamom developed through its seeds and its plantation begins with land preparation, seeds management and other activities associated with it. Generally, plantation started in June when the field gets enough rainfall. After planting seeds in the field, it takes 3 – 4 years to become mature cardamom plant and thereafter only it started producing cardamom. Moreover, it requires continuous irrigation during the dry season and about 4 to 6 months after harvesting. However, other inputs like fertilizers, plant protection materials are needed times to time according to necessity (Timsina et al. 2012).

b. Harvesting

The standard time for cardamom harvesting is between mid of August to end of October depending on elevation and slope of the field. Crops from the lower altitude start maturing faster compared to a higher elevation. The participation of female in cardamom harvesting is higher than male which is 60 percent and 40 percent respectively. Moreover, 70 – 80 percent of moisture contains in one fresh harvested cardamom (Timsina et al. 2012). A unique type of knives called *Chhuri* in local language which is little curve from the top and sharp from sides (figure A) is using to pick mature cardamom from its plant's root (Field

Observation 10.1: Appendix 2). Moreover, farmers also used a special type of shoes which called *Gumb Boot* in the local language (figure B) to find the grip on slope land and protect from snakes and other harmful insects. It requires lot of attention while picking cardamom from roots because there are small sprouts that becoming mature cardamom in next season, which can see in figure D (Field observation 2: Appendix 10.1)

Figure: A

Figure: B

Figure C

Figure D

Figure 3: Harvesting Procedures

Source: Field Observation 10.1, Appendix 2

c. Segregating and Drying

Segregation and Drying are post-harvesting activities in cardamom farming before selling to a local collector. After harvesting fresh cardamom required separation from its roots (see figure 4). In one root, there are 3 to 8 cardamom capsules depending on its development. These capsules are light pinkish, brownish pink or dark pink depending on its variety which becoming black after drying (Field observation 10.2: Appendix 2). After

segregation, the farmer put the cardamom in the dryer. Most of the farmer used local dryer called *Bhatti* in the local language. It made of stone and mud by making the wall at four sides which have a small opening in front to feed the firewood and in the top, there is bamboo mat or wire mat to put the cardamom over (figure 5: Appendix 2). Cardamoms need to placement shifting in 24 hours bottom to top to ensure the right amount of heat to each capsule. Otherwise some capsules could be burn and some of the remain moist. It takes around 48 hours to properly smoke and quality of large cardamom also depend on its drying condition (Field observation 2: Appendix 10.2).

Figure 4: Segregation procedure of Large cardamoms

Source: Field observation 10.2, Appendix 2

Figure 5: Drying Cardamom in local dryer (Bhatti)

Source: Field observation 10.2, Appendix 2

d. Tails cutting and Packing

This is final work for farmer before selling the final product to the local collectors. Tails are particularly clearly visible that attached with cardamom capsule after taking out from the *Bhatti*. The outer layer of capsule need to remove and this process called tails cutting. Normally, the tails are manually cut by scissors. Moreover, tails cutting and without tails cutting also graded when it comes to checking quality of large cardamom (Singh & Pothula, 2013) Following figure A and B shows before and after tails cutting cardamom respectively.

Figure A: Before tail cutting

Figure B: After tail cutting

Figure 6: Cardamom capsules before and after tails cutting

Source: Singh & Pothula, 2013 p: 458

Furthermore, packing of large cardamom begins after removing tails from the cardamom capsules. It looks black and brown and light in weight and moisture contains 10 – 12 percent which only considers as an A class of cardamom (Timsina et al. 2012). Polythene-line jute bags are normally using to pack cardamom capsules that should seal and store in dry place. To avoid the moisture absorption farmers using wooden platforms to store cardamom's capsules. There is little bit weight loss and damages were reported during the storage (Singh & Pothula, 2013). At this moment cardamoms are ready for sale and as per the price conditions farmer sold the cardamom to local collectors.

4.3.5 Major actors involved in Cardamom farming

a. Farmers

Since, cardamom farming became popular among Nepalese farmer as a cash crop, numbers of farmers are motivated towards its farming. As per the recent report, 67000 households

are engaged in large cardamom farming. These individual farmers who are the main actors of large cardamom farming, representing almost 97 percent production of large cardamom (ITC, 2017). Generally, these farmers are lives in villages and engage in various activities of large cardamom farming. Their main work is harvesting, curing, drying, grading and packing large cardamom during the season which started from mid of August to end of October. In other time, they are busy on irrigation, fertilizing and monitoring in cardamom's field. Apart from this they also have work that related to agriculture (Field observation & Interview, 2017).

b. Local collectors

In Nepal, most of the large cardamom farmer selling their produced cardamom to the local collector. Among these local collectors, some lives in the same village or could be one of the farmers and some of the lives in the nearest city and coming on seasonal time. Basically, cardamom farming requires elevation and these places are rural and village area where transportation facilities are limited and some places no transportation. Therefore, it's very difficult for a farmer to transport the product directly to the district trader or wholesaler who generally lives in the city area. In this situation, local collector buys the products from farmer's door which facilitates the farmer that's why local collector becoming a transporter of cardamom from village to the city or local market. Moreover, local collector keeps margin and resell products to the district traders (Timsina et al. 2012; Field observation and Interview, 2017).

c. District Trader or Wholesaler

District trader or wholesale lives in the city area. They collect all the cardamom from all the districts and exported to India. At present scenario, Nepalese cardamom's traders or wholesaler are not in a position to export the goods directly to the third countries. Hence, Nepalese cardamom exported to international market via India and Pakistan. Consequently, it makes India as a major market for Nepalese cardamoms so that more than 90 percent of cardamom exported to India through Birtamod port (Kc & Upreti, 2017). Furthermore, district traders or wholesaler can be found in two types. Firstly, those who are directly selling the products to India and another are those who export the products after some refinery process. These processes include further grading (tail cutting), sizing (according to the size of capsules), polishing, packaging (as per buyer's demand) for some quality improvement. They also manage the transportation from Birtamod to Biratnagar / Jogbani

border crossing point. After all the documentation and customs clearance, the cardamom transported to the Siliguri, Delhi and other parts of India (ITC, 2017).

4.3.6 Determining the Quality of Large Cardamom

In Nepal, quality of large cardamom is determined through the process of 'Grading'. Basically, it is a locally based process where products are segregating into three types such as Jumbo Jet (JJ), Standard (SD) and usual type which locally called *Chalan Chalti* (CC). This segregation is made on the base of its Size, Colour and tail cutting (ITC, 2017). Following table no. 8 shows the various quality measurement in large cardamom.

Types of cardamom	**Size**	**Colour**	**Tail cutting**
JJ	Above 14 mm	Pinkish to well brownish	Well tail cutting
SD	Between 10-14 mm	Pinkish to medium brownish	Medium tail cutting
CC	Less than 10 mm	Pinkish to less brownish	Poor tail cutting

Table 8: Quality indicators of Large Cardamom

Source: ITC, 2017 p17

Furthermore, among above-mentioned types of large cardamom, JJ type of large cardamom considers the as high grade of product. Similarly, SD type is medium grade and CC type is low taken as a low grade. Consequently, the price of the large cardamom depends on it grades. The following section shows the price trend of large cardamom based on its quality.

4.3.7 Price of large cardamom

As we mentioned above, the price of large cardamom depends on its grading and grading is based on the quality of large cardamom. Following the table, no 9 shows the price trend of large cardamom in the period three years from the three districts of the Eastern region of Nepal which are the major producers of Large cardamom.

Financial year	**Districts**	**JJ Type**	**SD Type**	**CC Type**
2014/15	Ilam	110,000	104,000	98,000
	Panchthar	107,000	102,000	96,000
	Taplejung	105,000	100,000	94,000

Table 9: Price of Large cardamom based on quality

Source: MOAD, 2015 p: 29

Furthermore, the above-mentioned price of large cardamom is indicated in Nepalese Rupees (NRS) and those prices are made for per 40 Kilogram. It means the price per kg for JJ type cardamom was NRS 2,625 to 2750 according to the districts. Similarly, the CC type large cardamom price was recorded NRS 2,350 to 2,450 per kg as per the districts. Moreover, SD type large cardamom's price was reached NRS 2,500 to 2,600 per kg in financial year 2014/15 (MOAD, 2015).

4.3.8 Distribution modes of large cardamom

As previously mentioned, trading of large cardamom mostly depends on the Indian market. In fact, in 2014 100 percent international trade of large cardamom taken by India (See section 4.3.3). But India is not the last destination of large cardamom market. Then after, large cardamom distributed into another part of the world (Such as; Pakistan, UK, UAE, Saudi Arabia, Kuwait and other countries) through the Indian stakeholders (ITC, 2017) The following figure no. 7 visualized the distribution modes of Nepalese large cardamom and involved distribution actors.

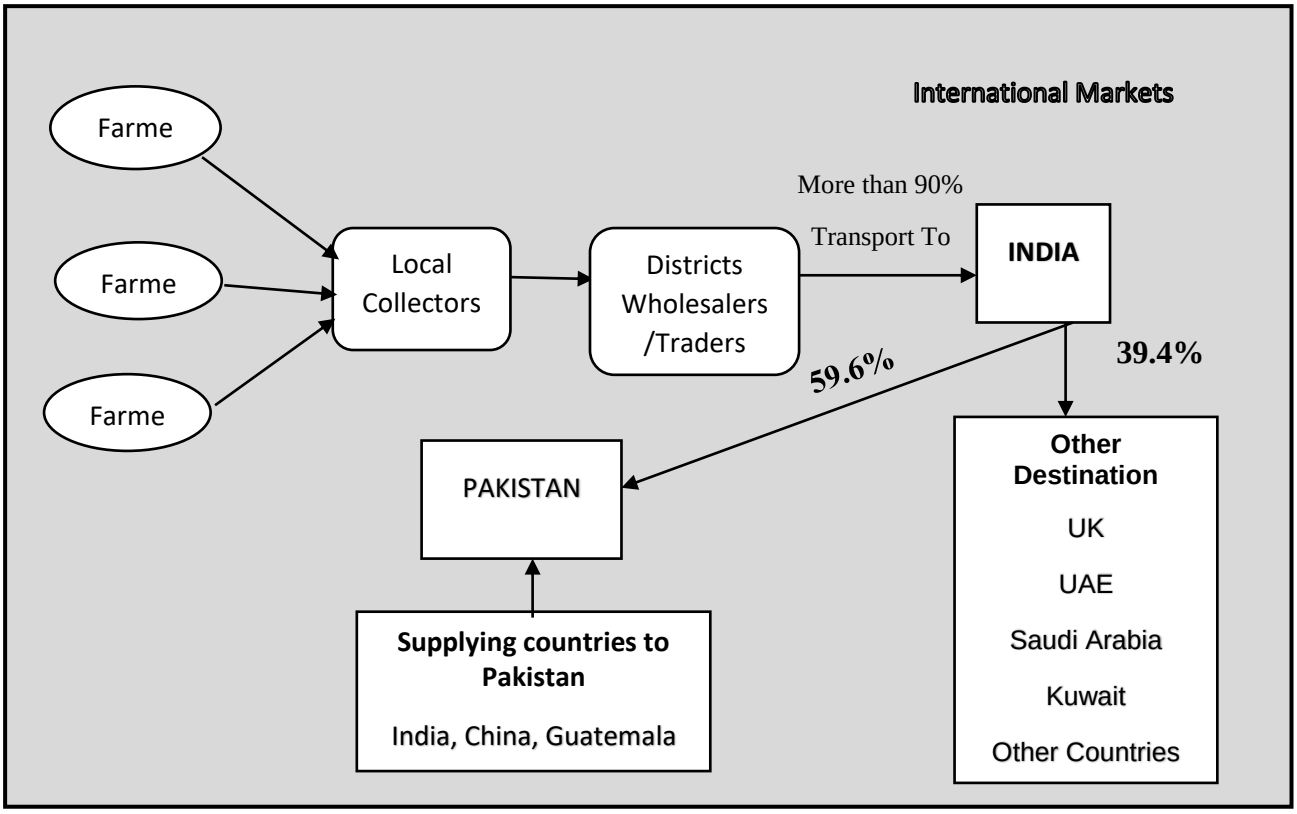

Figure 7: Distribution modes of large cardamom

Source: Singh Source: Adopted from ITC 2017, p. 32

4.3.9 Major problems in Large cardamom farming in Nepal

As per the MoAD report 2015, in last 15 years only the production area and the number of the farmer has been increasing in Nepalese cardamom farming. But compared to that production remains fluctuating in fact it is in decreasing trend from last 3 years. Consequently, production yield which measures the total production quantity per hector has gone down from 0.61 to 0.45 (Kc & Upreti, 2017). Similarly, the selling price of large cardamom also gone down from NRS2,750 per kg to NRS 1,350 per kg in last year (Kathmandu post, 2016). Apart from price and quantity there are numerous problems which are indirectly faced by Nepalese cardamom farmers and these are the causes which lead to the declination in Price and Quantity of large cardamom in Nepal and shortly describe below in table no 10.

Problems faced by Nepalese cardamom farmer

Causes/ Problems	Descriptions
Technology related	Less priority in Soil health, plant nutrients, manuring mgmt. and irrigation mgmt., Lack of seeds varieties as per elevation, Poor knowledge among farmers regarding disease and pesticide to protect, Lack of access to the grading, drying, packing and processing technologies.
HR related	Lack of skilled manpower in terms of research and technology generation, Available manpower also not in right man in right job
Financial related	Less investment and funding in HRD and R&D in cardamom farming
Government's policy related	Lack of precise policy towards cardamom farming, Less coordination, cooperation and linkage between government's sector, Very less attention from policymaker and politician in the filed
Private/Public sector related	Lack of cooperation, coordination and support from an established public organization such as; FNCCI, AEC, LCEAN etc. No investment from private sectors/stakeholders or cooperatives and so on.

Table 10:Problems in Nepalese cardamom farming

Source: Chaudhary & Vista, 2015 p: 3-7

Furthermore, farmers have very limited access to the information related to cardamom farming. Such as price, quality, technologies, facilities, grants and so on. Moreover, communication between districts traders and farmers also very less therefore sometimes local collector taking benefits of that. Less attention from government side even though it has exciting future is also one of the demotivating factors for farmers (Field observation and interview, 2017).

4.3.10 Development practices in Nepalese cardamom farming

In recent years, the farmer took some initiative from themselves and experienced some development practices in large cardamom farming. However, these practices not able to provide some fantastic result. Somehow production and quality of large cardamom going down in past couple of years along with selling price of large cardamom falling more than 50 percent in a couple of years and it is in decreasing trend (Baskota, 2016). Some development practices done by farmers in large cardamom farming presented below.

a. Development of local cultivars according to altitude

In past couple of years, farmers developed many local cultivars in large cardamom farming through trial and error method. There are numbers of local cultivars are available which are currently farming by Nepalese cardamom farmers. Such as; *Seremna, Bharlangey, chibeysai, Ramsai, Ramla* etc. These cultivars can be cultivating in range of 400 MASL to 2300MASL elevation. Moreover, these local cultivars can also grow in different soil moisture (Ghanashyam et al. 2017 p: 4-8).

b. Weather smart practices

Under this practice farmer alter the plantation time and planting varieties of cultivars which recommended as strong to the extreme weather condition. Moreover, it includes valuation of rainfall requirements and another measurement that cope with various problems such as; snowfall and frostbite (Ghanashyam et al. 2017 p: 1).

c. Soil nutrient and Water management activities

In recent years, farmers are more focus on soil nutrients consequently they started produce manure and its proper application. Moreover, farmer nowadays involving in the production of green manure, compost manure and intercrops weeding which providing sufficient nutrients to cardamom plant. Furthermore, water management activities primarily focus on the effective and efficient use of water in a different stage of plant development. Moreover,

effective use of technologies to manage available water such as; use of sprinkle for irrigation, mulching, shade management are some practices that farmer conducting to increase production quantity (Ghanashyam et al. 2017 p:1).

d. Concept of agroforestry

The concept of agroforestry is developed and run by Nepal Agroforestry Foundation (NAF) for the advantage of hill farmer so they can fulfil their subsistence need like timber, fodder for livestock and fuelwood for cooking. Moreover, this concept is designed for hill farmer who is mostly facing the lack of fertilizer for crops and lack of nutrition feed for livestock. The agroforestry concept is a system of hill farming which interconnected the plantation of trees, farming of crops and livestock. Basically, in this concept, farmers are used crops and trees for feed and fodder purpose to the livestock and manures of an animal provides the nutrition for the crops. Additionally, this concept helps to minimize deforestation, reduces the topsoil erosion and maintain the soil fertility. Consequently, it helps for sustaining the agriculture production in hill area (Neupane et al. 2002).

4.3.11 Major facilitator in Large Cardamom Farming

There are numbers of facilitators are involved in the large cardamom sector of Nepal. Both governmental and non-government organizations are linked with this sector whose prime objectives is focused on development of large cardamom sector. Among various facilitators, some major and their functions are explained below:

a. District Agriculture Development Offices (DADOs)

The government of Nepal established DADOs to support the overall agriculture in respective districts. In the case of large cardamom DADOs are focused on area expansion, therefore their main activities are establishing the cardamom nursery, distributing of seeds, conducting a training program for farmer related to the plantation and harvesting. Moreover, DADOs are collaborating with other institutions like FLCEN, FNCCI for the district level policies formulation and developing trade within the districts (MoAD, 2015).

b. Trade and Export Promotion Centre (TEPC)

TEPC is functioning under the Ministry of Commerce (MoC) of Nepal. The major objective of TEPC is to promote the national trade. Therefore, TEPC is conducting various trade and market research for the product development, export promotion and enhancing the country's participation in the international trade. Moreover, TEPC has registered the

trademark logo for large cardamom which called ‘Everest Big Cardamom’. Additionally, TEPC is cooperating with different other institutions for the distribution and plantation of the advance dryer to the farmer for the drying purpose of large cardamom (ITC, 2017).

c. Federation of Large Cardamom Entrepreneurs of Nepal (FLCEN)

FLCEN is one of the non-government agency that established about a decade ago which playing a mediator role between cardamom traders, businessman and government sector. Moreover, it is assisting towards the cardamom trading and advocating for the rights and facilities of the farmer in the trading process of the domestic and international market. Additionally, it is working to improve quality production of large cardamom through collaborating in NSCDP (MoAD, 2015).

d. Agro Enterprise Centre (AEC)

AEC is an NGO which is operating under the authority of FNCCI but it is funded by USAID. Basically, AEC is interacting with government sector for the policy formulation that could help farmers and private sector entrepreneurs in the production and trade of the large cardamom. Moreover, it is also contributing for the distribution of improved dryer to the farmer. In 2015, AEC distributed 120 improved dryers in the four districts of Nepal (ITC, 2015).

4.3.12 Policy structure in large cardamom

At present scenario, Nepal has lacking in terms of specific rules, policy and strategy regarding large cardamom farming, trading and development. Few guideline and policies are formulated such as; *NTIS 2010, Agri-business promotion policies* which providing guideline only. Moreover, there are some measurement test called SPS and TBT while exporting products to India which is also found less followed from the border side. However, moisture, size and tail cutting of the products is observed by the rule of thumb. Additionally, there are some policies need to formulate which were came as a suggestion from the stakeholder workshop held in 2015 regarding development of large cardamom sector. And these suggestions are; market diversification, Indian border and state taxation, insurance, payment system, customs agents and so on (MoAD, 2015.

5. Analysis

This chapter of the master thesis contains the various analytical aspects and discussion on the large cardamom farming in Nepal. These analysis and discussion are based on the literature and data which are mentioned in earlier.

5.1 The need of Market variation for Nepalese Cardamom

As previously mentioned, more than 90 percent of large cardamom production exporting to India. In fact, in 2013, the whole international market of large cardamom (100%) taken by Indian market (See section 4.3.3). But, India is not the last destination for large cardamom consumption. It will be exported to other countries like Pakistan, UK, UAE, Kuwait, Saudi Arabia and other European countries, where Pakistan took the major part (59.6%) of the Indian export and rest of products distributing to other countries (See section 4.3.8). Furthermore, India only the current market for Nepalese cardamom and whatever supply goes in other countries, it goes via India only. Therefore, Indian traders creating the monopoly environment and offering the average value even products has high quality. Moreover, they are hindering if Nepalese traders try to keep a direct link with other country's traders (ITC, 2017).

Furthermore, as Michel porter explained in *Porter's five forces strategy*, that less market access or buyer dominated markets generates high bargain power for the buyers and creates less competitive advantages for suppliers (Porters, 2008). This scenario can be seen in Nepalese cardamom trading, where Indian traders are dominating the Nepalese traders. Therefore, to enhance the competitive advantages, Nepalese traders should work on market diversification. And to do so Nepalese government need to provide support in every aspect. Such as; policies formulation, infrastructure development, financial and institutional support. In another hand, it is reported that trading of the duplicate product of Nepalese cardamom seen in the Indian market. This duplicate large cardamom looks as same as Nepalese cardamom but taste and quality are below the level (ITC, 2017; Field Interview, 2017). Therefore, the government of Nepal should take enough consideration regarding this issue. Moreover, formulated trade policies need to be revised and if needed other new policies must formulate between two governments to address this problem. The system of

regulation and monitoring need to be slight, perfect and effective to avoid such type of issues.

Additionally, earlier in table no.5, it is clearly presented that Nepalese cardamom has other exciting markets apart from India which needs to be motivated. The UK, UAE, China, Singapore, Ukraine and Canada are also providing 0% tariff as like India which is one of the encouraging factors for Nepalese traders to minimize the dependency towards the Indian market (See in section 4.3.3). Moreover, Pakistan is the largest cardamom consuming country where India exporting about 59.6% of their products, as well as supply comes from other countries like China and Guatemala (See section 4.3.8, figure 5). Therefore, Pakistan could be one the major market for Nepalese cardamom. Since Pakistan providing 5% tariff barrier which can be discussed between two authorities of the country. Moreover, Nepalese large cardamom's trader must look for the collaboration with others international traders and Nepal's government and government's institution should create the environment to make it happen.

5.2 Quality Vs Price of Large Cardamom

In Financial year 2014/15, the price variation of large cardamom depends on their quality and the quality is determined while in the process of grading. The products got a different name as per their grades which are Jumbo Jet (JJ), Standard (SD) and usual type which called *Chalan Chalti* (CC) in the local language (See section 4.3.7). The following figure no. 8 shows the average price of large cardamom according to quality in 2014/15, where price is indicated per 40 kg.

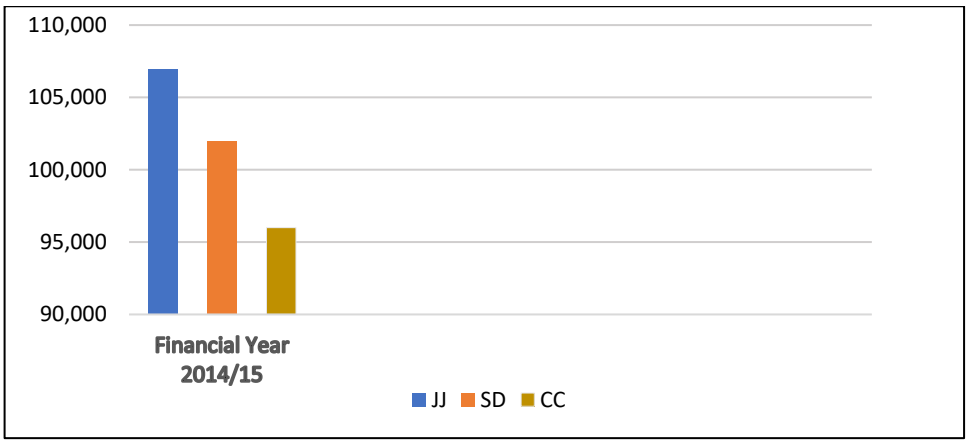

Figure 8: Price Variation based on quality

Source: self-constructed based on MOAD 2015, p29

Furthermore, above presented figure 8 shows the price variation of large cardamom based on their quality or grades in fiscal year 2014/15. It is clear from the figure that average price range of large cardamom during that period reached NRS 96,000 to NRS 107,000 per 40 Kg which comes an average NRS 2,400 to NRS 2,675 per kg. This figure clearly reflects that high quality of products gets the high price. Therefore, the farmer of large cardamom needs to improve the quality of products to get the higher price. In another hand, the market of cardamom is full of with the other player than India such as China, Guatemala which also fulfilling the demand of cardamom. Therefore, the competition is going to high in future so that Nepal needs to focus to increase quality and quantity of large cardamom. Along with that the other route of distribution also needs to explore more to supply the goods in another international market apart from India.

5.3 Role of Technology in Large Cardamom Farming

Since quality and grade of the products are one of the prices determining factor in large cardamom farming. The requirement of improved technology for the Nepalese farmer is increasing day by day. Here, the improved technology embraces all the new skills, knowledge and technology that are in practice. The quality of large cardamom is determining the grading system where size, colour and tail cutting of the cardamom's capsule is in main consideration. The size of capsule depends on pre- harvesting functions such as; plantation, irrigation, and fertilization where colour and tail cutting is depending on post-harvesting function such as; drying process and tail cutting process. Additionally, pesticides against the various disease and packing and storage method before the sale also matters in terms of quality of large cardamom (Field interview, 2017; Timsina et al. 2012). Therefore, new knowledge of farmers and improved technology playing the major role to enhance the quality of large cardamom. Moreover, the use of new knowledge and improved technology in pre-harvesting function and post-harvesting functions can be beneficial for a farmer to enhance the quality of large cardamom.

5.3.1 Role of technology in pre-harvesting functions

The pre-harvesting function known as those activities which farmer is conducting before harvest the mature cardamom. such as; Plantation, irrigation, fertilization. The cardamom is very crucial product and cardamom seeds need to a certain amount of temperature and rainfall (See section 4.3.4) to grow. Therefore, the farmer should be focused on seed selection according to an altitude of land, land preparation, irrigation management before planting the seed of large cardamom. In Nepal, most of the farmers are following the

traditional way of the plantation where seeds are planting into fertile land. But in some of the places in Sikkim (India) farmer were trained for the *Sapling Plantation* where seeds are growing in the nursery until it develops with 15-20 cm length and 1cm width. Then after, while cardamom crop attains the 3-4 leaf stage than it transplanted into the fertile field in a row 1 x 1 m spacing (Ghanshyam et al. 2017). This is the new way of doing plantation where the big size of cardamom capsule estimated to produce.

Furthermore, proper plantation of large cardamom is not sufficient to increase the productivity of large cardamom. it requires an effective irrigation system to provide adequate water. In the cardamom farming, if plantation is done once, the crops keep producing at least more than 10 years depending on the health of the crops, therefore irrigation required more after the harvesting (about 4-6 months) because there are small other sprouts that required enough water to become fully mature capsule in next season (Field observation, 2017; figure 3D). The following, figure no A shows the practice of modern nursery plantation.

Modern nursery plantation

Figure: A

Advance Sprinkler technology

Figure: B

Figure 9: Practice of improved technology in pre-harvesting function

Source: Ghanshyam et al. 2017, P. 9-16

Furthermore, another picture in figure no. B shows a kind of improved technology used to support for the proper irrigation which known as 'Sprinkler'. There are two types of sprinkler local made which are still in used due to lack of improved sprinkle and improved sprinkle. The improved sprinkler providing 35 – 45 mm rainfall to provide enough water for cardamom crops which was estimated about 40 – 50 litter per plant at least once in a

week (Ghanshyam et al. 2017). Therefore, farmers need to be used number of sprinklers depending on their farm. The farmers are lacking enough sprinkle therefore they keep changing the place of the sprinkler to manage sufficient irrigation with less sprinkler. Therefore, sometime the plants will not get enough water which effects to grow than plants. consequently, the size of cardamom becomes small. Moreover, farmers are also lacking the advance fertilizing materials and pesticides to avoid the various unknown disease which locally named as a *Chrikey, Furkey, Pahenley* based on their effect on the plants (Pratap et al. 2014). But in the lack of those advance fertilizer, farmers are using livestock manure to fertilize the farm. Therefore, if government's institutions and other facilitators could not provide enough amount of fertilizer, more consideration of agroforestry concept would be beneficial to manage the required amount of fertilizer and it also helps to minimize land degradation. In terms of pesticides, a farmer reported that there are no specific pesticides available that could minimize those diseases permanently (Field Interview, 2017).

5.3.2 Role of technology in post-harvesting functions

The post harvesting functions are known as all those activities that farmers are functioning after the harvesting. Such as; segregating and drying, tail cutting, grading, packing and storing. The best period for Harvesting is between mid of August to end of October where cardamom capsule becoming enough mature for the harvest. The timing can be change little bit according to altitude however, being late for harvesting can increase possibilities of damage where being early can hamper for enough development in size of cardamom's capsule (Field observation, 2017).

Drying and tail cutting process are major functions among other functions after the harvesting. Proper dying process eliminates the moisture from the capsule and provide the colour pinkish to light brownish. The farmer used drying mechanism called *Bhatti* for the drying process. In Nepal most of the farmer used a local or traditional type of *Bhatti* due to lack of advance drying technology. Moreover, while using the local *Bhatti*, there is no equipment to measure the heat and circulate the heat on each piece of the capsule. Therefore, some capsules are more drying (becoming black) and some capsule remaining moisture. Moreover, woods are only one source for the fire set up so this system that becoming one of the reasons for deforestation and dried capsule also smell Smokey. In another side, smoke coming from *Bhatti* affecting the farmers health.

Furthermore, the Tata Energy Research Institute (TARI), India has developed an improved technology for drying which called gasifier system of drying. In this system, *updraft-type biomass gasifier* connected to the traditional *Bhatti* which producing the high volume of fuel gas (Singh and Pothula, 2013). Moreover, instead of wood the gasifier is used to heat the flame arresting plate which generates the heat and dries the capsule. The TARI reported that, heating efficiency through this system is above 70% better than the traditional system provides. Additionally, the colour of the capsule also attractive and dried. Moreover, it found that this system can same fuelwood up to 65% (Singh and Pothula, 2013). Since Nepalese farmers are lacking this type of improved technology which can help to upgrade the quality of large cardamom. The following figure 8 shows the structure of gasifier system of drying.

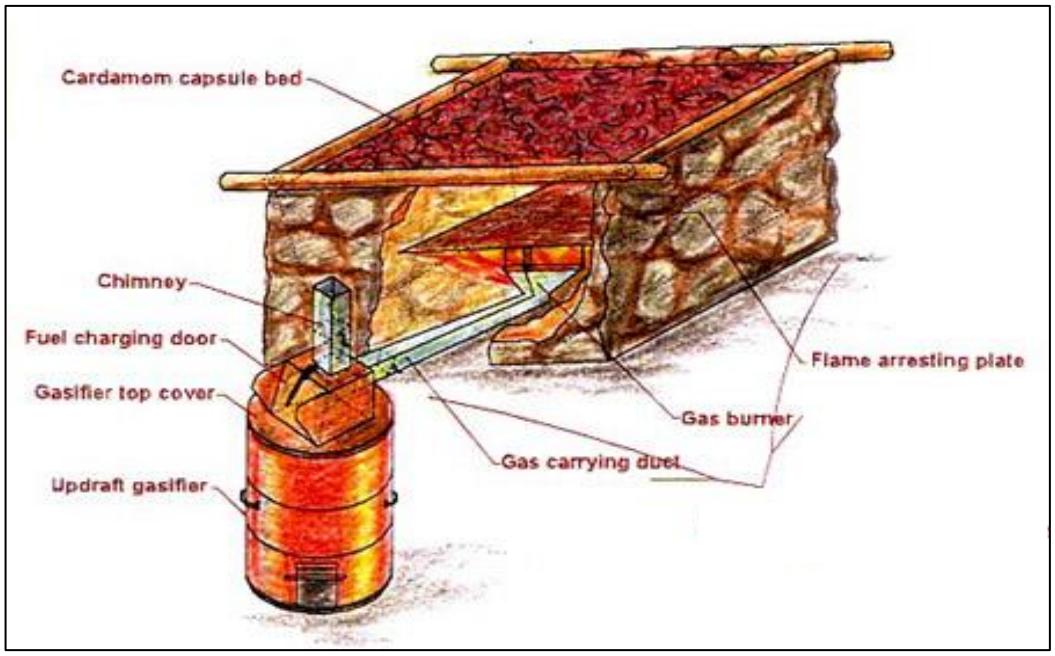

Figure 10: structure of improved drying technology

Source: http://www.cosmile.org/photogallery.htm

Furthermore, tail cutting process removed the unnecessary layer that attached and visible in cardamom's capsule after the drying. Due to lack of advanced technology this process is conducting by manually where scissors are using to cut the tail of capsules. This manual tail cutting process time consuming, annoying and not accurate as per the standard which affecting the quality of the large cardamom. Moreover, advanced technology for this process still not came in practice therefore farmers are doing in an existing way. However, farmers are expecting to innovate (Filed interview, 2017).

5.4 Universities - Agriculture Linkages

Universities are continuously involving in research and research-related activities that generate the scientific knowledge and technology and other side knowledge and technology are the key source of innovation which leads the society towards the transformation (Birungi Kyazze et al. 2014). Moreover, at present scenario, agriculture development mainly based on expanded knowledge, new technologies and innovative farming practices. However, trained and skilful human resources are also the major component for the agricultural development. Therefore, policymaker should pay more attention towards the human empowerment and development to achieve sustainable development in the agriculture sector (Asadi et al. 2011).

Furthermore, in Nepal, Tribhuvan University (TU) is the first national higher educational institution. It is the oldest educational institution which was established in 1959. Coming along almost 59 years of the journey it has 39 central departments and 4 research centre which are taking care of standard of higher education as well as the generation of capable human resources which required for the overall development of Nepal. All the research, planning, executive policies and academic curriculum formulated by its four body councils. Such as; Research coordination council, Planning Council, Executive council and Academic Council. Moreover, under the TU, Institute of Agriculture and Animal Science (IASS) is established which the main objective is to prepare skilled manpower through training, teaching, research and diffusion of agricultural technologies (http://tribhuvan-university.edu.np).

Moreover, Agricultural and Forestry University (AFU) is first purely technical university in Nepal, established in 2010 which the main moto was to produce highly skilled human resources for agricultural research and development. The AFU aimed to enhance the socio-economic condition rural people through quality education, research and development. Consequently, until 2016/17, the university started two more agricultural colleges in a different part of the country where still more 9 colleges were in pipeline. Furthermore, in 2016, the AFU established the Agricultural Science Centre (ASC) which contributing to the trained farmer about new technologies by demonstrating with practically involved in the real field. The AFU provides agricultural education from bachelor level to Ph.D. level where about 35% of students are girls (http://afu.edu.np/).

Even though, agricultural universities are started to open, the cardamom sector still lacking the contribution from these universities. The universities and college are mostly focused on

theoretical learning rather than problem-based learning. And mostly cardamom's farmers are lived in the rural area so that universities-agriculture linkage should be community-based and responsive for the overall development of the society where in reality universities are centred in the city area and communication gap between farmer and universities is huge. In other side government's and other institutions' consideration also less in terms of creating collaboration between cardamom farmers and universities (Field observation, 2017).

5.5 ICT-Agriculture Linkages

Earlier in literature part of this paper, it is clearly explained that Information Communication Technology (ICT) playing a key role in AIS to transfer the information and knowledge among the various stakeholder. Similarly, it is even more important for the interaction and collaboration among the actors of the agriculture system. Furthermore, policies towards the agriculture have great impact of its development, therefore, communication between farmers, related agencies and policymaker should be clear so that knowledge and information providing by farmers becoming the development topics and effective policy formulating according to that (Turpin and Ghimire, 2012).

Furthermore, Nepal has formulated the IT policy in 2000, where main concern of the policy was the development of IT infrastructure, R&D, manpower and e-governance. But in 2002 only, Nepal has connected with ICT global map then the concept of Telecentre emerged and the first time, different information (Such as; agriculture, health, economic activities) were transfer from the National information technology centre to that rural telecentre (Turpin and Ghimire, 2012). These telecentres are focused to provides one-way flow of overall information not only specific (like agriculture) sector to the rural internet users. Moreover, the ultimate motive is to communicate the information and knowledge through the IT-based medium and getting back the understanding of rural needs. However, this idea was not much successful but somehow able to share the information among the rural people (Turpin and Ghimire, 2012). Moreover, the access of Nepalese people towards the mobile phones exceeds more than 100 percent, in fact latest data of Nepal Telecom shows that, mobile penetration value reached about 106 percent (NTC, 2016). But it doesn't mean that number of people with mobile phones is higher than the population of Nepal, it could be because of dual sim, dual handset, unused sim from the people who go abroad. Nepal Telecom (NTC) and NCELL are two major telecom network provider authority in Nepal (NTC, 2016). Similarly, the access of Nepalese people towards the

Internet service crossed over 50 percent and these two service providers have many projects in pipe line. However, sufficient policies and fundamental infrastructure development needed to extend the data service among larger population (NTC, 2016).

Therefore, the application of mobile phone and software could be on effective option to develop the slight and perfect ICT in large cardamom farming. As farmer were reported the lack of information and communication about market conditions, price fluctuation, new technologies and new practices (Field interview, 2017). The bridging ICT with farmers of large cardamom through various informative mobile Apps, SMS facilities, call centre facilities would be a beneficial to improve learning ability of farmer of large cardamom. Additionally, use of mobile software and technology helps to reduce the cost of obtaining information compared to other information providing mechanism (Aker, 2010).

5.6 Analysis of Institution development

The agricultural development program conducted at national level in mid 1970s after getting the financial support from United nation and World bank through first 10-year agriculture development plan 1975-85, however, the Department of Agriculture (DOA) was established in 1924 (Yadav, 1987). The plan was mainly focused on location specific technological innovation and strategy development. Thus, during this time frame, the Terai region was focused with higher cropping intensity where cooler mountain region was focused for livestock production Then after various institutions were developed with various purpose for the agriculture innovation and development which are presented below table.

Institutions	Purpose of establishment
DOA (Department of Agriculture), 1924	To test the borrowed technologies
NARSC (National Agricultural Research and Service Centre), 1987	To take care of all the R&D activities of Agriculture sector
NARC (Nepal Agricultural Research Council), 1987	To develop location specific technology. To emphasize on diffusion of explicit knowledge that generate from traditional practices and local resources

Table 12: Development of agricultural institutions

Source: Chhetri et al. 2012, P: 6-7

Among the various institutions mentioned in table 12, the NARC is actively functioning as a body of government of Nepal. It has established 18 Regional Agricultural Research Station (RARS) to facilitate the farmer in every region (Chhetri et al. 2012). However, data shows the status of institutional development towards the agricultural innovation, the larger part of the farmers are out of link to those institutions. It has been seen in large cardamom sector also during the field interview. Most of the farmer reported that, they don't know about these institutions or their program, neither they are getting any help for the cardamom development. Thus, there is lack of initiative from these institutions to get connected with the actual farmers of large cardamom, especially in a rural area (Field observation, 2017).

WTO agreement **-** Nepal has signed the WTO agreement in 1998 to take the advantage of trade diversification and market extension. Under this agreement, Nepal has signed more bilateral and multilateral trading agreements with 17 trading partners of WTO. Moreover, Nepal also part of the other regional agreements in Asia such as SAFTA, BIMSTEC.

BIMSTEC agreement **–** This is the regional cooperation in Asia which was formed in 1997 but Nepal has signed in 2004 where Bangladesh, India, Bhutan, Myanmar, Thailand and Sri Lanka are connected for promoting trade and economic relation within the member countries. Moreover, BIMSTEC also carries the FTA (Free Trade Agreement) among the member states that allows for the trading goods without tariffs and barriers.

Foreign Investment & One Window Policy 1992 **-** This policy formulated to motivate the foreign investment by encouraging the private sector. Its prime objective is to increase border participation that generates the advance technology, capital, managerial and technical knowledge and skills which is helpful for the product development.

Agreement on Agriculture (AoA) – This agreement was finalized in 1994 after the Uruguay Round of negotiations. This agreement motivates towards the fair and market committed agriculture trading system without any help of protection mechanism. it embraces the trade of various crops, livestock and irrigation technology but excludes the fishery and forestry sectors. Moreover, market access and export competitions are highly emphasized on this agreement.

Table 13: Various agreements and policies

Source: Rutabanzibwa, 2006 p: 1-14

5.7 Agreements and Trade Policies Analysis

Development of different trade agreements and policies are playing the important role for AIS system of Nepal. These agreements and policies are committed towards the national and international trade to the expansion of the market. various taxes and tariffs are determined through these agreements and policies which impact for the import-export of the goods, technology transfer and ease of doing business. The polices also helps to bring the foreign investment along with technological opportunities, to acquire knowledge and enhance the institutional capabilities. Nepal has signed various trade agreementnts and policies among them some of the agreements and policies presented in below table 3

Above mentioned agreements and policies is symbolic representation of agreements and policies that Nepal has formed for the agricultural development. It is true that Nepal's trade policies and agreements are enough liberal and fulll of fundamental requirements to the accession of the WTO but the question arises that why Nepal could not fully have benefited through those trades agreements and policies? And the answer is Nepal still lacking the basic trading infrastructure to expand trade through market access that WTO trading regime is providing. Moreover, lack of proper and implementable plans to promote the liberalization process at national level and less interaction between internal and external institutions, society and policies are affecting Nepalese producer to get benefited by the trade (Rutabanzibwa, 2006). Therefore, Nepal needs further effective policies for improved infrastructure development, institutional development, the source of knowledge development to enhance the agriculture sector through agriculture innovation system.

Moreover, the similar scenario was seen in large cardamom sector also. The lack of basic infrastructure development hindering the development of this sector. Lack of roads to connect the major cities, lack of electricity, lack of water for irrigation, lack of communication mechanism and lack of learning environment are some major challenges lies in large cardamom sector (Field observation, 2017). Furthermore, it is true that most of the large cardamom farming is based on high alleviation and those areas are geographically difficult for the development, but it doesn't mean that it is impossible. The true initiatives from the government side and effective collaboration with other institutions and implementable policies can change the current scenario of large cardamom sector as well as overall development of Nepalese agriculture sector.

5.8 Good Governance-Agriculture linkages

Earlier it was explained in the literature review, that concept of good governance has emerged because of bad practices of government which is visible through the corruption, unaccountability and unclear decision of the government and lack of human right. Therefore, the necessity of good governance has increased where accountability, transparency and decision-making process by government affects the daily lives and their understanding of society (Taylor, 2016). But in Nepal case the scenario is different, the government practices in Nepal in terms of accountability and transparency towards the public, seems very poor and fragile. From the historic times, the government of Nepal remain unstable due to many political reformations. The political parties of Nepal always been focused on political issues rather the development agenda. In many ways the governance system of Nepal seems as a survival not pro-active where Nepalese parties mostly involved into fulfilling their personal interest, therefore, the cabinet became the reflection of conflict and partisan interest rather than a mechanism of collective action for national interest. The policies, strategic plans, national development agendas could not be forwarded due to lack of coordination between political parties. Moreover, most of the political negotiation take place the out parliament which is clary symbolizing towards the unaccountability and poor decision-making process (Dahal, 2010).

Furthermore, corruption is a major challenge in Nepal that affecting the good governance. Wills, (2014) explain that seeds of corruption produce through the person's internal factors such as; greediness, desire to rich and their upbringing, but it is cultivated and grow with the help of external environment such as; favourable environment for corruption, lack supervision and regulation from higher authorities, social norms, education, and so on. In Nepal, the weight of External factor influencing more compare to person's internal factor for the inspiration of the corruption. Which was first noticeable during Rana's rule and it forwarded into the political system, bureaucracy system and government's institutions of democratic Nepal (Khanal, 2000).

Moreover, according to latest data of Transparency International, Nepal has ranked 131 positions out of 176 countries that participate in the survey. Nepal scored 29 out of 100 where Denmark was listed as the cleanest country with highest 90 scores (Transparency International, 2016). Following table 14 shows the last 5 year's Corruption Perception Index (CPI) of Nepal.

Year	Rank	Score	No. Countries participation on survey
2012	139	27	176
2013	116	31	177
2014	126	29	175
2015	130	27	168
2016	131	31	176

Table 14: CPI of Nepal in last 5 years

Source: https://tradingeconomics.com/nepal/corruption-rank

Furthermore, above presented table shows the corruption situation of Nepal during the last 5 years. The Corruption Perception Index (CPI) made by Transparency International, an independent and accountable international organization established in 1993 (https://www.transparency.org/). CPI has prepared by analysing the various corruption-related data provided by the reputed institution in the world. Moreover, Transparency international closely analysing corruption in the participating country through its *Chapter* which is established in more than 100 countries. From the rural village of India to Brussels it provides the voice for the victim and becoming the witness for corruption (https://www.transparency.org/).

Furthermore, it clearly visible through the table, that Nepal has trapped by the corruption. Those 5 years data are the symbolic data only where previous periods were even more worst. In last 5-year Nepal has almost maintained its rank and score in CPI which means that, the corruption in Nepal is remained as it is. Generally, Bribery, Fraud, Favouritism and Nepotism and unlawful gratuity are commonly seen the form of corruption which is encouraging by the politician and bureaucrats of the country (Otusanya, 2011). Therefore, the politician and a state official are largely involved in political corruption by providing special treatment to their relatives and own people while allocation of public resources. Similarly, a game of bribery and commission is undergoing while the formulation of policies towards the development of any sector including agriculture. Moreover, issuing licences and contracts to the low-grade company for the shake of money, lack of

transparency and accountability while allocating valuable projects, financial irregularities and massive payoff and kickbacks are some of the activities of corruption that seen inside the country. Additionally, lack of regulation and monitoring in state offices, bureaucratic complexity, weak democratic institution are some the roots of corruption (Subedi, 2005).

Furthermore, spreading corruption all over the country affecting the all the sector of Nepal along with agriculture. The development of infrastructure is being late due to the low grade of contractor who receives the contracts. The formulated policies are unfriendly to the farmers and more beneficial to the limited power centric people or group. Due to lack of observation and monitoring form the government institutions, universities are more focused on business rather and research and development. Lack of accountability and lack of proper vision into the policy maker or political leader towards the innovation and development hindering to the development of all the sector including agriculture.

This chapter of the thesis contains the discussion in various analysis and findings of the research. Presented discussion providing brief understanding importance of NSI in large cardamom farming in Nepal. However, there are lot more other factors which hindering the innovation process.

6. Discussion

The analysis part of the study presents different dynamics of innovation which application could be beneficial to enhance the quality and quantity of large cardamom. It has been shown in the first section of analysis that high quality of cardamom generating the high price (figure 7) where price variation lies in the grades of the large cardamom capsule. Furthermore, it has been explained in earlier that pre-harvesting function determines the quantity of large cardamom and post-harvesting activities determines the quality of large cardamom (see section4.3.4) therefore, to upgrade the quantity and quality of large cardamom, the pre-harvesting and post-harvesting functions should be done in an innovative way. The innovating way means by using the different advance technology, method and procedure instead of traditional way and local technology. it helps to produce good quality as the well high quantity of large cardamom. Figure 8 shows the innovative way of doing the pre-harvesting activities such as; modern nursery plantation and use of advance sprinkle for the irrigation purpose. Since we mentioned earlier that cardamom quality mostly depends on size and drying of the capsule, figure 9 shows the structure of advanced drying technology which is another option for the farmer to enhance to quality of large cardamom. However, the fact is that Nepalese farmer is lacking that kind of advanced technology and methods.

In another hand, the collaboration between universities and large cardamom sector is seen very poor during the observation. None of the universities tried to cope with the farmers in terms of sharing the new knowledge, advance learning, or any kind of technology generation. Moreover, the result shows that this sector also lacking the research and development which also hindering for the learning process of Nepalese farmer. In Nepal, there are few universities are involving agricultural education and they have been teaching only the theoretical concept rather than practical demonstration and lacking the proper research institution where students can sharp their knowledge.

Furthermore, the ICT can play the effective role to enhance Nepalese cardamom sector. during the field observation it has been seen that the flow of information to the farmer and the communication between farmer and market is very less. In fact, the farmer doesn't have any medium to know about the price fluctuation. In another hand there is no any communication medium between farmer and governmental institution which affecting both parties. The farmers were not aware of the available facilities (such as credit, loan, training) and the other hand government's lacking to formulate effective policies that could support the farmer to upgrade their production. Moreover, governmental institutions are lacking to invest in research and development which another challenge for Nepalese agriculture to generate the innovation.

Additionally, it was found during the research that focusing on innovation and related activities are not enough to enhance the agriculture sector of Nepal. It also requires other infrastructure development, policies for promoting the agriculture, policies towards the market expansion, agro-industry development, ICT development, and moreover collaboration between the governmental institution, universities, NGOs, research centre and other important stakeholders. Therefore, the application of NSI in the agriculture sector in Nepal especially in large cardamom sector fits exactly.

Furthermore, the gap has been seen in terms of involvement of various facilitators, governmental institutions, non-governmental organization, universities research towards the cardamom sector of Nepal. Farmer was reported during the field visit that most of the government offices, enabler's offices and other agro-related institution are closed during the working time. officer and workers are not available during the office time, information is not transparent and policies are not workable for the large cardamom farmer of this sector. It shows the lack of accountability, transparency and consistency towards the state officials. Moreover, universities are promoting their business rather promoting the innovation, government's policies are unfavourable for the rural farmers and more centralized in the city area. The reason behind all of this is lack of good governance. Therefore, along with the focus on promoting the innovation in agriculture, the attention must be paid effectively towards the good governance.

This Chapter of this provides the overall conclusion of this research study as well as the recommendation for the further research.

7. Conclusion

Presented thesis gives the brief understanding of different features of NSI and application of NSI in agriculture of developing country. Throughout the study, this paper is highlighted that NSI could help through the technology innovation and development where universities and research institutes are the source of knowledge and knowledge motivate in the direction of technological change and development. moreover, policies can promote the innovation and good governance make that policy applicable to promote that innovation. Furthermore, a collaboration between all the components of the system is required to sustain the innovation. Since, innovation bring the changes and NSI focusing the innovation at the national level, its application obviously supports to enhance the agriculture of Nepal. Similarly, NSI is advocating for the importance of knowledge for the innovation process and providing the opportunities for continued learning which can generate the technological innovation and that innovation could be the key driver for the change in the large cardamom sector. Hence, it is possible to enhance the quality and production of large cardamom with the help of NSI, but all another factor such as development, policies, governance should support to apply this effect.

7.1 Further research

The information and data used in this research were collected from reliable and credible sources so it is highly recommended for other researchers to use if they find relevant to them. But due to time and money constraint, the researcher could not visit more places for the primary data collection. Therefore, the result of this thesis is based on the large cardamom farming of Taplejung district only, so it might be possible to have more efficient and reliable research if it was conducted by giving enough time and more field visit of large cardamom area. Moreover, the other researcher could have more efficient result by having an interview with other actors of large cardamom which are Traders, facilitators and local trader apart from farmers to have the better, clear and reliable result.

8. References

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9. APPENDIX 1: Semi-Structured interview

9.1 Semi Structured Question Guide

Theory	***Topics***	***Questions***
Basic Interview facts	Personal facts	a. Name b. Age c. Education d. Profession e. Experiences
	About large cardamom farming	a. Production b. Average Cost per hector c. Profit d. Difference than cereal crops
Innovation/NSI/ASI	Technology	a. Local technology b. advance technology c. Smart farming practices
	Interaction/ Collaboration/Communication	a. Universities b. Research Institutes c. Facilitator d. Trader e. Governmental Institutions
	Policies	a. Finance b. Training c. Infrastructure Development
Good Governance	Overall Situation	a. Policies Implementation b. Corruption c. Support

Source: Self structure for the Interview purpose

9.2 Summery of the Interviews

Since the semi structured interview conducted on the base of research guide which provides the basic ground for the question. The total 10 farmers were taken for the interview purpose because most of the farmers were busy on harvesting functions. However, researcher put his depth involvement to understand the farmer's perspectives, beliefs, and understanding in terms of research subject in related to research problem. During the interview the researcher found almost the same understanding from all the interviewee. Therefore, researcher put summery of interviews rather than presenting the one by one.

The interview started with asking the general interview questions such as; name, address, age, education and their prior profession before involving in large cardamom farming. The researcher found that all the farmer has basic education (under high school) where 2 were found up to high school level. Moreover, most of the farmer's age found in between 35 to 55 years. Furthermore, most of the farmers following the cardamom farming as legacy which comes from their parents and all the farmers were involving in this since more than 10 years. None of the interview has a prior profession apart from cardamom farming. However, one farmer took brake for the one year and went for abroad job. During the interviews it is found that cardamom farming is very supporting for them compare to other normal crops in terms of upgrading their economy because of its high value.

After knowing the general information regarding famers and their experiences towards cardamom farming the researcher went deeper in terms of innovation in cardamom farming. During the interview it came to know that, most of the farmer unknown regarding interaction and communication with universities and research centre. In terms of knowledge generation, they are following same procedure what their parents used to follow. However, farmers are known about the advance dryer for the cardamom drying but they are not able get that. In other hand, the facilitators, governmental institution are just for the name only as the farmer reported. Because they are not getting any support from them and they all are centralize in city area only. Even this sector has huge possibilities to enhance the economy of farmer as well as country, due to lack of proper policies, development initiative towards the cardamom farming and lack of technological support, the production and quality both are degrading as farmers explained during the interview.

Furthermore, most of the farmer are explained to interviewer that some of the policies wer formulated earlier to support this sector such as; modern plantation training, facilitating farmers to visit Sikkim (India) for the observation of advance technologies and modern farming practices. Apart from this, credit facilities, loan facilities, fertilizer and pesticides were decided to provide from the headquarters of the district but that policies were not implemented till the date. Farmers accusing that, these all facilities were came but either it was taken by the state officials or distributed to their own people. This scenario represents the lack of good governance. Moreover, poverty, lack of education, lack of basic utilities, lack of investment, lack of information and communication, less women participation, are some the major problems seems hindering this cardamom sector to gorw.

10. Appendix 2: Field Observation

10.1 First day of Field Observation

The First day of field observation conducted on 11th October 2017. The observation conducted in *Aankhub VDC (*situated in more than 3,000-meter elevation) which is one of the rural VDC of Taplejung district. First day of observation was focused in harvesting activities and process of large cardamom. The researcher observed 10 different farming lands where 3 lands was cultivated and rest of the land remaining to harvest. Researcher have asked short questions in between the observation regarding pre-harvesting activities such as plantation, irrigation, advanced seeds availability, fertilizer and pesticides and so on. During the observation researcher found that the cardamom lands are basically situated inside the forest (a kind of) and reason behind it, is to protect from direct sun and direct rainfall. The farmers told that cardamom is a very sensitive crop which needs a certain range of temperature (10 degree to 22 degree).

Interestingly, the researcher observed various kind material that used for cardamom farming. Such as; *Chhuri* (A special knife that used for cardamom harvesting), *Gumb boot* (A long shoes that used to find the grip and protect from snakes while harvesting). Apart from that it is also observed that most of the cardamom farmer are poor and un-educated and highly depend of large cardamom farming. The infrastructure development is very poor like lack of good access of road, absence of electricity, lack of proper mechanism of water, lack of schools and health post and so on. Following section 10.3 presented some of the pictures taken during the first day of observation.

10.2 Second day of Observation

The second day of observation conducted on 12th October 2017 which was focused on post-harvesting activities. The researcher observed various post harvesting activities such as; Segregation, drying procedure, grading method, and tail cutting process and storing practice. The first job after the harvesting is to segregate the cardamom capsule from its roots. The farmers were reported that one roots having maximum 8-10 capsule depending on the plant growth. After segregating the cardamom capsule are ready for the dryer purpose and it was observed that maximum 3 to 4 *Mund* (around 100 to 150 Kg) of fresh capsule can make dry at one time in the normal dryer. The Dryer is called *Bhatti* in local language which made of mud and stone by making wall at four sides that having the small opening in front, to feed the firewood and at the top there is bamboo mat or wire mat to put the cardamom over. Moreover, it has been observed that, about 10 kg of fire wood is using to make the capsule dry for the one lot. Additionally, the local *Bhatti* is generating lot of smoke and farmer were facing health issues due to that. The researcher could not see tail cutting and grading method lively because most of the farmers were busy to harvest and bringing those harvest cardamoms in home. However, tail cutting and grading process also done by local method and it has not been seen any technology related to these functions.

Furthermore, the quality if large cardamom depending on its size, colour, and amount moisture containing. And these local technologies could not generate the good quality of large cardamom. Similarly, the size of the cardamom also not up to the mark due to traditional way of farming. Moreover, it also observed that farmers were lacking the information about advances farming practices, about the new technology, lacking the collaboration with other source of innovation (Universities, research centre) and lacking two-way communication with government institutions, facilitators and other organizations. Moreover, farmers were facing problem in distribution of large cardamom. Due to lack of good road and transportation most of the farmers selling their products to the local collector and local collector supplying to the districts traders. In this selling process, local traders are the one who informed regarding price fluctuation and farmer does not have any technology to cross check. In some cases, farmers were in trap to sell their products. In following section 10.3 page presents different pictures that taken during the second day of field observation.

10.3 Pictures from the Field Observation

a. Cardamom Plant

b. Cardamom Forestry

c. Harvesting and used materials

special knife (Chhuri) to harvest

special shoes (Gumb boot)

Farmer is involving in harvesting and collecting

Mature Cardamom Capsules for harvesting

Dumping the harvested cardamom

Segregation of capsules

Fresh cardamom capsules (Pinkish colour)

Cardamom capsules drying in local dryer (*Bhatti*)

Cardamom capsules after drying (Dark brownish colour)

--------Thank you--------