AN ASSESSMENT OF PRE AND POST HARVEST FACTORS AFFECTING QUALITY OF GINGER IN THE EXPORT CHAIN

A CASE STUDY OF SALYAN DISTRICT AND NEPALGUNJ CITY, MID-WESTERN DEVELOPMENT REGION, NEPAL

A Research Project Submitted to Van Hall Larenstein University of Applied Sciences in Partial Fulfillment of the Requirements for the Degree of Master Agricultural Production Chain Management Specializing in Horticulture Production Chain

By

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September, 2013

Wageningen

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ACKNOWLEDGEMENT

I am very grateful to the Royal Netherlands Government for its support to the Nepalese Agriculture Education Program, under which I was offered this opportunity to pursue my postgraduate studies in Agricultural Production Chain Management (APCM), specialization in Horticulture Chain Management.

My thanks go to many people, who helped to make my work successful, firstly, my special thanks go to my supervisor Mrs. Kijne Albertien, for her valuable time provide in my research. This document is the output of her professional, critical and productive remarks throughout my research.

Secondly, I am very grateful to all staffs of the Van Hall Larenstein University of Applied Science. My sincere appreciation goes to my course coordinator Dr. Tracey Campbell for her support and encouragement throughout the study.

Many thanks go to my friends Dr. Lekhnath Adhikari, Dr. Subhash Chaudhary, Mr. Arun Thapa and Mr. Ram Kumar Basnet who support to edit my thesis report.

I also express my gratitude to Mr. Govinda Kc, Department Head of the National Ginger Research Program and Dipesh Oli, Head of the District Agriculture Development Office, ginger traders and ginger growers who helped me during the field study.

Finally, my special thanks go to my family who supported and encouraged me throughout the study period.

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ABBREVIATIONS

ADB	Agricultural Development Bank
AEC	Agri-Enterprises Centre
CADP	Commercial Agriculture Development Project
CBS	Central Bureau of Statistics
CYMMIT	International Maize and Wheat Improvement Centre
DADO	District Agriculture Development Office
DDC	District Development Committee
DFID	Department for International Development
DOA	Department of Agriculture
FAO	Food and Agriculture Development Organization
FAOSTAT	Food and Agriculture Development Organization: Statistics
FYM	Farm Yard Manure
FNCCI	Federation of Nepalese Chamber of Commerce and Industry
GRP	Ginger Research Program
HMRP	Hill Maize Research Project
HVAP	High Value Agriculture Development Project
ITC	International Trade Centre
ITDG	Intermediate Technology Development Group
MOAC	Ministry of Agriculture and Cooperative
MT	Metric Tones
NEAT	Nepal Economic Agriculture and Trade
NARC	Nepal Agricultural Research Council
NITS	National Trade Integration Strategy
NGRP	National Ginger Research Program
NSCDP	National Spice Crop Development Program

NGOs	Non-Governmental Organization
NPK	Nitrogen, Phosphorus, Potassium
PFA	Prevention of Food Adulteration
RH	Relative Humidity
RS	Rupees
SBI	Spice Board of India
STDF	Strengthening Trade Development Facility
SPS	Sanitary and Phyto-Sanitary
SUPPORT Foundation	Social Upliftment through Participatory Program Research and Training Foundation
SWOT	Strength, Weaknesses, Opportunity, Threats
USAID	United State Agency for International Development
VDCs	Village Development Committees

TERMINOLOGY

Agriculture practices: Activities conducted during ginger productions such as irrigation, weeding, earthen up.

Decay: Decomposition of the rhizome through action of bacteria & fungi.

Dirty ginger: Ginger attached with soil.

Doko: Locally made bamboo basket, use during manually transportation of goods.

Earthen up: Protect the roots as covering with soil during the growth of the plant to prevent expose to sunlight and for good aeration.

Ginger: Spice crops also having medicinal value.

Post- harvest handling: The series of activities or process, that occur from harvesting to reach to the consumer, it covers, trimming, washing, sorting, grading, packaging, storage, transport.

Pre cooling: Pre-cooling refers to the control of product heat generated during harvesting and handling.

Pre harvest practices: Agricultural practices operated during ginger production.

Rhizome: Usable and underground swollen part of ginger plant.

Rupees (Rs): Rupees is the currency of Nepal and one dollar is equivalent to 105 Nepali or one euro is equivalent to 145 Nepali Rupees (1USD= 104 Rupees, 1 Euro=140 Rupees).

Ropani : Ropani is the unit to measure land in mid hill of Nepal, and 1 hectare of land equals to 20 Ropani (1 hectare = 20 Ropani, 1 Ropani =500m^2).

Shelf life: The length of time that ginger can be stored and is suitable for consumption.

Sorting: Removal of disease infected and damaged rhizomes.

Terai: Lower and plain belt of Nepal

Trimming: Trimming refers to the removal of undesirable parts or roots from the product.

ABSTRACT

Ginger is one of the promising high value spice crops which has a large production and export potential for Nepal. Ginger is traditionally grown in the mid-hill areas of Nepal for cash income.

The objective of the study was to analyze the pre and post- harvest factors affecting the quality of ginger in the export chain and to recommend proper pre and post- harvest handling practices to improve and maintain the quality in order to meet the export market requirements. In order to achieve the objective of the research; desk studies, survey and personal interviews with different actors and supporters of the ginger chain were conducted.

The main factors identified for the quality deterioration of ginger are traditional agricultural practices are use of traditional old varieties, unavailability of an appropriate variety, unavailability of irrigation facilities, lack of washing facilities, and cold storage. Besides that the lack of technical knowledge and awareness to the producer and traders about the quality management during production and supply is the other important factor affecting the quality of ginger.

The quality parameter required in the Indian export markets is a big size rhizome, pale yellow colour, high oil content, high oleoresin content, less fibre content, cleaned, washed, graded and free from diseases and pests.

In order to reduce the deterioration and improve the quality, the recommendations were presented to the government agencies like DADO, NARC and the non-governmental organization SUPPORT Foundation. The main recommendations to improve the quality ginger to get high market prices in India, from this study are availability of an appropriate variety, the development of irrigation facilities, washing facilities, and storage. Besides that empower the producer and traders about production, marketing and quality management to maintain and improve the quality of ginger to meet the quality standards of international markets through development of irrigation facilities, washing facilities and cold storage and the trainings about the selection and use of appropriate variety, methods of irrigations, the importance and methods of washing and during use of cold storage.

The government agencies (DDC, DADO) are recommended to develop infrastructure like irrigation, washing, and cold storage and SUPPORT foundation have to provide trainings to the chain actors and the NARC have to develop and provide appropriate variety to preserve and improve the quality of ginger for the supply in national and international markets.

Key words: Ginger, Pre and post- harvest factors, Quality parameters, and export chain.

Chapter 1: Introduction

1.1 Background

1.2 Brief introduction of Nepal

Nepal is a Himalayan country situated in South Asia, known as land of Mt. Everest and birth place of Lord Buddha with an area of 147,181 square kilometers (SPCR, 2011). It lies between the two largest countries, India and China. It is a landlocked and mountainous country, have an elevation ranges from 60 m to the 8848 m from the sea level. Nepal has three ecological belts running from east to west. The three belts are: Mountainous, Hill and Terai. The three ecological belts comprise an area Mountain 42%, Hill 35% and Terai 23% of the total area. According to Central Bureau of Statistics (CBS) report of 2012, the population of Nepal is approximately 26.5 million in 2011, and the population growth rate is 1.35 % per year.

Administratively Nepal has 5 development regions, 14 zones and 75 districts. Each district is divided into small Village Development Committees (VDCs) and municipalities (FAO, 2012). There are 3914 VDCs and 58 Municipalities in the country (Paudyal, and Mandougall, 2008). The VDC represents the rural areas and the Municipality represents the urban areas of the country. The five development regions of the Nepal are: the eastern development region, mid development region, western development region, midwestern development region and far western development region. Kathmandu is the capital city of Nepal.

Nepal has huge variations in altitude and topography, which leads to diversity of weather and climate. According to Friendship Nepal (2009), there are four climatic seasons in Nepal which is spring, summer, winter and autumn. The rainfall season in Nepal starts at mid of June and end in September. The annual rainfall pattern of Nepal is different from east to west, the rainfall is higher in the eastern part of Nepal and in the far west development region there is lower rainfall than other region. According to the report of the World Bank, (2011), the total agricultural land in Nepal is 29.65% and only 16.4% is arable land.

1.3 Introduction of agriculture sector in Nepal

According to DOA, (2013), Nepal is an agricultural country; more than 65% people are engaged in agriculture. Agriculture is the backbone of Nepalese economy, which provides an employment opportunity for more than 66 % of the total population and contributes about 39% of the national gross domestic product. According to World Bank report published in 2012, the annual growth of agriculture was 4.51 % in 2011.

Ginger is one of the promising high value spice crops, which has a large production and export potential for Nepal (ITC, 2007). There are more than twenty types of spice crops use in Nepal and half of them are grown in Nepal (GRP, 2009). Spice crops have significant contribution to raising the socioeconomic status of the rural people, increase income and protect the environment (NSCDP, 2007). According to Poudel, (2007), India is the major trading partner for spices of Nepal and its shares are 87 % in total trade value.

According to FAOSTAT (2012) ginger is traditionally grown in the mid-hill areas of Nepal for cash income. The country produced 11.5% of world's total ginger production and became 3rd largest producer in 2010 and the 8th largest exporter in 2010 (see table 1 and table 2).

Table 1: Top producer country of ginger of the world in 2010

Rank	Country	Production (Mt)
1	China	396,600
2	India	385,330
3	Nepal	210,790
4	Thailand	172,681
5	Nigeria	162,223
6	Indonesia	109,024
7	Bangladesh	74,841
8	Japan	53,600
9	Philippines	27,099

Source (FAOSTAT, 2012a)

Table 1 shows that Nepal produced 210,790 metric tons of ginger in 2010 and ranked third largest producer country in the world.

Table 2: Top ginger exporter country of the world in 2010

Rank	Country	Quantity (tons)	Value	Unit value ($ /tones)
1	China	303,525	439,832	1449
2	Netherland	20,621	37,756	1831
3	Thailand	31,383	28,616	912
4	India	20,384	23,870	1171
5	Ethiopia	10,268	19,883	1936
6	Nigeria	5,602	11,275	2013
7	Brazil	6,212	8,392	1351
8	Nepal	30,416	6,234	205
9	Myanmar	8,064	4,410	547

Source (FAOSTAT, 2012b)

Table 2 shows that the volume exported from the Nepal in 2010 was 30,416 metric tons and ranked as the 8th largest exporter but the value of the ginger was 205 euro per tons, which was lowest value among the top exporter country in the world.

According to the ITC (2007), this sector of Nepal contributes 0.59% of total export volume of Nepal with export value of about NRs. 403 million in 2007 and about 75 % ginger is traded in the fresh form and the remaining 25% in processed form. Due to its high volume and value in a unit area compared to competitive crops, it has a bigger impact on smallholder farmers.

According to CADP (2008), the major ginger production districts of Nepal are Salyan, Ilam, Nawlaparasi and Palpa. The average yield of ginger is 11.96 MT/ha in 2007. Nepalgunj, Birtamod, Dharan, Biratnagar, Hetauda, Butwal, Tulsipur, Dhangadhi, Mahendranagar, Birgunj, Bhairawhaha and Kathmandu are the major market hubs of ginger in Nepal.

Ginger is one of the agriculture products having an export potential identified by Nepal Trade Integration Strategy (NITS, 2010). According to NITS from 2004 to 2008, the export volume of ginger has increased by 34%. The production area also increased from 11, 830 in 2003/4 to 16788 hectares of land in 2009/10. According to NITS, ginger production has increased to 190,544 tons in 2009/10 from 150,593 tons in 2003/4. The productivity was 11metric tons per hectare which is lower than 18 tons per hectare in India.

According to MOAC (2008), the Salyan district is the fourth largest ginger producer district in terms of area and production. The total area covered by the district for ginger production was 724 hectares and the productivity of the district was 12.26 per hectare in 2008 (see table 3).

Table 3: Area, production and productivity of ginger in major districts of Nepal

Districts	Area (Ha)	Production (Mt)	Productivity (Mt/Ha)
Illam	2,114	27,675	12.84
Palpa	1,275	12,688	10.2
Nawalparasi	1,290	12,126	9.4
Doti	588	9,300	15.55
Salyan	724	12,300	12.26
Morang	603	8,400	13.23
Arghakhanchi	614	6,357	10.35
Dang	285	6,100	21.4
Sindupalchok	395	5,620	14.22
Syanja	537	5,000	9.4
Others	5,552	59,384	10.69

Source (MOAC, 2008)

1.4 Problem statement

According to ITC (2007), Nepal has a high production and export potential of ginger, but it needs to improve the quality of the ginger. The ginger production and export has increased in recent years due to the increase in the growing area and extension services provided by government and different NGOs.

According to Joshi (2010), the ginger produced from Salyan district does not meet the quality standards of international markets. The limited efforts to improve technologies and

production practices to improve the quality of ginger from the governmental and non-governmental organization, leading to the quality of ginger is deteriorating, which is influenced from pre harvest to post harvest management practices.

According to Joshi (2010), various NGOs have worked on improving the production level of the chain, and supported ginger growers and traders. However, the ginger growers and the other actors in the chain complain that the quality of ginger is deteriorating along the chain. Therefore, SUPPORT Foundation, is interested to know the factors causing quality deterioration along the ginger chain in order to improve the quality of ginger for export market. So this study is focused on pre and post-harvest practices and its effect on quality of ginger along the chain.

SUPPORT Foundation has worked on improving the income level of the farmers through the development of the ginger chain. It has focused on the production level. Less attention was given to the product quality management during the supply chain, which leads to the farmers and traders being unable to supply the quality product in the international market. SUPPORT Foundation wants to improve the quality of ginger so that farmers will be able to meet the quality requirement of the international market especially India. The organization is interested to study on factors affecting the quality of ginger during production and supply to meet the quality standards of international markets. The recommendations from the study will help to improve the strategy of the organization to adopt appropriate pre and post-harvest measures to improve and maintain the quality of ginger during supply.

1.5 Problem owner: SUPPORT Foundation

Social Upliftment through Participatory Program Research and Training (SUPPORT) Foundation is a non-governmental organization (NGO) established in 2004 and its head office is in the Bhimdatta Municipality in the Far - Western Development Region of Nepal.

The organization was established with the objectives of the improvement of the livelihood standard through the agricultural activities. The organization started to work for the least developed region, the Far Western Development Region. The organization started to organize the farmers' groups for collective production and marketing. The organization has implemented a food security project in the remote districts of the Nepal which was financially supported by the European Union and the Food and Agriculture Organization (FAO) in 2011. Recently the organization implemented Hill Maize Research Development Project (HMRP) supported by the CYMMIT international and value chain development project financially supported by the Department for International Development (DFID).

1.6 Objectives of the research

The main objective of the research is to explore the effects of pre and post-harvest practices on quality of ginger in the chain of Salyan district and to recommend appropriate pre and post-harvest handling methods for improvement of quality of ginger to meet the quality standards of international markets.

1.7 Main research questions

To meet the objectives of this research, three main research questions were developed, and sub-questions are developed for supporting each main question.

1. **How is the ginger value chain organized in Salyan district?**

1.1 What is the existing ginger value chain?

1.2 What is the role of key stakeholders involved in the ginger chain of Salyan?

1.3 What are the constraints of the ginger export chain? (Production/post-harvesting/Physical/infrastructure/legal/political)

2. **What are the ginger quality requirements of the buyers in export markets?**

2.1 What are the quality standards of ginger for buyers?

2.2 What are the current quality and factors influencing quality requirements of buyers?

3. **How the ginger quality is influenced by pre and post-harvest handling practices in the ginger value chain of Salyan?**

3.1 What are the current pre- harvesting (production and harvesting) practices of ginger?

3.2 What are the indicators to determine the harvesting time of ginger?

3.3 What are the post-harvest handling methods at different level of the chain?

3.4 What are the factor influencing the post-harvest losses at different level of the chain?

1.8 Structure of the report

The report is divided into 8 chapters. The first chapter is the introduction chapter, which includes the background information, problem statements, problem owner, objectives and research questions. The second chapter is the literature review, which include the concepts of the value chain concept of pre-harvest considerations and post harvest considerations. The third chapter is the research methodology, which includes the research framework, study area, population size and sampling procedure, methods of data collection and methods of data analysis. The fourth chapter includes the findings of the desk study, survey and interviews regarding the organization of the chain. The fifth chapter includes the findings of a survey with producers. The sixth chapter includes the finding of interviews with traders and service providers. The seventh chapter is the discussion chapter, which includes the discussion on the findings of the value chain of ginger, pre and post harvest considerations of ginger. The conclusions and recommendations are included in the chapter eight.

Chapter 2: Literature review

2.1 Value chain

The value chain includes a series of activities product/services must pass through until it serves its final purpose of solving a customer need. At each stage of the product or service gains some value. If a phase is malfunctioning the chain will break down and the mission of generating value for the customer will not be accomplished (TBK, 2012).

"The value chain concept was first used by Michael Porter in his book Competitive Advantage: Creating and Sustaining Superior Performance'' in 1985. According to him mainly two types of activities are involved in a value chain. The primary activities are directly related to the delivery of product or services, which includes raw materials, production, processing, packaging, labelling, storage, transport and distribution of the product to the end consumer. The actors involved in a value chain are suppliers, producers, traders, wholesalers, exporters, retailers and consumers. The secondary activities which are not directly related to production but it indirectly supports to create value in the chain. It includes basic infrastructure development such as physical infrastructure, administration, human resources, technology development, purchasing, procurement and research and development". (Porter, 1985)

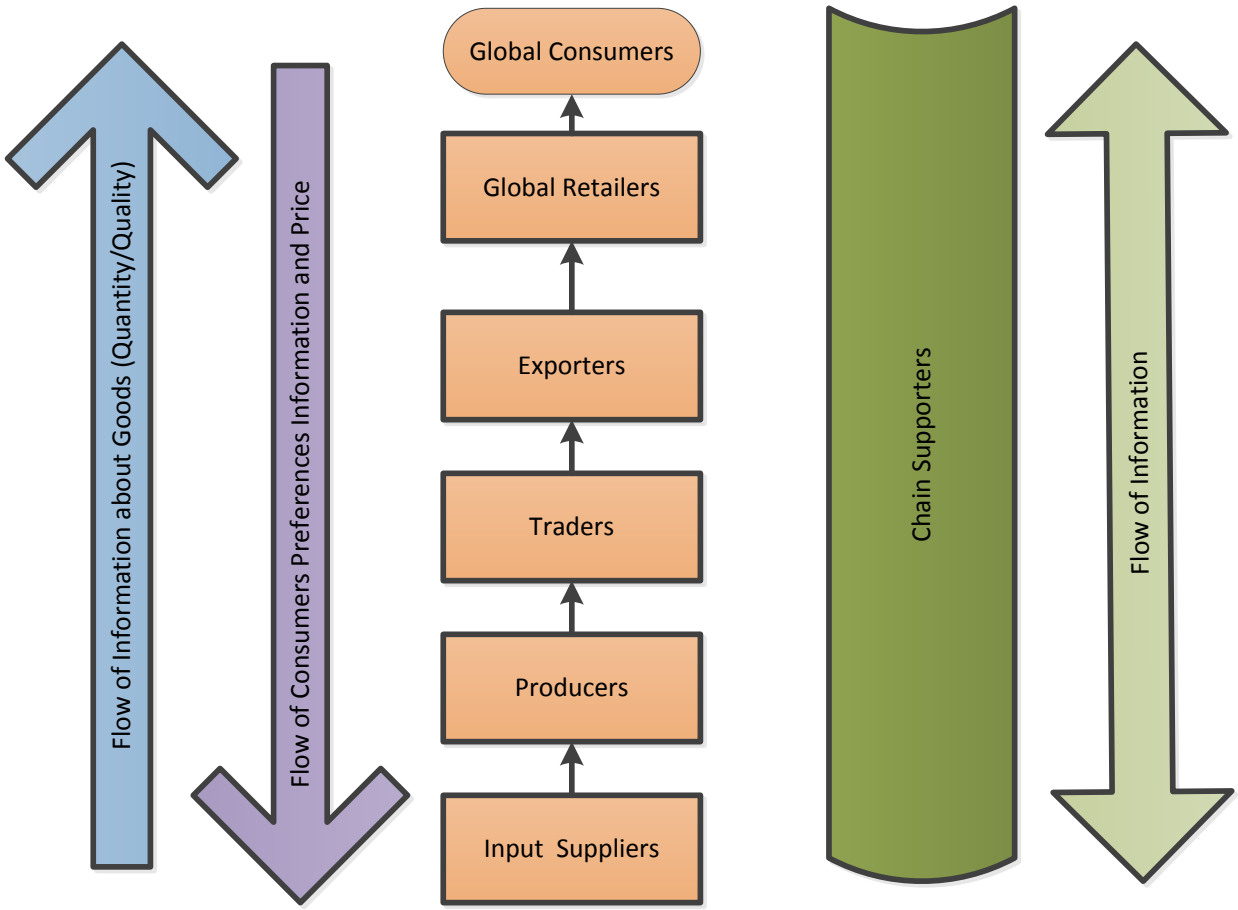

Figure 1: Value chain concept

Source: Verschuur, (2013)

2.2 Quality attributes

According to Luning and Marcelis (2009), “quality is meeting or exceeding customer and consumer expectations”. It shows that from the consumer perspective there are many quality attributes in food like shape, size, colour, taste, oil content, and nutrient content. In order to keep this quality it is important to control external and internal damage of the produce. These quality attributes rely on composition of food processing methods, packaging, materials used in packaging, storage system, and transportation.

According to Kader (2002a), quality is defined as any of the features that make something what it is, or the degree of excellence or superiority. The word quality is used in various ways such as market quality, edible quality, dessert quality, transportation quality, nutritional quality, internal quality and appearance quality.

Kader (2002a), mentioned that the quality of fresh horticultural commodities is a combination of characteristics, attributes and properties that gives the commodity value of food. Producers are concerned that their commodities have good appearance and free from visual defects, but the variety will be high yielding, disease resistance, easy to harvest and has a transportation quality.

As suggested by Kader (2002a), in his book that for receivers and market distributors, appearance quality is most important; they are also interested in firmness and long storage life. Consumer considers good quality commodities to be those that look good, are firm and offer good flavour nutritive value.

According to Gautam (2005), product quality is the quality characteristics of the products that are acceptable to consumers. This includes external and internal factors such external appearance are shape, size, colour, gloss, consistency and internal chemical, microbial, physical.

2.3 Pre and post-harvest handling

According to ITDG (2013), the quality of the final product of ginger is determined by both pre-harvest and post-harvest factors. The most important factor is the cultivar grown. This determines the flavour, aroma, pungency and level of essential oil and fibre. The stage of maturity of the rhizome at harvest determines its end use.

2.4 Pre-harvest considerations

According to Kader (2002b), various pre-harvest factors including management practices and environmental factors influence post-harvest quality. A diverse range of biotic and abiotic factors can alter the appearance of produce prior to harvest. Even under optimum condition a portion of every crop is invariably downgraded due to appearance defects. If poor management decisions are made during crop production, the texture of the product which reaches consumers may be undesirable.

According to Dubey and Tiwari (2008), ginger requires tropical, subtropical and humid climate for production. It can grow successfully up to 1500 meters. Dry weather with the 28-30 ^{0}c about one month before harvesting is ideal but high humidity throughout the growing period is necessary. It requires good garden soil rich in humus, light, loose friable, well-drained soil having a pH range from 6.5 to 7 is well suited for rhizome growth.

“The appropriate time for planting of ginger is March, in Northern India planting distance between row to row and plant to plant is 25-45 and 15-20 cm respectively. The recommended dose of farm yard manure (FYM) or compost is 25-30 ton per hectare. The inorganic fertilizers 100:75:100 (NPK/kg/hectare) is recommended. Mulching is essential to enhance sprouting, increase infiltration and organic matter. A crop planted in April –May require 2-4 initial watering at an interval of 7 days and in October to December at 15 day intervals. Rhizome initiation, sprouting and rhizome development is the critical stages for irrigation. Harvesting for preserving ginger should be harvested after 5-7 month after plantation while for harvest for dried ginger and oil is best at 8-9 month after plantation”. (Dubey and Tiwari 2008)

According to Jha and Deka (2008), the varieties with less fibre, high dry matter recovery, and high oil and oleoresin contents are having great export potentials in international markets. Therefore, more emphasis should be given to develop those varieties, which are having the above qualities.

According to NGRP (2012), quantity and quality of ginger depend on the weather conditions. In 2011 high rainfall during the growing season causes the high incidence of rhizome rot, which deteriorate the quantity and quality of ginger.

2.5 Harvesting

According to the Practical Action (2009), when the rhizomes are harvested they should be handled with care to prevent injury. They should be washed immediately after harvest to obtain a pale colour. The wet rhizomes should not allow lying too long in heaps as they are liable to fermentation. Storage for a long time results in the loss of flavour and pungency.

2.6 Post-harvest considerations

2.6.1 Pre-cooling

According to Sharma (2009), pre-cooling should be done to remove the field and product heat of ginger to withstand transport better. Cooling in the shade under trees or covering the stake with the dry leaves of ginger.

2.6.2 Trimming

According to Chaudhary (2008), the removal of undesirable stems, roots and other portions, diseased, insect pest infected parts should be cut with the help of a sharp knife to protect from decay of rhizomes during storage and supply.

2.6.3 Washing/cleaning

According to Chaudhary (2008), cleaning is an important practice to fetch the best market price in the market which also helps to improve the quality. Physical contaminations, generally termed as macro contaminants decide the extrinsic quality of the produce. Extraneous foreign matter includes stones, soil, dusts, metallic contaminants, chaffs, sticks, glass, pieces and insect excreta or any other foreign matter which finds their way to produce. It is better to wash the ginger in clean water to remove soil, residual effect of chemicals from the surface and improve the appearance.

According to FAO (2002), fresh rhizomes should be washed from dirt, parts of the plants and soil attached to roots. If available the pressure washing is recommended, which is more efficient and tends to reduce the microbial loads. After the harvest, cleaning is essential to ensure minimum loss from microbial contamination, mould growth and decay. The mechanical washers or hot air dryers may help minimize contamination from dust during post-harvest handling operations.

2.6.4 Curing

Ginger intended for storage should be cured by air drying the rhizomes at ambient temperature (22^0c to 26^0c) and 70% to 75% RH for several days to allow the skin to thicken and the cut surfaces to heal. Curing will help reduce post-harvest weight loss and decay. Following this curing treatment, the ginger should be put in well-ventilated containers for long-term storage (USAID, 2004).

According to Acharya (2012), curing helps to heal the injured, scratched and cut rhizomes wounds by keeping for 3-4 days under the shade at a desirable temperature (22^0c to 26^0c). The periderm formation is favoured by high temperature and relative humidity (70^0c to 75^0c). Curing helps to increase the storage life and check the attack and spread of diseases.

2.6.5 Sorting and grading

Remove all damaged and injured rhizomes during sorting. The remaining marketable rhizomes should be stored according to size and overall performance (USAID, 2004).

According to report of Agrisnet (2011), in India grading is generally done only in Himachal Pradesh. The first grade is popularly known as “Gola” having the maximum dry matter and low fibre contents. Second grade is known as “Gatti” includes smaller size than the first grade. The third and the fourth grade are small amount of dry matter and high fibre content.

Generally grading is done based on the size, colour, and freshness, while sorting is carried out to sort out the diseased, injured, and decayed rhizome. The rhizomes that look fresh, big size and good pale yellow colour are regarded as high grade and small, shrink rhizomes regarded as low grade.

2.6.6 Packaging

Adequate packaging reduces the post-harvest losses of ginger. Fresh ginger exported is usually packed in brace boxes (wire balance crates) to ensure maximum ventilation and is shifting under refrigeration at 13^0C. Packaging is an important process by which the intrinsic quality of the spices and spices product is preserved and spoilage due to microbes and insect infestation is prevented. Fresh and dry ginger is packed in gunny bags for local and distance market (Kc, Gautam, and Acharya, 2009).

“Ginger of roughly similar size per rhizome should be packed in each market container. The container should be strong, well-ventilated, and capable of being stacked without damaging the rhizomes. In the export market, ginger rhizomes should be placed in a clean, strong, well ventilated fibre-board carton. The surface of the rhizomes should be thoroughly dry prior to packing. Wet or damp ginger should not be packed into cartons destined for export, as surface mould will soon develop. Ginger destined for export should be loosely packed in layers inside the carton. The carton should not be overfilled. The net carton weight is typically between 10 kg and 14 kg for export market.” (USAID, 2004)

2.6.7 Storage and transportation

“Ginger may be successfully stored for several months if the correct post-harvest handling and storage procedure are utilized, and healthy, undamaged rhizomes are initially selected. The optimal temperature for storing and transportation ginger is 12^0C. At this temperature, the rhizomes will remain in marketable condition for at least 3 months. On the other hand surface mould will begin to grow at RH above 90% and sprouting will be stimulated, especially if the temperature is above 16^0C. In order to minimize weight loss but avoid surface mould, a comprise RH from 70% to 75% is recommended for storing ginger. Ginger stored at 22^0C and 70% RH for 3 months will lose about 20% of its initial weight”. (USAID, 2004)

2.6.8 Post harvests diseases and disorders

“Post-harvest disease in ginger is normally due to rough harvesting and handling practices which result in injury to the skin and the flesh of the rhizome. Holding ginger at a less than optimal temperature and RH will accelerate post-harvest decay. Post-harvest losses from diseases are caused by various fungi and bacteria soft rot. The rate of sprouting grows as the temperature increase. Keeping temperature at 12.5^0C will prevent sprouting”. (USAID, 2004)

Chapter 3: Methodology

3.1 Introduction

This research was based on a quantitative and qualitative approach based on the survey, interviews and desk study. The secondary data was collected through desk study, while primary data was collected through field survey and interviews by using a semi-structure questionnaire and checklist respectively. The desk study was carried out to find out the organization of chain, quality standards of international markets and consumer preferences in export markets. The survey and interviews were carried out to gather information from the producers and traders about the organization of the chain and the pre and post-harvest factors affecting the quality of ginger in the export chain.

3.2 Research framework

The figure 3 shows that the research was done by desk study, literature review, and field study. The results of the field study were analyzed separately. The results were compared with literature review during discussion. At the end conclusions and recommendation were made based on the results and discussion.

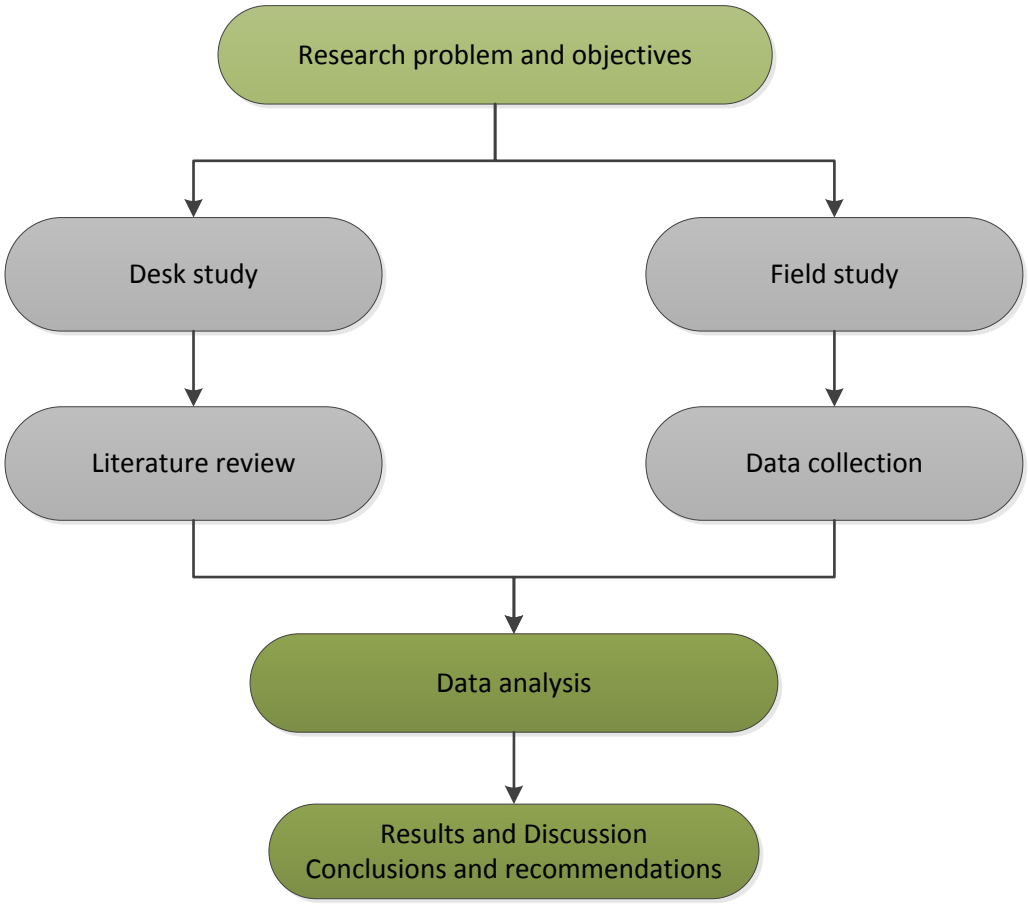

Figure 2: Research framework

3.3 Desk study

Desk study was carried out to search the background information about the process of ginger production and marketing. The materials used are reports, books, articles, and official statistical data. The use of existing materials helps to gain the information of ginger production and marketing process. The information gathered from desk study is used to compare with the findings of the field research. The following was searched during desk study.

- Ginger value chain analysis report
- Pre and post-harvest handling technologies
- Export problems in Nepal
- Quality attributes
- Quality requirements of buyers

3.4 Survey

A semi structured questionnaire was used to collect primary data (see annex 1). The survey was carried out on randomly selected farmers from two VDCs of Salyan district. Altogether thirty two randomly selected farmers were surveyed. Sixteen farmers from each VDC were surveyed during field research. The list of farmer surveyed is included in the annex 5 (see annex 5). The questionnaire focused on the production technology, factors affecting quality of ginger, harvesting, marketing and services they received. Questionnaires were filled from 20th July to August 15th in both areas (see annex 6).

3.5 Interviews

A personal interview was conducted to get information from the extension workers, collection center, traders and exporters. This was helpful to gain insight information about the organization of the value chain of ginger, constraints of ginger export chain and quality requirements of buyers, constraints in different stages in pre and post-harvest handling.

Altogether ten personal interviews were carried out, among them one within an expert from the Ginger Research Center (GRC) in Salyan district and one with the District Agriculture Development Office (DADO). The personal interviews were also carried out, with two local traders, two collectors, two wholesaler and two exporters. The name list of traders interviewed during field study is included in annex (see annex 5). The issues related for interviews was the post-harvest handling of ginger, quality standards of markets, constraints in different step of pre and post-harvest handling (see annex 2).

3.6 Study Area

This study was carried out to explore the effects of pre and post-harvest practices on quality of ginger along the chain in Salyan district. Therefore, one district that has large scale ginger production and the Nepalgunj a main market hub in the midwestern development region was selected as the study area for the research. According to the DADO (2011), out of 47 VDCs of the district the 8 VDCs of the districts are major gingers producing VDCs. The major

ginger producing VDCs is Chaychetra, Jhimpe, Dadagaun, Lekhapohkhara, Sidheshowari, Damachaur, Marke and Dhanbag. Out of 8 VDCs the major 2 ginger growing VDCs were selected randomly. The randomly selected VDCs are the Dadagaun and Dhanbag VDC.

Figure 3: Map showing Salyan district and Nepalgunj of Banke district

Source: Compose InfoBase Limited, (2012)

Figure 3 shows that the Salyan district is situated in Rapati zone in the Midwestern development region. The altitude varies from 457 to 3049 m above sea level. The study VDCs are situated at 1400m to 1500m altitude. The three yellow arrows show the studied VDCs Dadaguan and Dhanbag and Nepalgunj City.

Salyan district is situated on the mid hills of Nepal, where the climatic and geographic suitability provides an ample opportunity to grow ginger. Ginger is the main cash crop for the people of the district. According to the Ministry of Agriculture and Cooperatives (2008), Salyan district is the fourth largest ginger producer district of Nepal, the area under cultivation of the ginger in Salyan district was 724 hectares, the production 12300 metric tons and productivity was 12.26 metric tons/hectare in 2007.

Nepalgunj city is the major market hub for the ginger, which also comes under the mid-western development region of the Nepal. Almost all volumes of the ginger produced from the Salyan district and of the ginger produced from the whole mid-western development region of Nepal are exported through the Nepalgunj city. The major stakeholders of the ginger chain are doing business from the Nepalgunj city, so it was necessary to study their contributing in the quality management and the factors affecting the quality of ginger in ginger value chain. So this study was the focus of the Salyan district and the Nepalgunj.

3.7 Population size and sampling procedure for survey and interviews

According to DADO (2011), about 110 households are involved in ginger cultivation in the Dadagaun VDC, and 95 households are involved in ginger cultivation and marketing in the Dhanbag VDC of Salyan district. The average of 16 % producers was selected randomly for the study from two VDCs as the representative of the whole population. From both the VDCs altogether 32 producers are selected and 16 producers from each VDC were selected for survey. There are 7 local traders, 3 collectors near to the VDCs, 6 wholesalers, 4 exporters involved in the ginger chain in the present situation and 4 service providers were involved to provide services. Ten respondents were selected for interviews, which included 2 respondents from each of the stages of the chain including service providers. The traders were selected randomly to get information about chain organization, pre and post-harvest management practices in the ginger supply chain. The list of farmers selected for survey and traders selected for interviews are mentioned in annex 5 (see annex 5).

3.8 Summary of survey and interviews

The table 4 shows that the number of stakeholders involved in the survey and interview during the field study. There were 32 producers and 10 traders surveyed and interviewed during the field study to find out the answers of the research questions.

Table 4: Summary of survey and interviews

S.N.	Stakeholders	Survey	Interviews	Venue
1	Collection center (Director/chairperson)		2	Two VDCs (Chain, constraints, post-harvest)
2	Traders (local/regional)		2	Salyan district (chain , post-harvest)
3	Wholesalers (Regional)		2	Neplagunj (quality requirements, chain, post-harvest,
4	Exporters (District/Regional)		2	Nepalgunj (quality requirements, chain, post-harvest)
5	Extension workers/experts (DADO/GRC)		2	Salyan district (pre and post-harvest, chain)
Total		32	10	

3.9 Data analysis

The data collected through the field research was tabulated and analyzed separately based on the information gathered from the survey and interviews. The information gathered from the survey, interviews and desk study was analyzed and evaluated the problems related to pre and post-harvest quality management of ginger in the chain. The result gained from surveys, interviews and desk study about the organization of the chain, buyers requirements

and pre and post harvest factors affecting quality of the chain was interpreted and compared with relevant literature.

After collection of necessary information it was entered into the computer for analysis. Data entry and analysis was carried out by using excel. The SPSS was used for preparation of the figure's base on the data gathered during survey and interviews. SWOT analysis was carried out to find out Strength, Weakness, Opportunity and Threats of the ginger value chain.

3.10 Operational data and sources

The sources of information used for data collection are mentioned in table 5 (see table 5).

Table 5: Summary of information data and sources

Q.N.	Information/Data	Sources
1.1/1.2	Organization of ginger chain/stakeholders of the chain	Survey and interview with actors and collection centers
1.3	Constraints before and after harvesting	Survey with farmers and interview with other stakeholders (traders/exporters)
2.1	Quality standards of international market and preference of consumer	Desk study and interview of exporters
2.2	Current quality and factor influencing the quality	Survey with producers and interview with other stakeholders (traders/exporters)
3.1	Pre-harvest consideration (production/harvesting)	Survey with ginger producers
3.2	Determination of harvest time (maturity)	Survey with producers
3.3	Pre and post-harvest practices (producing, harvesting, sorting, cleaning, grading, packaging, storage, transporting	Survey with producers and interview with other stakeholders (traders/exporters)
3.4	Factors of post-harvest loss	Survey with producers and interview with other stakeholders (traders)

Chapter 4: Research findings about the organization of the ginger chain

This chapter includes the findings of the desk study, survey with producers and interviews with traders about the organization of the ginger chain and buyers requirements.

4.1 Existing ginger chain

The study reveals that there are two types of chain currently existing for supply of ginger into the markets. The two chains are the domestic chain and export chain. The export chain is the main chain of ginger of the Salyan district. The domestic chain split from the export chain from the wholesaling stage of the chain, from where wholesalers supply small size ginger into the domestic markets after grading of the rhizomes. The structure of the ginger chain (figure 4) based on the information gathered from Salyan district and Nepalgunj city.

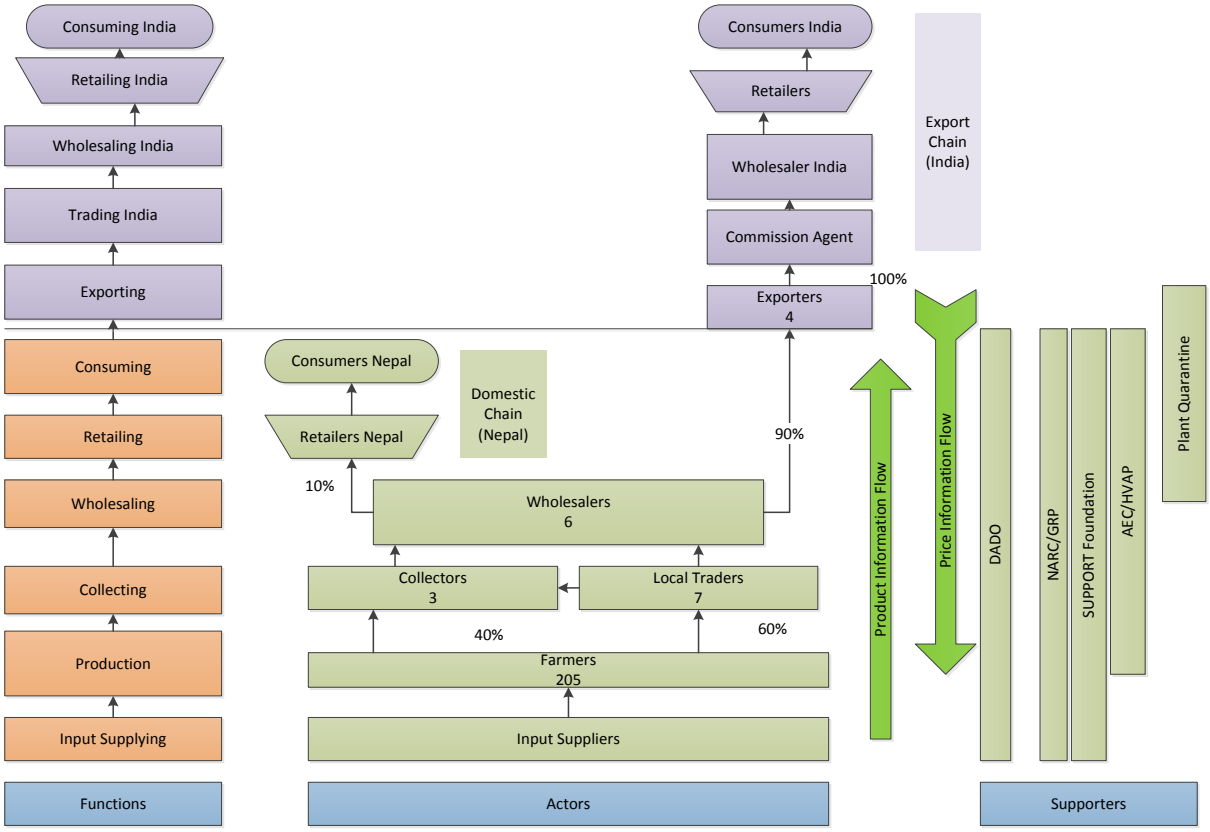

Figure 4: Structure of the ginger chain (Chain map)

4.2 Actors and supporters in the export chain

The export chain is the main chain for the ginger. The main stakeholders involved in this chain are input suppliers, producers, local traders, collection center/cooperatives, wholesalers, commission agent, exporters, retailers and consumers. The supporters involved in this chain are DADO, NARC, SUPPORT Foundation, AEC and HVAP. Each of the actors and supporters has its own importance and influence which is described below.

4.2.1 Input suppliers

The input suppliers are the local agro-vets of the local markets. They mostly supply tools, fertilizers and pesticides to the ginger producers. The seeds and compost manure are usually managed by producers themselves. There are 3 agro-vets supplying inputs to the producers in Salyan district.

4.2.2 Producers

Producers involved in this chain are small farmers of the remote areas, who are involved in production of ginger. There are more than 200 producers producing ginger in the concerned VDCs. They sell their produce individually to the collectors or local traders. Producers are themselves responsible for harvesting and marketing of ginger. The traditional harvesting tools (local hoe, local spade) and harvesting methods are used during harvesting of ginger. Generally producer harvest ginger twice in year, one is the main season during November and next during off season June/July. They fetch higher market prices from the ginger harvested during the off season as compared to the main season of harvesting.

Producers never wash ginger after harvest; they are trimmed and stored without washing. They have never graded of ginger after sorting; they only select big size rhizomes for their seed for next year. The producers are not aware about the methods of washing and grading. They are supplying ginger directly either by packing into jute bags or by transport directly without packaging using Doko (a man-made traditional tool used for packaging) to the traders (see figure 14).
Most of the producers sell their produce in the main season (November/December) 25-to 30 Rs/ kg but in the off season (June/July) they sell their produce more than 70 Rs/ kg. This year the price of the mother rhizome was 110 Rs/kg. Farmers are also engaged in local processing of the ginger especially dried ginger (Sutho).
According to Ghimire (2009), the quality of Nepalese ginger is superior for the production of dried ginger and essential oil. But lacking of processing facilities within the country, farmers have to sell their products in fresh form or traditionally dried form.

4.2.3 Collectors

There are 3 collectors involved in the collection of rhizomes; they buy and collect rhizomes from the producers and local traders. They have their own personal collection room for ginger. The collection centre is not functional for the ginger collection and marketing because the traders want to do business individually, so that they can get more benefits. After the collection of ginger, collectors store ginger in their own store room, which is not facilitated with cooling facilities. The local collectors store rhizome in open ground or in the room without packing or packed in jute bags. Three collectors are doing their business near to the study VDCs, one in Dadagaun VDC and two collectors in Dhanbag VDC. They are sorting the ginger before packaging in jute bags but they never grade, clean and wash ginger before selling to wholesalers. Collectors are not much aware about quality requirements in the market, they only focus on big size rhizome having pale yellow colour. Due to poor storage facilities they lose 15%-25% ginger before supply to traders. Collectors are not aware about the buyers' requirements and also they don't know how to grade, package and store properly to maintain quality as well as to prevent post-harvest loss.

4.2.4 Local traders

Altogether 7 local traders are involved in the collection of ginger from farmers. They buy rhizomes at the local village level from the producers and sell to collectors. They do not have any special storage room for the storage of ginger. Generally they pack rhizomes in jute bags and sell to the collectors or sometime they directly sell to the wholesalers. They do not grade ginger, but they remove decayed rhizomes and dirt but never clean, wash the rhizome before selling. They are not aware about the quality requirements of buyers, they are lacking awareness about grading, packaging, labelling and storing of ginger.

4.2.5 Wholesalers

There are 6 regional wholesalers engaged in marketing of ginger. They buy the ginger from the collectors, or local traders and they sell ginger to the exporters and local retailers. They grade ginger based on the size and colour of the rhizome and sell low grade ginger to domestic market and sell good rhizomes to exporters. They sell almost all volumes of rhizome to the exporters; they sell small amounts to the retailers or domestic market. They have storage room without cooling facilities. Sometime they store up to six months in this storeroom, when price in the international market is low. In this condition they lose more than 20% ginger due to decay and weight loss. They store ginger by using plastic crates and jute bags, they have not good ventilation facilities in store room, and there is no temperature and humidity control. They are not aware about how to maintain quality of ginger and to prevent losses during storage.

4.2.6 Exporters

There are 4 exporters involved in the supply of ginger they are exporting ginger to the India. They buy the ginger from the wholesalers. They export almost all volumes of the ginger to India either in fresh form or dried form. Exporters hire commission agent to export ginger in India on commission basis. Exporters have their own storage room but they do not have cooling facilities. They do not have any packaging facilities, grading facilities, washing, cleaning facilities. They directly supply to India through the commission agent. Most of the commission agents are Indian who have direct contact with Indian traders and who determine the price and flow information up and down about price and product. Exporters do not store ginger for a long time, they supply ginger within a maximum of two weeks. Exporters do not repack, grade, sort, clean, and washing the ginger after buy, they supply same as they buy from the wholesalers.

4.2.7 Commission agents

Commission agents are those who are hired by exporters on commission basis. The commission agents usually take 6-7% as commission on the total sales amount. Most of the ginger exported to India initially goes to the Indian commission agent, who is doing business from major market hubs of Nepal and India. Commission agents are responsible to manage at the customer clearance in both Nepal and India boarders. They also determine the price of the product by negotiating with both parties. They are not involved in any post-harvest management practices. They are only responsible to negotiate with both parties of India and Nepal.

4.2.8 Retailers

In the domestic chain the Nepalese retailers buy goods from wholesalers and sell to end consumer at local level. They sell the product in the open market, they are not selling ginger in a package, and they sell directly from the shop without packaging to consumers. They are not conscious about quality management of rhizomes. None of the retailers have storage and cooling facilities to maintain quality of ginger. In the export chain, the Indian wholesalers supply to the retailers of the India.

4.2.9 Consumers

Most of the international consumers are the end consumer of ginger. The Indian consumer is an end user of the ginger exported from Nepal. The consumers prefer to buy fresh rhizomes at low cost which contain high pungent flavour. They are not conscious about the quality of the product.

4.2.10 Supporters

Supporters are those who are not directly involved in the chain activities but they are supporting from outside of the chain. Mostly supporters are involved in providing technical services, infrastructure development and capacity development of the chain actors. DADO, NARC and Plant Quarantine Office are the government organizations supporting production and supply of ginger in some extent. Non-governmental organizations are also involved to provide technical service and development of linkage. SUPPORT Foundation is providing training to farmers about production technology of ginger. It is working to develop linkage among the chain actors in a proper supply chain development. HVAP is supporting to develop the infrastructure and training to the producers about production management in some extent. AEC is supporting business development of ginger and providing training and inputs on marketing management and marketing infrastructure development.

4.3 Additional information about domestic chain

Domestic chain is the local chain of Nepal, which is divided from the wholesaling stage of the chain. The same actors and supporters involved in the export chain are also involved in the domestic chain except exporters and commission agent. The actors involved in this chain are input suppliers, producers, collectors, local traders, wholesalers, retailers and consumers (figure 4).

The wholesalers in this chain supply low grade or small size rhizomes to the retailers. Retailers are buying ginger from the wholesaler which they sell to consumers from their own small shop. The transportation medium is a local bus in every stage of the chain; there is no special transportation system to supply ginger. National or local consumers are the end user of the ginger produce. They prefer ginger with lower price even if that is low quality. They are not interested to pay high prices for high quality ginger, so wholesalers supply low grade ginger for local consumers.

4.4 Buyers Requirements

The requirements of Indian buyers are big size rhizomes, pale yellow colour, sorted, and washed, cleaned, graded, less number of fingers in the rhizomes and free from diseases.

The buyers requirements refer as the quality specification of the product prefer by the consumers. The ginger surface should be clean, bright yellow brown, and appear fresh. It should not be wilted or have any evidence of sprouting. The rhizome should be free from bacteria or fungal infection and not have any visible skin blemishes. The minimum rhizomes weight for export is 250 grams. Rhizomes which have more than 4 side branches should not be packed for export. The export quality of ginger should be smooth and firm, which must have uniform shape and size, be free from insect damage and decay, and have a uniform peel colour typical variety. Depending on the cultivar, ginger flesh colours should either be cream or pale yellow". (USAID, 2004)

According to Yadav, et al. (2005), ginger is generally sold as raw form or in several other products like dry ginger, ginger powder, ginger oil and oleoresin. The oleoresin and oil are known as high value and low volume products, which are highly demanded in the international market.

"The problems to manage the quality of ginger in Nepal are, quality standard are not much emphasis sector by the all the actors in the chain. Lacking awareness and proper mechanism of quality control leads to the Nepal export India almost all the products at low prices. However the minimum quality standard should assure like grading, sorting, cleaning and disease prevalence during export to India. During export to India exporters have to get a PFA (Prevention of Food Adulteration) test certificates from Indian authority. Exporters of Nepal get a PFA test certificate from Kolkata and Luckhnow". (HVAP, 2011)

Most Nepali ginger is exported "dirty" for subsequent washing, grading and packaging in India in standard 60 kg gunny bags. Indian traders buy most of the ginger produced in Nepal, which is taken to West Bengal of India for washing. Nepalese farmers are price takers and unable to verify the feedback from Indian brokers on price, levels of post-harvest rotting and other quality issues (STDF, 2011).

Chapter 5: Findings of the survey with producers

The findings from the survey amongst 32 farmers include the pre and post-harvest practices by the producers and its effects on quality of ginger during production and supplying of ginger.

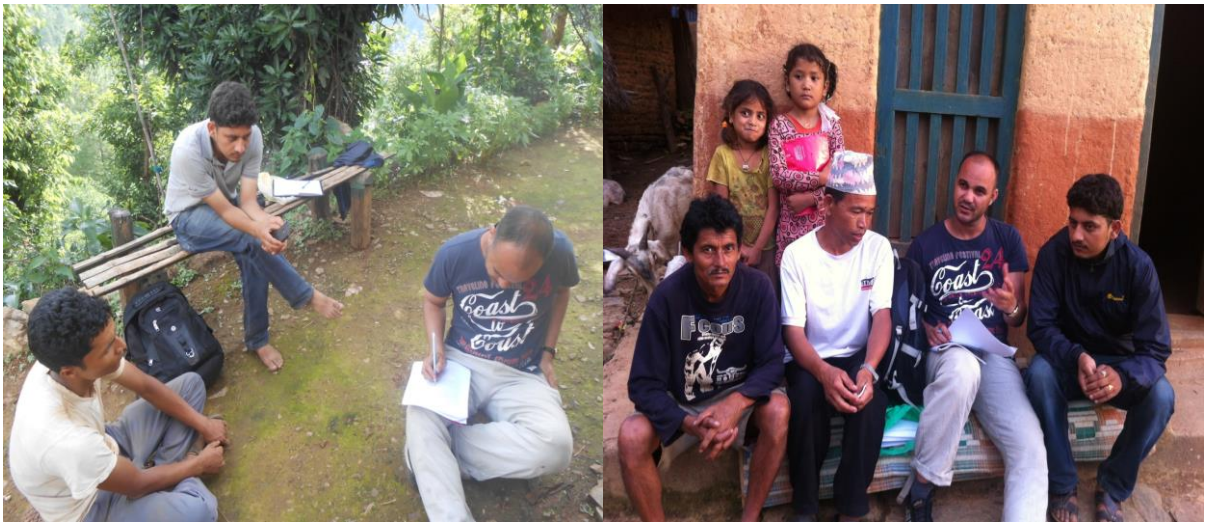

Figure 5: Survey with producers in Dhanbag and Dadagaun VDC

The traditional way of ginger cultivation practices are common among the producers and most of them are using their own local ginger seed and variety for production. Producers preserve ginger seeds traditionally in soil pits. Most of the farmers are not using chemical pesticides and fertilizers during production in the study area. Producers prepare organic manure themselves; they never buy organic manure from the input suppliers. They are using pine leaves and paddy straw for mulching during ginger production. Crop rotation is common for the producers they have grown ginger only after three years in the same land. During crop rotation they produce maize and barely as alternative crops in the field. The producers do not irrigate the ginger field during production because of the unavailability of irrigation facilities. The farmers are not organized into groups and are not engaged with any cooperatives, so they do not sell their produce through organization or cooperatives.

5.1 Variety and planting materials

5.1.1 Type of varieties grown by growers

In this field research we find that there are three types of ginger varieties grown by the farmers. Figure 6 shows that 50 % of the farmers are growing the variety Bose. Variety Nase is also produced by 40% farmers, variety Kapurkot-1 is not popular among the farmers because it is susceptible to rhizome rot, only 10% farmers are producing this variety.

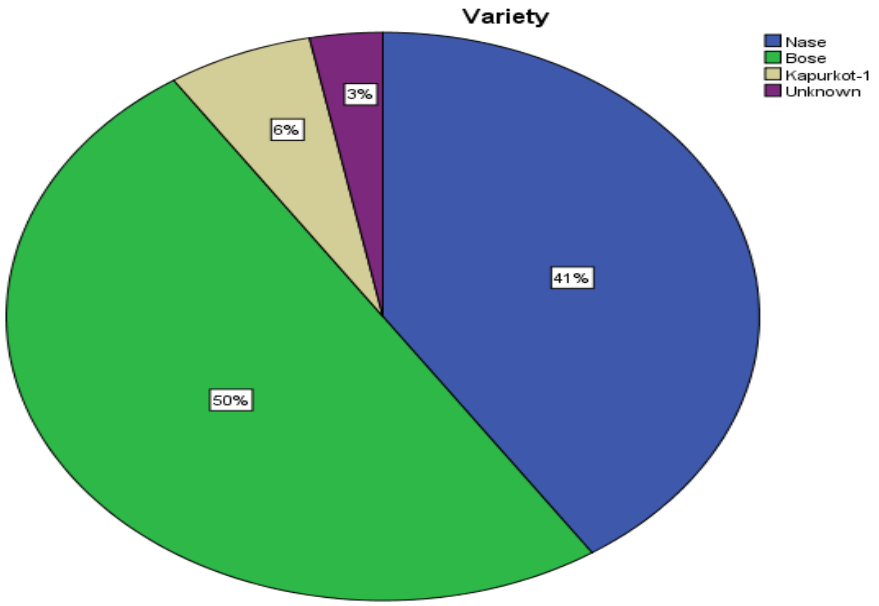

Figure 6: Farmers growing different type of varieties (n=32)

According to AEC (2006), farmers in Nepal traditionally cultivate two landraces of ginger, namely Nase which containing more fibers and Bose rhizome which contain less fiber. Ginger research program, Kapurkot develops another variety named Kapurkot Aduwa-1 in 2001; but the demand for seed of this variety of rhizome among farmers cannot be satisfied because variety Kapurkot-1 is susceptible to rhizome rot**.**

5.1.2 Type of planting material used

Figure 7 shows that almost all (91%) of the farmers are using their own seed which they stored for producing of ginger. Only 9% farmers are using seed from neighbours or other sources.

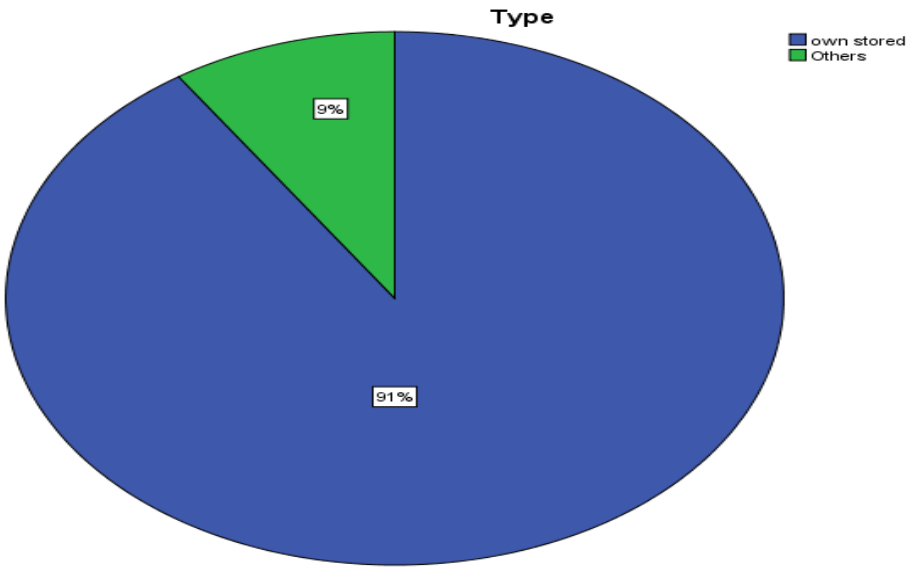

Figure 7: Farmer using planting materials (n=32)

5.1.3 Source of planting materials

Figure 8 indicates that the major source of planting materials is their own stored seed, which they preserved in soil pits for seed purpose. Around 90% farmers are using their own seed as planting material for producing ginger. Only few farmers are buying planting materials from agro-vets or other resource centres to produce ginger.

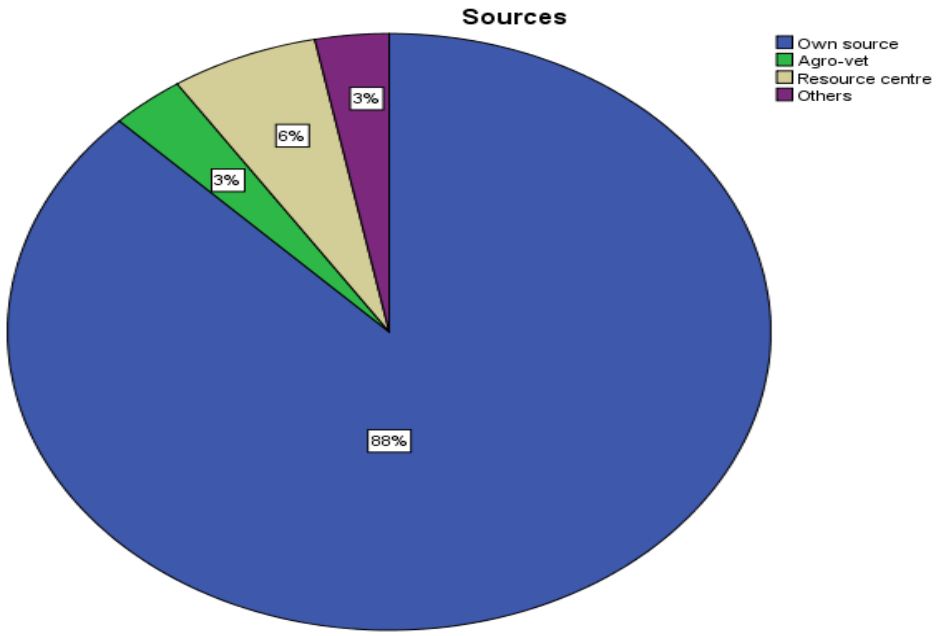

Figure 8: Sources of planting materials used by farmers (n=32)

5.2 Availability of irrigation facilities

Irrigation facilities are completely not available in the study VDCs. Farmers are not doing irrigation after planting, they depend on rainfall for irrigation of the ginger for production. All of the respondents say that they never irrigate ginger field after plantation because of lacking irrigation facilities.

Figure 9: Ginger cultivation practice without irrigation

5.3 Harvesting

According to respondents all of the farmers are harvesting themselves, which is done manually in the traditional way. Harvesting of ginger is carried out 9 months after plantation in November when the ginger rhizome is fully mature. The farmers harvest ginger twice a year, once in the June, July and another time in the main harvesting season in November. They harvest seed rhizome in June/July to sell at the market, at that time the price of the ginger is higher than at the main season of harvest. The respondents consider the maturity of the rhizome for harvest because if they harvest too early they can't preserve rhizome as seed for next year, if they harvest too early the rhizome will decay during storage in soil pit. The local tools are used for harvest, the tools like local hoe is mostly used during harvesting. Farmers didn't provide training to harvester about the methodology of harvesting and precaution to manage quality of ginger. After harvesting farmers sort and select big size, uncut rhizomes for seed and they sell the rest of the rhizomes to local traders without cleaning and washing. They were not aware about the methods of harvesting and lacking appropriate tools for harvesting.

5.3.1 Factors considered during harvest

Present figure 10 shows that the majority of the farmers considered maturity of rhizome during harvesting. The main reason for harvesting at full mature stage of rhizome, it will increase the storage life. Some farmers considered methods of harvesting to protect the rhizome from injury during digging. Only 3% of farmers are considering market prices and 9% are considering harvesting materials during harvesting.

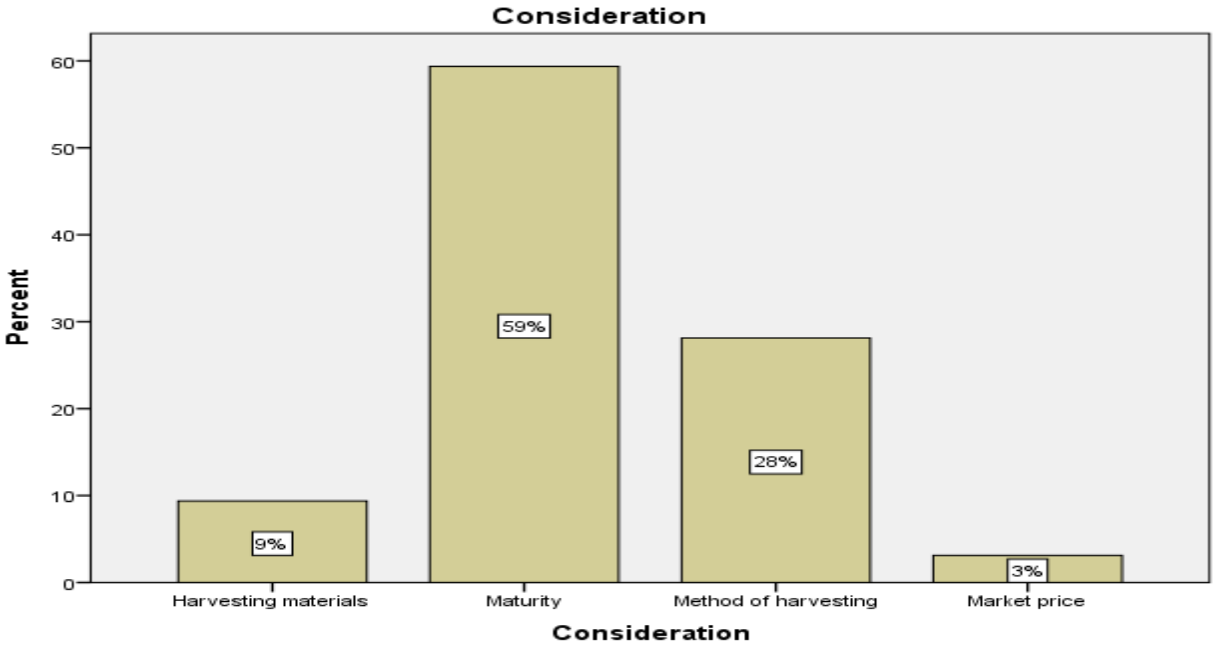

Figure 10: Factors considered during harvest (n=32)

5.3.2 Problems during harvesting

Figure 11 shows that around 60% of farmers are inexperienced about proper harvesting methods. While some respondents say that the unavailability of harvesting materials and inexperienced harvesters is the problem for them during harvesting. Beside that some farmers express that they do not know about harvesting requirements from a market point of view. The 3% farmers are not aware about the methods and importance of proper harvesting.

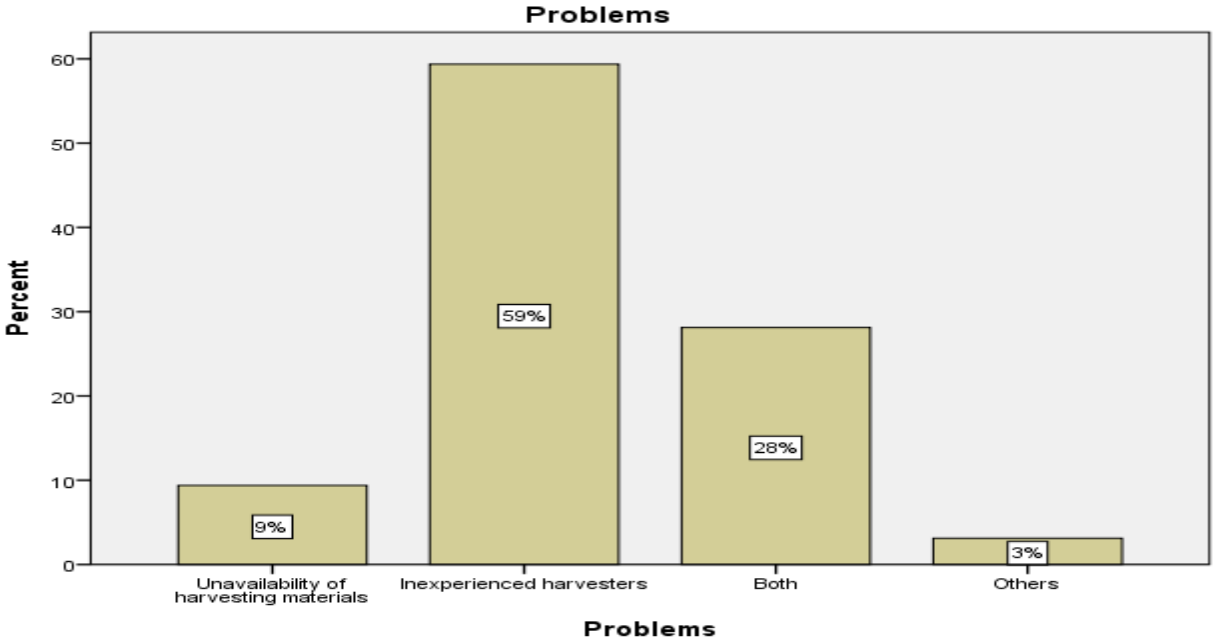

Figure 11: Problems during harvesting (n=32)

5.3.3 Trainings to the harvesters

According to the respondents none of the farmers are providing training to their harvesters because they still lack training themselves about the production and harvesting of the ginger as well as about washing, cleaning, grading and packaging after harvesting of the ginger.

5.4 Awareness about quality requirement in the markets

Figure 12 shows that 22 producers are unknown about the ginger quality requirements in the market where they are supplying. Around 70% farmers are unknown about the quality requirements of the product in markets. Some of the respondents received training from the non-governmental organization. They know about quality requirements in markets but they are not using their knowledge because the traders are not given an incentive for good quality ginger.

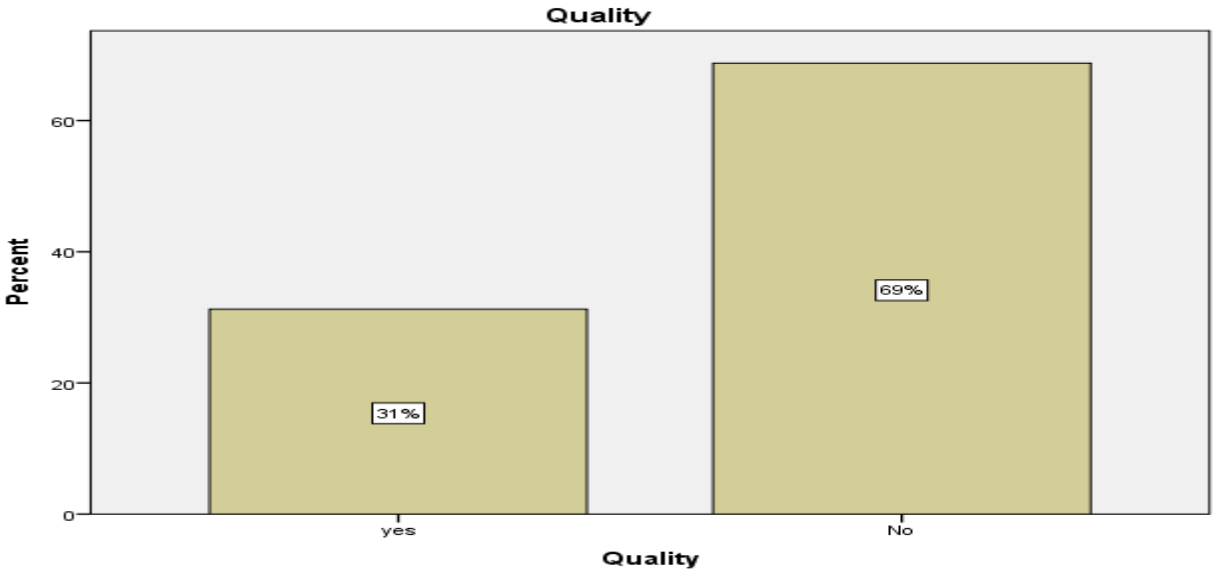

Figure 12: Farmers awareness about ginger quality requirements in markets (n=32)

5.5 Precaution to protect the quality of ginger

Farmers are knowingly or unknowingly always trying to protect the rhizome from injury during harvesting. Beside that they trim, cure and sort before supplying to traders. There are no other precautionary measures practiced by farmers to protect the quality of ginger. They are preserving big size rhizomes as the seed to get good quality ginger for next year.

5.6 Factors affecting quality of ginger during production

Figure 13 shows that according to the farmers the climate and diseases during the production are affecting the quality such as high rainfall during the rainy season, drought and diseases. Some of the respondents said that the quality of ginger is not good because of lacking fertility in the soil.

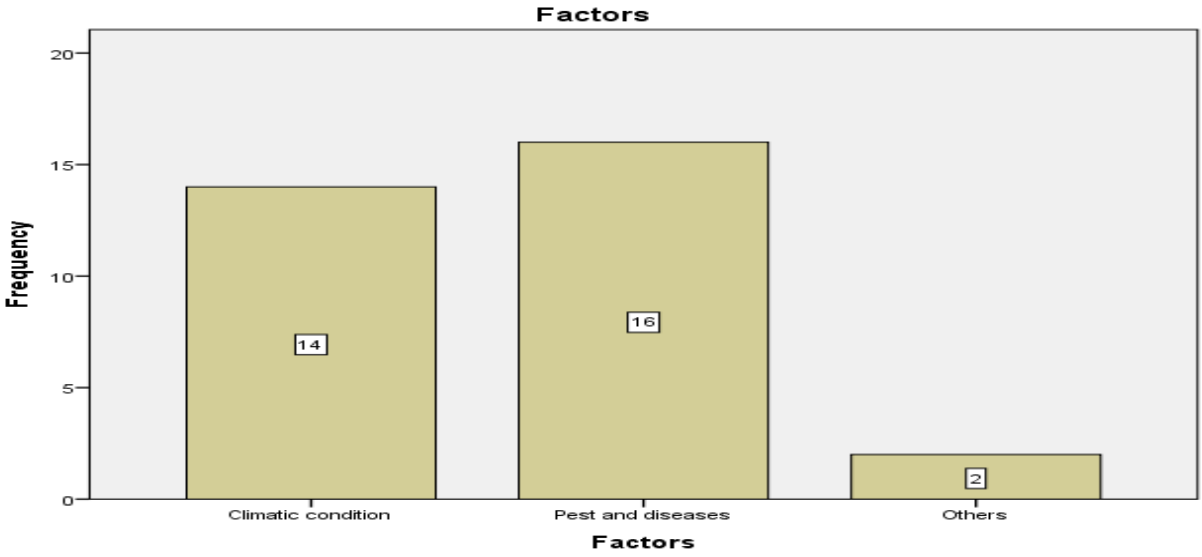

Figure 13: Factors affecting quality of ginger during production (n=32)

5.7 Transportation and packaging

According to the respondents all of the farmers are doing transportation till the collection centre or local trader's shop. Usually transportation is done manually by using Doko (see figure 15) traditional tool made up of by bamboo for carrying good. Other means of transportation are not available in the remote village of the Salyan district. Transportation is done without packaging or local jute bags.

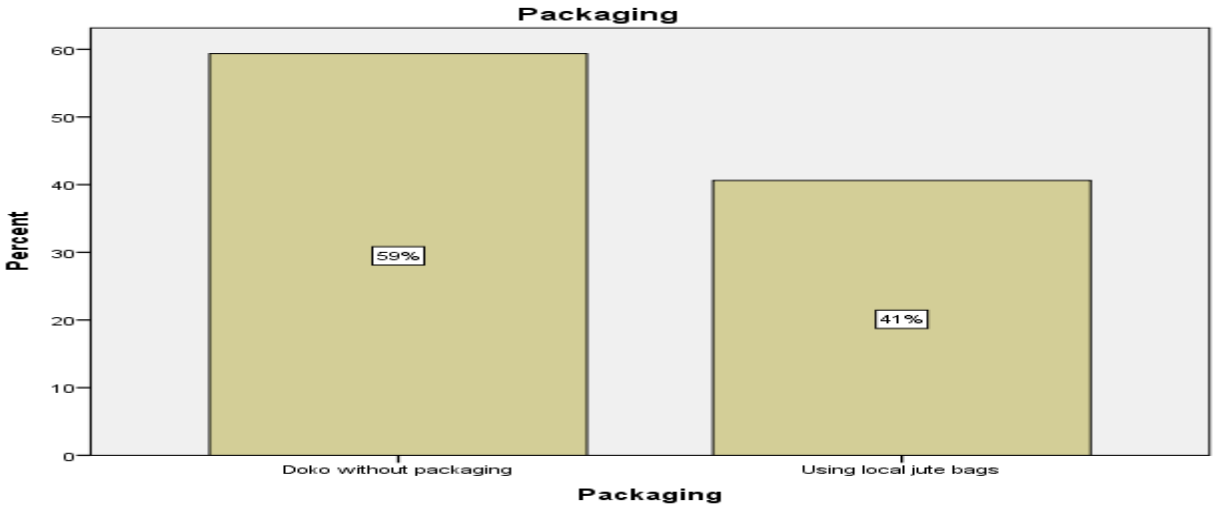

Figure 14: Packaging for transportation

Figure 15: Doko used by farmers during transport of ginger

5.8 Storing

According to the respondents all of the farmers are carrying out storing manually in the traditional way. There are no storing facilities having cooling facilities. Storing is carried out by using local techniques in soil pits. The storage of rhizomes is only for seed purpose, farmers sell remaining products after selection of ginger for seed.

5.9 Washing

All of the respondents are not washing ginger after harvest. They sell ginger without wash to the traders. The washing facilities are not available in the study area.

5.10 Marketing

5.10.1 Sources of market information

The respondents are getting market information from local traders and collectors where they meet them in the nearest market and or by phone they contact with traders. Besides that the respondents have no other means to get information about price, and quantity of the amount demanded in the market.

5.10.2 Value creation

Figure 16 shows that the 65% of the farmers are doing sorting to add the value of the product, while some of the farmers are doing grading to add value and 25% farmers are saying that they are doing transportation and packaging to add value.

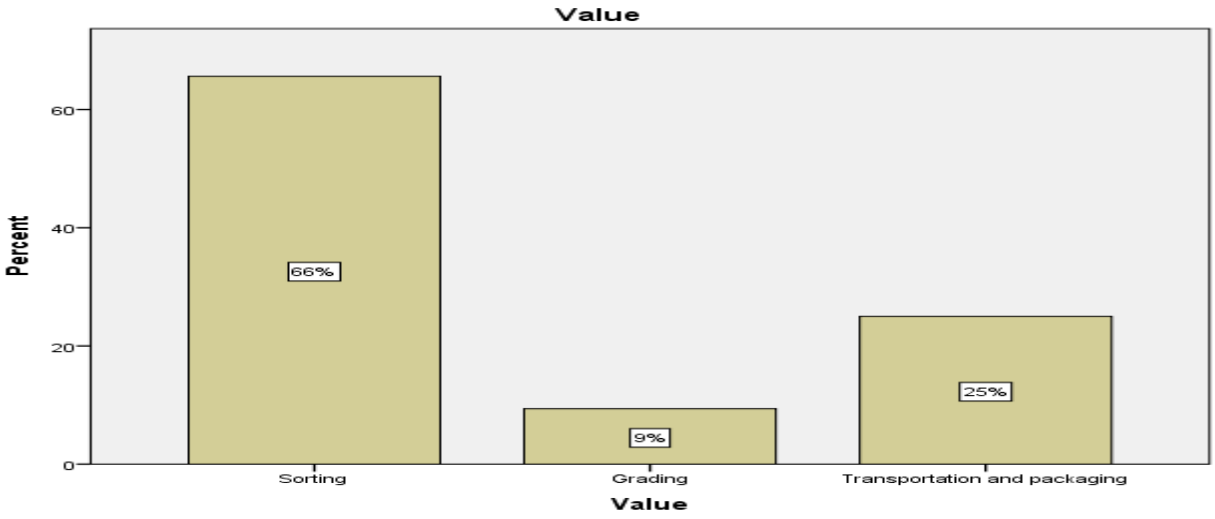

Figure 16: Added value of the product (n=32)

5.10.3 Buyers of the ginger

According to the respondents the local traders and collectors are the main buyers of their product. The farmers sell the ginger only after the harvest. They did not sell ginger to the collection centre because collection centre is not functional. Buyers are paying cash to the farmers immediately after the buy from the producers.

5.10.4 Selling of ginger

Figure 17 shows that the majority of the farmers are selling ginger to the local traders. About 35% of the farmers are selling ginger to the collectors. The collectors have their own shop and collection centres, while local traders are collecting ginger near to the production area, which they sell to the collectors.

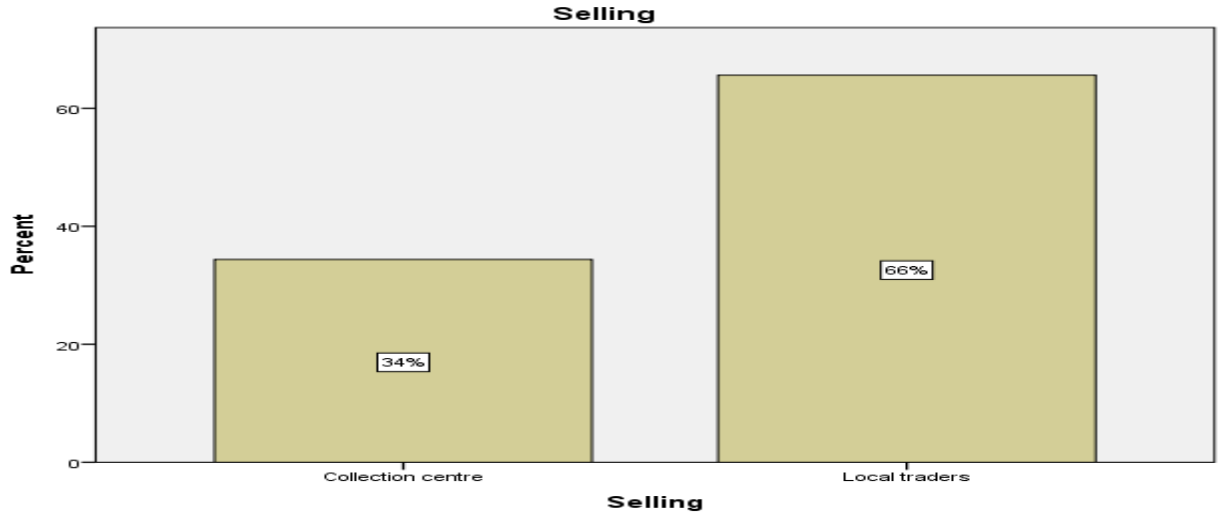

Figure 17: Selling of ginger by farmers (n=32)

5.10.5 Familiarity with quality requirements in the international markets

Figure 18 shows that around 65% farmers are unknown about the quality requirements in the markets, while 25% farmers say that they do not have any idea about quality requirements in the markets. It indicates that around 90% farmers are not aware about quality requirements in the markets. The study showed that only 12% farmers know about the quality requirement in the markets. They know the quality requirements in markets like big size rhizome, pale yellow colour, cleaned, washed, graded, sorted, and disease free.

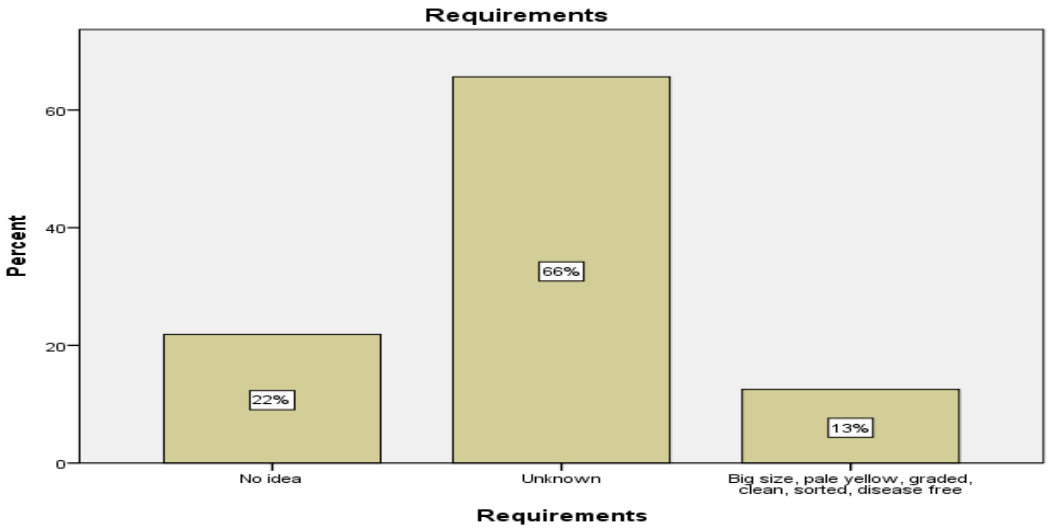

Figure 18: Familiarity with quality requirements in the markets

5.10.6 Problems in quality management during marketing

As shown in figure 19 most of the farmers are facing problems like washing, proper storage, and accessibility of market, agricultural materials and weak economy to manage the quality of ginger for marketing. They mentioned that they do not have any physical facilities for storage, are lacking washing facility, they cannot invest huge money to develop physical facilities and they do not have direct access to international market to manage the quality of ginger.

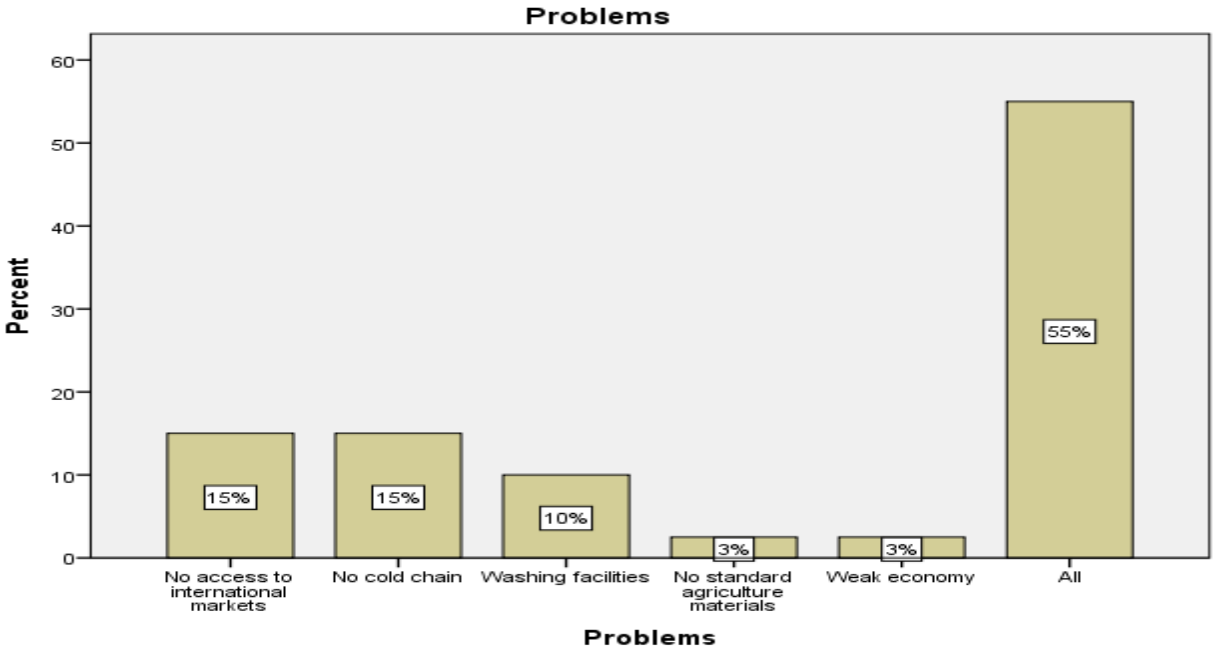

Figure 19: Problem facing to manage the quality of ginger during marketing

5.11 Extension service providers

Figure 20 shows that Government agencies and NGOs are working as service providers in the study area. Around 60 % of the producers are not getting any services from either governmental sector and or nongovernmental sector. The frequency of service providing is low DADO a government agency which is responsible to provide technical services to the farmers is unable to visit frequently they rarely visit this area. The NGOs like SUPPORT foundation and HVAP project provide services to the farmers to some extent. The farmers are taking technical information from the DADO office if they face some problems during production and marketing.

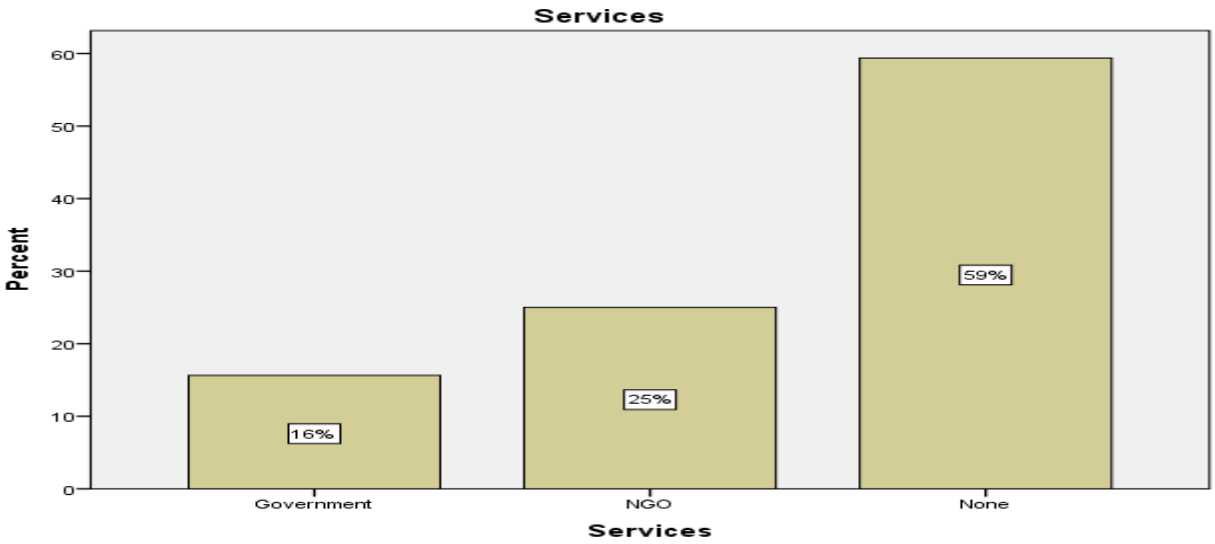

Fig 20: Extension service providers (n=32)

5.11.1 Type of services and support to the ginger growers

Figure 21 shows that around 63% farmers are not getting any type of services. While 19% of the farmers are saying that they are getting technical service from the supporting organization. It shows that only few farmers are getting services from the service providers.

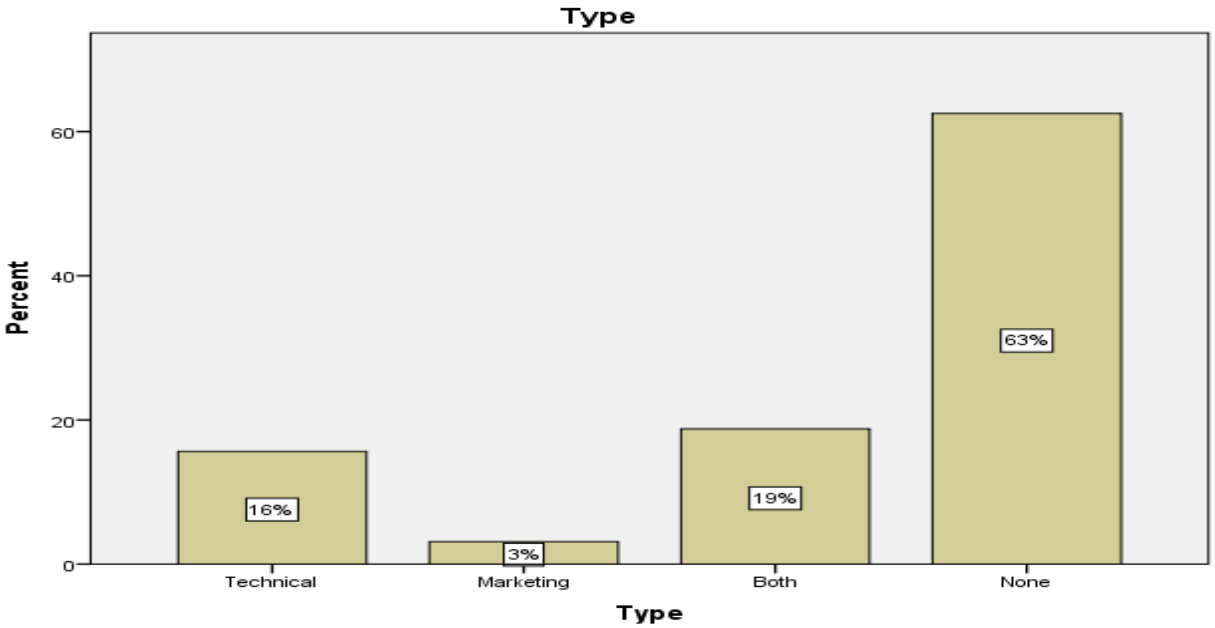

Figure 21: Type of service provided by the service providers (n=32)

Chapter: 6 Findings of the interviews

The findings of the interviews with the local traders, collectors, wholesalers, exporters and service providers are presented in this chapter. This chapter mostly focuses on the post-harvest management practices carried out by the actors and services they received from service providers for quality management of ginger during supply.

There are about 7 local traders, 3 collectors 6 wholesalers, 4 exporting companies (exporters) and 4 service providers are involved in trading of the ginger produced from the Salyan district through Nepalgunj city in India. The two local traders, two collectors, two wholesalers, two exporters and two service providers are interviewed during the field study. These traders are involved in supplying of vegetables, fruit and ginger to other parts of the country and India.

6.1 Characteristics of the exporters

Table 6: Characteristics of export companies

Companies	Export country	Variety	Volume exporting ton/year	Remarks
Yadav Export Company	India	No specific variety	2100 tons/year	Mostly they prefer variety Bose but they export all types of varieties.
Sitaram Export company	India	No specific variety	1200 tons/year	Mostly they prefer Variety Bose, however export all types of ginger.

6.2 Purchasing and collection

Exporters are buying ginger from the wholesalers and directly from local traders, but one of the exporters made a contract with the wholesaler to supply ginger to him. The information between the exporters and wholesalers flow by phone and or they meet to deal with the price and volume of the product. After purchasing from the wholesalers or local traders, exporters store ginger for a short time, they store up to 2 weeks in the local store house. The cash payment is common for the local traders and collectors and rest actors made payment either cash or through bank. All of the traders are purchasing all types of ginger varieties supplied by the producers. Dadagaun VDC is renowned for producing Bose variety, so the demand for the ginger produced in Dadagaun VDC is highly demanded. Exporters deal with all types of varieties because Bose variety is produced in the limited area of the district, so the volume is not enough for export.

Figure 22: Trader collecting ginger

6.3 Harvesting and packaging

The traders are doing sorting, storage and transportation of the product. Exporters are not involved in harvesting but they prefer rhizome not having any injury during harvesting.

The exporters did not repack after purchasing from the wholesalers; they just store and transport ginger to India. They usually used the jute bag for packaging and export to Indian market. Exporters never provide training to their workers about grading, packaging, storing and other quality management activities.

Wholesalers repack after sorting and grading for domestic market and export market in a jute bag. None of the trader provides training for their workers about grading, sorting, cleaning, washing, packing and other quality management activities. During packaging there is not enough space available, they packed ginger in the store room after sorting.

Collectors usually pack the ginger after sorting after they buy from the growers. Washing, cleaning, grading, labelling is not practiced by the collectors or local traders. They are unknown about grading, washing and cleaning requirements for the export market. Their emphasis is on mainly three qualities attributes of ginger, they are the big size, pale yellow colour, and disease free which is necessarily required for export market.

Figure 23: Packaging practices of traders

6.4 Washing and cleaning

Washing and cleaning is not carried out by any actors in the chain. The actors in the chain are not aware that the washing and cleaning is essential to improve the quality and also to supply in export markets. There are no washing facilities available near in the producing area or near to the Nepalgunj city. Pressure washing is carried out in India after export.

Figure 24: Unwashed and unclean ginger

6.5 Grading and sorting

Grading is not carried out by the local traders, collectors, and exporters. The wholesalers are grading the ginger for sell to the export markets and domestic market in Nepal. The grading and sorting is carried out manually.

Figure 25: Manual sorting practice by traders in Dhanbag VDC

Grading is done based on the size and colour of the rhizome. The rhizomes that look fresh, big size and good pale yellow colour are regarded as high grade and small, shrink rhizomes regarded as low grade. Sorting is carried out by the local traders and collectors before supply to the wholesalers; they sort out the diseases, injured, decayed rhizomes. The local unskilled labour is used for grading and sorting of gingers, they were not much aware about the grading and sorting requirements for markets. The traders are not aware about the grading requirements of the markets like shape, weight, no of branches in rhizomes. They only considered size and colour of the ginger during grading.

The main problems for the grading and sorting are the lack of technical knowledge and unavailability of mechanical grading and sorting facilities to grade properly, which ultimately affects the quality of ginger during supply.

6.6 Storage

All of the traders store ginger at their own local store room, where cooling and ventilation facilities are not available. This leads to sometime they lose large amounts of ginger due to decay during storage. Storage is common problem for all of the traders; they don't have appropriate cooling facilities. They are unknown about the storing requirements for ginger like temperature, humidity, space. The wholesalers stored up to three months while the collectors stored up to two months, which also depends on the exporter demand to supply of the product for export. According to traders they are not aware about quality management system, even they were not much aware about the quality requirements in export markets. They were not trained from any institution about grading, packaging, storage, transportation management of ginger during supplying. Traders are facing problems during storage of ginger due to lack of proper storage facilities which is directly affecting the quality of ginger.

Figure 26: Traders sorting ginger in the storage room

6.7 Transport and marketing

Generally producers transport ginger till to the collectors and collectors are responsible to transport to ginger to the wholesalers and the wholesalers are transporting ginger to the exporters. The exporters are responsible to transport ginger up to Indian borders and from the Indian border the Indian traders pick up ginger. During this process the local bus, small truck and small van are used for transport, which is not facilitated with the cooling facilities. The growers transport manually to the collectors or local traders, and the local traders use local bus, truck, van to transport in Nepalgunj, that affecting the quality of ginger during transportation to the hot area. During the load and unload of the packages at high temperature from the bus, truck and van affect the quality of ginger. The bumpy roads during transportation are also affecting the quality of ginger. The unavailability of means of transportation in time leads to delay in transportation that deteriorates the quality. During the rainy season the roads are blocked due to landslides which lead to delay in transportation which affect the quality of the ginger. There are no vehicles available which have cooling facilities during transportation, which directly affects the quality of ginger.

There is no legal contract between the producers and traders to supply products but some of the traders made agreements with producers. But the collectors and local traders have agreements with wholesalers to supply product. The wholesalers have agreements with the exporters to supply product to them. The exporters do not have any agreements with the Indian traders. The commission agent plays a role as the mediator between the exporters and Indian traders to flow of the information between them. Commission agent determines the price of the product and flow information about the quantity and quality of the product to the Indian traders.

6.8 Factors affecting post-harvest losses

According to the traders the main factors affecting post-harvest losses during the supply of the ginger in the chain are an unavailability of a storehouse with cooling facilities and lack of mechanical washing facility. The use of transportation means, which not facilitated with cooling facilities and improper packaging are the main cause of loss of ginger and deteriorating quality of ginger after harvest. Besides that, lack of awareness about the buyers requirements and the product quality management during storage, washing, packaging, and transportation.

6.9 External factors

Delay on custom clearance leads to more time loss for supply. Customs clearance takes at least 3 days and also SPS certification which is held in India takes sometimes up to a week. There is no provision for lab test facilities in national level. To export obligated to do a lab test in India. Governments and NGOs are not able to provide training to the traders sufficient and frequently.

6.10 Supporters (Extension service providers)

The supporting organizations who are involved in the production and marketing of ginger are the government agencies like District Agriculture Development Office (DADO) and Nepal Agricultural Research Council (NARC) are interviewed to understand the services they are provide to producers and traders for the production and marketing of ginger.

According to DADO, they have a mandate to provide technical services to the producers and traders but as they lack sufficient human resources they were unable to provide services frequently. They visit farmers or traders field once in a month or even not once in a month. They are providing training to the producers about production technology and post-harvest management of the product which is not sufficient, only few selected farmers get training. According to DADO and NARC the lacking technical knowledge and physical facilities like washing, cleaning, grading, packaging, storage and transportation are the main factors affecting quality of ginger during production and supply of ginger. They are unable to provide any services to the traders; they focus on the development of linkage between producers and traders.

National Ginger Research Program (NGRP) under the NARC has a mandate to develop varieties and supply to farmers. As mentioned by the department head of the NARC, they were unable to develop the proper variety which fulfils the market requirements. According to them the main problem of the quality ginger production is the lack of a proper variety which is unavailable to farmers; even the climate is suitable for production of ginger. Besides that the traders are lacking technical knowledge and physical facilities regarding to operate post-harvest handling practice to supply quality ginger in the markets. They are providing training on the processing of ginger by using solar dryer and improved soil pit storage to maintain the quality of ginger.

Chapter 7: Discussion

This chapter focuses on discussion of findings and comparing the finding results from the desk study, field survey and interviews with the literature review presented in the second chapter. This chapter includes different sections like value chain analysis, pre and post-harvest consideration, quality management problems and SWOT analysis.

7.1 Value chain analysis of ginger

From the findings, it seems that the export chain and domestic chain are functional but not well established. The largest amount of ginger produced in Salyan district is exported to India through the export chain because of no other market options and higher return than domestic markets. In the present condition to get a high market price in India, the product quality upgrading is essential to upgrade the chain to make it more competitive and sustainable. To upgrade the product it is necessary to improve the quality and protect the quality deterioration of the ginger during the supply to Indian markets. It is necessary to improve the pre harvest practices like appropriate variety, the development of irrigation facilities and at a post harvest level the development of washing facilities, cold storage and capacity of the traders and growers to improve the product quality to make it more competitive, to get sustainable supply and to get high market price. That will not only help to increase the income level of the people, but also create employment opportunities, which will support in the socioeconomic development of the country.

The collection centre is not functional because it is mostly focused on other fresh vegetable marketing. Farmers are not organized into groups for collective production and marketing of ginger so that the farmers have weak bargaining powers. It leads to farmers are not getting the same price for the product from different traders. The information does not flow properly. This leads to the chain actors are unaware about the requirements of the product and price. It is essential that the chain actors know proper information about quality, prices, quantity and demand of the product in the market, so that they can supply quantity and quality as demanded.

The chain upgrading is only possible when the chain actors are aware about the process and product quality management practices during the supply. The lacking knowledge on quality requirements and quality management system makes traders are not conscious about the quality of the product. The business of the ginger is rapidly increasing but if the traders don't empower the business of the ginger may lose. So it is necessary to develop the physical facilities (irrigation, washing, storage) and trainings to the producers and traders to improve the quality of the ginger. This will be helpful towards the improvement of the quality of ginger during the supply to the national and international markets.

The role of supporters is very crucial to upgrade the chain through the upgrading product quality in the chain. The low frequency of services to the producers and traders leads to them practicing the traditional production system like the use of old varieties, production without irrigation and a traditional trading system (supply ginger without washing and use of poor storage room). It is essential to change the traditional practices of farming and marketing into the modern practices like the use of improved varieties, the use of cold storage and supply washed ginger. It is only possible when the chain actors are aware about the modern

practices of production and marketing and availability of the modern inputs and tools to upgrade the product quality. The supportive activities like training and development physical facilities will help to improve the product quality. The concerned agencies have to support in trainings about the selection of appropriate variety, methods of irrigation, methods of washing, storage, and development of physical facilities (irrigation, washing, storage house), that will help to upgrade the chain and creates employment opportunities, sustainable supply, and to get higher market price. That is beneficial for the socioeconomic development of the country. The supporters (SUPPORT Foundation & DADO) should take initiation to the development of the basic infrastructure to improve the quality of the ginger and strengthen the chain and to get higher market prices.

7.2 Pre-harvest considerations

According to Kader (2002b), various pre-harvest factors including management practices and environmental factors influence post-harvest quality. The quality of the product will be maintained better at the post harvest level if the proper pre-harvest techniques are in practice. The findings show that the use of an inappropriate variety by the producers and lacking irrigation are the main barriers to get high quality products. It is possible to get higher market prices, creates employment opportunities, and sustainable supply only through the use of appropriate variety and development of irrigation facilities.

Variety

The quality of the product can only improve by the use of quality inputs such as seed. The government agencies and NGOs have to focus on the availability of the quality seeds to the producers, so that they are able to produce ginger as required in the Indian markets.

Availability and awareness about the use of appropriate variety is essential to produce as the requirements of the buyers. The product quality depends on the type of variety used for production. It is essential to know about the characteristics of the variety to produce as required quality. In the context of Nepal, the growers are using traditional varieties which are not able to fulfill the market requirements of India. In fact the variety will be changed to produce as required in the Indian market to fetch high market prices.

So it is essential to encourage producers to use of appropriate varieties to generate more employment opportunities, increase income level and make more competitive in the markets. The responsible organization (NARC) has to develop the proper variety for the product upgrading. This will help to increase the product quality as well as quantity. That will help in the promotion of ginger business.

Irrigation

Due to the lack of focus on the development of irrigation facilities by the concerned agencies (government, NGOs); the farmers are not able to irrigate the ginger at the proper time during production. This cause the product quality is not as required in the Indian markets. That affects the value of the products and gets a low market price in India. The improvement of the product quality means the increase the value of the product, so it is necessary to improve the quality of the ginger to supply as required in the market and to fetch higher market prices. That is only possible by the development of irrigation facilities to properly irrigate the ginger during production.

According to Dubey and Tiwari (2008), ginger planted in April –May requires 2-4 initial watering at an interval of 7 days and in October to December at 15 day intervals. That is only possible, when irrigation facilities will be available for irrigation in the ginger during critical stages of growing. In the context of Nepal, the producers are not irrigating the ginger during the production, because they were not aware about the importance of irrigation for quality ginger production and the lack of irrigation facilities to irrigate ginger during production period. Nepal rainfall based production system is prevalent that leads to the producers are unable to produce the quality ginger.

7.3 Post-harvest consideration

The most important factors to be considered at the post harvest level to maintain and improve the quality of ginger are the washing, storage and awareness.

Washing

According to Kader (2002), supportive activities like development of physical facilities (washing, storage) are important factors to generate the value of the products. Washing is the key issue of the ginger producer and traders to supply quality products in the Indian markets. According to the findings unwashed ginger is supplied from Nepal into the Indian market. This leads to the value of the product is low. It is one of the key issues for the traders to fetch higher market prices; it directly affects the income level of the all actors involved in the chain.

According to Chaudhary (2008), washing of the ginger after harvest is essential to improve the quality of ginger as well as to fetch a good market price. The establishment of washing facilities is essential to improve the quality of the ginger to fetch higher market prices in India. If the washing facilities available the new market opportunities will generate beyond India. This will be helpful to increase the market options that have direct impact on the producers and traders level to increase the product quality as well as quantity.

Unwashed rhizome which not only deteriorating physical appearance, it also affect the whole quality of ginger during storage, packaging and transportation, which increase post-harvest loss during this period. The lack of awareness about the washing methodology and its importance for export markets is one of the main reasons the traders are supplying ginger without washing in the markets. So they are unable to fetch a high market price in India.

Storage

Storage is another key issue to preserve and improve the quality of ginger. The availability of appropriate cold storage is essential to improve and preserve the quality of ginger.

According to USAID (2004), the appropriate temperature and relative humidity for storage of ginger is 12^0 C and 75% RH. In this condition the ginger can be stored for 3 months in marketable condition. Improper storage causes loss of weight, surface shrivelling, sprouting of rhizome and infection of diseases.

The establishment of the appropriate cold storage, which have temperature and humidity control system during storage, will help to improve the quality of ginger that will help to fetch

higher market prices in India. Instead of that it creates lots of opportunities for the supply in the market, it makes it feasible to supply in the off season when the market price is high. In present condition the suppliers are selling most of the products in the Indian market immediately after buy from chain actors. The availability of the storage facilities not only helps to increase the market prices, this will also support to consistent supply in the markets by the use of appropriate cold storage.

There are not cold storage facilities available to store ginger in the Midwestern development region. Storing ginger in cold storage can reduce the post-harvest loss and maintains the quality of ginger and traders can keep for the longer period.

7.4 Awareness and buyers requirements

The awareness about the activities carried out along the chain to maintain the quality of ginger during supply to the export market is essential. The awareness about the requirements of buyers helps to supply the required quality of ginger. To produce and supply as required quality in the Indian market the knowledge about the quality management is essential to know. The proper methods of irrigation, use of appropriate variety, washing and proper methods of storage should be known by the producers and traders so that they can produce and supply quality ginger as required in the Indian market.

The producers and traders are not aware about the variety, irrigation, washing, and storage requirements of the export markets. It is essential to supply the products as the buyer's requirements to fetch higher market prices as well as to create more opportunities; develop the quality brand, create more employment opportunities, expansion of production area and productivity to increase the volumes of the products leads to more transaction will occur. According to findings from the desk study, the buyers' requirements of the Indian target markets are large size rhizomes, washed, cleaned, free from diseases, finger less than four, pale yellow colour, and appear fresh. But the traders of the export chain of Nepal are not able to supply as the required quality in the Indian market so they are getting low market prices.

The trainings and workshops are useful to empower the producers and traders about the quality management of ginger and to supply according to buyers requirements. This will be helpful to increase the price of the product and increase the income level of the people. The SUPPORT Foundation has to support to enhance the capacity of the traders and producers through training activities and by conducting workshops.

7.5 SWOT Analysis

The strength, weakness, opportunities and threats identified during the study of the ginger chain of Salyan district is mentioned in table 7 (see table 7). The analysis indicates that the strengths of the ginger supply chain are at producer as well as the trader's level; the weaknesses of the chain in the quality management of ginger during production and supply, the opportunities are for strengthening ginger chain and the threats to manage quality of ginger to supply according to buyers requirements.

Table 7: SWOT Analysis of ginger sub sector

Strengths	Weaknesses
• Low labour cost • Traders are available at local level • The chain is functional • High level of oil content in ginger • Market available for supply of ginger • More profitable than other crops • Fertile red soil and climate is highly suitable for ginger production • Preference of ginger produced in Salyan district by consumers in domestic and international markets	• Unavailability of appropriate variety • The unavailability of physical facilities for washing, and cold storage. • Lacking irrigation facilities for timely irrigation • Chain actors not having technical knowledge of production and quality management during supply of ginger • Service providers are not providing services frequently • Growers are not organized into groups, they are acting individually • Unskilled labour for harvesting of ginger • Collection centre is not functioning
Opportunities	**Threats**
• Geographic and climatic suitability for production • High market demand in international market • Potential to increase production area • High potential for product diversification like, jam, jelly, for value addition • Increase more employment opportunities • Government policy on value chain development of high value crops • Export potential of the ginger	• Possibility of high rainfall and drought during production • Disease and pest incidence during production • Illegal charges for custom clearance and SPS certification in Indian border • Competition in international market • No clear government policy for the development of physical infrastructure • Unstable market prices • Generally farmers are not allowed to determine price

Chapter 8: Conclusions and recommendations

8.1 Conclusions

The aim of this study was to explore the effect of pre and post-harvest practices which are affecting the quality of ginger along the ginger export chain of Salina district.

- Salyan district chain is marketed mainly thorough two chains, domestic and export chain, but the export chain is considered as the most important chain for Salyan ginger.
- Stakeholders in this chain consist of input suppliers, ginger growers, local traders, collectors, wholesalers, commission agent, exporters, retailers and consumers.
- The supporters involved in this chain are the DADO, NARC, SUPPORT Foundation, AEC, HVAC, and Plant Quarantine Office.
- Pre-harvest practices such as the traditional farming practices, use of traditional local variety and lack of irrigation facilities are the main factors which affect the quality of ginger during production and supply.
- The lack of washing facilities and the unavailability of cold storage directly affecting the quality of ginger during supply in the post harvest stage.
- Lacking awareness about variety, irrigation, washing and storage management are the important factors affecting the quality of ginger in the export chain.
- Improper storage is affecting the quality of ginger, storage in a house or room not having any cooling facilities decays the ginger, which results in the loss of quantity and infection of diseases, shrinking of rhizomes, and so storage in the cold store can maintain the quality, and increases the shelf life of the ginger.
- Quality parameters for Indian markets are big size rhizome, pale yellow colour, and rhizome having four fingers, disease free, clean, washed, graded, sorted, and free from decay. The chain actors are not able to supply as quality required in the export market so they are getting low market prices.
- The supporters are not able to provide a sufficient level of training to the producers and traders about quality management during production and supply as well as unable to development of physical facilities.
- The producers and the traders are not aware about the quality requirements of the market. It is important to know quality requirements of the market to produce as required in the markets.
- The chain actors should be aware about the quality management practice during the production and supply so that they can manage the quality of ginger. But they are lacking knowledge about production and quality management during supply. It is essential to train them about the quality management during production and marketing.

From this research, finally we can conclude that the main factors affecting the quality of ginger in the export chain are the lack of an appropriate variety, lack of irrigation facilities, lack of washing facilities, lack of cold storage, and the lack of awareness among the growers and traders about the production, quality management and market requirements. That leads to the ginger produced in the Nepal are not able to get the higher price in the Indian market.

8.2 Recommendations

Based on the conclusions, recommendations and suggestions are made to enhance and to maintain the quality of ginger in the export chain during supply to the international markets, so that the quality of ginger to be acceptable in the international markets and to fetch a higher market price.

Recommendations to the farmers

. The major factors farmer should consider during production and marketing to improve and maintain the quality of ginger are as follows.

- Selection of appropriate varieties before the start of ginger cultivation, which can produce as the requirements of the buyers.
- Irrigation during the ginger growing period is essential, which facilitate to increase the size of the rhizome, develop pale yellow colour and attractive appearance. Irrigation should be managed during the growing period to improve the quantity and quality of the ginger.
- Organize practical training on new agricultural techniques and application of agricultural inputs.

Recommendation to traders

The following post-harvest activities should be considered to improve and maintain the quality of ginger during the supply in the markets.

- The ginger quality is deteriorating due to storage in the house or room not having temperature and humidity control facilities. The proper storage room should be made available for the ginger storage to maintain and improve the quality during supply. The traders should be aware about the storage methodology and requirements for ginger storage i.e. temperature and humidity. Training should be provided to traders about storage management of ginger.
- The washing facilities should be made available. The ginger stored without washing cause the spread of disease and decay of rhizome during the storing condition and during supplying into the markets. The traders are not aware about the importance of washing, methodology of washing and washing requirements of the markets. They should be aware about the washing requirements and methodology of washing of ginger.

Recommendations to supporters

The following recommendations are made to the supporters for intervention in the ginger export chain.

- The SUPPORT Foundation should develop the collection centre by organizing individual growers into groups.

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- The organization should provide trainings on production technology as well as methods of selection of variety, methods and the importance of irrigation, washing, and storage, of the ginger during production and supply.
- The producers and traders should be aware about quality requirements in the market. They should get training about quality requirements in the markets. SUPPORT Foundation has to provide training to the chain actors to make aware about market requirements and quality production of ginger.

Recommendation to government

- The government agencies like DADO and DDC should develop the physical infrastructure like washing facilities, storage facilities, and irrigation facilities.
- Introduce higher yielding and better quality varieties of ginger. NARC should develop an appropriate variety of ginger which fulfils the quality requirements of the international markets.

The recommendations should be implemented as follows by the government and support organizations

- The government agencies (DADO&DDC) should develop physical infrastructure like irrigation, washing and cold storage. The irrigation canal in the Dhanbag VDC and Dadagaun VDC and washing facilities and cold storage should be developed in the Kapurkot area by the district development committee and district agriculture development office. The SUPPORT Foundation takes initiation to develop coordination and linkage among the line agencies through the workshops, and meeting for the development of physical facilities.
- The NARC should develop the appropriate variety. The variety developed by NARC can expand into the field by the SUPPORT Foundation through the developments of demonstration plots and creating awareness to the producers by providing trainings.
- The SUPPORT Foundation should provide training and technical services for the quality management during production and supply to the producers and traders. It is possible by conduct training activities and mobilizes the technical staffs.
- The SUPPORT Foundation can’t construct the physical facilities alone because to develop irrigation facilities, cold storage and washing facilities need big amount of fund. The organization has to develop the joint project including the government agencies to implement the activities. This organization has to take initiation to develop joint project collaboration with government agencies to establish of washing, cold storage and irrigation facilities.

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Annexes

Annex1: Questionnaire for the producers

The interview will start with open questions to ease and get an understanding of his thinking; the interviewer will ask questions according to the pre structured questionnaire and take notes as the interviewee explains.

General Information

Interview date:	Interviewer:	Signature
Interviewee:	District:	V. D.C:
Village:	Contact#:	Age:

1.0 What is your education level?

a) University b) High school c) Grade 9th d) Grade 6th e) Illiterate

2.0 What is your land holding size of ginger (Ropani/500 m^2)?

3.0 Which varieties of ginger do you grow?

a) Nase b) Bose c) Kapurkot-1 d) Hybrid e) others (specify)…….

4. How much is the yield per Ropani?

a) 50-499 kg b) 500-999kg c) 1000-1499kg d) 1500 – 1999kg e) Other (specify)……

5. What is the planting material are you using?

a) Tissue cultured seeds b) Own stored c) Other……

6. From where are you getting planting materials?

a) Own source b) Agro-vet c) Resource center d) Others

7. How you planted?

8. When you planted the rhizomes?

9. What are the planting distances between row to row and plant to plant?

10. Are you doing mulching in the field?

a) Yes b) No
If yes what materials are used for mulching?

11. Do you have irrigation facilities?

a) Yes b) No
If, no how do you manage irrigation?

12. How often you irrigate the ginger and when?

13. What is your system of ginger cultivation?

a) Inter-cropping b) Monoculture c) Others

14. Are you weeding the ginger field?

a) Yes b) no
If, yes how often/when……?
If not why…….?

15. How much ginger are you selling per year?

a) 1-49kg b) 50-99 kg c) 100-199kg d) 200-299kg e) 300-499kg f) 500-999kg g)1000-1999 kg h)more than 2000 kg

16. Do you know about the quality requirements of ginger in the market?

a) Yes b) No
If yes how…….?
If no why not……?

17. What precautionary measures do you take to ensure the quality of gingers?

18. How the information you received about market requirements of ginger?

a) Radio b) trainings c) Traders e) Collection center f) Friends g) Television h) Others…

19. What kind of agriculture practices do you use?

a) Traditional b) Modern technology c) GAP

20. What influences the quality of ginger during production?

a) Climate conditions b) Pest and Diseases c) Variety d) Others (specify)……

21. Which pest and disease do you face during production?

a) Rhizome rot b) Blue mold c) Pythium d) all e) Others.....

22. How do you control Pest and diseases?

a) Mechanically b) By using chemicals c) Both

23. Are you using chemical fertilizers during production?

If yes what…..

If not why……..

24. Do you know how to use chemical fertilizers?

25. Are you using organic fertilizer?

If yes what….
If not why…….

26. What are the sources of organic fertilizers?

a) FYM (own) b) Poultry farm c) Agro vet d) Others….

27. Do you know about the methods of organic fertilizer application?

28. Where do you buy your inputs (seed/fertilizer/chemicals)?

a) Local Agro-vet b) District c) Regional market d) Others

29. Are there any extension services in your areas?

a) Yes b) No

30. Who is providing extension services in the district?

a) Government ……b) NGOs ……..c) No one

31. What kind of advice and services do they provide?

a) Technical information b) Marketing information c) Others

32. When do you sell your product?

a) Before harvest b) During harvest c) Others……

33. Who buys the product from you?

a) Local traders b) Regional traders c) Agents of exporters d) Others

34. Are you selling ginger before harvest?
a) Yes b) No
If yes Why…….
If not Why……

35. Do you harvest ginger?
a) Yes b) No

36. How do you determine harvest time (maturity) of ginger?

a) By color b) By size c) By sugar level d) a, b e) All , f) Days after plantation

37. How do you harvest ginger?

a) Manually b) mechanically c) others …….

38. How many times do you harvest ginger?

a) 1 b) 2 c) 3

39. Why you harvest ginger at different times?

40. What factors do you consider while harvesting ginger?

a) Harvesting materials b) Maturity
c) Methods of harvesting d) Others specify ……..

41. When do you harvest ginger?

a) Early in the morning b) In the afternoon c) Late afternoon

42. How do you harvest ginger?

a) Manually b) Mechanically c) Others

43. What tools you use during harvest?

44. What are the problems during harvesting?

a) Unavailability of harvesting materials b) inexperienced pickers and packers
c) Both d) others……..

45. Do you provide training to your harvesters and packers?

a) Yes b) No

If yes, what kind of training?

a) Harvesting techniques b) Sorting & grading c) Standard packaging and packing materials
d) GAP e) All
If no, why not?

a) It is costly b) There is not training facility c) Others…….

46. What kind of activities you do for creating added value?

a) Sorting b) Grading c) Packing d) Cooling and Storing
e) Others f) all

47. How do you communicate with the buyers?

a) Meet them in market b) By phone c) Agents d) Others

48. Where do you get market information (Quality standards, prices, demands)?

a) Traders b) Other producers c) Associations d) District market e) Others……..

49. What kind of ginger quality is preferred in the international market?

50. What are your main problems? Rank

a) No access to international markets b) No cold chain
c) No standard agriculture materials d) Weak economy e) All

51. Where do you sell your product?

a) Collection Centre b) Local traders c) Wholesalers d) Commission agent e) Others…..

52. How do you transport to collection centers/traders?

a) Manually/Doko b) By donkey c) By bus d) By truck e) Others …….

53. How do you packages to supply during collection center/traders?

a) Doko, without packaging b) Local bags c) Cartons d) Others…….

54. Are you satisfied with the price you earn from selling?

a) Yes b) No

If yes, why?

If no why?

55. What was the price per kg of ginger you sold?

a) 10-15 per kg b) 16-25 c) 26 -40 d) 41- 60 e) More than 60

56. Are you aware about the quality requirement in the market?

If yes what is the quality requirements?

57. What are the constraints to achieve quality requirements in the market?

a) Lacking knowledge b) Lacking information c) Lacking physical facilities d) Others

58. How you are storing your ginger rhizomes as seeds?

a) Locally /traditionally b) Modern techniques and tools c) Cold storage d) Others specify

59. Do you have any facilities to store ginger seeds in your areas?

If yes, what facilities are available?

If not, why?

60. How do you wash ginger after harvest?

a) Manually b) Mechanically c) Others

61. Which water do you use during washing if manually wash?

a) Tap water b) River water c) Well water d) Clean drinking water e) Others

62. Do you have cooling facilities after harvest?

a) Yes b) No

If no, how do you cool ginger after harvest?

63. Are you sorting and grading after harvest?

a) Yes b) No

If yes, how?

If not, why?

64. How you package ginger to sell?

Annex 2: Checklist for traders/exporters

The interviewer will start with open questions to ease and get an understanding of his thinking, the interviewer will ask questions according to the semi-structured questionnaire and checklist and takes notes as the interviewee explains.

General information

Interview date…… Interviewer…….Signature…….

Name of interviewee…… Company…….. District……

Contact…… Address……..

A. Educational level

a) University b) High school c) Up to grade 9th d) Up to 6th e) Illiterate

B. Purchasing/collection

1. How many active exporters are available for ginger?
2. Where do you export ginger?
3. Which varieties do you deal with?

a) _____ b) _____ c) _____
d) _____

4. From whom do you buy ginger?

a) _____ b) _____| c) _____

5. How do you buy ginger?
6. Which criteria or characteristics do you consider while buying ginger for export market?
7. How do you fix the price with the ginger suppliers?
8. What are your payment methods?
9. How the information you got from producers/suppliers?
10 From whom you are purchasing ginger?
11. How do you manage collected ginger after purchased?

C. Harvesting & Packaging

12. Who does the harvest?
13. How ginger is harvested?
14. What factors do you consider while harvesting ginger?

15. What kind of activities you do for creating added value?
16. What is the adequate place for packing ginger in order to maintain the quality? Why?
17. What kind of packaging system do you use for export market? Explain?
18. Do you provide trainings to your workers?

a) Yes b) No

If yes, what kind of trainings?

a) _____ b) _____ c) _____
d) _____ d) _____

19. What factors influence the quality of ginger during harvesting and packaging?
20. How much loss occurs during harvesting and packaging?
    a) 0-5 % b) 6-10% c) 11-15% d) 16-25% e) More than 25%

D. Washing and cleaning

21. Are you washing and clean the ginger?
    a) Yes b) No
22. Who do the washing and cleaning of ginger?
23. How washing and cleaning of ginger carried out?
24. Where washing and cleaning is carried out?
25. What are the constraints during washing and cleaning of ginger?
26. Do you know the washing and cleaning requirements of the market?
    a) Yes b) no
27. How much losses occur during washing and cleaning?
    b) 0-5 % b) 6-10% c) 11-15% d) 15-25% e) More than 25%

E. Grading/sorting

28. Are you grading or sorting of ginger?
29. Who does grading and sorting?
30. How grading and sorting carried out?
31. Where grading and sorting carried out?
32. Do you know the quality requirements of ginger in terms of grade? (Shape, size, color, weight, no of branches in rhizomes)
33. What are the grading requirements of the markets?
34. What are the constraints facing during grading and sorting?
35. How much losses occur after grading and sorting?
    c) 0-5 % b) 6-10% c) 11-15% d) 15-25% e) more than 25%

F. Storage

36. Do you have storage facilities?
    a) Yes b) no

If yes, what type of storage facilities do you have?

37. Do you store gingers?

a) Yes b) No

If yes, how long do you store ginger? If No, why?

38. What are the existing cooling/storage facilities in the area?
39. At what temp and RH do you store ginger?
    a) 0to 5 (90-95%) b) 5 to 7 (90-95) c) 7-12 (70-75) d) room temperature and RH don't know e) any other specifications……
40. What are the effects of storing or not storing on the quality of ginger?
41. What are the constraints during storage?
42. How much loss occurs during storage?
    a) 0-5 % b) 6-10% c) 11-15% d) 15-25% e) More than 25%

G. Marketing & Transport

43. Who are the buyers of your product?
44. What are the quality parameters that importers (international market) consider?
45. From where do you get marketing information about quality standards, price and demand in the international market?
45. How do you contract with your importers?
46. Do you transport the product to international markets (importers)?
a) Yes b) No
If yes, how do you transport ginger into international market?
47. What kind of transport facilities do you use for the product?

48. How much loss do you have in your business and at which step?
49. What do you do with the losses?
50. Explain the factors influencing the quality of ginger during transport?
51. What are the external factors affecting your business and marketing gingers?
52. What are your main problems?
53. Additional comments

Annex 3: Checklist for the producers' organizations/collection center

Respondent identification
Name:……..Department: ……Organization
Qualification: ……Telephone number:…….Address……..
Email:…….Post……..

1. How ginger chain is organized in Salyan?
2. Who are the key stakeholders of ginger chain?
3. What are the external factors affecting ginger chain?
4. What are the main problems in the export chain?
5. How do you manage collection center?
6. Is there sufficient infrastructure to collect and storage of ginger?
7. What are the main constraints of collection center?
8. How do you collect ginger from farmers?
9. How do you manage quality of ginger?
10. Do you know about quality requirements of ginger in the market?
11. What facilities are you providing to the farmers?
12. Are you washing/grading/packing of ginger before sale?
13. How are you doing washing/grading/packaging?

Annex 4: Checklist for the extension workers

1. Respondent identification

Name:…… Department: …… Organization…
Qualification: …… Telephone number:…… Address……..
Email:…… Post……..

2. Services to the farmers

a) Do you visit the community/farmers?

b) How often do you visit them?

c) What type of services do you generally provide when you visit farmers?

d) What kind of services/supplies do you provide related to post-harvest practices?

e) What are the problems you think as an extension worker that farmers have in regards to post-harvest processes?

f) What are the problems you feel you have as an extension worker**?**

3. Services to the traders/exporters

a) Do you visit traders?

b) How often do you visit them?

c) What type of services do you generally provide when you visit them?

d) What are the problems you think as an extension worker that the traders have in regards to post-harvest handling?

Annex 5: Name list of the respondents

The name list of the respondents interviewed during the field survey

Producer level					
Name of respondents	Interview date	District	VDC	Village	Age
Top Bdr Rana	July-29-2013	Salyan	Dhanbag	Khimchaur	60
Dhankali Thapa	July-29-2013	Salyan	Dhanbag	Khimchaur	51
Kamala Thapa	July-29-2013	Salyan	Dhanbag	Khimchaur	48
Sushila Shah	July-28-2013	Salyan	Dhanbag	Khimchaur	45
Amrit Budhathoki	July-28-2013	Salyan	Dhanbag	Khimchaur	45
Chanu Airi	July-28-2013	Salyan	Dhanbag	Khimchaur	55
Lil Bdr Airi	July-26-2013	Salyan	Dhanbag	Khimchaur	53
Khem Budha	July-26-2013	Salyan	Dhanbag	Khimchaur	45
Sita Gharti	July-26-2013	Salyan	Dhanbag	Khimchaur	61
Deshmaya Gharti	July-26-2013	Salyan	Dhanbag	Khimchaur	39
Ram krishana Khadka	July-26-2013	Salyan	Dhanbag	Khimchaur	43
Tikaram Khadka	July-25-2013	Salyan	Dhanbag	Khimchaur	37
Harilal Pun	July-25-2013	Salyan	Dhanbag	Khimchaur	23
Ran Bdr Chand	July-25-2013	Salyan	Dhanbag	Khimchaur	41
Chnadra Bdr Malla	July-25-2013	Salyan	Dhanbag	Khimchaur	56
Mangal singh Rawat	July-25-2013	Salyan	Dhanbag	Khimchaur	53
Hukum Bdr Budhathoki	Aug-2-2013	Salyan	Dadagaun	Kajari	46
Laxman chalaune	Aug-2-2013	Salyan	Dadagaun	Kajari	27
Gyan Bdr Pun	Aug-2-2013	Salyan	Dadagaun	Dharkhani	48
Tej Bdr Kunwar	Aug-3-2013	Salyan	Dadagaun	Dharkhani	43
Nep Bdr Chalaune	Aug-3-2013	Salyan	Dadagaun	Bodikhola	33
Bhumi Kumai	Aug-3-2013	Salyan	Dadagaun	Amrani	16
Gopal Thapa	Aug-3-2013	Salyan	Dadagaun	Kajari	48

Hira Chalaune	Aug-4-2013	Salyan	Dadagaun	Kajari	38
Sher Bdr Giri	Aug-4-2013	Salyan	Dadagaun	Tusar	22
Raj Kumar Giri	Aug-5-2013	Salyan	Dadagaun	Tusar	40
Bhim Bdr Khatri	Aug-5-2013	Salyan	Dadagaun	Tusar	45
Inda Lal Giri	Aug-5-2013	Salyan	Dadagaun	Tusar	45
Shyamlal Giri	Aug-6-2013	Salyan	Dadagaun	Tusar	46
Deepak Giri	Aug-6-2013	Salyan	Dadagaun	Tusar	42
Krishana Giri	Aug-6-2013	Salyan	Dadagaun	Dharkhani	30
Balram Giri	Aug-7-2013	Salyan	Dadagaun	Dharkhani	15

The list of respondents interviewed during the field study

Name	Address	Village	Remarks
Hom Lal Bohara	Dadagaun VDC	Tusare	Local trader
Chandra Bdr Gharti	Dhanbag VDC	Kapurkot	Local trader
Min Bdr Bohara	Dhanbag VDC	Kapurkot	Collectors
Chtra Khadka	Dadagaun VDC	Sirsire	Collectors
Uma Basnet	Nepalgunj	Kohalpur	Wholesaler
Ramesh karki	Nepalgunj	Banke gaun	Wholesaler
Krishna Jaisawal	Nepalgunj	BP chowk	Exporter
Pappu Yadav	Nepalgunj	Rupadia	Exporter
Govinda KC	Dadagauu VDC	Kapurkot	Service provider (GRC)
Dipesh Oli	Khalanga VDC	Khalanga	Service provider (DADO)

Annex 6: Planning

The time schedule was used during the study of the effect of pre and post-harvest factors in the export chain of ginger.

Table 6: Planning

July Week 1	Literature review
July Week 2	Preparation of questionnaire
July week 3 to Aug 3rd week	Field survey
Aug week 4	Data entry & Writing drafts
Aug week 5	Analysis of results & Writing drafts
Sep week 1	Writing draft
Sep week 2	Finalization of report

Annex 7: Photographs taken during the field study

Photo 1: Unwashed/ dirty rhizomes, Kapurkot, Dhanbag VDC, Salyan

Photo 2: Mulching materials (Pine leaves, height 1500m) collected by farmers from the pine forest in Dadagaun VDC of Salyan district

Photo 3: Storage practices and packaging materials of ginger in Dadaguan VDC

Photo 4: Doko (Means of transportation in the hills of Nepal)