Potato in Bhutan - Value Chain Analysis

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FOREWORD

Agriculture is the main foundation of Bhutanese economy. It provides the livelihood base for 79% of Bhutan's total population. The Royal Government of Bhutan is giving the highest priority to the development of sustainable agriculture. Government policy is geared towards transforming the agriculture sector from subsistence farming to market-oriented commercial farming. The RGoB with the support of many development agencies has been devoting considerable effort to lift the overall productivity of Bhutan's RNR products on a sustainable basis and to improve their quality and competitiveness. The Ministry of Agriculture (MoA) has adopted the concept of three pillars- Production, Accessibility and Marketing to consolidate these efforts. The MoA has established an Agricultural Marketing Services (AMS), which is now upgraded to the Department of Agricultural Marketing and Cooperatives (DAMC) to facilitate the marketing of RNR products. Under DAMC, the Regional Agricultural Marketing Services (RAMS), which is now known as Regional Agricultural Marketing and Cooperatives Office (RAMCO) has been actively engaged in Eastern Bhutan in an area covering 6 Dzongkhags, which are predominantly characterized by inaccessibility and marginality. RAMCO has a pivotal role to play in linking producers/ small cash crop holders with the market.

Over the last few years remarkable progress has been made in the field of agriculture development. With the expansion of road networks, the construction of farm and feeder roads and increased access to information and technology, the farmers are gradually moving from subsistence farming to commercialisation. Areas under cultivation vis-à-vis production of several RNR products, like mandarin, potato and kidney beans have been rapidly growing. Potato is the most important crop for Bhutanese farmers, especially for rural households where it is the major source of cash income. The crop is ideally suited to the topographic and climatic conditions of Bhutan. At present, potato runs first in terms of volume of agriculture trade and is placed second in terms of value of export (next to oranges).

This study of the Potato Value Chain was carried out within the overall framework of the partnership agreement between DAMC and SNV. The main aim of the study was to identify the critical bottlenecks which needed to be addressed to improve competitiveness. The authors have adopted the value chain approach to map the subsector, identify gaps in support services and suggest areas of improvement. This publication provides a critical overview of the existing production system, product delivery and trading practices and support services, and presents a descriptive analysis of the market looking at the production trend, price, demand and supply conditions in neighboring countries and comparative advantages of the Bhutanese potato.

The efforts made by the authors in collating and analyzing the information and bringing out this publication in this form are appreciated. It is hoped that this publication will be useful for development agencies, business development service providers, potato traders and other actors and supporters in designing and implementing appropriate interventions in the potato subsector.

Tashi Delek!

Sherub Gyaltshen
SECRETARY
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ABBREVIATIONS

AMC	Agricultural Machinery Centre
AMS	Agricultural Marketing Services
AMEPP	Agriculture, Marketing & Enterprise Promotion Project
BAFRA	Bhutan Agriculture and Food Regulatory Authority
BCCI	Bhutan Chamber of Commerce and Industry
BDFCL	Bhutan Finance Development Corporation Limited
BNPP	Bhutan National Potato Programme
BOF	Business Opportunity Fund
BPDP	Bhutan Potato Development Programme
CAs	Commission Agents
CFC	Common Funds for Commodity
CIP	International Potato Centre
CoRRB	Council of RNR Research for Bhutan
DAMC	Department of Agricultural Marketing and Cooperatives
DoA	Department of Agriculture
DAO	Dzongkhag Agriculture Officer
DSC	Druk Seed Corporation
EOs	Extension Officers
FAO	Food and Agricultural Organization
FCB	Food Corporation of Bhutan
FYM	Farm Yard Manure
GDP	Gross Domestic Product
GNH	Gross National Happiness
GoI	Government of India
HH	Household
IFAD	International Fund for Agriculture Development
IPM	Intergrated Pest Management
Kg	Kilogram
MoA	Ministry of Agriculture
M/SMES	Micro, Small and Medium Enterprises
MT	Metric Tonnne
NPPC	National Plant Protection Centre
NPHC	National Post Harvest Centre
NSB	National Statistics Bureau
NSSC	National Soil Science Centre
Nu	Ngultrum
PPD	Policy and Planning Division
PTM	Potato Tuber Moth
RAMCO	Regional Agricultural Marketing and Cooperatives Office
RAMS	Regional Agricultural Marketing Services

RGoB	Royal Government of Bhutan
RNR	Renewable Natural Resources
RNRRC	Renewable Natural Resources Research Centre
RSGs	Registered Seed Growers
RSTA	Road Safety and Transport Authority
RTIO	Regional Trade & Industry Office
SDC	Swiss Development Cooperation
SNV	Netherlands Development Service
SSP	Single Super Phosphate
SWOT	Strength, Weakness, Opportunity and Threat
TSP	Triple Super Phosphate
UN	United Nations
VC	Value Chain

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CHAPTER ONE: INTRODUCTION

1.1 Background

Bhutan has a good potential for the production of RNR products, which include agriculture, livestock and non-wood forestry products. The contribution from the agriculture sector to GDP was 21.4% in 2006, while its contribution to employment activity was 64.2% in 2007 (Wangchuck, 2008). The country has a favourable environment for the production of RNR products such as potato, off-season vegetables, medicinal plants, mushroom, etc, which have high value chain enhancement opportunities. These products significantly contribute to national income and employment among the rural population.

The Royal Government of Bhutan (RGoB) is emphasizing the need to diversify agricultural production from that of a subsistence type of farming to high value cash crops. Many development agencies have been supporting this government initiative by providing grants, loans and technical assistance. As a result of these efforts and with the expansion of road networks and increased access to information and technology, the areas under cultivation vis-à-vis production of several RNR products, like mandarin, potatoes and kidney beans (*rajma*) have rapidly grown over the last few years. According to all reports and research, the RNR sector is expected to grow fast in the coming years and it will continue to play a vital role in the national economy. The desire of the farmers to increase the production of such RNR products is very high, but they are concerned about the delivery of their produce to the competitive market.

The present study was conducted as a part of ongoing collaboration between the Netherlands Development Programme (SNV) and the Department of Agricultural Marketing and Cooperatives (DAMC) of the Ministry of Agriculture, RGoB to address issues of production and income and employment generation. This study looked at a full range of activities required to bring a product from producer through processors/ traders to consumers and suggests measures required for strengthening the value chain linkages. Potato is chosen for the study since it provides a livelihood base for a large number of rural households and is the largest in terms of volume of exports.

1.2 Objective

The primary objectives of the study was to provide a descriptive analysis of the Potato Value Chain, identifying the major constraints of the sub-sector, understanding the business service provisions, and suggesting the specific areas of intervention to upgrade the value chain. More specifically, the study looked into the following 3 broad areas:

Value Chain

- Develop a value chain map and identify the major players in the value chain
- Identify the constrains and opportunities faced by the value chain members
- Identify the competitive advantages/ disadvantages of the subsector players: market access, technology/ product development, management/ organization, input supply (raw materials), finance, policy, operating environment/infrastructure, trade regime, etc.
- Identify the Strengths, Weaknesses, Opportunities and Threats (SWOT analysis) of the subsector

Market Conditions

- Identify the present market conditions of the sub-sector: market size, key players, demand supply gap, pricing trends, imports, exports and distribution networks
- Identify the sector prospects and barriers to growth

Support Services

- Identify and prioritise the business development services needed by the sub sector
- Identify the existing service providers and assess what they are providing to the sub-sector and their relationship with clients
- Identify further potential service providers and assess their ability and willingness to provide the needed/missing services

The study was divided into three primary activities 1) information gathering, 2) analysis of the information in the light of the subsector dynamics, and 3) presentation of key findings to the relevant stakeholders.

1.3 Methodology

The data compiled and analysed for the assignment was gathered under the following methodologies:

Review of Secondary Information: The secondary information was collected from project documents, internet data and reports of RAMCO, SNV East Portfolio, AMEPP and other government and non-government agencies. The publications of the International Potato Centre (CIP), Lima, the data of FAO on various aspects of potato, reports and agriculture statistics of MoA, RGoB, and earlier publications on the Bhutan Potato Development Programme by Dr. Walter Roder, Karma Nidup, Ganesh B. Chhetri and G H Scott and others provided an important basis for the

review of past experiences and practices. The full list of publications and websites visited for understanding the potato value chain in general and marketing systems and support service structures in particular is given at the end of this report under the heading “References”.

Primary information: Primary data were collected (1) by observing people, places and practices and (2) by asking questions to actors and supporters of potato value chain. Focus group discussions were also organized to get collective view of the participants on what they do and don’t like about the existing practices and how there can be better market linkage. A number of meetings, informal interactions and interviews were conducted with the professionals of support providing agencies, business entrepreneurs, and farmers for in-depth understanding on selected key issues of production, marketing, trading, processing, customs, as well as constraints/ opportunities and potential interventions to remove the constraints and to take advantage of the opportunities. Field visits were carried out to all the major potato producing Gewogs in the Eastern Dzongkhags.

Observation data were collected by watching people, production and marketing practices, storage conditions and other market infrastructures.

Q**uestionnaire data** were collected by asking questions to the value chain actors (producers/ groups, middlemen, wholesalers, retailers) and support providers. The different sets of questions and checklists were prepared for the different group of actors/stakeholders and interviews/interactions held at following level:

- Potato growers
- Middlemen
- Traders at auction yard
- Retailers/ local vegetable vendors
- Support Service providers/ VC promoters

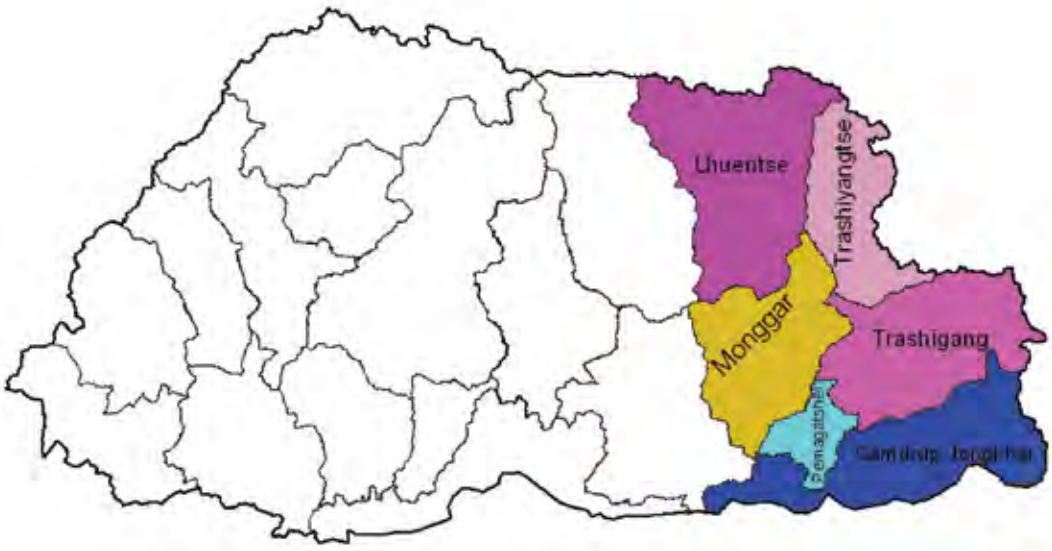
1.4 Study Area

The main geographical focus of the survey was Eastern Bhutan, which includes 6 Dzongkhags: Mongar, Lhuentse, Pemagatshel, Samdrup Jongkhar, Trashigang and Trashiyangtse as indicated in the map (Figure 1). This region is the most under developed in the entire Kingdom and now forms a focus area of the RGoB development efforts. The population is sparse and the remote terrain poses challenges for the marketing of agricultural products. The potato is the most important cash crop across all agro-ecological zones in the region. The per capita production of potato is higher in Eastern Bhutan than the national average.

For the field survey almost all major potato growing Gewogs of the Eastern Bhutan were selected. In total, 127 potato farm households were surveyed along with the physical observation of potato stores, collection centers and market sheds. Apart from the farmers, local vegetable vendors, middlemen, traders in Samdrup Jongkhar Auction Yard and other relevant stakeholders providing support in the potato sub-sector were also interviewed.

As potato is the principal export crop, the study also looked beyond the geographic boundary of Eastern Bhutan to understand the flow of the product and price dynamics. The data collected from Eastern Bhutan were compared with national as well as regional data.

Figure 1: Map of Bhutan Showing Eastern Dzongkhags



CHAPTER TWO: GENERAL OVERVIEW OF THE SUBSECTOR

2.1 Introduction

Potato is the fourth most important world food crop after wheat, rice, and maize. In five centuries, this diverse and adaptable tuber has spread from its origin in the Andes Mountains of South America to all the other continents. The potato's popularity has substantially grown since the end of World War II, particularly in its forms of standardized industrially produced potato fries, chips, and other frozen and processed "convenience" foods. The introduction of improved potato varieties has accelerated around the world after the creation of the International Potato Center (CIP) in 1972 with its mission to increase potato production and consumption in developing countries.

Several international organizations have been giving emphasis to the potato as a key part of world food production. However, due to high perishability and its bulky nature, only about 5% of the world's potato crop is traded internationally; its minimal presence in world financial markets contributed to its stable pricing during the 2007–2008 world food price crisis. In recognition of this importance, the United Nations officially declared the year 2008 as the International Year of the Potato in order to "increase awareness of the importance of the potato as a food in developing nations" and calling the crop a "hidden treasure" (www.potato2008.org).

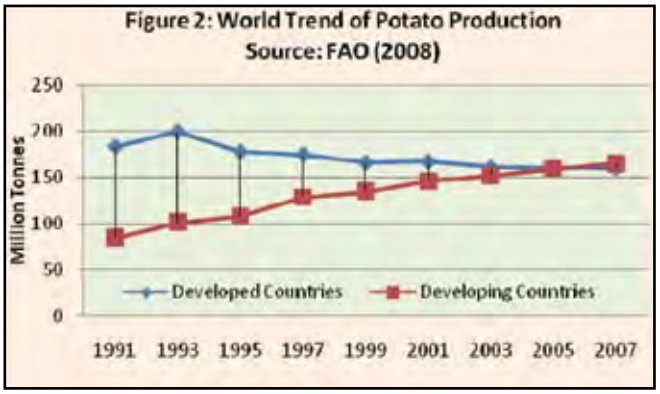
2.1.1 Description

Potato is a short-duration crop that can be planted and harvested as per the requirement of cropping system(s). The crop is capable of providing more nutritious food from less land in less time - and often under more adverse conditions- than other crops such as wheat, maize or rice (CIP, 1984). The plant species belongs to the Solanaceae family of flowering plants, and shares the genus *Solanum* with at least 1,000 other species, including tomato and eggplant. The botanical name of potato is *Solanum tuberosum*. It is divided into two subspecies: *S. tuberosum andigena*, which is adapted to short day conditions and is mainly grown in the Andes, and *S. tuberosum tuberosum*, the potato now cultivated around the world.

The potato plant produces tubers – are also called potatoes. The tuber is the enlarged apical portion of the underground stems called stolons. The tubers vary in shape and colour depending upon the light, temperature and moisture condition around the stolon. But, most of the commercially grown potatoes are either round or oval in shape and white or red in colour. Except for the new potato varieties, which are grown from seeds, also called "true potato seed" TPS or "botanical seed", all potato varieties are propagated vegetatively by planting whole tubers or pieces of tubers, cut to include at least one or two eyes. Confusingly, these tubers or tuber pieces are called "seed potatoes".

2.1.2 World Trend of Potato Production

Potato is grown in more than 150 countries, under temperate, subtropical and tropical conditions feeding more than a billion people. Production of potato is on the rise in most parts of the world. Asia and Europe are the world's major potato producing regions, accounting for more than 80 percent of world production in 2007. According to FAO data, the production of potato has more drastically increased in developing countries than in developed countries. Until the early 1990s, most potatoes were grown and consumed in developed countries but since 2005 the developing world's potato production exceeded that of the developed world. China is now the biggest potato producer, and almost a third of all potatoes are harvested in China and India. Between 1960 & 2000, potato production in India increased by almost 850% (FAO, 2008). Similarly in Pakistan, potato production rose between 1995 and 2007 from one million to more than 2.6 million tonnes and in Nepal it increased from 300,000 tonnes in 1975 to a record 1.97 million tonnes in 2006. In Bhutan, the total production of potato was 35,340 metric tonnes in 2000 (PPD-MoA and ICIMOD, 2006), which reached 61, 233 metric tonnes in 2007 (Agriculture Statistics 2007). The quantity of potatoes produced in the world since 1991 to 2007 is given in Figure 2.



Expansion of potato production and consumption has resulted from the inherent plasticity of the crop; the international training, technical programme, and technology transfer offered by CIP and other development organizations; the ecological opportunities fostered by the "Green Revolution" in other kinds of farming, especially Asian cereal-based systems; and overarching political-economic transformations in income and trade that have influenced local potato production and consumption, especially via the fast-food industry (Kenneth et al, 2000).

2.1.3 Dietary and Nutritional Aspect

Potato - simply boiled, baked, or roasted -is an inexpensive, nutritious, and ordinarily harmless source of dietary energy. Potato is a versatile, carbohydrate rich food highly popular worldwide. Potato is prepared and served in a variety of ways. The potato's nutritional value refers mainly to the nutritional value of tuber when it is used as food. Freshly harvested potato contains about 80 % water and 20 % dry matter. According to Qu and Xie (2008) each100 gram of potato tuber contains 79.8g water, 17.2 g carbohydrate, 2g protein, 0.7g dietary fiber, 0.8g ash and 0.2g fat (Figure

3). On a dry weight basis, the protein content of potato is similar to that of cereals and is very high in comparison with other roots and tubers (Woolfe 1987). In addition, the potato is low in fat and rich in several micronutrients, especially vitamin C - eaten with its skin, a single medium sized potato of 150 g provides nearly half the daily adult dietary requirement (100 mg).

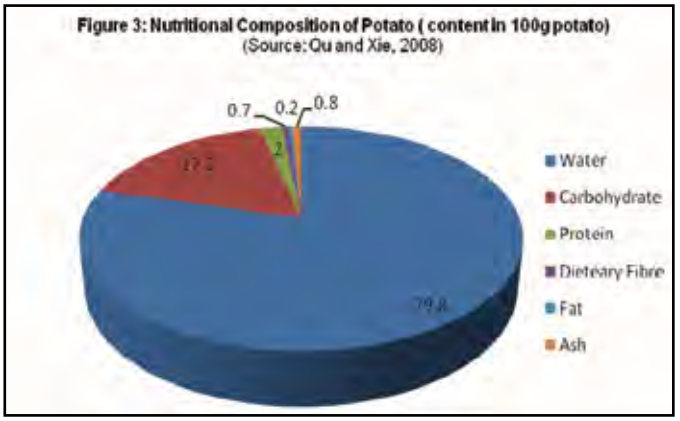


Figure 3: Nutritional Composition of Potato (content in 100g potato)
(Source: Qu and Xie, 2008)

The potato is a moderate source of iron, and its high vitamin C content promotes iron absorption. It is a good source of vitamins B1, B3 and B6 and minerals such as potassium, phosphorus and magnesium, and contains folate, pantothenic acid and riboflavin. Potatoes also contain dietary antioxidants, which may play a part in preventing diseases related to ageing, and dietary fibre, which benefits health (www.potato2008.org).

Potato protein, like that of legumes, is high in lysine and low in sulfur-containing amino acids, making potatoes a good nutritional staple for adults, especially if consumed with cereals as a protein complement. Prepared in fresh form, however, tubers are too bulky to provide a staple for infants or children without an energy-rich supplement.

In terms of edible energy potato ranks top among other food crops and is considered the best crop in developing market economies (Box 1). Thus, potato seems highly competitive with other foodstuffs from the point of view of nutritive value (Beukema and Van der Zaag, 1990).

Box 1: Edible Energy in Different Crops
(Source: Horton and Fano, 1985)

Crop	Energy (MJ/ha/day)
Potato	216
Yams	182
Carrots	162
Maize	159
Cabbage	156
Sweet Potato	152
Rice	151
Wheat	135
Cassava	121
Eggplants	120

2.1.4 Consumption Pattern and Uses

The consumption of potato is increasing worldwide. Asia consumes almost half of the world's potato supply, but its huge population means that consumption per person was a modest 24 kg in 2005. The world's highest consumption is reported in Belarus with 181 Kg per capita (FAO, 2005). In South Asia, the habit of potato consumption is rapidly increasing. For example in Bangladesh annual consumption has been growing briskly, from around 7 kg per capita in 1990 to more than 24 kg in 2005. Similarly in India, since 1990 consumption has risen from around 12 kg to 17 kg a year and in Nepal, the per capita consumption has almost doubled since 1990 to 51 kg a year in 2007. Chinese consume 40 kg potato per head on an average (FAO, 2008). In Bhutan, the per capita consumption of potato has increased from 20 kg (Scott, 1982) to 40 kg a year in 2006 and is expected to increase to about 60 kg by 2020 as per estimates by the Bhutan Potato Development Programme (Nidup et al, 2007).

Potatoes are used for a variety of purposes, and not only as a vegetable for cooking at home. Most of the potatoes are used as fresh food – boiled, baked, fried or roast. The rest are processed into potato food products and food ingredients, fed to cattle, pigs and chickens, processed into starch for industry, and re-used as seed for growing the next season's potato crop. Some of the most popular uses are described below:

Fresh food: FAO estimates that just over two-thirds of the 320 million tonnes of potatoes produced in 2005 were consumed by people as food, in one form or another. Home-grown or purchased in markets, fresh potatoes are baked, boiled or fried and used in a staggering range of recipes: mashed potatoes, potato pancakes, potato dumplings, twice-baked potatoes, potato soup, potato salad and potatoes au gratin, to name a few.

Value added food products: In recent years, the global consumption of potato as food is shifting from fresh potatoes to processed food products. One of the main items in that category is French fries served in restaurants and fast food chains worldwide. Another processed product, the potato crisp, is the long-standing king of snack foods in many developed countries.

Industrial ingredients: Potato starch is also widely used by the pharmaceutical, textile, wood and paper industries as an adhesive, binder, texture agent and filler, and by oil drilling firms to wash boreholes. Potato starch is a 100% biodegradable substitute for polystyrene and other plastics and used, for example, in disposable plates, dishes and knives.

Potato peel and other "zero value" wastes from potato processing are rich in starch that can be liquefied and fermented to produce fuel-grade ethanol. A study in Canada's

potato-growing province of New Brunswick estimated that 44,000 tonnes of processing waste could produce 4 to 5 million litres of ethanol (www.potato2008.org).

Seed for next season: As potatoes are reproduced vegetatively from other potatoes, a part of each year's crop - ranging from 5 to 15 percent, depending on the quality of the harvested tubers - is used for seed. Most farmers in developing countries select and store their own seed tubers. In developed countries, farmers are more likely to purchase disease-free "certified seed" from dedicated suppliers.

Box 2: Global Importance of Potato

Potato is the world's number one non-grain food commodity, with production of over 325 million tonnes. Asia accounts for more than 80% of potatoes produced in the developing countries. Potato production is smoothly increasing in developing countries for several reasons. One is that a crop produces more edible energy and protein per hectare and per unit of time than practically any other crop (CIP, 1984). Potato is a valuable cash crop for millions of subsistence farmers who can fit the potato into their multiple cropping systems. Due to strong consumer demand for potatoes and high profitability, the development of potato will remain as an important part of efforts to ensure food security for present and future generations. Other reasons that highlight the global importance of potatoes are as follows:

Potatoes are a truly global food: The potato has been consumed in the Andes for about 8,000 years and until last century most world potato production was concentrated in Europe. Today potatoes are grown all over the world, on an estimated 192 000 sq km, or 74 000 square miles, of farmland, from China's Yunnan plateau and the subtropical lowlands of India, to Java's equatorial highlands and the steppes of Ukraine.

Potatoes feed the hungry: The potato is ideally suited to places where land is limited and labour is abundant, conditions that characterize much of the developing world. The potato produces more nutritious food more quickly, on less land, and in harsher climates than any other major crop - up to 85 percent of the plant is edible human food, compared to around 50% in cereals.

Potatoes are good for health: Potatoes are rich in carbohydrates, making them a good source of energy. They have the highest protein content (around 2.1 percent on a fresh weight basis) in the family of root and tuber crops, and protein of a fairly high quality, with an amino-acid pattern that is well matched to human requirements. They are also very rich in vitamin C - a single medium-sized potato contains about half the recommended daily intake - and contain a fifth of the recommended daily value of potassium.

Demand for potatoes is growing: World potato production has increased at an annual average rate of 4.5 percent over the last 10 years, and exceeded the growth in production of many other major food commodities in developing countries, particularly in Asia. While consumption of potato has declined in Europe, it has increased in the developing world, from less than 10 kg (22 lb) per capita in 1961-63 to almost 22 kg (48.5 lb) in 2003. Consumption of potato in developing countries is still less than a quarter of that in Europe, but all evidence suggests it will increase strongly in the future.

Source: Compiled from various sources

2.2 Potato in Bhutan

2.2.1 History of Potato Production

Potato was believed to have been introduced in India in the 16th century, where good crops of potato were reportedly seen in Northern India as early as 1617 (c.f. Roder et al, 2008). From there it may have reached some parts of Bhutan in the 17th century. Markham (1879) gives the earliest documented evidence of potato introduction in Bhutan. According to his records, George Boggle, a representative of the East India Company, planted potato tubers at every place he stopped on his journey to Bhutan and Tibet in 1774-75 (Roder et al, 2008). It is popularly believed that potato must have spread gradually through most parts of the country in the 17th and 18th century. However, the modern era of Bhutanese potato production dates back roughly to the 5th decade of the 20th century, when the farmers around Chapcha first started regularly planting and exporting potatoes to India (Scott, 1983).

The area under potato cultivation and yield has dramatically increased in Bhutan after the establishment of the Department of Agriculture in 1961. It started to increase at a very fast rate in the late seventies when production areas became accessible to the Indian markets. The phenomenal increase from 1965-1975, with a 3-fold jump in the production area was largely possible due to the farmers' own initiative (Roder et al, 2008). The RGoB initiatives and projects, which greatly influenced potato development in the country, are listed in Table 1.

Table 1: RGOB Initiatives and Projects that have boosted potato production

Year	RGOB Initiatives/Projects	Effect
1960	Creation of Government Structure and Road Construction	Access to market
1961	Establishment of Department of Agriculture	Technical services, marketing policies & structure to facilitate input supply
1974-83	Rural Development Project, Bumthang which mainly dealt with activities relating to germplasm introduction and testing, seed production, mechanized planting and weeding.	Availability of improved cultivars, technologies and technical advice which form basis for high yields
1977-81	UNDP/DANIDA Project with major focus on seed multiplication.	
1981-87	CIP country programme whose activities involved germplasm introduction and testing, seed multiplication, marketing studies and training.	
1983-95	Bhutan National Potato Programme which focused mainly on activities involving germplasm introduction, seed multiplication and training.	
1980	FCB Managed Auction Yard System	Farmers' confidence that a market would be available
2004	Bhutan Potato Development Programme (BPDP)	Capacity building and technology development for increasing production and strengthening of marketing linkages

In addition to above initiatives and projects, various development programmes such as Helvetas, SDC, Danida, UNDP, IFAD, SNV and CFC in collaboration with other partners have carried out a range of activities with the objective to promote the potato subsector as a source of cash income for the rural poor. A number of studies have been conducted by various individuals and organizations to get a better understanding of production processes, marketing mechanism and the potential of value addition and export (Roder et al, 2008)).

2.2.2 Importance for Poverty Reduction

In Bhutan, potato ranks first in terms of volume of agriculture trade and is placed second in terms of value of export (next to oranges). The crop is ideally suited to environment and climatic conditions of Bhutan. The high yield potential, affordability, nutritional value and consumer preference for potato has provided tremendous

impact on the rural population through income and employment generation and at far higher growth rates than other cash crops in the country (Nidup et al 2007). For most high altitude rural households, potato is at present the only economic cash crop available for both, local and export markets.

Potato is produced by all kinds of farmers from small landholders to tenant and large farmers. It is grown by all types of farmers from high altitude yak herders to the farmers of the sub tropics and consumed by almost all people from children to old and poor to rich. Potato can be cooked in many different ways with meat and cheese and is highly compatible with chili, an essential ingredient in most Bhutanese dishes. Furthermore, potato can be easily stored. It is especially important for high altitude dwellers where it is the only fresh vegetable available throughout the winter months beside radish and turnip.

Due to the combined effects of the superior standing in productivity, nutritional qualities and adaptability to environmental conditions, the promotion of Potato Value Chain fits in well with the agenda of a development programme focusing on poverty reduction (Table 2).

Table 2: Suitability of promoting potato in the context of poverty reduction

Criteria*	Potential	Explanation
Development Goal: "Equitable and Sustainable Socio-Economic Development"	Positive	Potato is the major source of cash income and nutrition for many rural households and it significantly contributes to achieving the RGoB objective and MDG 1 "eradicate extreme poverty and hunger".
Geographical context (covering locations where poor people live)	High	The soil type and climatic conditions are suitable for potato cultivation and the per capita production is highest in Bhutan in the region. Highly feasible for rural poor and highlander farmers who are dependent on rain fed land.
Breakdown of value chain into sub-chains	High	Potatoes are used as food; table potato (vegetable, staple), value added products (chips, crisps) or food ingredients, fed to cattle, boars and chickens, and re-used as seed tubers for growing the next season's potato crop. For each product a specific sub-chain can be developed
Value chain driven by demand	High	Potato is liked by every society on earth and the trend of potato production and consumption is on rise. There is good market demand for the Bhutanese potato (both table potato and seed potato) in neighbouring states of India.
Entry Barriers	Low	Potato can be grown easily using family labour and low-tech but requires high seed rates.
Use of local skills and raw materials	High	Seeds, fertilisers, other agricultural inputs and technical expertise are locally available.
Number of actors in the chain	High	Potato is the most widely cultivated and the most popularly purchased vegetable in Bhutan. About 20% of total households, truckers, porters with pack-horses, small and medium sized enterprises are involved in the potato value chain
Returns	High	Returns can be obtained within half-a year of the investment
Potential for niche market	High	Niche market can be harnessed with difference in time of harvest and near organic nature of cultivation.
Impact on environment	Medium	Contributing to food security without reducing availability of clean water, but cultivation requires special attention to soil fertility and conservation. High inputs of organic manures, intercropping with maize, mulching with crop residues, planting in heaps are some of the strategies used by Bhutanese producers to maintain fertility and minimize soil erosion.

*Pro-poor criteria adopted with slight modification from Springer-Heinz (2007)

2.2.3 Potato Varieties

Although the potato cultivated worldwide belongs to just one botanical species, *Solanum tuberosum*, the tubers come in thousands of varieties with great differences in size, shape, colour, texture, cooking characteristics and taste. Potato varieties commonly grown in Bhutan are *Desiree*, *Kufri jyoti, Khangma kaap* and *Yusikaap*. *Desiree*, a Dutch variety introduced in the 1970's for cultivation is currently the only red-skinned variety grown in the country covering almost 90% of the total acreage under potato cultivation. Of the three white skinned varieties, *Kufri jyoti* (an Indian variety) and *Yusikaap* (an Argentinean variety) - were both released for cultivation in 1988. *Khangma kaap* (a CIP clone) was the latest variety released in 2002 (Nidup et al, 2007). The old German variety 'Cosima' and the Dutch hybrid 'Maritta' were also introduced to the country in the 1970's (Scott, 1983).

Most studies indicate that Bhutanese farmers and consumers prefer the red skin variety Desiree because of its excellent keeping/storing quality, better prices and good eating quality. Recent efforts to capitalize on the export potential for seed potato may lead to the adoption of other varieties, especially the variety *Kufri jyoti*, which is preferred in many parts of West Bengal. *Yusikaap* is preferred by the growers due to its higher yield potential compared to the other varieties.

2.2.4 Production and Consumption Pattern

Potatoes are mostly produced under rain fed conditions at the elevation range of 2,000-3,500 masl. Most households grow potatoes in <1 hectare of land and commercial production is limited to areas within 1-5 km radius distance from the road (Roder et al, 2008). Data on annual potato production since 1970 shows a dramatic increase. During the 70s the area cultivated with potato increased by 10-20% every year and amounted to 5982 ha in 2007 compared to 760 ha in 1970 (SDC, 2008). In 2007, the total production of potato was 61, 133 metric tonnes from an area of 5,982 ha (DoA, 2007). In some Gewogs the area under potato has probably reached or even exceeded the maximum, with over 80% of the arable dry land planted annually with potato (Nidup et al, 2007). In other Gewogs, especially those which are newly becoming accessible through roads, substantial area expansion is possible. In four of the Dzongkhags (highlighted with green in Table 3), the annual production of potato exceeds 5,000 metric tonnes. In Eastern Bhutan, Khaling was the first major production area initiating production in the early seventies. After villages became accessible by road, most households in the east had adopted potato cultivation. Today, potato has become the most extensively cultivated crops, being grown by over 20% of total households in Bhutan (Roder et al, 2007).

The expansion of potato cultivation can be directly related to the construction of access roads starting in 1961(Roder 2004) and the rapid increase in production is largely due to the farmers' own initiative enthused with the introduction of modern

varieties and the support in seed production and marketing by various development agencies and RGoB departments. Over the last three decades, there has been remarkable increase in productivity as well. The average national yield of potato for 1981-82 was 2.74 tonnes/acre (Scott, 1983), which has increased to 4.14 tonnes/acre in 2007 (DoA, 2007). The harvested area, total production and yield as reported in Agriculture Statistics 2007 by DoA is given in Table 3.

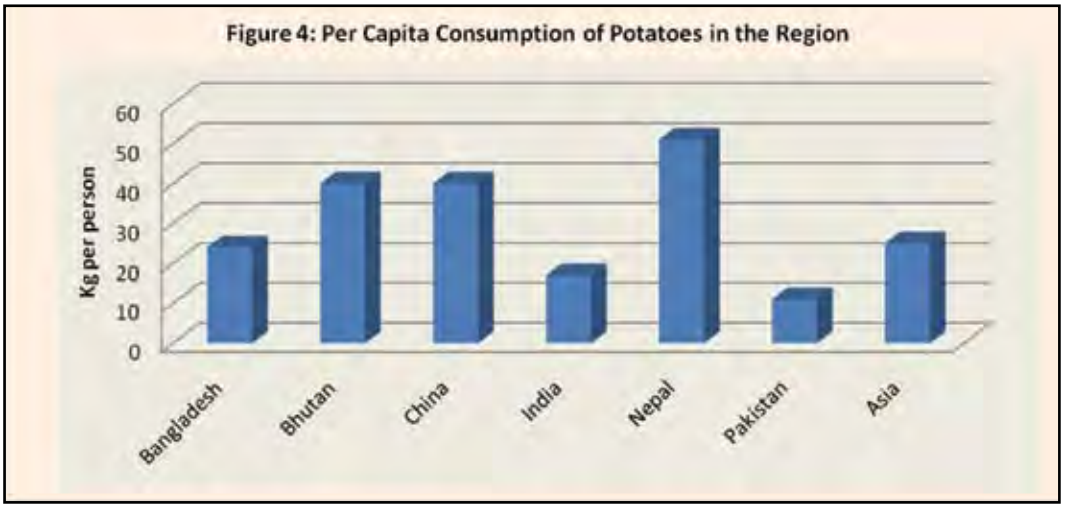
Table 3: Potato Harvested Area, Production and Yield (Kg/acre)

Dzongkhag	Area (Acres)	Production (MT)	Yield (Kg/acre)
Bumthang	1,060	6,901	6,508
Chhukha	874	4,887	5,591
Dagana	780	2,687	3,444
Gasa	4	6	1,488
Ha	510	3,621	7,104
Lhuentse	303	467	1,542
Mongar	1,449	3,449	2,379
Paro	1,407	7,445	5,290
Pemagatshel	964	2,856	2,962
Punakha	176	502	2,851
Samdrup Jongkhar	756	1,402	1,854
Samtse	731	1,199	1,641
Sarpang	206	223	1,082
Thimphu	577	2,667	4,621
Trashi Yangtse	23	62	2,678
Trashigang	2,151	6,815	3,168
Trongsa	261	1,021	3,914
Tsirang	741	2,372	3,200
Wangdue	1,658	12,326	7,434
Zhemgang	149	226	1,517
Total	**14,782**	**61,133**	**4,136**

The value of potato exports in 2007 was Nu 262.1 million (PPD, 2008) and the total contribution of potato production to the Gross Domestic Product (GDP) of Bhutan was about 2% (SDC, 2008).

Over the last 3 decades, the level of potato consumption has remarkably increased in Bhutan. Until 1983, potatoes were considered complimentary vegetables by most of the Bhutanese people and grown almost exclusively as a cash crop for export (Scott, 1983). Eating potato as a staple was socially and culturally unacceptable and many Bhutanese believed that potatoes caused problems of the lower abdomen,

vomiting, constipation and diarrhea (Roder et al, 2007). Today, unlike the seventies, potato is widely eaten as a vegetable and sometimes even as a staple food. The average potato consumption is estimated to be 40 kg per person compared to 17 kg per person in India and about 24 kg per person in Asia as a whole (Figure 4). Potato consumption in Bhutan is still on the rise and per capita consumption is higher in urban settlements than in rural areas (Roder et al, 2008).



Potato consumers in Bhutan could be classified first as growers or non-growers. Non-growers include individuals and institutions. The individual non-growers such as urban dwellers, road workers, resident expatriates, tourists and shopkeepers purchase potatoes on a continuous basis all year round. Similarly, institutional non-growers such as boarding schools and colleges, hotels and restaurants, monastery, army and police posts also buy potatoes on a continuous basis, mostly in bulk.

The preferred and most widely eaten potato dish in Bhutan is *Kewa datsi,* a local preparation with cottage cheese, chilli and potato. Other uses include whole baked potatoes, boiled potatoes, *Alu sabzi* (sliced potatoes cooked with other vegetables and spices). French fried potatoes or chips, *Alu pakoda* and *samosa* are also the favorite snacks among Bhutanese. *Samosa* is spicy mashed potato and other vegetables (little amount) stuffed in conical dough and fried in oil. *Alu Paratha*, a north Indian stuffed chapatti is another dish, which is a very popular food item for breakfast.

2.2.5 Potato in Eastern Bhutan

Eastern Bhutan includes 6 Dzongkhags; Mongar, Trashigang, Trashiyangtse, Pemagatshel, Samdrup Jongkhar and Lhuentse (Figure 1). It is a region of deep V-shaped valleys. Roads reach the major towns, but most settlements are hidden in the steep hillsides of remote valleys. The dominant language here is Sharchop and people of the East are known to be humble and soft spoken (Wangchuck, 2008)

Potato is the principal export crop of the Eastern Bhutan. The survey conducted in Eastern region clearly indicate that among all the fruits and vegetables, potato is the crop with the highest market demand and with the potential to increase rural income thereby reducing poverty (Table 4).

Table 4: Attractiveness Matrix of Fruits and Vegetables in Eastern Bhutan

Potential to increase Rural Income	**High**		Radish	**Most Attractive:** Potato, Orange, Chili
	Medium	Peach, plum	Bamboo shoot, Fern, Asparagus	Cauliflower, Cabbage, Broccoli, Kidney Beans (*rajma*)
	Low	**Least Attractive:** Pumpkin, Green sag	Ginger, Garlic, Onion	Pear, Persimmon, Passion fruit
		Low	**Medium**	**High**
		Potential Market Demand		

Potato is grown mostly under rain fed conditions, except in few places like Pam, where it is planted on irrigated land. In most Gewogs of Eastern Bhutan, potatoes are intercropped with maize. The major potato growing areas, which are quite famous in the Eastern region, are Khaling, Kanglung, Udzorong and Nanog Gewogs. The households in these Gewogs meet their livelihood needs solely with the cash earned from the sale of potatoes. In many Gewogs, the production of potato produces a surplus but most of the lower quantity is sold within 3-4 months of harvesting. Some growers keep a good quantity of potatoes for seeds and their own consumption throughout the whole year, while others buy seeds during the time of plantation from other farmers or commission agents. The Gewog-wise production of potato in Eastern Bhutan is given in Table 5.

Table 5: Gewog-wise Production of Potatoes in Eastern Bhutan in MT

Mongar Dzongkhag		Trashigang Dzongkhag	
Tsamang	68.222	Yangnyer	526.497
Tsakaling	55.865	Udzrong	1144.152
Thangrong	136.215	Thrimshing	491.176
Silambi	58.7	Shongphu	254.378
Sherimuhung	73.592	Sakteng	129.111
Saling	125.541	Samkhar	310.11
Ngatshang	195.736	Radi	32.097
Narang	679.231	Phongme	172.49
Mongar	307.314	Merak	11.468
Kengkhar	119.409	Lumang	684.604
Jurmey	63.662	Khaling	1128.964
Gungdue	45.253	Kanglung	1080.614
Drepung	153.835	Kangpara	652.08
Drametse	1,027.287	Bidung	37.2
Chaskhar	138.302	Bartsham	122.126
Chali	67.423		
Balam	60.098		
Samdrup Jonkhar Dzongkhag		***Pemagatshel Dzongkhag***	
Wangphu	453.208	Zobel	451.009
Serthig	36.901	Yurung	409.503
Samrang	0	Norbugang	34.101
Phuntshothang	21.186	Shumer	409.503
Pemethang	0	Nanong	1286.883
Orong	68.018	Khar	78.444
Martshala	402.647	Dungme	33.994
Lauri	225.834	Dechhenling	101.298
Langchenphu	6.801	Chongshing	41.986
Gomdar	148.548	Chokhorling	0
Deothang	38.528	Chhimung	8.954
Trasiyangtshe Dzongkhag		***Lhuentse Dzongkhag***	
Yangtse	712.241	Tsenkhar	95.59
Yalang	0	Minjay	0
Tongmijangsa	76.175	Metsho	0
Toetsho	149.267	Menbi	117.328
Ramjar	470.08	Kurtoe	32.051
Khamdang	537.15	Khoma	25.29
Jamkhar	61.594	Jaray	84.738
Bumdeling	717.302	Gangzur	112.435

Source: Agriculture Statistics 2007, Department of Agriculture, MoA, RGoB

The potato is generally planted during the months of February–March, and harvested from June–August depending on the altitude. However, in the Pam area of Trashigang Dzongkhag, farmers plant potatoes in November and harvest in March. The area under potato cultivation and production of the six Eastern Dzongkhags is presented in Table 6.

Table 6: Dzongkhag-wise Potato Statistics for Eastern Bhutan

Dzongkhag	Total Population[1]	Total Number of Households[1]	Area under Potato (Acre)[2]	Production (MT)[2]	Yield (Kg/ Acre)[2]
Mongar	38,200	7,300	1,449	3,449	1542
Lhuentse	15,700	3,000	303	467	2379
Pemagatshel	23,600	4,900	964	2,856	2962
S. Jongkhar	34,900	7,000	756	1,402	1854
T. Yangtse	18,200	3,800	23	62	2678
Trashigang	47,700	10,300	2,151	6,815	3168
Eastern Part	**138,300**	**36,300**	**5,646**	**16,148**	**2431**
Nationwide	**629,700**	**125,500**	**14,782**	**61,133**	**4136**

Source: [1]= Bhutan Living Standard Survey Report, National Statistics Bureau, 2007;
[2]= Agriculture Statistics 2007, DoA (www.moa.gov.bt)

The Eastern Dzongkhags produce over 25% of the total potato crop in the country. Trashigang is the leader in potato production followed by Mongar and Pemagatshel. The per capita production of potato in Eastern Bhutan is 117 kg, which is higher than the national average (97 kg per person). The productivity (yield/acre) is however quite low in Eastern Bhutan compared to the national average. In some of the Dzongkhags, like Wangdue (7434 kg/acre), Ha (7104 kg/Acre) and Bumthang (6508 kg/Acre) the productivity is more than double that of the Eastern Dzongkhags (DoA, 2007).

CHAPTER THREE: VALUE CHAIN OPERATORS AND SUPPORTERS

3.1 Value Chain Operators and their Functions

The success or failure of a value chain intervention depends principally on the partnerships that are built between actors and support providers that participate in a particular chain (Lundy et al, 2004). The VC approach therefore requires that the VC operators are clearly identified and existing relations understood. This information enables the VC supporters involved in the design and implementation of strategy to increase competitiveness and to promote the fair distribution of income among the VC actors.

The potato value chain in Bhutan is very short as most of the functions are performed by potato growers themselves. The involvement of private entrepreneurs (seed and fertilizer agencies), registered transport companies and agro-trade houses is nearly absent or it is at a subtle level. The main actors (inputs suppliers, producers, middlemen and traders) and the functions performed by them are described in the following paragraphs.

3.1.1 Input Suppliers

Most potato farmers in Bhutan use their own seeds and farm yard manure. There are not any traders or private companies engaged in importing, wholesaling or retailing inputs (seed, fertilizer, pesticides, etc.) to the potato growers. Only a few growers use Government labeled truthful seeds, fertilisers and other inputs that are mainly provided by Druk Seed Corporation (DSC) through commission agents or through Dzongkhags.

Commission Agents (CA): The system of Commission Agents (CA) was introduced in 1989 and is the main channel for the sale and distribution of agricultural inputs. Commission Agents are identified and appointed by the Dzongkhags and are responsible for the distribution of seeds, saplings, fertilisers, agricultural tools and small machineries. The cost of transportation for the supply of most inputs to the farm is subsidized by the government. The CAs receives 10% of the value of inputs distributed to the farmers as commission from the government.

However, the performance of CAs is far from what they are expected to do (Gurung, 2005). The majority of CAs does not have much knowledge of farming and lack motivation to deliver information to the farmers with the seeds (Nidup et al, 2007). A survey conducted by Nidup et al (2007) showed that 18% of the CAs visits the farms once a year, whereas an astounding 81% never made any farm visits. Especially

the farmers who live in remote areas, far away from a road head, do not receive a timely supply of fertilisers, seeds and chemicals (van der Wal and Wangchuk, 2002). As the number of farmers who use certified seeds, chemical fertilisers and other services is very limited, the system operated at present does not seem lucrative for CAs. Thus, there is a need to assess and review the system to strengthen the input supply mechanism (Gurung, 2005).

Extension Officers (EOs): There are 205 Gewogs in the whole country, with RNR EOs (also called Extension Workers or Extension Agents) in every Gewog. These EOs are supposed to provide updated information, promotional seed and pesticides on a cash-and-carry basis, technological awareness and training to the farmers. However, they are overloaded with different tasks, look after number of agricultural crops and most of them lack exposure and knowledge of modern potato production technologies. Moreover, some EOs are supposed to look after large Gewogs with far flung villages and households making it difficult for a single person to cater to the needs of the most farm.

3.1.2 Potato Growers

Potato growers are generally small holder farmers with an average landholding of only 1.98 acre per household. As per the field survey conducted in the Eastern Dzongkhags, potato is grown in almost 87% of the agricultural land. The respondents had 1.73 acres (0.7 ha) of land under potato cultivation, which is higher than the national average of 1.2 acres (0.48 ha) estimated by Nidup et al (2007). The proportion of land holding is presented in Table 7. Almost all the potatoes are grown in the kamzhing (dry land) type of land.

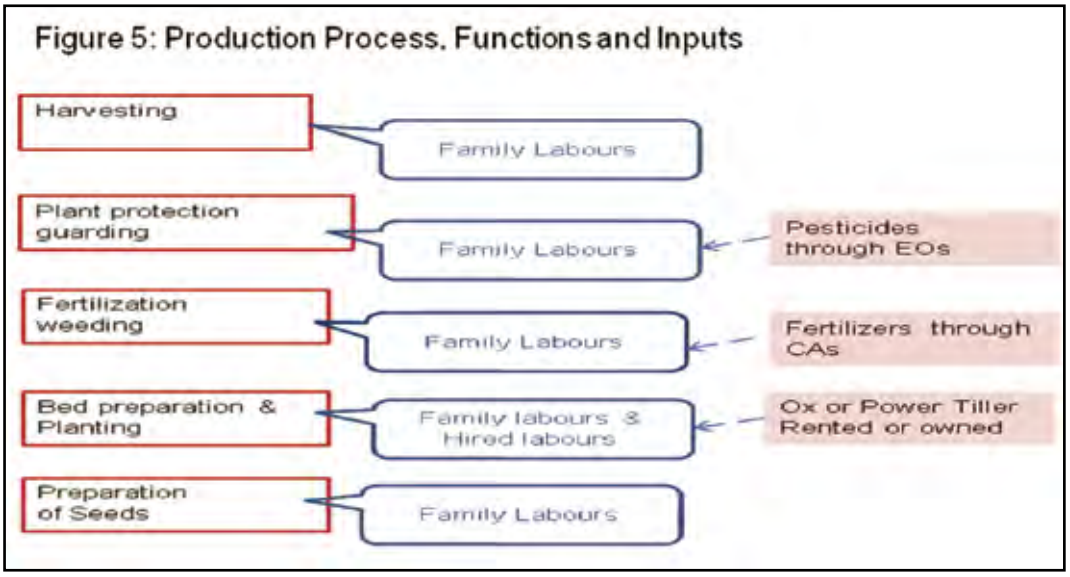
Potato growers are the major actors who perform most of the value chain functions right from arrangement of farm inputs to post harvest handling and marketing. Only a few growers are confined to just the production processes, while the majority act as integrated VC operators and perform multiple tasks (Box 3). The different functions carried out by famers are briefly described below:

Table 7: Landholdings of Potato Growers in Eastern Bhutan

Land Holdings	Percentage of Respondents (N=127)	
	Total Agricultural Land	*Land under Potato Cultivation*
< 1 acre	17%	14%
1-3 acre	64%	82%
3-5 acre	14%	3%
>5 acre	5%	1%
Average land	**1.98 acre**	**1.73 acre**

A. Production Process

The potatoes produced in Bhutan go through five basic operations– 1) selection of seeds 2) bed preparation and planting, 3) fertilization/weeding/earthing up, 4) plant protection-guarding to protect from wild animal damages and application of pesticide if needed, and 5) harvesting. The functions and inputs applied in the production process are presented in Figure 5.

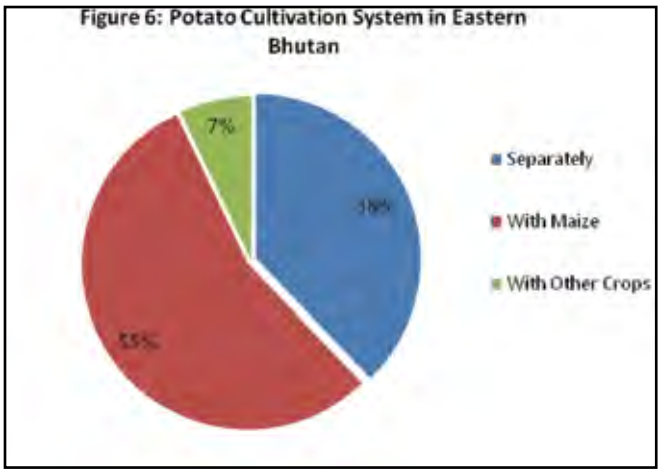


Land Preparation: Depending on the terrain, farm size and the access to resources, potato growers use power tillers and bullocks for tilling their land. As indicated in the Table 8, a majority of the farmers use bullocks for land preparation, power tillers are not much used in the Eastern regions of the country. All production systems are highly labour intensive as most of the work is done manually. Small plots, sloping land and the widely used maize intercropping system limit the opportunities for mechanized production. 96% of the growers, who used bullocks for land preparation, said that they undertake their work on a labour and bullock sharing basis.

Table 8: Different methods of land preparation adopted by the farmers

Method		Percentage of Respondents (N=127)
P/tiller	Hired	**3%**
	Owned	**8%**
Bullocks	Sharing	89%

Cropping System: Potato and maize intercropping is the most popularly practiced cropping system in the East. The maize intercropping system offers a range of advantages for small holder farmers especially: increased productivity, improved soil conservation, reduced risk and increased food security (SDC 2008). As per our field survey, 55% farmers grow potatoes intercropped with maize, 7% grow potato with other crops (pea and mustard mainly), whereas 38% grow it separately (Figure 6). Over 90% respondents keep the land fallow after harvesting their potato and maize. Only 6% farmers grow vegetables and 2% of the total respondents grow mustard in their field after harvesting of potatoes.



Fertiliser Usage and Irrigation: The production of potato depends on the application of farm yard manure (FYM) for fertilizer requirements. The use of inorganic fertilisers is not very common in Eastern Bhutan. As per the field survey, 35% of the respondents do not use any fertilisers, 44% use only Suphala, whereas others use Urea with SSP or with Suphala (Table 9). The rate of fertilizer application is not uniform; farmers use it arbitrarily depending upon their own judgment and the availability of fertilisers.

As potatoes are grown under rain-fed conditions, generally irrigation is not required. Only in Pam area (below 1500 msl), where potato is grown as a winter crop is irrigation provided; this represents only 4% of the total land covered in this study.

Table 9: Use of chemical fertilisers on potato crops

Fertilisers used	Percentage of Respondents (N=127)
None	35%
Suphala	44%
Urea	1.5%
Urea/SSP	5.5%
Urea/Suphala	6.3%
Suphala/SSP	6.3%
Urea/Suphala/SSP	1.5

Crop protection: Damage of crops by wild pigs is a serious problem for potato growers in Bhutan. As per Bhutan Food Security Strategy paper (2006), about 6% of the crop is damaged by wild animals every year. While the actual yield loss may not be significant - except for individual farmers - the economic opportunity lost due to the need for guarding the field is considerable (Roder et al, 2007). Wild animal crop damage adds a significantly to the total cost of potato production, as growers have to guard the crop for 4-5 months.

Hut used by farmers to guard the crop

Pest and Disease: Potato Tuber Moth (PTM) is one of the most severe problems in the Eastern Bhutan. During the field survey, the infestation rate of PTM was found from 6-80%. Most growers cover potato with ferns, artemisia, banana or vitex leaves to prevent PTM, while other use ash, lemongrass oil or cannabis extract to fight against PTM. Only a few growers use chemicals like Mancozeb, Cypermethrin (0.5ml/litre), Linear Alkybenzene, Sulfonate Sodium Salt, Cocamido Propyl Betane, Sodium Lauryl Ether Sulfate, etc. As 85% of the growers do not use any chemical pesticides, the efficacy of different traditional techniques against PTM would be an interesting area of research. The findings of the survey are presented in Table 10.

Larva of potato tuber moth

Table 10: Use of chemical pesticides on potato

Chemical Pesticides Used	Percentage of Respondents (N=127)
No use of any chemicals	85%
Mancozeb	13%
Cypermethrin and others	2%

Harvesting: Harvesting takes place after potato tubers reach maturity. The potato growers determine the maturity of the tubers by looking at the plant; i.e. when the haulm turns yellow and dies. In Eastern Bhutan, the bulk of potatoes are harvested during July to August. Harvesting is mostly done by household members using a long handled spade or a hoe to unearth the plant and shake the soil from the tubers. Most farmers collect the tubers in the basket and bring to the store immediately after harvest. During the time of the potato harvest maize plants are already growing up to 2-3 feet high in the fields.

Harvesting of potato

Box 3: Potato Grower working as an integrated VC Operator

Mr. Pema Lendrup, Drametse, Mongar
Interviewed on 18th September, 2009

I grow potato in almost all of my land and in the fields that belong to my father. I generally keep my own potato seeds but some years I also exchange my seed potato with other growers. I intercrop my potatoes with maize. Ploughing and land preparation work is done by using a pair of bullocks. All of my family members help in planting, weeding and harvesting. I use farm yard manure as well as some quantity of chemical fertilisers.

After harvesting the potatoes, I assemble them in my farm store and after a week or so I carry them to collection center in Drametse. I own two horses, which I use to transport potatoes from my house to Drametse. In one trip, I can bring about 150 kg of potatoes (30 kg in each side bag, meaning 60 kg by one horse, and 30 kg on my back). Otherwise, the rate for bringing potato from my farm to this center is Nu 150 per horse. Once I carry all of my potato bags to Drametse market place then I look for a truck to transport my potatoes down to the auction yard. I prefer to go myself to the auction yard rather than selling my potatoes to local traders and middlemen. The transportation cost is charged on per bag basis, which is Nu 55 per bag from Drametse market to Samdrup Jonkhar. I put 60-70 kg of potatoes in a bag.

I already sold 47 bags of potatoes and have 20-30 bags kept at my house for auctioning during the last week of September. This year the price was good. When I sell my potatoes personally in Samdrup Jonkhar there is nothing to regret. But if I sell them here at a cheaper price then I always think of the margin taken by the intermediaries. Another reason for going there is to buy clothes and household items. Over there, the price of clothes and household item is quite cheap. Damage by insects (PTM) and crop predation by wild pigs is a major problem. For me storage and transportation is not a big problem but the fluctuations in price worry me to a greater extent.

B. Postharvest Handling

Post harvest handling, which includes different activities (sorting, grading, packing, storing, carrying to the road heads, transportation, loading and unloading), is mainly done by the growers themselves. After harvesting, potatoes are collected in bamboo baskets and carried to the potato store. Most of the growers use the ground floor of their dwelling house as a potato store, however some have built separate sheds. Most farmers store potatoes on wooden planks or bamboo mats separating large, medium and small potatoes into different portions. They also partition the chamber to separate red and white potatoes. Others put all sizes and colours in one chamber.

Sorting and Grading: During the field survey, many farmers told us that they separate damaged and undamaged tubers, and throw away any tubers, which are bruised, off types, diseased, damaged, misshapen or rotten. They added that they put red and white potatoes in separate chambers/ bags, and select medium and large sized potatoes for immediate sale and keep small sized potatoes for seeds. During the interview, 85% farmers said that the sorting and grading helps in fetching a better price (Table 11).

Table 11: Sorting and Grading

Type of Store	Percentage of Respondents	
	Yes	No
Does sorting and grading help in fetching better price?	**85**	**15**

However, during our field visit we noticed that either knowingly or unknowingly farmers were closely following the recommendations made by the government authority:

- Tubers of more than 60 gram for market as large size potatoes
- Tubers of 30-60 gram as standard size for market
- Tubers of 35-60 gram size for own seed purpose
- Marble size tubers (about 20 gram) to be stored until Oct/ Nov and sold as seed when there is high demand in Assam

During our visit to the auction yard in Samdrup Jongkhar, the bidders complained that the farmers generally still tend to put diseased and all sorts of damaged and injured potatoes in a bag. We also noticed this in some bags.

Traditional on farm Potato store

Storage: Potatoes are stored for a maximum period of 4-5 months mainly for seed purposes, home consumption and for domestic sale. Storage methods used by farmers vary depending on the

design of the houses and climatic conditions. Data on the types of stores used is presented in Table 12, which indicates that 45% of farmers store potato in the ground floor of their houses, 18% in the attic, while 37% store their potatoes in traditional stores built on their farms.

Table 12: Types of stores used by potato farmers

Type of Store	Percentage of Respondents (N=127)
Ground floor	45%
Attic	18%
Separate Store	37%

During the field observation storage conditions were found to be very poor; many of them were damp, with poor air circulation, while some were exposed to the sun. Potatoes need to be spread out on the dry floor of the storage area to prevent them from rotting. It is better to store them in a dark, cool place in order to keep the glycoalkaloid content low. Under exposure to light, potatoes turn green in colour due to increased levels of chlorophyll, which can also indicate higher levels of solanine and chaconine. Since glycoalkaloids are not destroyed by cooking, they spoil the taste and give a negative impression to buyers.

During storage, the potato tuber moth (PTM) causes severe damage of potatoes in many Gewogs of Eastern Bhutan. According to the RNR-RC Wenkher Professionals who have been with us during the time of our field visit, the PTM infestation rate ranged from 7-80% depending up on the conditions of storage in the Gewogs. Sprouting of potatoes is also found to be a problem during storage. Especially in mid-altitude areas, where potatoes are harvested early, the high temperature accelerates the physiological development of tubers resulting in early-sprouting.

Potato with high glycoalkaloid due to over exposure to sun light

Sprouting of Potatoes in store

Transportation: In most of the growing areas, potato growers themselves bring down their potatoes to the Samdrup Jongkhar auction yard. They carry potato bags from their fields or stores to the road head on their back or on horses. Sometimes, they need to wait for 2-3 days at the road head to find a vehicle. Once they find a truck which is going down to the auction yard, they negotiate the price and load the potatoes. The price is fixed on a 'per bag basis', which ranges from Nu 20-70 per bag depending up on the distance. As weighing facilities are not available in villages, it is difficult to charge transportation fee on a 'per kg basis'. Potato growers tend to be clever in taking advantage of this situation and try to put 60-75 kg potatoes in a perforated nylon bag of 50 kg capacity. But in the end they get a lower price for their potatoes as overloading causes damage to the tubers. In some Gewogs, one or two producers (generally the big farmers) collect potato from fellow producers and transport with their own potato to the auction-yard. The middlemen (sometimes truck owners also function as a middleman) also play a role of bulk buyers; they collect potato from the road-head collection centre and bring the product down to the auction yard.

Transporting potato bags to road head

Filling 50 Kg bags with over 60 kg potatoes

Various reports indicate that small producers often lack access to critical post harvest knowledge, technology and infrastructure. Hence, they prefer to deliver their produce to the market as soon as possible, no matter whether there is a glut or the prices are lowered in the market. Poor households generally find it more difficult than wealthier households to store their potatoes for a long period of time due to their urgent need for cash.

Box 4: Common Causes of Postharvest Losses

Mechanical Injury: Potatoes are highly susceptible to mechanical injury owing to their tender texture and high moisture content. Slipshod harvesting, poor handling, unsuitable packaging and improper handling during transportation are the main causes of bruising, cutting, breaking, impact damage, and other forms of injury in potatoes. Standing on potato sacks, the use of iron hooks to drag or lift the sacks, stacking huge loads of potato sacks on top of others also leads to mechanical damage to the tubers.

Pests and parasites: Infestation by potato tuber moth (PTM), formation of glycoalkaloids due to over exposure of potatoes to the sun, and invasion of tubers by fungi, bacteria, insects and other organisms, are the other major causes of postharvest losses. PTM readily attack fresh potatoes and spread rapidly, owing to the lack of appropriate storage facilities and control measures. Control of postharvest losses is becoming an increasingly difficult task, since the use of pesticides is not considered good practice due to consumer concern for food safety and hygiene.

Physiological Deterioration: Fruit and vegetable tissues are still alive after harvest, and continue their physiological activity. Physiological disorders occur as a result of mineral deficiency, low or high temperature injury, or undesirable environmental conditions, such as high humidity.

3.1.3 Middlemen (Intermediaries/Transporters/Local Traders)

In many countries the middlemen are considered the friends of producers, as these traders are specialised in performing various functions related to sale or purchase of goods and services. They normally buy from farmers, and sell to larger wholesalers. By doing this they serve the interests of traders- who do not have the time to carry out small purchases from local markets or from scattered farms. At the same time they also serve the interests of farmers by purchasing produce from the farm-gate for sale to large traders. However, in Bhutan their role is not well appreciated. Many producers see them as 'profit makers' or 'value capturers'. This could be one of the reasons that the involvement of middlemen/intermediaries is very low in the potato business. There are only a very few middlemen who purchase potatoes from the local growers, assemble them in one place and then transport to the auction yard. In most cases, the farmers themselves have to bring the potatoes to the road-heads and transport to the auction yard by using various modes of transport depending on road accessibility. Trucks and DCMs are preferred means and the transportation cost depends on the distance of the farms from the auction yards. This could be one of the reasons that the involvement of middlemen/local traders (See Box. 5)

3.1.4 Traders at the Auction Yards

The traders at the auction yards are mostly Indian merchants who purchase in bulk and sell the produce in the major border towns of Assam, like Barbetta, Rangia, Nalbari, and Guwahati. These traders are also involved in the import of fresh tubers from December to March every year. Auction yards are the most commonly used market outlets for trade of Bhutanese potatoes.

Farmers and middlemen find auction yards in the border towns convenient, as they can combine the marketing of potatoes with the purchase of their annual essential household food utenils. Moreover, there is no risk of default payments for sales since the team of FCB professionals manages the auctioning process.

Auctioning of potatoes in Samdrup Jongkhar

Loading potatoes for export to India

Box 5: A closer look at the middlemen

Mr. Duba, Proprietor of Duba General Shop, Yangnyer, Trashigang Dzongkhag
Interviewed on 16th Sept 2009

I have been running a general shop in this village and also engaged in the agri-business for the last 15-16 years. I collect potatoes, soybeans and kidney beans (rajma) from the villagers and bring them down to the Samdrup Jonkhar Auction Yard. Last year, I was able to sell 16 truckloads of agricultural produce, of which 60 bags were soybean, 130 bags were rajma and the rest was potato. This year up till now, I have sold 9 truckloads of potatoes. One truckload comprises 160-180 bags of potatoes. As we do not have a weighing balance to measure the weight of the large quantity in our village, I generally purchase potatoes on a 'per bag basis'. The standard bag full of potatoes is considered 50 kg and this year I paid around Nu 650 per bag for red potatoes and Nu 500 for white potatoes. Mostly the bag contains 4-6 kg more than the said quantity (50 kg) and that is how I compensate myself for the loss incurred while sorting. I am flexible in price and quality and will purchase all sort of potatoes from any farmer. After buying potatoes, I store them in the community store, which was built with the support of AMEPP/RGoB. Then I hire labourers for sorting and grading based on size and colour. Out of 9 truckloads, roughly 2-3 bags of potatoes were found damaged this year.
The price in the Auction yard is highly fluctuating and is largely controlled by Indian traders. However, I have good relations with the staff of FCB in Samdrup Jonkhar and hence before taking potatoes to the

auction yard, I check the price and quantity in the store by telephone. If the price is good and there is no glut in the store, then I send my potatoes for auctioning. Otherwise, I hoard them until mid September when the price in India goes up. During the peak harvesting season, I take a loan from BDFC and pay cash to the growers. If everything goes right, I can make a profit of Nu 28,000-50,000 from a truckload of potatoes. I am interested in investing more in this business but the storage capacity and supply is limited at my village.

Mr. Leki Wangdi, Gonpasingma, Zobel Gewog, Pemagatshel Dzongkhag
Interviewed on 12th Sept 2009

Collection of potatoes from the villagers and transportation to Samdrup Jonkhar for auctioning is a seasonal part-time business for my family. We collect both agricultural and dairy products from the villagers and sell to Samdrup Jongkhar market. This year up till now we have sold 4 truckloads of produce, which included 500 kg radish, 18 kg of butter, 1,500 balls of cheese and 720 bags of potatoes. Potato is the major marketable commodity of this village and many growers like to bring their produce to the auction yard by themselves. Mostly the small growers who produce only a few bags of potatoes sell their produce to our shop. We generally pay half of the amount at the time of purchasing and another half after selling the potatoes in the auction yard. The transportation cost is charged on a per bag basis, which is around Nu 30/bag.

There is a high risk involved in this business as the price at the auction yard keeps on fluctuating. Once we purchased 90 bags of potatoes in the village keeping little margin on the price offered in the auction yard. But when our potatoes reached Samdrup Jonkar there was a huge glut in the FCB store and I had to wait for 8 days. By that time, out of 90 bags around 12 bags of potatoes were damaged due to humidity and heat. Last year, when we were purchasing potatoes in the village the price was reasonably good at the auction yard but when we were ready to transport our potatoes to the auction yard, the price gone down. Hoping to fetch a better price, we hoarded the produce for a few weeks but the price did not go up. Interestingly, this year when we sold our potatoes the price was around Nu. 13/kg for large red, Nu 12/kg for white and Nu 11.5 /kg for medium size potatoes but now the average price has reached Nu 18/kg. To minimize the risks and generate more income it is necessary to improve the information flow regarding the price and demand and also develop storage facilities. We also request to have one marketing shed at the junction of the road in our village where trucks can be loaded.

Mr. Zhogpola Tshangkhang, Bumdeling, Trashi Yangtse Dzongkhang
Interviewed on 15th September

I have been engaged in the agri-business for the last 35 years. I purchase potatoes from the villagers, store for a few weeks and then sort, grade and pack them into standard size bags. Then I hire a truck and transport them to the auction yard. It is not difficult to get a vehicle but road conditions are not good. The transportation cost is around Nu 60/bag and damage during transportation is 2-3 kg/bag losses. In former days, there used to be many small vendors with Rickshaw and Bicycle involved in trading of Bhutanese potatoes in Samdrup Jonkhar. But in these days, there is only one option, i.e. FCB managed auctioning system for sale of potatoes. Last year there was glut of potatoes at the auction place when I brought my potatoes to Samdrup Jonkhar. Hence, I had to wait for about a week and spend Nu 300-500 in a day for lodging and food. In one of the trips, I had to sell my potatoes at Nu 5/kg whereas the price I paid for that lot to the growers was Nu 8/kg. This year I got a good price, Nu 14-18/kg. The business goes like this, sometime I make a good profit, and other times there are losses. But I am still interested in continuing with this business and I always hope there will be more buyers in the auction yard and it will take less time to sell.

3.1.5 Processing Agencies

Bhutan imports most processed potato products like chips and other snacks from India, Thailand and other countries in the region. Very small quantities of homemade potato chips are available in grocery shops, restaurants and small stalls (Nidup et al, 2007). There are only a few processing units, like HIFI Enterprise in Samdrup Jongkhar in Bhutan for making chips and crisps. Under the Business Opportunity Fund (BOF), the Agriculture, Marketing and Enterprise Promotion Project has supported a few enterprises in creating value addition by converting potatoes into chips. Tashi Namgyel is one such enterprise involved in the value addition of potato and other agricultural products. Apart from these enterprises, there are few household level enterprises which produce potato chips, pack in polythene bags (150 -250 gm/pack) and sell at prices ranging from Nu.10 to Nu.20 in the local market. Some hotels, restaurants and bars also prepare French Fries and other items from potatoes. NPHC has trained some growers to make chips using a fully automatic frying pan at home.

These initiatives seem important to take advantage of the opportunity through diversifying potato markets. However, the study conducted by MTI in Eastern Bhutan suggested that the net realization of Bhutanese potatoes may be better when sold without processing (Sherpa Consultancy, 2000). Furthermore, in comparison to imported chips, the packaging, taste and appearance of locally produced potato chips is very poor. Hence, a detailed economic analysis is needed to look at the issue whether to promote small-scale processing units for making potato chips or related by-products or to encourage farmers to sell their produce as table potatoes or seed potatoes.

3.1.6 Vegetable vendors/Retailers

Non-storing retailing is the most prevalent practice in Eastern Bhutan. In most cases, the growers bring their produce to the designated market places (mainly the Sunday Market) and sell it by themselves. Only in town areas, do local vegetable vendors buy potatoes from the growers at the farm gate and sell to domestic consumers through their grocery stores/ stalls. The profit margin from the sale of potato is not lucrative in comparison to the sale of other fruits and vegetables. As most of the institutional buyers (Boarding Schools, Police, Army) purchase a bulk quantity of potatoes for several weeks directly from producers, so the quantity of potatoes sold in a day is generally less than 50 kg and the profit margin is around Nu. 1-2/kg (Pers. comm. with retailers, Aug 2009).

Box 6: A closer look at the retailers

Ms. Dechen, Samdrup Jonkhar
Interviewed on 21st August 2009

I originally come from Thimphu and have been running a grocery shop since my husband got transferred to this Dzongkhag. I sell all sorts of vegetables, fruits and spices depending upon their availability. I generally purchase vegetables and fruits from middlemen. But I buy some locally grown fresh vegetables and NWFP like ferns, mushrooms, cane-shoots, zanthoxylem directly from producers. My total sales in a month are around Nu 15,000 and over 50% of which is represented by potato. On an average I sell 700 kg of potatoes in a month. This time I bought red potatoes at Nu 15/kg and white potatoes at Nu 12/kg from bidders at the FCB auction yard and am selling red potato at 20/kg and white potato at 16/kg. Damage while keeping potatoes for sale in the shop incurs losses of around 5%. Most of the consumers buy potatoes from here for table consumption (cooking as vegetables) and they say that the taste of Bhutanese potato is better than the Indian potatoes.

In retailing vegetables the profit margin is minimal due to high competition. There are many producers acting as non-storing retailers; they come to the town with baskets-full of vegetables and sell the produce. However, as potato has a longer shelf-life than many fresh vegetables like mushrooms, tomatoes, ferns, cauliflower etc, there is less risk in the potato business. I am interested in expanding my business but it is not easy to get a loan from the banks and to have a consistent supply of vegetables and fruits from the middlemen or farmers.

Rameswor Vegetable Shop, Samdrup Jonkhar
Interviewed on 22nd August 2009

We have been selling vegetables and fruits for the last 30 years. Our shop is registered with the Regional Trade and Industry Office at Samdrup Jonkhar. As per RGoB rules we pay sales tax and keep on renewing the license. We generally buy local potatoes from June to November from the bidders of the FCB auction yard paying Nu 1/kg more on the auction price. However, from December to May we buy Indian potatoes and sell them in the local market. We keep Nu 2-3 margin in a kg while retailing to the local consumers. Our daily sale is around 50 kg/day. The net profit from the sale of potato is not very high but it is one of the vegetables sought after by almost all customers.

Except for potato and chilli, all the vegetables (cauliflower, cabbage, tomatoes, onion etc) we sell are purchased from nearby Indian towns. Though Bhutan offers good potential for the production of diverse types of vegetables, their cultivation on a commercial scale is limited and the availability of locally grown vegetables is far less than the demand. We think that Bhutanese farmers should focus more on the production of off-season vegetables in a commercial manner.

Non-storing Retailers, Gangola, Mongar
Weekend markets are very popular in Bhutan for selling and buying locally grown vegetables, fruit, dairy products and handicrafts. In every town there are spaces allocated for the marketing of vegetables. Generally, every Saturday and Sunday growers come to the sabji bazaar (vegetable market) with baskets full of their agri-produce to sell to local residents/urban dwellers who buy vegetables, fruits and other products for the coming week. Gangola-a road side RNR sales centre was in strategic location established by RAMCO with the support of Mongar Dzongkhag and funding of GoI with an aim to provide opportunities to the rural producers to sell their produce. The market shed is located at the junction of two roads; one goes to Lhuentse and another towards Mongar-Samdrup Jonkhar. Every passenger who passes through this road has a chance to see the local products or purchase fresh vegetables. Consumers say that the vegetables sold in this market are costlier but fresher than in the grocery shops. Interestingly, in comparison to other vegetables which are grown at a small scale, not many growers come to sell their potatoes in such market. Potato is somehow considered as product to be sold in bulk.

3.2 Support Service Providers in Subsector

Along with Regional Agricultural Marketing and Cooperative Office of Department of Agricultural Marketing and Cooperatives, the lead organizations that provide agricultural support services in Bhutan, particularly in the Eastern region are:

1. Druk Seed Corporation (DSC)
2. Dzongkhag Agriculture Office (DAO)
3. Food Corporation of Bhutan (FCB)
4. Agricultural Marketing and Enterprise Promotion Project (AMEPP)
5. Bhutan Potato Development Programme (BPDP)
6. Bhutan Development and Finance Corporation (BDFC)
7. Regional Trade and Industry Office (RTIO)
8. Renewable Natural Resources Research Centre (RNR-RC), Wengkhar
9. Bhutan Chamber of Commerce and Industry (BCCI)
10. Agriculture Machinery Centre (AMC)
11. National Plant Protection Centre (NPPC)
12. National Post Harvest Centre (NPHC)

Beside these organizations, there are many donor support programmes and RGoB departments and units provide support in one way or another to the development of the agriculture sector in general and the potato value chain in particular. However, all these support providing agencies plan and implement activities as per their own organizational mandate. They seek support from each other in implementing activities, but there is not one single forum or formal platform where all of them can sit together on a regular basis to look at existing practice and functions at each level of the value chain, identify areas of interventions and plan activities for enhancing the competitiveness of the subsector.

3.2.1 Druk Seed Corporation (DSC)

The DSC is mandated to function as the national seed grid and meet the domestic demand of quality seeds and plants of recommended and released varieties plus fertilisers to support agriculture and horticulture development in Bhutan. It is the sole agency dealing with the production and distribution of seed potato to the farmers through the network of CAs, who place their order to the DSC between December and January along with an advance payment of 50% of the total cost. The DSC delivers the seed potato either directly to the CAs or at the distribution points as per request. The transportation cost of the seed potato to the various Dzongkhags is borne by the MoA.

During the year 2003, there were about 475 registered seed growers (RSGs) across the country located at various altitudes out of which 359 were involved in seed potato multiplication. Initially, the growers were provided with all the necessary inputs for production by means of credit. Later, inputs like fertilisers and chemicals were withdrawn and only seed was given in credit to the growers as growers had become

hugely in debt. The repeated failure of growers to repay the initial cost due to a poor harvest or not complying with the agreement, while they were also selling produce on the open market, brought the programme into disrepute. In 2003 the new management of DSC introduced a 'cash and carry' system in the programme with the objective of reducing the accumulation of outstanding dues against the growers. The introduction of this system unfortunately reduced the numbers of contract growers. This reduction in numbers was too large for a corporation which was aiming to form farmer's groups.

3.2.2 Dzongkhag Agriculture Office

All the six Dzongkhags in Eastern Bhutan have a well elaborated Horticultural Development Plan, which aims to contribute to national development and the poverty reduction objective of the 10th Five-Year Plan. The Dzongkhag Agriculture Offices have a vast network of Extension Officers in each Gewogs in the East. Horticultural development interventions focus on crops that simultaneously satisfy all of the following four criteria: i) production potential; ii) proven market demand and/or were prioritized in the 9th Five-Year Plan iii) proven production technologies available within RNRRCs in Bhutan and iv) farmers' interest in cultivating. Potato fulfils all of these criteria and so is well qualified to be in the list of crops which require support from Dzongkhags.

Currently, DAO's support to the potato value chain is confined to (i) appointing CAs for supply of quality seeds, (ii) updating production profile through EOs (iii) providing technical support in capacity building of producers, and (iv) developing collection centers and market sheds.

3.2.3 Food Corporation of Bhutan (FCB)

The FCB is a RGoB initiative that was established to support agricultural marketing in 1973. The introduction of the auction yard system under FCB management in 1980 provided a mechanism to optimize the interaction between potato growers and buyers (Roder et al, 2007). Although the auctioning process does add to the cost, it is clearly appreciated by both potato suppliers and buyers (Roder et al, 2007).

Box 7: Details of the auctioning process for potato

- FCB owns the auction facility and facilitates the auction system through management and provision of facilities like storage and truck parking.
- After arrival each grower is given a Lot Card, as an acknowledgment for the receipt of goods based on which auctioning is done. The goods are stacked in the auction yard.
- At the time of auctioning randomly selected bags are slit open to allow buyers to assess quality.
- The lot is given to the highest bidder. Weighing of each bag is done after the bidding process. Producers who are not satisfied with the bid can retain their merchandise.
- After billing is completed, goods are delivered to the bidders. FCB collects payments from the buyers against the bills. A 24 hour grace period is given to the potato buyers for clearance of the bill amount. FCB charges a service charge of 6% (3% each from growers and buyers). In addition of Nu 2 is charged per bag to cover handling cost.

- Adapted from Roder et al (2007)

3.2.4 Agriculture, Marketing and Enterprise Promotion Project (AMEPP)

AMEPP was designed as a six year programme based on experience and lessons learned from the IFAD-funded Second Eastern Zone Agricultural Project. This project is being implemented in six Dzongkhags of the Eastern Bhutan. The goal of the Programme is to "enhance the livelihoods of about 22,000 rural households in the programme area living in conditions that suffer most from isolation due to lack of access to infrastructure." The programme has five components: i) On-farm Production; ii) Marketing and Enterprise Promotion; iii) Rural Financial Services; iv) Infrastructure Development; and (v) Programme Management. The expected outputs of the Programme are:

- Enhanced crop and livestock production support services
- Establishment of beneficiary and market focused produce marketing services
- Supported income generating activities and small rural enterprises
- Provision of gender and poverty-sensitive rural financial services by BDFCL
- Improved access to infrastructure and incremental irrigation infrastructure supplied
- Decentralized economic management

3.2.5 Bhutan Potato Development Programme (BPDP)

BPDP was established in 2004 as the National Potato Programme under the Department of Agriculture with its objective being to facilitate, develop, optimise and provide leadership on potato production in order to achieve food security and enhance sustainable rural livelihoods through increased production and cash income generation. The services of BPDP as the National Potato Programme include the following:

- Identify and develop potato varieties with market potential for seed export and processing qualities.
- Develop and support a pragmatic yet sustainable seed production and distribution system leading to seed export through producer groups.
- Develop and disseminate appropriate strategies to increase and maintain yields.
- Introduce and develop improved production technologies to reduce labour requirements.
- Develop and introduce new models for marketing seed and consumption potatoes.
- Optimise soil fertility management and conservation.
- Minimise loss in yields and labour due to weed, disease, insect and wildlife pests.
- Develop extension information materials and train farmers/extension agents
- Build, collaborate and coordinate relations with research centres, extension and other relevant institutions within and outside the country.

BPDP also provides training and technical assistance, information and documentation, facilitation of groups and information exchange through organising workshops, exposure visits, etc. BPDP has published a number of studies on potato production and marketing.

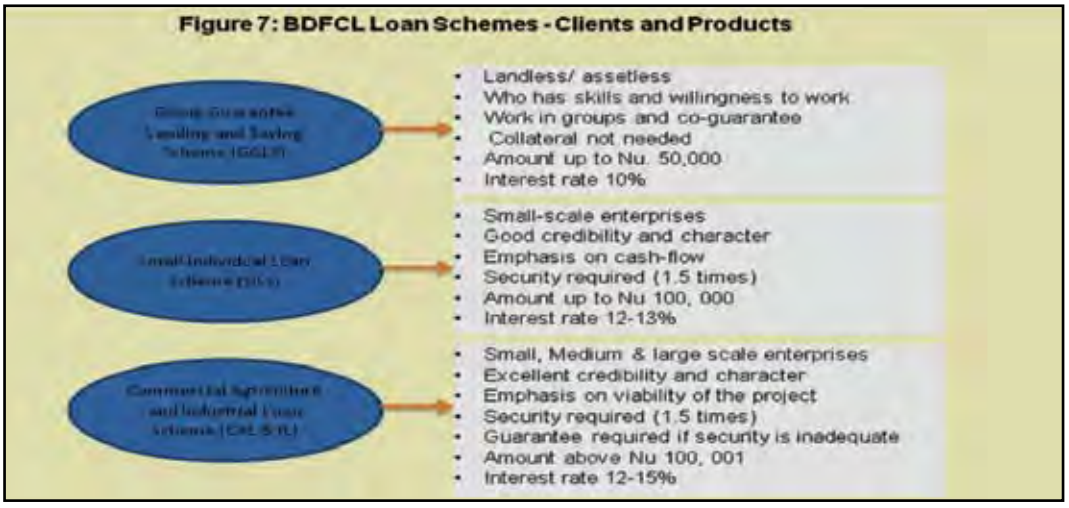
3.2.6 Bhutan Development and Finance Bank (BDFC)

BDFC is an independent development bank mandated by the Royal Government of Bhutan to provide the following services:

- Provide micro, small and medium financial services for the development of agricultural, commercial and industrial enterprises in the country
- Enhance the income of the people thereby improving their standards of living through provisioning of financial services in production, investment and marketing
- Provide financial services for private sector development
- Provide technical and advisory services to enterprises
- Alleviate poverty
- Mobilize external and internal funds for investments
- Dual mandate: Sustainability and social development

The products and services offered by BDFC are given in Figure 7. The bank has three different schemes to render the services to group members, individual entrepreneurs and micro, small and medium enterprises (MSMEs).

Figure 7: BDFCL Loan Schemes - Clients and Products



3.2.7 Regional Trade and Industry Office (RTIO)

There are two regional offices in Eastern Bhutan. The Regional Trade Office (RTIO) located in Mongar was established in 2005 and it looks after four Dzongkhags: Mongar, Lhuentse, Trashi yangtse and Trashigang.

Another office is located in Samdrup Jongkhar that looks after Samdrup Jongkhar and Pemagatshel. The RTIOs are mandated to provide the following services to micro, small and medium enterprises (S&MEs):

- *Information services:* Provide information to S&MEs regarding rules and regulations, procedures of business operations, market and business opportunities.
- *Intermediary services:* Facilitate business match-making
- *Training service:* Provide training mainly in the areas of business management and book keeping.
- *Event organising:* Organise information day, facilitate trade fairs and business match making.
- *Licensing:* Raise awareness about procedures and assist in business registration and licensing.
- *Business planning support service:* Help prepare business plan/report and project profile for environment clearance and access loan

3.2.8 Bhutan Chamber of Commerce and Industry (BCCI)

BCCI is the apex forum for the private sector. It was established as a non-government and non-profit making service oriented organization in the year 1980 under the Royal Command of the 4th King. However, it remained dormant from 1985 until 1988 due to a weak private sector base, lack of member's voluntarism and poor management (BCCI, 2008). Under Royal Command it was reinvigorated in May 1988 as a potential partner for nation building. The BCCI has a broad range of functions and services on its agenda. Some of these services include:

- Representation in both national and international forum
- Networking and linkages
- Business information services
- Training/capacity building and entrepreneurship development programme
- Organization/participation in trade fairs
- Business contacts and business referral services

The BCCI has two regional offices in the East; one is in Mongar and the other one is in Samdrup Jongkhar. These offices have been established in 2007 and consistently striving toward creating a business enabling environment. However, because of lack of funds so far they could not do any substantial work in the potato value chain.

3.2.9 Renewable Natural Resource Research Centre (RNRRC)

Institutionally, RNRRC is mandated to coordinate horticultural research programme at national level. However, the RNRRC office based in Wengkhar has particular responsibility for 4 commodity groups, namely citrus, pear and persimmon, vegetables and roots and tubers. Potato is one of the priority crops for RNRRC

Wengkhar, and hence 90% of the resources available for roots and tubers are allocated to it (RNRRC, 2008). RNRRC has been collaborating with various national and international development organizations in order to achieve the dual objectives of contributing to poverty reduction and increasing horticultural production. It has a well elaborated Horticulture Research Strategy and Plan, which is expected to deliver the following outputs (RNRRC, 2008):

- Informal and formal seed system to optimise seed quality available to producer and for export
- Production technologies adopted to optimise yield and quality, increase production, reduce labour cost and preserve production base
- Post harvest and marketing support to reduce storing losses and increase value addition
- Production area is expanded

3.2.10 Agricultural Machinery Centre (AMC)

The AMC is responsible for farm mechanization through the procurement and supply of farm machines and equipment such as power-tillers, tractors, planters, reapers, threshers, weeders, etc. AMC is also responsible for conducting R&D of small tools and implements and imparts training to farmers on the use and maintenance of farm machines and equipment. However, the marketing and supply of small tools and implements have been privatised and private entrepreneurs/shopkeepers, (such as Sherab Enterprise) deal with farm implements. The big machines like tractors and power-tillers which come to AMC through Japanese grants are subsidised, but their numbers are limited and create a huge difference in demand and supply.

3.2.11 National Plant Protection Centre (NPPC)

The NPPC is the sole distributor of pesticides through the Dzongkhag Agriculture Extension system. Based on demand, the NPPC procures and distributes fungicides, insecticides, herbicides, and rodenticide to the farmers. In addition, it is also responsible for providing technical advisory services to farmers and conducts R&D activities on the integrated pest management and diseases control in the country.

3.2.12 National Post Harvest Centre (NPHC)

NPHC is responsible for developing technologies for reducing post harvest losses through better handling and storage. NPHC is also responsible for providing training on grading, packaging and handling of potatoes during storage and transportation. Together with AMC, NPHC has worked on the introduction of mechanical grading however this has not been adopted because of mechanical problems (Tshering et al 2006).

CHAPTER FOUR: VALUE CHAIN ANALYSIS

4.1 Introduction to Value Chain

A Value Chain is a sequence of related business activities (functions), from the provision of specific inputs for a particular product to primary production, processing, sales and distribution, to final consumption. From an institutional perspective, a value chain can be defined as the organisational arrangements linking and coordinating the producers, processors, traders, and distributors who perform these functions.

Value chain (VC) analysis is a method for accounting and presenting the value that is created in a product or service as it is transformed from raw inputs to a final product consumed by end users. VC analysis typically involves identifying and mapping the relationships of four types of features: (i) the activities performed during each stage of processing/product flow; (ii) the value of inputs, processing time, outputs and a final value added; (iii) the spatial relationships, such as distance and logistics, of the activities; and, (iv) the structure of economic agents, such as suppliers, the producer, and the wholesaler (FIAS, 2007). According to Richter (2005) a value chain systematically takes all steps of a production process into perspective, it analyses the links and information flows, it reveals strengths and weaknesses, even losses in the process, the boundaries between the national and the international chain, the buyer's requirements, international standards, it allows international benchmarking, etc'. A value chain analysis helps strengthen production relationships to find solutions to the so-called critical success factors, which determine if a product meets the requirements with regard to quality, price, dependability, volume, design and speed of delivery and consequently improves competitiveness.

Value chains generally include three or more of the following: producers, processors, distributors, brokers, wholesalers, retailers and consumers. The partners within the value chain work together to identify objectives, they are willing to share risks and benefits, and invest time, energy and resources to make the relationship work. A value chain is therefore regarded as an actor oriented approach and considered very effective in tracing product flows, showing the value adding stages, identifying key actors and the relationships with other actors in the chain (Schmitz, 2005).

One of the dimensions of a value chain is its flow, which is also called its input-output structure. In this sense, a chain is a set of products and services linked together in a sequence of value-adding economic activities. In other words, a value chain is a series of participants along the entire marketing spectrum who collaborate to satisfy market demands for specific products or services to their joint and collective mutual benefit. The participants in the case of a potato value chain would be:

- Seed and associated input suppliers

- Growers
- Packer/graders/transporters
- Bulk buyers/bidders at auction yard
- Retailer/food service sector

The advantages of being a participant in a value chain would be:

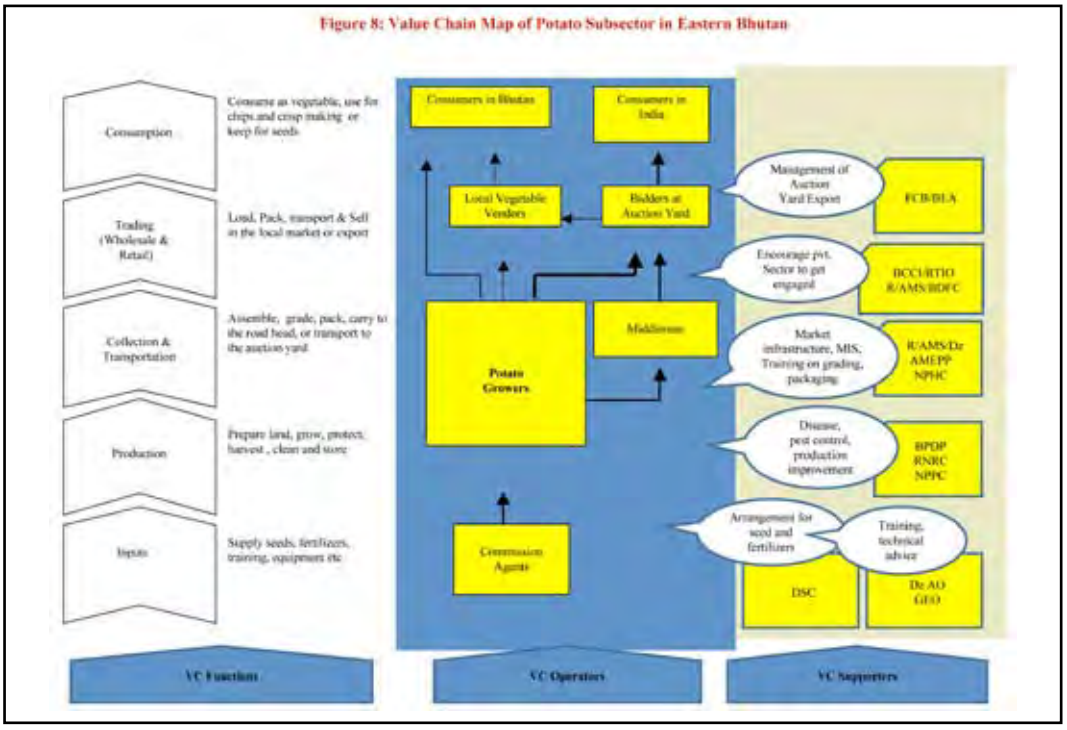
- Reduction in the cost of doing business
- Increase in bargaining power
- Improved access to advanced technology, information and capital
- Transport and logistics
- Formation of alliances
- “Trueness to promise” that strengthen backward and forward linkages
- Inventory management including the quality of the inventory storage

The key objective of value chain analysis is to find the most pressing bottlenecks first and address them in a systemic manner. These bottlenecks can be either issues related to functions, actors, linkages among them or even external factors such as policy and infrastructure. In addition, the isolation of the value added by each link in the chain can give useful clues to the areas where remediation is most needed, and where the most benefit is likely to follow from further focus of resources directed to improvement.

4.2 Value Chain Map

Value chain mapping means drawing a visual representation of the chain, which involves various linkages among the potato growers, inputs and logistical service providers, transporters, middlemen and traders. The value chain map depicts the flow of potato in the market, activities carried out at each stage of the value chain, the structure of actors and the support involved in the value adding process (Figure 8). The map shows general trend that prevails in the Eastern region of Bhutan. A more detailed location specific map for each sub-channel can be developed and functions at each level of the value chain can be spread over. For example, potato of Khaling Gewog in Trashigang may not follow the same routes that potatoes from Zhamling, or Gangjur Gewog in Lhuentse traverse.

Figure 8: Value Chain Map of Potato in Eastern Bhutan



The farmers in and around Khaling enjoy a different competitive advantages because of their proximity and easy access to transport and other necessary business services, and also have better access to market information. Since the production of potato in Khaling is much higher than in Zhamling, the farmers of Khaling are more interested in dealing with bulk quantities, whereas the farmers of Zhamling are more interested in selling their produce to middlemen. Accordingly, the map presented here can be used as a generic one but there is a need to provide more details such as identifying the number of producers, proportion of table potatoes and seed potatoes sold, local demand, quantity passing through different channels, transportation system, etc. This map consists of three elements: functions, operators and supporters. There is a clear distinction between operators and supporters of a value chain (Springer-Heinz, 2007).

Value Chain Operators: The people or enterprises performing the basic functions of a value chain are operators (also called actors). At one stage in the value chain, they become owners of the (raw, semi-processed or finished) product. Actors can be grouped by the following functions:

- *Production: A*ctors whose functions are directly related to basic agricultural production, including pre-cultivation, cultivation, harvest, or extractive activities.
- *Post harvest and processing: A*ctors whose functions are directly related to post harvest management (cleaning, sorting, packaging, etc) or processing of basic goods into value added products.
- *Trading: A*ctors whose functions are related to the buying and selling of the product(s).

Value Chain Supporters: The Associations, Network or Organisations who provide support services and represent the common interests of the VC operators. They remain outsiders to the regular business process and restrict themselves to temporarily facilitating a chain upgrading strategy.

Bus*iness Development Services:* The Services offered by individual actors, organisations, or companies to the value chain, which can be tangible (transport, machinery, storage, among others) or intangible (technical assistance, training, etc.).

As depicted in the map, many potato growers in Bhutan act as integrated value chain operators and perform two or more functions. They often arrange farm inputs (FYM, seeds etc) on their own, grow potatoes, harvest the tubers, grade and pack them, and then assemble to the road head and transport them to the auction yard for sale. The involvement of logistical service providers, middlemen and traders in linking growers with the market is very low. The potato growers have a lot of dependency on government services - right from inputs supply to auction management. They have grown to expect direct support services and subsidies from government agencies. In addition to technical inputs, training and market information and infrastructure (e.g. farm roads, road-head collection center, and auction yard) development, they also expect support for transportation, good prices and market guarantees for their potatoes from the Government agencies.

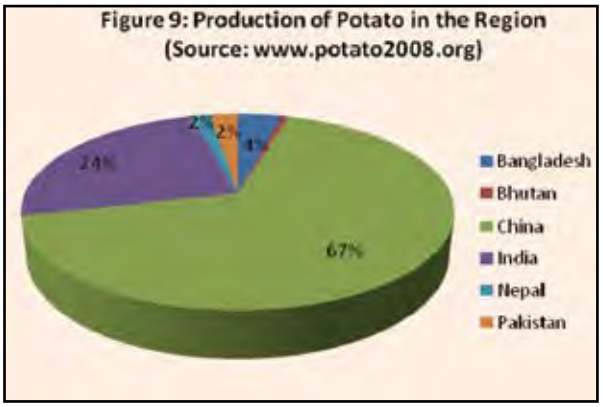
In the past, when farmers were in desperate need of an outlet for their perishable produce, the government agencies also became directly involved in marketing (Bellotti and Cadihon, 2007). RAMCO was also expected to provide transport service and to engage in selling of the produce. However being a facilitator, organizations like RAMCO is supposed to remain outsider and focus on creating the business enabling environment rather than getting involved in the core business. Direct provision of commercial services is not a good use of Government resources.

Though the potato runs first in terms of volume of agriculture trade and is placed second in terms of value of export (next to oranges), interestingly none of the private companies or business houses of Bhutan are engaged in the potato business. Almost all the traders who take part in auctioning and involved in export business are Indian nationals (pers. comm. with Complex Manager, S/Jongkhar).

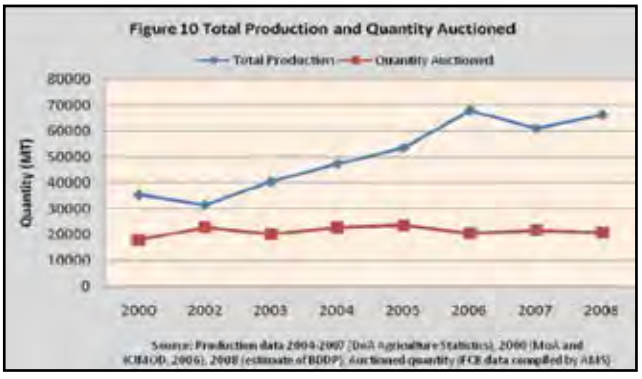
4.3 Market Analysis

4.3.1 Market Share and Production Potentials

The total production of potato in Bhutan is 61,133 metric tonnes (DoA, 2007). When comparing this quantity with the production of neighboring countries, it is a very small amount (Figure 9). China is the largest potato producer in the world with an output in 2007 of 72 million metric tonnes. It exports over 225,000 metric tonnes of potato in a year. India is the third largest potato producing nation in the world, with production in 2007 of around 26 million metric tonnes. Other neighbouring nations in the region also produce a good quantity of potatoes with output in 2007 of around 4.3; 2.6 and 1.97 million metric tonnes respectively in Bangladesh, Pakistan and Nepal (FAO, 2008).

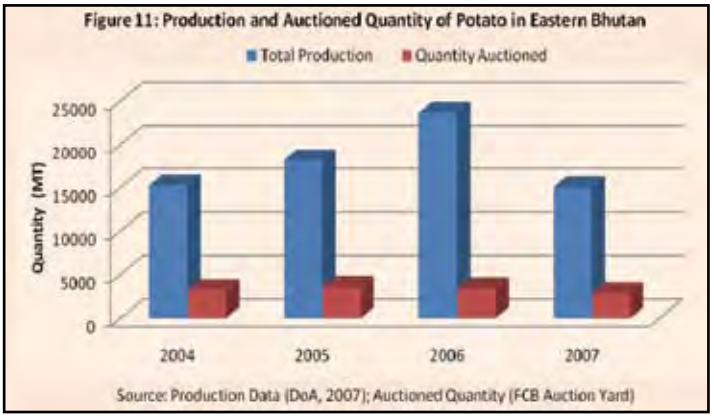


The trend in potato production in Bhutan is very positive. Several reports and studies have shown a tremendous increase in the production of potato in Bhutan after the construction of access roads starting in 1961 (Roder et al, 2008). According to the study conducted by PPD-MoA and ICIMOD, the production of potatoes in year 2000 was 35,340 tonnes and the area under its cultivation was 7,715 acres (MoA and ICIMOD, 2006). By the year 2007, production reached to 61, 133 tonnes and the area of cultivation increased to 14, 782 acres (DoA, 2007). During the period of last 9 years, production has almost doubled but interestingly there has not been an equivalent increase in



the quantity of potatoes auctioned for export. In the year 2000, the total quantity of potato sold was reported as 20,972 (MoA and ICIMOD, 2006), in 2001 it was 20,538 metric tonnes (WWMP, 2006) but since then either it has remained stagnant or there was marginal increase. In 2006, the total auctioned quantity was 20,620 metric tonnes, where as in 2007 and 2008, it was 21, 608 and 20,974 metric tonnes. Nidup et al (2007) have reported that the growers sell 72% of the total production in the market; of the total sold quantity the proportion is reported as 7% local market, 16% urban market, and 77% at the auction yards. However, in recent years the quantity sold in the auction yards has further dropped below 40%; it was only 31.6% in 2008, 35.3% in 2007 and 30.3% in 2006. The total national production and quantity sold in the auction yards is given in Figure 10.

In Eastern Bhutan the percentage of auctioned quantity is even less than the national average (Figure 11). For example in Trashigang Dzongkhag, which is considered as the leader in potato production in the East, the total production for the year 2006 was 10,150 metric tonnes, where as the auctioned quantity for the same year was 2,439 metric tonnes (about 24% of total production). In the year 2000, the total production of potato in Trashigang was recorded as 4,139 metric tonnes and the sold quantity was 2,281 metric tonnes, which made up 55.1% of the total production (RNR Statistics 2000 c.f. van der Wal and Wangchuk, 2002).



There is some discrepancy in the reported quantity at auction; Nidup et al (2007) reported that 56% of total production was sold through the FCB auction yards, 12% was sold in the urban market, 5% in rural market, 2% used as feed/gift, 15% kept for seed and 5% for home consumption. The simple calculation, which is made based on the findings of earlier studies and published data, shows that the auctioned quantity may not be over 40% if per capita consumption is around the level of 40/kg/annum (Table 13).

Table 13: Proportion of domestic need and auctioned quantity

Parameters	Quantity (MT)
Total Production (DoA, 2007)	**61,133**
Domestic Consumption (@40 kg/person/year for total population of 629,700)	**25,188** (41.2% of the total production)
Requirement for Seed (recommended amount is 1200 kg/acre but farmers normally use 1000kg/acre) for total of 14,782 acre under potato cultivation (DoA, 2007))	**14,782** (24.2% of the total production)
Auctioned Quantity (FCB data 2007 compiled by BPDP)	**21,608** (35.3% of the total production)
Post Harvest Loss (assuming 5% of total production)	**3,056**
Need for Import	**3,501**

The yield of potato varies considerably. Some areas like Paro, Bumthang and Wangdue with productivity conscious commercial growers have the highest average yields: 5.3, 6.5 and 7.4 tonnes per acre respectively, whereas in other areas, like Sarpang and Gasa, the yields are as low as 1.1 and 1.5 tonnes/acre. Gasa is declared as an organic area so no fertilisers and pesticides are allowed to be used there, whereas Sarpang is mostly subtropical area, its main crop is rice and environmental condition are not very suitable for potato. In the recent past, there has not been an increase in productivity. In 2000, the national average yield was calculated at 4,593 kg/acre (MoA and ICIMOD, 2006), whereas for 2007 it was estimated to be 4,136 kg/acre or 10.3 metric tonnes/hectare (DoA, 2007), which is one of the lowest for Asian countries. Examples of productivity level (metric tonnes/hectare) in other countries of the region are 19.9 for Pakistan, 16.4 for India, 14.4 for China, 13.9 for Bangladesh and 12.7 for Nepal (Table 14). A number of recommendations have been made in the past by various studies for increasing the productivity level with enhancing the access to irrigation, extension and high yielding inputs such as fertilisers and improved seeds. But as results have not been very encouraging, the question arises of how effectively these recommendations have been adopted. It has been learned that farmers could not make use of recommended levels of fertilisers due to inadequate access and the financial crunch. Since the time of manuring and the purchase of fertiliser coincide with the beginning of the school year, the cash requirement during Feb/March is the highest for farmers; the priority of their limited cash is purchasing school clothes and other stationeries for their children rather than purchasing fertilizers.

Though yield per acre is relatively low, the per capita production of potato is very high in Bhutan compared to other countries in the region (Table 14). The sloping land, rugged topography and rain fed conditions provide better options for growing potato than cultivating rice or other irrigation demanding crops. Farmers in Bhutan may take advantage of these conditions with their highly developed farming skills to give higher yields.

Table 14: Potato Statistics for Bhutan and its Neighbouring Nations

	Bangladesh	Bhutan	China	India	Nepal	Pakistan
Production(x1000 MT)	4,300	61	72,040	26,280	1,943	2,622
Production (kg/person)*	27	97	55	22.5	7.5	16
Consumption#(kg/person)	24	40	40	17	51	11
Cultivated Area (x1000 hectare)	310	5.96	5,000	1,600	154	83
Yield (MT/ hectare)	13.9	10.3	14.4	16.4	12.7	19.9

Source: Bhutan adapted from Agriculture Statistics, DoA 2007, others from www.potato2008.org;
* Production divided by Total Population of the country as mentioned in www.unescap.org/Stat
# Consumption for Bhutan (Nidup et al, 2007), others from www.potato2008.org

Box 8: Potato Statistics in Bhutan: Data Discrepancy and Limitations

Data available on the total production, auctioned quantity and local consumption of potato are inconsistent and incomplete. It is difficult to get reliable data since most growers and traders do not keep any records of their inputs or outputs. There are some data limitations, especially if data are used from different sources. For example in the year 2007, the DoA reported a total production of potato in Trashi yangtse Dzongkhag as 62 metric tons, whereas FCB data revealed a total auctioned quantity of potato from this Dzongkhag as 264.5 metric tons. This could be because if buyers prefer the potatoes of Trashi yangtse, producers from other places might have sold their potatoes in the name of Trashi yangtse.

As per Agriculture Statistics (DoA, 2007), the total production of the 6 Eastern Dzongkhags in 2007 was 15,051 metric tons and the auctioned quantity of the same year was 2,861 metric tons, which makes up 19% of the total quantity. However, various reports published by earlier researchers stated that the quantity sold in the market is over 50% of the total production. Scott (1983) reported the total production of Bhutan at 24, 923 metric tons and its marketable surplus at 16,075 metric tons. The commodity chain analysis revealed that the growers sell 72% of total production in the market and keep 15% for seed, 5% for household consumption and the remaining 2% for gift and feed. Of the total sold quantity the proportion is reported as 7% local market, 16% urban market, and 77% at auction yard (Nidup et al, 2007).

There is also some discrepancy in the reported values for per capita potato consumption. The survey carried out by Poats in 1982 estimated the average consumption of potato at 39.6 kg/person/year (Scott, 1983). However, Roder (1982) reported an average annual consumption of <5 kg for the 1970s. The difference between these two estimates is remarkably high and Roder et al (2008) indicated that earlier estimates overrated the consumption at that time, as the survey was limited to settlements with commercial potato producers along the national highway only. Roder et al (2008) further mentioned that the per capita consumption of potato by rural households is highly variable and estimating a national average is difficult.

According to the BPDP consumer and producer survey for 2005, the average national consumption of potato was 40 kg/person/year. The variability in reported per capita consumption is extremely high. The quantities consumed by urban households are as high as those for households in major potato producing areas in the world but nonproducing rural households consume lower quantities (Roder et al, 2008). As per the study, the consumption of potato (kg/person/year) in Thimphu and Phuentsholing was estimated to be 10-316 and 13-217 respectively, whereas the consumption of potatoes by rural households who produce potatoes for self consumption only was 10 kg/year (Roder et al, 2008).

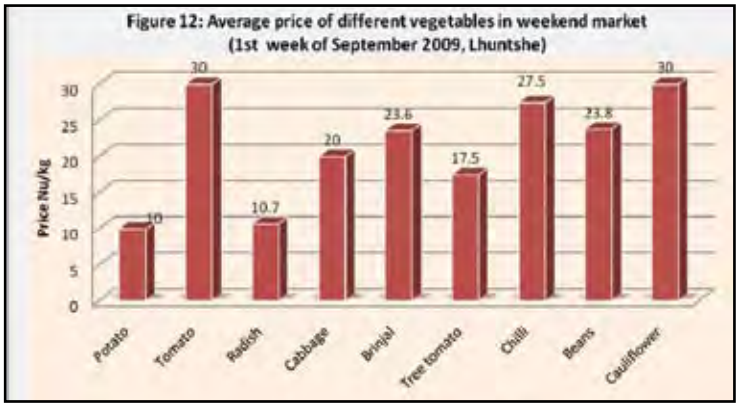
4.3.2 Domestic market

According to the Bhutan Living Standard Survey Report, the annual consumption expenditure on food is Nu 5,423/person; of which only Nu 554 (about 10%) is spent on vegetables that also includes potatoes (NSB, 2007). However, with the increase in urban population and the overall increase in potato consumption, the requirement for potato by the domestic market is increasing by about 7-10% (Roder et al, 2007). During the field survey of potato production areas in Eastern Bhutan it was learnt that of the total production, producers sell 69% of their potatoes in the market through different marketing channels as depicted in Figure 14. They keep 8% for their household consumption and 24% as seed for next season.

The prospect for marketing potato produced in Bhutan is very good, as the requirement of the domestic market is increasing annually due to the increase in consumption levels (SDC, 2008). The per capita annual consumption of potato in Bhutan is estimated to be 40 kg/person, which is expected to increase to 60kg/person by 2020 (Nidup et al, 2007). This level of consumption is much higher than the average annual consumption in Asia (24 kg/person).

The price of potato is relatively low compared to the price of other vegetables: A price survey carried out during first week of September 2009 in Lhuntshe showed that except leafy vegetables (e.g. broadleaf mustard, onion leaves, spinach, soruburu etc), ferns and cane shoots, all other vegetables cost higher than potato (Figure 12). Leafy vegetables, ferns, asparagus, cane shoot, coriander, broccoli and garlic leaves are sold as bundles and pumpkin, cucumber etc are sold on a per piece basis; hence their price is not included in the figure. Of all the vegetables, potato, beans, chili, cabbage and leafy vegetables (saag) are locally grown and sold in the weekend market. Potato is cooked together with beans, cauliflower and many other vegetables. It is well preferred by children in Bhutan and is very compatible with chili (Roder et al, 2008). The overall trend therefore promises well for the increase of the domestic market in future.

Prospects for marketing potato seed are also very good. The annual estimate of total seed potato demand in the country for 2004/2005 was about 4,040 metric tonnes, which is more than 10 times higher than the potato seeds sold by DSC (Gurung, 2005).



4.3.3 Export market

India is Bhutan's main trading and development partner and there is considerable open trade between the two countries. From June to November, Bhutan exports its potatoes to India, whereas from December to May, it imports Indian potatoes; though in much lesser quantities than those exported.

India: Most of the potatoes from Eastern Bhutan are supplied to the state of Assam in India through the auction yard in Samdrup Jongkhar. Almost all bidders in the auction yard come from India. They buy the bulk quantity, grade as per the requirements of their clients, repack and transport the potatoes to nearby cities in Assam. Potatoes from other parts of Bhutan are sold through Phuntsholing auction yard to the towns and cities of West Bengal, where there is usually a shortage of potatoes during harvesting time in Bhutan.

India has made tremendous progress in potato production and excess production frequently leads to glut in the market (Khurana, 2003). But thanks to a different seasonal production cycle, Bhutanese potatoes enjoy an excellent market in India (Box 9). In most parts of India, the bulk of potatoes are grown during the winter season under short-day conditions and are harvested from January to March; whereas in Bhutan, potatoes are grown as summer crop with seed planting in March and peak harvesting in July. From September to November there is a high demand for Bhutanese potatoes in India. Given the large population with a fast growing middle class it is expected that there will be increasingly strong demand for high quality fresh potatoes in India (SDC, 2008).

In 2007 the value of potato auctioned was Nu 231.31million. Bhutan's advantageous agro-ecological conditions also offers excellent opportunitities for the export of seed potato to India. There is a huge demand for Bhutanese potatoes in the neighboring Indian states of West Bengal and Assam where it is used as seed. The seed potato demand for the year 2002 for West Bengal and Assam was estimated at 732, 210 metric tonnes, and it can be highly significant if Bhutan meets only 1% of the total demand of these two Indian states (Gurung, 2005). However, the question of the sale of this genetic material, developed and maintained at a high standard at cost to the RGoB, should be discussed.

Bangladesh: There is also a promising alternative export market in Bangladesh. In May 2003, Bhutan signed the Bilateral Free Trade Agreement with Bangladesh. However, due to lack of established buyer-seller relationships, long transportation distances and the bulky nature of the produce potato traders prefer to supply to nearby Indian cities.

Nepal: The potato is Nepal's second staple food crop, after rice, and per capita consumption is estimated to be 51 kg a year, one of the highest for South-Asian

countries (FAO, 2008). Nepal imports a substantial quantity of potatoes via Indian traders during the time of potato harvesting in Bhutan. The price offered for potatoes in Nepal during August-October is higher than the price of potatoes in Bangladesh, Bhutan and India. This year (2009) in August and September, a few Indian traders exported Bhutanese potatoes to Nepal and fetched Nu 2-3 more per kilogram than in Indian States (personal communication with Brinda Prasad, Indian Potato trader based in Jaigaon, WB, India in Sept 2009) but the data is not reliably recorded in Bhutan. If access for agro-trade was improved and business relations strengthened, potato from Bhutan could enjoy an excellent market in Nepal.

Europe: Although potatoes are a main staple food (and sometimes categorized as vegetables) in many European countries, they offer few opportunities for suppliers from developing countries. Advanced storage techniques in Europe guarantee that potatoes can be supplied almost year-round at a low price (www.cbi.eu).

Box 9: Comparative Advantage of Bhutanese Potato

Owing to the RGoB's concern for nature conservation and the negligible use of pesticides and chemicals, Bhutanese potatoes are considered 'organic'. According to Indian traders who bid for potatoes in Samdrup Jongkhar auction yard, the taste of the Bhutanese potato is better and it fetches Nu 2-3/kg more than the Indian potato. Another comparative advantage for Bhutanese potato is the difference in the potato harvesting season. In India, the bulks of potatoes are grown during the winter season under short-day conditions and are harvested from January to March. Similarly, in Bangladesh potatoes are grown from October to April and in China, potatoes are harvested in March-April and kept until October. Where as in Bhutan, potatoes are grown as a summer crop with seed planting in March and peak harvesting in July, when there is a high demand for fresh potatoes in India and Bangladesh. Therefore, the potato in Bhutan is likely to remain as a strategic crop for enhancing rural income and earning foreign exchange.

Another comparative advantage of the Bhutanese potato is its high demand as seed in India. Having been produced in a cold temperate zone with the traditional seed exchanging practice, the potential for disease is very low in the Bhutanese potato. Furthermore, the RGOB's initiatives in encouraging farmers to replace seeds with certified ones contributed a lot to the production of disease free potatoes that fetch a very good price in India.

4.3.4 Marketing Channels

Marketing channels describe the routes taken by products from producers to consumers. The route followed by Bhutanese potatoes can be broadly divided into two types:

a. Informal and Unorganised Channels
b. Semi-organized and Organised Marketing Channels

Figure 13 shows the four most common marketing channels for Bhutanese potatoes. Channel A and B represent the informal and unorganised sector because growers and consumers deal directly with each other. It is made up of many small growers who either sell their produce to institutional consumers or to individual consumers. Institutional consumers include local organisations such as boarding schools, hospitals, army, police and monasteries; whereas individual consumers include the local population, urban dwellers, civil servants, construction workers and others.

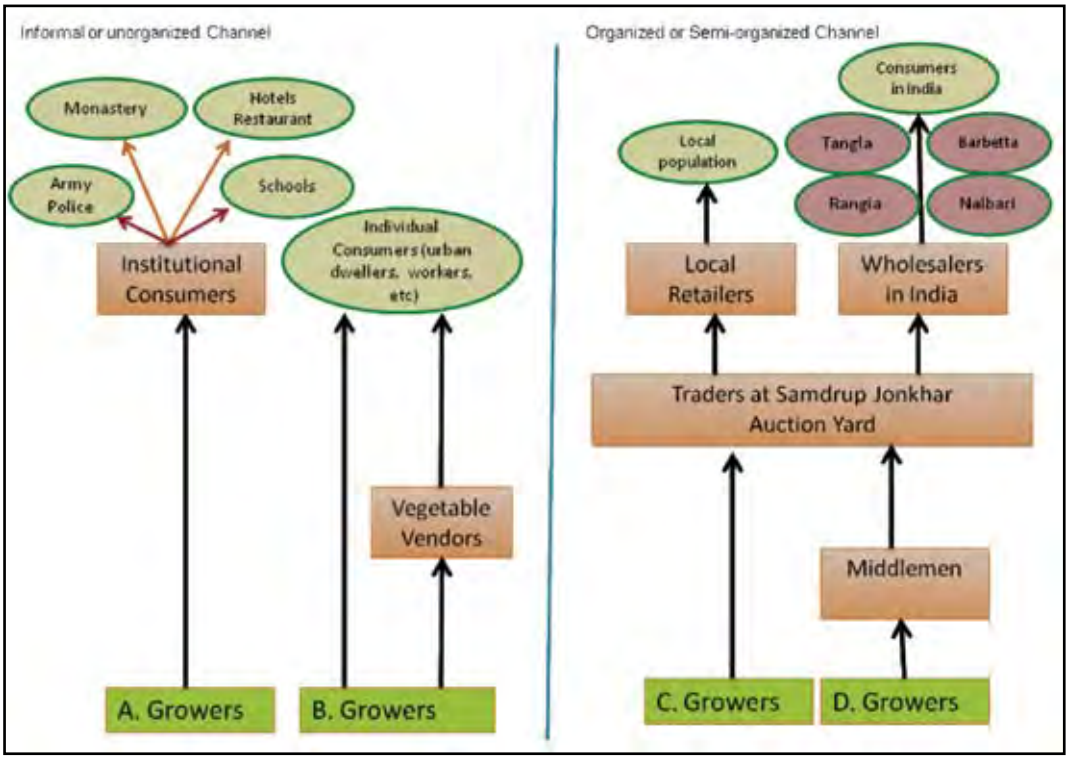
Non-storing retailing is the most prevalent practice in Eastern Bhutan. In most cases, the growers bring their produce to designated market places (mainly Sunday Markets) and sell it by themselves. In some cases, the local vegetable vendors buy potatoes from growers at the farm gate and sell them to domestic consumers at weekend markets or through grocery stores/ stalls.

The semi-organised or organised marketing channel is made up of a few contractors or growers, who bring potato to the auction yards. Channel C is most common in areas where potato production is relatively high and growers have easy access to bringing their produce to the auction yard and selling it to bidders through the FCB managed auctioning system. Channel D, with a contractor added, is more common in areas where the production of an individual farmer is less than a truckload. In this case, local traders and transporters (also known as contractors) buy potatoes from growers at the farm store/road head collection centre and sell it through the auction yards. The growers, traders or transporters from Eastern Bhutan prefer to use the auction yard located at Samdrup Jongkhar. The buyers at this auction yard are mainly Indian traders from neighbouring border towns.

During the visit to the auction yard it was observed that even the bulk suppliers of potatoes do not follow sorting, grading and packaging practices as per the buyers' requirements. They tend to put big, medium and small size together in a bag with a few injured or damaged potatoes as well, though the buyers offer the price based on the following features:

- Quantity (larger the better, at least 10 bags)
- Size of the potato (large and medium fetch better price than small size)
- Quality (clean, free from injury and well shaped)
- Colour (red fetches better price than white)

Figure 13: Marketing Channels of Potato Distribution in Bhutan



The figure above depicts local shops, schools, hospital, army, police and monasteries constituting a good domestic market for the farmers. For example the Agriculture Statistics of 2007 reveal that the total production of potato in Bhutan was 61,133 metric tons, of which only 21, 608 metric tons (35%) was sold in auction yards. Out of the remaining 65% of total production, about 24% (calculated @1,000 kg/acre for 14780 acre of land – as practiced by the farmers) plus 14,780 metric tons is used for seeds, whereas the rest of the potatoes are consumed locally (either consumed by households or supplied to local market). If the per capita consumption is taken to be 40 kg/person, this makes the annual requirement to meet the demand of the total population of Bhutan 25,188 MT of potatoes.

There are a total of 23 traders registered with FCB, Samdrup Jongkhar, of which only 2 traders are Bhutanese nationals. In the year 2008, the Bhutanese bidders bought about 80 truckloads of potatoes but

Box 10: Potato prices hit all-time high in India

This season the retail price of potato touched Rs 20 a kilogram; call it a short supply from neighbouring states or no quality production by local farmers, the common people are having a tough time and may face more difficult days in future as the price might cross Rs 25 after Dussehra. Due to scanty monsoon and a possible drought looming large over most parts of India, the supply is not `encouraging'. On the other hand, with a `shift of focus' and agriculture getting `lesser prominence', farmers are actually not `interested' in growing vegetables, thus disrupting supply-demand chain.

Source: expressbuzz.com (8/31/2009)

this year (2009) they are not engaged in the auction purchase (pers. comm. with Complex Manager, Aug 22, 2009). The observation is that mostly 7-10 Indian traders take part in bidding for potatoes during the auction time, and by and large are controlling the market.

As depicted in Figure 13, after buying potatoes from the auction yard, most of the Indian traders grade and repack the potatoes in standard size bags and sell them to wholesalers in the nearby Indian border towns (Rangia, Tangla, Barpetta, Nalbari). Some of them even sell to the local retailers and processing industries. A few traders also store the potatoes for some time hoping to fetch higher prices during festival seasons in India (Box 10).

The small or under-size potatoes are generally separated for seeds. They fetch a very low price at the time of harvest but receive a higher price than table potatoes during potato planting season. Hence, the traders often hoard seed potatoes till the planting season in India, which is November-December.

4.4 Economic Analysis

4.4.1 Price dynamics

Generally speaking, the price of an agricultural commodity tends to go up during the planting period and eases down during the harvesting period. But in the case of Bhutanese table potatoes, this does not apply. As the peak harvesting time of potato in Bhutan coincides with the peak demand period in India, Bhutanese potato fetches a very good price. The seed potatoes however do not receive a good price during the time of harvest but fetch a better price during the potato planting time in India (November-December). Hence, some traders tend to buy seed potatoes at lower price during harvesting time and hoard the commodity for 4-5 months in expectation of fetching better prices during the planting season. Whether the cost of cold storages operation for hoarding seed potato until planting time gives greater benefit than selling during peak harvesting time could be one of the areas which need to be investigated in the context of Bhutan. The possible loss caused by PTM, damages incurred due to high humidity and other storage conditions need to be assessed against the price fetched after 4-5 months of storage. A few governments intervene to control the price of potatoes or dampen their fluctuation by buying potatoes at harvest time when they are cheap, storing for 4-5 months and selling them later when they are scarce. This idea makes sense if storage costs and losses from damage are lower than the expected profit.

During the time of planting, it is difficult to predict the price to be fetched. However, by the months of March-April, some genuine guesses can be made by having a closer look at the harvest of Indian potatoes. If there is a boost in potato production in the

states of India, the price is likely to have gone down for Bhutanese potatoes and vice versa. As the domestic market is very small and production is much higher than the local demand, the price cannot be controlled or determined by Bhutan itself. The major factors affecting the price are as follows:

Weather in key growing regions of India plays a major role in determining the price of the harvest. Particularly cold spells, frost and heavy rains during tuber formation result into low yields and high prices. Whereas good weather conditions lead to higher production but lower per unit price.

Price of other vegetables in India also affects the price of potato. If the price of other vegetables is very low then the price of potato also goes down and vice versa. This cross-substitution effect is well documented.

Demand for potato from other cities and food processing industries could also have a role in determining the price of potato. If there is high demand for Bhutanese potatoes in Bangladesh, Nepal and other countries (besides neighbouring states of India), then the price may go up. However, because of the long distances, high transportation costs from Bhutan to third countries and the lack of business relationships, at present this factor does not play a significant role in fixing the price.

Based upon economic theory the price of commodity generally falls when the quantity of supply is high. But in case of Bhutanese potato the domestic demand and supply conditions of the country are not the determinant of the price. It is governed by the Indian markets; if there is bumper production in India the price of Bhutanese potatoes go down and vice versa. Unlike the price of other food commodities, the potato price is highly unstable and unpredictable. For example, the auction price up till August 23, 2009 was more than double than the price in previous year (Bhutan Times, 30/8/2009). As presented in Table 15, this year there is more than a two-fold increase in auctioned quantity vis-à-vis the auction price and the monetary value of potato against the previous year. The resulting fluctuation in quantity and price places a heavy burden on the infrastructure at auction yards.

Table 15: Comparison of total quantity, value and price of potato auctioning*

Year	Quantity		Value		Price	
	S.Jongkhar	Phuntsholing	S.Jongkhar	Phuntsholing	S. Jongkhar	Phuntsholing
2008	0.838	2.167	5.099	12.8	6.08	5.91
2009	3.795	5.985	46.125	80.23	12.15	13.4
Times Increased	**4.53**	**2.76**	**9.05**	**6.26**	**2**	**2.27**

*Cited from Bhutan Times 30/8/2009

This year the price of potato was exceptionally good for the farmers of Bhutan and traders who exported the potatoes to Nepal have even fetched extremely high price (Box 9). Figure 14 shows both the whole sale price and the retail price of potatoes in Bhutan and its neighbouring countries, which are the promising export market for Bhutanese potatoes.

Figure 14: Comparison of Potato Price in the Region

Source: Internet search, 3rd week of August 2009
Note: Local currency converted into Nu. using Currency Converter

4.4.2 Production costs

The production costs of potatoes vary between area to area and farmer to farmer depending upon weather conditions, soil type, the level of farmers' cultivation knowledge etc. On average it is calculated as Nu 7.6 per kilogram of potato. Nidup et al (2007) reported the cost of production for small, medium and large producers as Nu 7.2/kg, Nu 4.6/kg and Nu 3.9/kg, respectively. Roder et al (2007) mentioned the cost of production as US$ 1,465/ha and yields/ha as 12 metric tonnes; this makes about Nu 5.64 per kg of potato produced, whereas in the present study the average cost production comes to slightly higher. This might be because of the rise in price of inputs and labour costs during the last 2-3 years.

A breakdown of the average production costs shows that seed is the largest input component (34.6% of total input costs), followed by labour costs (31.3), FYM (23%), draft power (6.4%), and fertilizers (4.6%). A summary of average production costs with calculations based on the survey carried out in the year 2009 is provided in Table 16.

During the survey, it was noted that the most potato growers do not keep a record of labour inputs used for production. They generally use FYM prepared by themselves and do not keep a record of the number of baskets of FYM used in the farm. Similarly, there is a general trend of providing food and drinks beside their daily wage to the farm labourers. Hence, it is difficult to calculate the exact cost of labour inputs. Furthermore, many growers guard the crop to protect from wild animals (mainly from wild pig) for about 2-3 months. Regardless of the size of land, whether it is only one Langdo (one third of an acre) or 5 Langdo, the cost involved in guarding the crop is the same. This makes it difficult to get the right figure.

Table 16: Cost of Potato Production in Eastern Bhutan

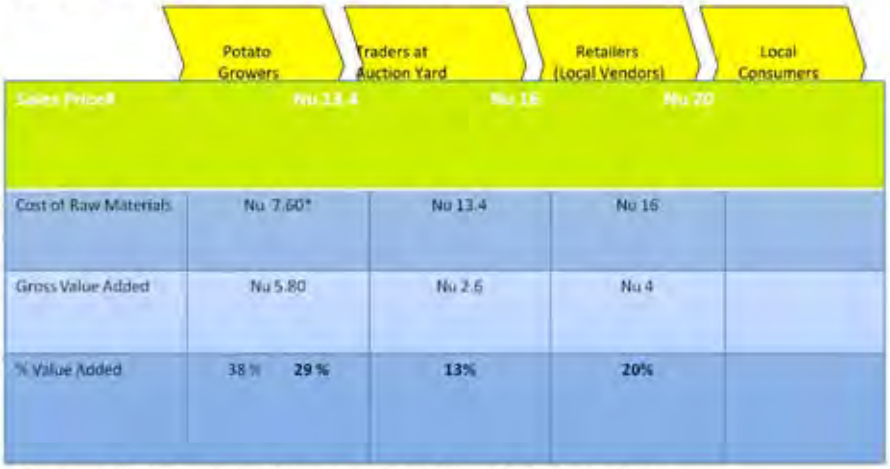
Component	Cost * (Nu/kg)	Remarks
Seed	2.63	Cost of seeds represent **34.6%** of total production cost
FYM	1.75	Cost of FYM represents **23%** of total production costs (calculated @ Nu. 20/basket of 30 kg FYM)
Fertilisers	0.36	On an average **4.6%** of the production cost is spent for fertilisers, however 35% growers do not use any chemical fertilisers in potatoes
Labour	2.37	Of total production cost, **31.3%** is spent for labour (hired or household member) force engaged for preparation of land, FYM application, guarding, weeding, harvesting etc
Draught Power	0.49	Drought powers accounts for only **6.4%** of total production costs
Total	**7.6**	Production costs vary greatly depending on the terrain, farm size, mode of cultivation, disease and pest infestation and the accessibility to resources. It was reported as low as Nu 2.9/kg to Nu 13.04/kg (as crop is heavily damaged by wild pig)

*Calculated based on figures provided by the respondents during the survey carried out in Aug-Sept 2009

4.4.3 Distribution of Value Addition

Figure 15 shows the distribution of value addition across the value chain actors. Value addition is the difference in sales price and cost of inputs (raw materials) at each stage of the value chain. In Bhutan, the role of local traders and middlemen is negligible, and there are very few actors who receive a share of the value addition and profit margin. Many potato growers act as integrated value chain operators and perform two or more functions in the chain. They grow potatoes, harvest the tubers, grade and pack them, and then assemble produce to the road head and transport the potatoes to the auction yard for sale. Their value added comprises of 67% of total value addition. Of this net value addition, 35.15% is production cost and 31.85% value is added while handling the product after harvest.

Figure 15: Distribution of Value Addition Across the VC Actors



#Price is recorded while interviewing VC Actors during 3rd week of August 2009 in Samdrup Jonkhar
*Cost of seed, fertilizer, labour, drought power) is Nu 7.03 per kg, which makes 35.15% of total value addition

The price differential between producer and consumer prices is 33%, which is not as high as in other countries where potatoes find their ways to consumers through several actors. In Kenya, for example, the price differential between producers and consumers are reported up to 300% (Muthoni and Nyamongo, 2007). Thus it can be inferred that the net profit (or loss) for the potato growers is higher than that for other VC actors (Fig 15).

4.4.4 Competitiveness

The competitiveness of the potato subsector was analyzed using Porter's Diamond[1]. According to Porter there are four conditions that support or hinder the organization from being competitive in the market:

- Demand Conditions
- Factor Conditions
- Related and Supporting Industries
- Firm strategy, structure and rivalry

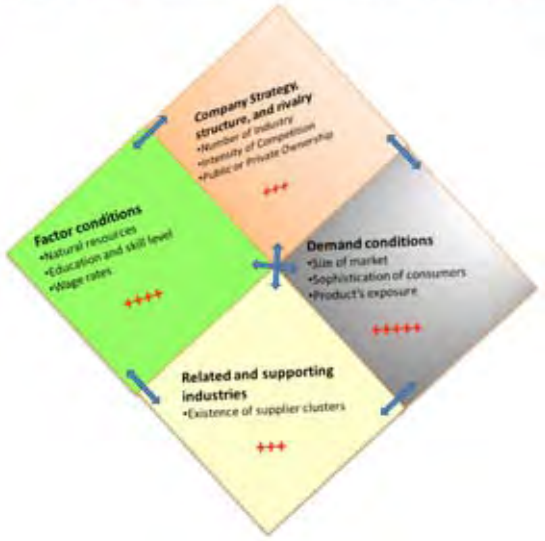
***Demand Conditions*:** High level local market demand creates a national advantage. In Bhutan, potato is primarily considered an export commodity: and about 40% of the total production is exported. Bhutan has a free trade agreement with India, where there is a very high demand both for table potato and seed potato. There is also a demand for Bhutanese fresh potatoes in Nepal and Bangladesh. The trend of potato consumption in the domestic market is also very encouraging. It is an affordable food available to most people (rich and poor). The per capita consumption of potato

1 Michael Porter in his book, 'The Competitive Advantage of Nations' proposed a four factor model of national advantage known as 'Porter's Diamond'.

in Bhutan is much higher than the Asian average. So as per Porter's Model, demand conditions can be seen to be highly favourable.

***Factor Conditions*:** Factor conditions are basically the production factors that include the suitability of agro-climatic conditions, availability of raw materials, skilled human resources, technology and capital. Except for the shortage of labour and limited access to transportation, all other conditions are highly favourable for the potato value chain in Bhutan. As highlighted in Table 2, the potato value chain is suitable for the agro-climatic conditions of Bhutan and fits in well with the development goal of RGoB. The rain fed conditions and sloping terrain suit to potato cultivation more than irrigation demanding cash crops.

Figure 16: Porter's Diamond of National Competitive Advantage



***Related and Supporting Industries*:** In terms of supporting industries, the competitiveness of the potato subsector is rated as medium. The involvement of logistical service providers and private business firms is very minimal in the potato business. Support services are very poor and supporting industies lack resources and capacity to carter to services. However, (i) the strong focus of RGoB in promoting organic farming, IPM and quality seed production, (ii) community based seed production and seed potato growers groups (iii) well established auction facilities managed by FCB, (iv) a market information system and infrastructure being developed by MoA, together give a good competitive advantage to Bhutanese potatoes. Furthermore, trucks generally supply goods from urban to rural areas; so that, while travelling back they are in position to carry potatoes at reasonable rate.

***Industry strategy, structure and rivalry*:** The number of firms/enterprises, the size of enterprises and domestic rivalry all affect the level of competitiveness. While the particular firm or industry may prefer less rivalry, more local rivalry is better for the growth of subsector as it puts pressure on firms to innovate and improve. In Bhutan, local rivalry in the potato subsector is very small; there are not many competitors in the business.

According to Porters Diamond model, the competitiveness of the Bhutanese potato is high in terms of demand and factor conditions and medium in terms of industry structure and support industries. There is much that can be done to make this subsector more competitive.

4.5 Input/Service Market

The input market includes physical products such as seeds, irrigation, fertiliser and chemicals as well as market services such as information, loans/financial support, training, storage and transportation. The major inputs and services used by actors are briefly discussed below:

Quality seeds and fertilisers: This is an extremely critical area for increasing the farmers' productivity and profitability. At present, adequate services are not available. The DSC is supposedly responsible for supply of certified seeds and fertilisers to the growers through Commission Agents but their service currently reaches a fraction of farmers who are near the road-heads. Both physical and human capacity of DSC is inadequate to fulfill the double mandate of commercial seed production and distribution. According to an estimate, only 5-7% of the potato growers use certified seeds of improved potato varieties (Nidup et al, 2007).

Knowledge and information about cultivation techniques: Extension workers are primary responsible for the dissemination of the improved faming technologies and information. However, due to limited resources as well as poor knowledge about improved farming techniques, the dissemination process is not very functional. Various efforts have been made to provide training by different projects/agencies and Dzongkhags, but many farmers remain in need of this service.

Soil testing: National Soil Service Centre (NSSC) at Semtokha, Thimphu provides the soil testing facilities. Farmers are not very aware of the importance of soil testing: they either use an excessive amount of fertiliser or inappropriate fertilisers. This significantly reduces the yield and productivity of the farmers.

Chemicals/Pesticides: The NPPC is supposedly the primary supplier of this input and associated pest control techniques; however, due to limited resources the dissemination process is not very effective. The majority of the farmers do not get access to the right information and the chemicals or pesticides needed. A large quantity of potatoes gets wasted due to unavailability of these services.

Bullock, Power Tiller and Labourers: Cultivation is done by both powered equipment and manually (animal draft power). In eastern Bhutan, most farmers use animal draft power to cultivate their lands. Availability and usability (as land is steep) of power tillers and tractors is found to be a major constraint in eastern Bhutan. Many farmers rely on

manpower and bullock for cultivation but it is very difficult to find labourers and bullocks during the peak cultivation period. Especially, small land holders who cannot afford to keep their own bullocks have to wait 2-3 weeks until draft animals are available.

Irrigation: This particular input is also considered very important for enhancing the yields. However, as the majority of potatoes are grown in summer time, Bhutanese potato crops take advantage of the spring and summer rains. In areas like Pam where potato is grown in winter farmers need irrigation, due to low rainfall during this part of the year. Again, the unavailability of irrigation canals and inaccessibility of irrigation devices such as pipes is a common problem that hinders the growth of the agriculture sector.

Packaging Materials: In Bhutan, the service market is not well developed to provide value-added services to the SMEs. Farmers in the East need to go to Samdrup Jonkhar even to buy small things like empty bags, and sometimes there is a shortage of bags in the market. As decided during the National Stakeholder Workshop, a 50 kg standard perforate bag was recommended for packaging potato and FCB was requested to supply the bag. These bags are now increasingly used by farmers, but supplies from FCB may not be available.

Transportation: Producers and traders expressed serious dissatisfaction regarding the availability of transportation services particularly in the rural areas. The price of transportation is significant and the quality of service is generally poor. Some say that transporters lack a sense of professionalism when it comes to transporting potatoes to the Samdrup Jonkhar auction yard (van der Wal and Wangchuk, 2007). Rough handling during transportation (sitting on top of the potatoes, keeping 4-5 (or more) layers of potato bags without any partitioning, lack of proper covering material causing possibility of drenching if rain occurs) cause significant damage to potatoes during the journey.

Cold Storage: Cold storage facilities are seen as one of the critical factors in the overall profitability of potato production and trading. The excess supply of potato during the peak season could be stored and when the market price increases the products can be sold at the relatively higher price. Generally, the price reaches a peak during the time of festivals in India, i.e. Sept/October, whereas potatoes are harvested in Bhutan during July/Aug. According to the study carried out by PPD in Bhutan there is not much value addition (price difference) from storing potato and selling later as the market is controlled by the Indian market.

Marketing information: Marketing information is a powerful tool in helping to make a decision whether to buy or sell the goods. It includes prices in the destination markets and the cost of marketing margins (that is the cost of transportation, cost charged by the middleman, cost of the marketing fee, and cost of handling and so on). It also includes information that would affect supply and demand, such as weather conditions

in the growing areas, changing market regulations and road-blockage, political strikes or other conditions that might affect price and access to market. DAMC in cooperation with FCB, national media and other relevant agencies has been developing this system. But so far, this has not been effectively implemented. Many farmers do not know the price and other conditions unless they have already reached to the auction yard. Interestingly, a few farmers were found to be unaware even about the FCB commissions and loading/unloading charges.

However, a marketing information system (MIS) based on mobile phones has now been developed by DAMC in collaboration with Telecom and other agencies. This will provide up to date price information in four languages to farmers across the country. This system is about to be launched (December 2009), and pilot trials found it was 84% effective for farmers in the main growing areas. This will be matched by an SMS based system to be launched in 2010.

Capital: Though some middlemen and local traders have appreciated the services of BDFC but many farmers involved in potato production and delivery of their produce to the auction yard were found to be unaware of the schemes of BDFC. Some of them were keen to buy a power tiller for their own use as well as to rent it out to small farmers, but they did not know how to get a loan. BDFC has mobile banking service in place but there is still a need to increase awareness about the services of BDFC.

4.6 SWOT Analysis

Strength, Weakness, Opportunities and Threat (SWOT) is a powerful tool used in developing strategies for intervention. The tool provides a framework for understanding controllable and non-controllable factors that the interventions should address for the entire value-chain. The critical issues of the SWOT are generally categorized into the following four broad categories as presented in table 17:

S - What are the subsectors internal Strengths?
W - What are the subsectors internal Weaknesses?
O - What external Opportunities might move the subsector forward?
T - What external Threats might hold the subsector back?

The typical assessments of subsector's strengths and weaknesses as well as the opportunities and threats specific to each of the interventions consist of the following:

- Production system and delivery of products in the value chain
- Quality of business service provisions
- Competitive advantages of the value chain members
- Market access, infrastructure, management information and financial systems
- Policy environment.

When designing the interventions, the focus is generally given on the exploitation of strengths rather than simply addressing on the weaknesses. In other words, the interventions are not only about addressing the constraints, but also nurturing the strength of the subsector. Similarly the opportunities and threats - the external trends that influence the subsector are also analysed. The external opportunities and threats are usually categorised into political, economic, social, ecological, demographic and legal forces. These external forces include such circumstances as changing business trends, increased competition, changing regulations, and so on. They can either help the subsector move forward (opportunities) or hold the subsector back (threats) -- but opportunities that are ignored can become threats, and threats that are dealt with appropriately can be turned into opportunities. Any non-controllable factors are generally dealt through advocacy and networking to bring about changes in the policy framework.

Table 17: SWOT Analysis

	Strength	**Weakness**
Internal Factors	• Climatic conditions and topography are suitable for potato farming, can be grown by resource poor farmers • Per capita production (97 kg/person) is very high and farm inputs are locally available. • Potato harvesting season in Bhutan coincides with peak potato price time in India • Well established and functional auction facilities and infrastructure. • Trucks generally supply goods from urban to the rural areas. While travelling back they are empty and hence they are able to carry potatoes at a reasonable rate. • Nearly-organic nature of farming offers good potential for quality seed production for both domestic purposes and exports.	• Low yields due to both abiotic and biotic stress, collapsing formal seed system • Inefficient input delivery system; a lot of dependency on Commission Agents, Government services. • Small land holdings, scattered farms and low productivity. • Shortage of labour, unavailability of vehicles during peak marketing season and high transportation cost make product price high • Lack of appropriate storage facilities and poor handling of potatoes during transportation and storage cause high post-harvest losses. • Poor grading and packaging methods. • Limited number of Indian buyers at the FCB auction yard
	Opportunities	**Threats**
External Factors	• Demand for quality seed is very high in neighboring Indian states of Assam and West Bengal • Potato in Bhutan is grown as summer crop whereas in most part of India, Bangladesh and other countries it is grown as winter crop, this provides distinct seasonal advantages • Bhutanese table potatoes fetch better prices in India as demand is on the rise for fresh potatoes during the harvest time in Bhutan • Rapid increase in the number of middle class families buying organic foods in India offers good potential for Bhutanese potatoes • High possibility of exporting Bhutanese potatoes to Nepal, where demand is very high	• Very high fluctuation in price, which is mainly controlled by Indian market and dependent upon the harvest of potatoes in India. • High incidence of pest problems, mainly potato tuber moth and late blight. • Disruption of transport during rainy season. • Security problems in neighboring states of India

4.7 Constraints

From the point of view production and productivity, the most important constraints are damage of potatoes by disease and pest (mainly late blight and potato tuber moth infestation), wild animal crop depredation, unavailability of quality seeds and other farm inputs (e.g. fertilisers), lack of appropriate storage facilities, limited land holding and sloping topography, moisture stress and soil unproductiveness, high labour cost or shortage of labour, etc. Whereas from the marketing perspective, major constraint in the potato value chain is underdeveloped link in the market chain and the lack of combined efforts to address the pressing bottlenecks. Table 18 presents the list of problems highlighted by potato growers during the field survey. According to their views, PTM is the number one problems followed by crop depredation by wild animals, unavailability of quality seeds and difficulty in selling their produce.

Table 18: Major problems in potato sub-sector

Major Problems	Percentage of Respondents (N=127)
PTM Infestation	25.2
Crop predation by wild animals (mainly wild pig)	13.4
Unavailability of quality seeds	12.6
Marketing (price uncertainty, lack of buyers, etc)	11.0
Lack of proper storage	7.9
Unavailability of fertilisers, chemicals	5.5
Labour shortage	4.7
Diseases (mainly late blight)	4.7
Small land holdings and steep slope	3.9
Lack of draught power	2.4
Others (weeds, hard soil etc)	3.9
Not any problems	4.7

Most of these constraints are inter-linked. Small plots and sloping topography limit the options for mechanization and result in high labour costs. The high labour requirement is further amplified by the requirement for guarding fields against wildlife crop depredation. Small land holdings and low availability of inputs and services result in low productivity, whereas the lack of group enterprise, pest and disease problems (mainly PTM), lack of appropriate storage, rough handling during transportation, loading and unloading all lead to high post harvest losses.

4.7.1 Pest and disease problems

Among the pests and diseases potato tuber moth (PTM) and late blight are reported as the most damaging ones in Bhutan. During the potato survey, we recorded the

infestation rate of PTM in the store from 7 to 85%. None of the potato store was found free of PTM. Potato growers have been using different measures to prevent potatoes from PTM. Many growers cover their potatoes with artemisia, vitex, fern or banana leaves, while others use chemical sprays and mild pesticides to prevent PTM but these are not very effective.

Late blight, which is a fungal disease common throughout major potato producing areas in the world, causes lot of damage to Bhutanese potatoes. In the main potato producing areas, it occurs annually without fail, a few weeks after the onset of the rainy season. Depending on the crop stage at the time of appearance, the yield losses can be substantial.

4.7.2 Wild animal damage

Potato producers consistently cite wild pig problems as one of the most important constraints to potato production. In 2005, an average household spent 73 nights watching their potato field. The wild pig or feral pig, a hybrid between the domesticated and the wild pig, is the cause of most of the miseries of potato producers. Conservative estimates of income lost annually are in the range of Nu 600-60,000 per household in potential potato producing areas, or a total of about Nu 240 million per year. This estimate includes the cost of guarding fields as well as loss of opportunities for extending potato cultivation (SDC, 2008).

The wild pig is a complex problem and cannot be solved overnight. Electric fencing and other high-cost technology can help control wild pig but to adopt such measures, huge investments and serious efforts are needed. As the wild pig is in the IUCN 'red list' of vulnerable animals, killing it is not permitted. However, in view of the increase in the pig population and the extent of damage caused to agricultural production, RGoB may rethink its policy regarding the hunting/killing of wild pig. DoF have developed a device which makes a loud noise and flashes when the wire is touched and NPHC have developed a device which makes a loud sound at regular intervals. These devices help to keep away wild animals but still need to be tested widely. Meanwhile, farmers will still have to watch their crops day and night (WWMP, 2006).

4.7.3 Weak input/service market

As discussed under 4.5, input/service market is very weak in Bhutan. A shortage of good quality seed has been cited as the principal constraint in many reports (Scot, 1983, Nidup et al, 2007, Roder et al, 2008). Interestingly, during the crop year 1979/80 and 1980/81 less than 10% of the total potato area used improved DoA seeds (Karmacharya, 1981), and two and a half decade after this report the seed replacement rate was found around to be 10% (Nidup et al, 2007). The survey conducted by Nidup et al (2007) reported that only 18% of farmers sourced seeds from DSC or CAs, whereas 78% of farmers used their own seeds. Potato production is also handicapped by its dependence on fertiliser shipments from India.

4.7.4 Lack of group enterprise

Most of the potatoes in the Eastern Bhutan are cultivated in less than one hectare of land thus the quantity produced is very small at the individual farmer level. At Gewog or village level this still makes for a substantial number of growers, but farmers are not organized in a group or co-operative, so even for a few bags of potatoes they travel long distances to the auction yard. They generally are not aware of business principles and hence do not calculate the travel and accommodation costs to be incurred while going to the auction yard. Some growers haphazardly collect the potatoes, tending to put as many as possible in each bag and then loading them anyhow into the truck for transportation. This leads to a lot of damage and a lower price. Furthermore, most of the potato growers seem to be individualistic; they seek short-term solutions based only on their individual needs as opposed to developing initiatives that promote competitiveness for a number of fellow producers within a market chain in the medium or long term.

4.7.5 Lack of seed storage facility

It is crucial that the storage area is dark, well ventilated and under optimum conditions with temperature maintained near 7 °C (45 °F). But most of the farmers in Bhutan do not have access to any kind of purpose-built stand-alone store houses. They use their existing residence, especially the ground floor of their houses for storage, which lacks adequate ventilation adjustable temperature and darkness. Many growers pile up the potato tubers on the humid ground, which leads to a lot of post harvest loss. Only a few growers have appropriate storage facility with air circulation and wooden racks for spreading out the tubers.

4.7.6 Underdeveloped value chain

The links in the value chain (production, post harvest management, marketing, and business development services) are underdeveloped, generating an inefficient flow of information along the chain. Though potato comes first in terms of its volume of agricultural trade and is placed second in terms of value of export (next to oranges), there is not a single registered buyer involved in transporting potatoes from road-head collection centre to the auction yard. Out of 23 traders, there are only 2 Bhutanese nationals registered for bidding potatoes in Samdrup Jongkhar auction yard. Interestingly, during the auctioning process only 7-10 Indian traders take part in the bidding. Because of the limited capacity of FCB professionals and low number of bidders, during the peak harvesting season less than half of the stored quantity is auctioned in a day. The flow of information along the market chain is very poor; sometimes there is a huge glut of potatoes in the store, while other time there are not enough. The farmers do not have a reliable system for accessing information on transport and prices in various markets.

CHAPTER FIVE: VALUE CHAIN PROMOTION STRATEGY

5.1 Development of Vision, Goal and Strategy

The Value Chain Promotion Strategy is a set of activities that are planned and carried out to increase the competitiveness of a subsector with the active participation of a value chain's diverse actors to achieve common objectives, around which one or more business organisations and/or interest groups are linked. VC promotion strategy basically focuses on two areas: 1) market orientation - meaning the greater volume sold and/or better end price gained and 2) income distribution - the poor benefit at least equally or above average from the income generated (the poor get their "share of the cake").

A VC promotion strategy for the potato subsector of Bhutan has been developed based on mapping and detailed analysis carried out to identify (i) the comparative advantages of the subsector and (ii) the most pressing bottlenecks that are hindering the growth. Some of these bottlenecks are related to functions, actors and linkages among them, government policy and infrastructure while others are related to external factors such as political unrest and frequent strikes in neighbouring states.

RAMCO in close cooperation with Dzongkhag Agriculture Offices and other concerned Government departments/units and development agencies has carried out a survey on the potato value chain in 6 Eastern Dzongkhags, with its objective being to provide a comprehensive outlines of the dynamics of the potato value chain and to identify challenges that affect smallholder farmers, traders, processing industries, exporters and service providers. To address these challenges in a systematic manner and to contribute to achieving the RGoB objective "equitable and sustainable socio-economic development" by promoting economic opportunities through broad-based growth and boosting critical sectors such as agriculture and rural industries/enterprises that are important for the poor (Box 11) the following vision, goals and areas of interventions have been suggested for the potato subsector: Though field surveys have been carried out only in Eastern Bhutan, interactions and meetings were held with a wide range of stakeholders, and literature and data from the entire country were reviewed. Hence the vision,

Box 11: RGoB 10th Five Year Plan RNR Targets (2008-2013)

- Rural Poverty less than 20%
- Mean rural household cash income above Nu. 35,000
- At least 70 farmers group established for NWFP production and commercialization
- 20% of rural population living within one hour's walk from a road-head
- 15% of farmers are certified natural/organic producers
- Master Plans developed for at least two main watersheds
- 4% of forest area to be managed as community or private forestry

goal and strategies recommended in this chapter may be applicable not only to Eastern Bhutan but also to the whole country.

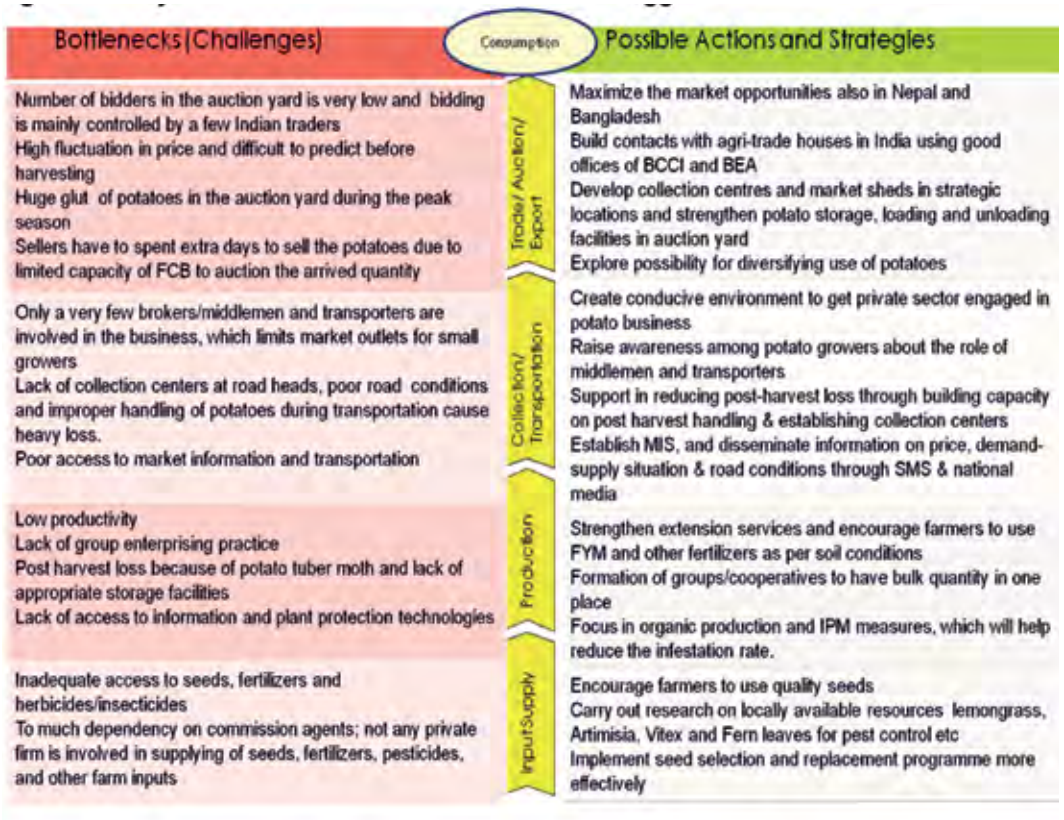
Vision: To expand the domestic market and increase the export volume and value of Bhutanese poatoes maintaining their position at the top of Bhutanese export commodities

Goal: To lower the cost of production and increase the volume, yield and quality through better provision of inputs and use of business development services.

In order to achieve the goal described above, strong collaboration between the public sector, development agencies and the private sector (business associations) is a precondition. From the public side, investments in transport and other basic infrastructure (irrigation, cold stores etc), regulation of trade and support for technology development are required. From the private sector, greater linkages are needed to structure value chains, create scale effects, and explore post-harvest processing and marketing opportunities. VC operators performing different functions (vertical relation) and the firms and companies engaged in a particular level of value chain (horizontal relation) needed to put collective efforts into upgrading the value chain. Small producers could benefit through cooperatives or links with large companies as suppliers. Particularly with regard to delivery of the produce from farm to the auction yard/export market, the farmers/small growers are often too small to meet the needs of big traders. Therefore, small producers need to join hands and form a group/ cooperative to be able to supply the required quantity to big traders/bulk buyers.

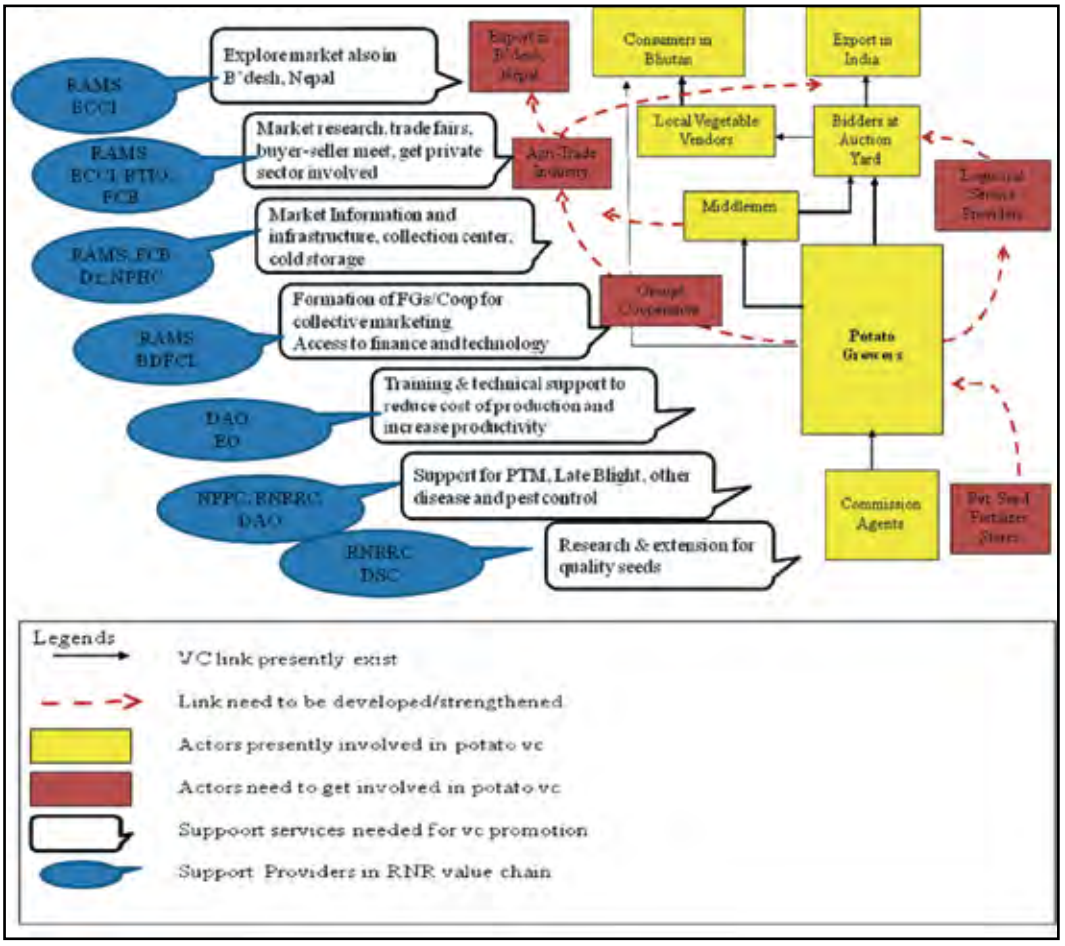
The major bottlenecks identified in potato value chain and actions/strategies suggested to address the challenges are given in Figure 17.

Figure 17: Major Bottlenecks and Possible Actions Suggested for VC Promotion



It is obvious that no one single organization can overcome all the problems nor it is advisable to have a huge crowd of supporters at a particular level of the value chain when there is no-one working at another level. The first pre-requisite is therefore to clarify the roles among the support service providers as to which organisation can best provide which services. Based on the analysis of functional flow, mapping of actors and supporters and market analysis, we suggest the following model (Figure 18).

Figure 18: Supporting Agencies and Services for VC Upgrading

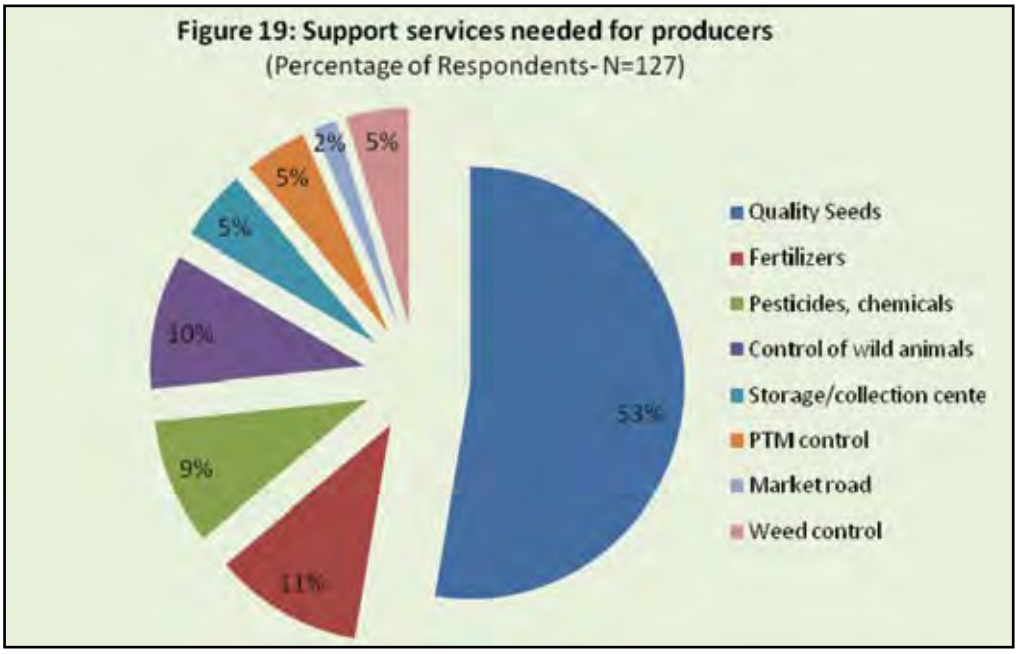


As depicted in the figure (with red dotted line and box filled with maroon colour), there is a need to get more actors involved in the core business.

- At input supply level, private agro-input industry or seed and fertiliser dealers need to be attracted into the business. Support services like disease forecasts and spray schedules, seed delivery/ accessibility and market information need to be readily available, and farmers should also be educated on farm economics.
- As for the delivery of potatoes from the farm to the auction yard, there is a need to develop and strengthen farmers' groups/cooperatives on the one hand and get logistical service providers engaged in the business on the other.
- Moreover, to explore the export market for Bhutanese potatoes in Bangladesh, Nepal, and other potential markets, support may be needed from private sector agro-export industries.

- To make business lucrative for the private sector, there would be a need for policy level changes as well. BCCI in cooperation with BEA, RSTA, BAFRA and RTIO can look at this issue (transportation costs, agri quarantine provision, trade relations etc) and come up with concrete suggestions.

During the survey it was impressive to discover that the majority of producers are aware of the importance of quality seeds. For 53% of the respondents, the provision of quality tuber seeds on time is the most important area in which support services are needed (Figure 19). The survey results show that the issues differ from place to place: for some growers it is more important to get access to transport, whereas for others, transport is not a problem but support is needed to protect crops against PTM. It is interesting to note that during the field survey of potato growing areas 97% of the respondents said that they were willing to pay for inputs, especially for fertilisers and seeds. Only 3% expected to get inputs (seeds, fertilisers, chemicals) free of cost from government agencies. Those respondents (7%) who wanted to have market shed and collection centers showed their willingness to provide a labour contribution.



To develop the value chain, the potato growers provided several suggestions that include (1) the formation of groups, (2) the establishment of processing units for making potato chips, (3) making quality tubers available for seeds, (4) the establishment of collection centres and market sheds, (5) organising study tours for farmers, (6) looking for new market outlets and (7) bringing more buyers into the auction yard.

In contrast, traders at auction yard have a different set of suggestions for the development of the potato value chain, which include (1) proper grading of potatoes based on their size (large, medium, small), colour (red and white), use (table potatoes and seed potatoes), (2) cleaning and sorting (damaged, diseased and mechanically injured potatoes should not be brought down to the auction yard), (3) standardized weight (potato should be packed in 50 kg nylon perforated bags, (4) 6-7 days to be allowed for payment for potatoes bought at auction.

5.2 Key Areas of Interventions and Recommendations

Based on the above analysis, the following recommendations and interventions are proposed under broad categories:

5.2.1 Establishment of a Commodity Specific VC Forum

Many studies have already been done on the subject of the production and marketing of Bhutanese potatoes in the past. Now is the time to go for action. Given the various challenges that Bhutanese farmers face and the fact that the Bhutanese sell potatoes in a highly competitive and volatile market, efforts are needed to lower the cost of production, reduce the post-harvest losses, expand the domestic market, and increase export volume and value. To have co-ordinated efforts for the promotion of the value chain, we suggest a practical starting point is to develop a mechanism, which can be called the 'Potato VC Forum' whereby all the supporters can sit in one place and look at the chain from beginning to end. They should start at the point of production - the activities on the farm, and then follow backwards linkages to assess the provision of inputs, before working forwards to look where and how (post harvest management, processing, selling up to retailing) the produce moves from farm to the final consumers. At each point in the process, names of the organisation with clear roles and responsibilities should be worked out. Such a mechanism will help not only to develop a common understanding but also create synergy for the growth of the subsector and avoid duplication of efforts.

5.2.2 Developing and Strengthening of Input/Service Market

This is a critical intervention that can result in increased access of farmers to farm inputs and services leading to high profitability. Both physical products such as seeds, irrigation, fertiliser, chemicals, packaging materials as well as market services such as soil testing, cultivation services, pest management, information, financial, storage and transportation services need to be developed and strengthened for desirable growth of the subsector. The government departments need to revisit the existing input delivery mechanisms and look at alternative ways for providing these inputs and services to make them viable commercially and earn profit for sustainability. Some of the areas which need to be looked at carefully are:

Availability of quality seed and fertilisers: This is a key factor to ensure higher productivity. At present, this input is mainly provided by the Commission Agents but their outreach is quite low. Only 10% of the farmers manage to get their services, while others have to rely on their own traditional seed exchange practices. Hence, the current approach of reaching out to farmers through the CAs needs to be reviewed and alternative approaches need to be explored to find a suitable mechanism for ensuring the availability of inputs. Mass awareness needs to be created among growers about the beneficial effect of good seed in yield and quality. This will increase the demand for quality seed leading to expansion of the customer base, which can then make it lucrative for the private sector to get into the seed business.

Farm machinery: Farm mechanization is becoming crucial with acute shortage of labour as a result of increasing rural-urban migration in Bhutan. Alternative approaches to farm mechanization, especially through small implements and machinery need to be explored. The private sector can be encouraged to invest in cultivation equipment and leasing this out to farmers. Also the farmer's groups/ cooperatives can invest in machinery to earn revenue from lease money.

Collection center: Most of the potato growers in Bhutan are smallholders, working on isolated farms far from the road-head. To bring their potato bags down to the auction yard, first they need to assemble them in a location where they can get them on to vehicles. For this purpose collection centers need to be established in strategic locations, like those built in Drametse and Yangnyer.

Collection centre at Drametse

Collection centre at Yangnyer

Cold storage: Given the production and price pattern in India, Bhutanese potatoes have distinct seasonal advantages. The demand and price for fresh potatoes is high in the Indian market during potato harvesting time in Bhutan. Generally, the price goes further up during the time of festivals (mid September to mid of October) in India during the peak potato harvesting time (July- August) in Bhutan. Therefore, by the establishment of cold storage facilities at village level the value chain actors can take further advantage in getting peak prices during festival times.

It is felt that a number of relatively small sized cold storage facilities for storing seeds especially in 1500-2200 m potato growing belts can have a great impact on seed potatoes. Initially, such stores could be established in major potato growing areas like Kanglung, Drametse, Zobel, Nanong on a cost-sharing basis with registered seed growers' groups.

Transportation: The mountainous terrain of the country presents a major obstacle for marketing agricultural products. Though farm roads now connect many villages, the majority of villages still remain isolated and without access to markets. There are two basic reasons for this: the movement of vehicles on the road could be very low and/or the quantity of agri-produce in many places is not even a full truckload. To address this issue, farmers need to be organised in a group/co-operative so that they can have a bulk quantity in one place, which is attractive for transport companies. It is also worth looking for the possibility of building gravity ropeways from major potato (as well as other agro-products) growing villages to the road head.

Financial Services: Access to financial services is an important aspect for increasing productivity and fetching better market prices. Many farmers know the importance of fertiliser applications but could not do this due to lack of money, as the time of fertiliser application coincides with the time of school admission.. Promotion of group saving and credit schemes and strengthening of BDFCL services could help farmers make use of much-needed inputs.

5.2.3 Raising Awareness and Capacity Development

During the field survey it was observed that inadequate knowledge and awareness is one of the critical constraints that resulted in low yields and high post-harvest losses. More effort is needed on capacity development regarding the use of the appropriate amount of fertilizer, the right dose of pesticide, and improved harvesting and post harvesting techniques (including sorting, grading, packing and arrangement for safe transportation). VC operators have not even been following simple practices that make a big difference in pricing and reducing post-harvest losses. Such things can easily be avoided by focusing on the following areas:

Damaged potatoes being collected as rubbish

- Provide training to producers about the appropriate storage conditions, sorting and correct grading, requirements of buyers in terms of colour, size and type (seed or table potatoes) during different months (when they should bring, what grade, at what time to send them to the auction yard).

- Develop capacity of EOs and assign them to collect and forward information on quantity, price and demand conditions along with technical information on cultivation techniques, sorting, grading, packing etc.
- Provide transporters with simple pamphlets about the correct handling of potatoes; making partitions by putting wooden plank between different layers of potato bags, loading and unloading without causing damage to potatoes, covering the bags properly so that rain does not affect potatoes etc.
- Provide training to auction yard staff and labourers to handle the produce with care, avoiding the use of iron hooks for dragging and lifting of potato bags, standing on potato bags, and dropping of sacks.

5.2.4 Improvement of marketing systems and market information

Farmer perspectives: Farmers' perspectives need to be changed in the context of price and market dynamics. Farmers should always focus on production; how they can produce the desired quality and more yields per unit of land. They need to be made aware that the price can vary significantly depending up on demand-supply conditions and that producers in other parts of the region can supply similar potatoes at a lower price. They need to be aware that they are not the only players in the market, and so they have to be ready to compete with others in terms of price and quality.

Getting the Private Sector engaged in marketing: In future, more interaction with private sector organisations is required to get them involved in the potato business. RGoB may think of providing short term assistance or incentives to intermediaries (wholesaler/exporter/processor). This type of assistance can benefit the producers more than if they had received the subsidies themselves.

Establishment of MIS: Market information is the system of conveying a message to an actor in a value chain. The system includes a channel of communication, a message or information (price, demand and supply situation) and a receiver (name and address of service providers and other value chain actors). DAMC has already been working on establishing an MIS system. It is suggested that the MIS system may not only provide the information on price but it should also provide information on critical current issues affecting production and sales of potatoes such as the backlog of produce at the auction yard, the security situation and roads condition, pest infestation and measures to take, etc. Dissemination of market information through SMS can be an effective way to reach large number of farmers at a significantly lower cost. This can be highly effective in the remote areas. The use of national media and farmers newsletter that can be prepared by DAMC and distributed to the farmers through Gewog Extension Offices to provide similar information and knowledge on a weekly basis.

Organic Production: With increasing awareness about the health aspects of food, organic produce from diverse agro-climatic conditions has been seen as the key to success in the agriculture sector, thereby highlighting the need for agricultural

diversification. The RGoB policy is already geared towards this but effort is needed to popularise organic farming practices and getting farms who do this officially certified.

5.2.5 Development of farmer's institutions (Groups/cooperatives)

At present, each farmer is involved in marketing of their own produce grown on a limited production area, which is neither cost effective for farmers nor lucrative for the intermediaries. In order to assure a consistent supply of the required quantity (at least a truckload, full power tiller or DCM load) of potatoes in one place, it is necessary to focus on group enterprise. In line with the RGoB 10th 5 year plan, which highlighted the need to strengthen existing farm cooperatives with technical backstopping and extend assistance with material support, we suggest promoting the formation of potato producers/seed growers group and cooperative.

5.3 Summing Up

The Royal Government of Bhutan is very committed to improving nutrition and increasing income of rural people through enhancing the overall productivity and competitiveness of RNR products. RGoB policy is geared toward transforming the agriculture sector from subsistence farming to market oriented commercial farming. During the period of the 10th five year plan (2008-2013), the RGoB wishes to increase the value of horticultural export from 474 to 900 million. To achieve this ambitious target the Ministry of Agriculture (MOA) has utilized the concept of three pillars- Production, Accessibility and Marketing.

Over the past few decades, the RGoB has done a tremendous job in transforming agricultural production from subsistence nature of farming to high value cash crops. Many development agencies have supported the government's initiative by providing grants, loans and technical assistance. As a result of these efforts and with the expansion of road networks and increased access to information and technology, the areas under cultivation vis-à-vis production of several RNR products, like mandarins, potatoes and kidney beans have rapidly grown. According to all reports and research, they are expected to continue growing.

The potato subsector is potentially of great importance for pro-poor growth in Bhutan since it is the best option for many households to generate a cash income. It is highly suitable to the agro-climatic conditions of Bhutan and fits in well with the development goal of RGoB. The rain fed conditions and sloping fields are more suitable for potato cultivation than other more irrigation demanding crops.

This study reveals that the market for Bhutanese agricultural products is highly competitive and volatile. The price generally depends upon the harvest of the same crop in India; if there is a bumper harvest price goes down and vice versa. Generally

speaking prospects for marketing Bhutanese potatoes are very good due to the seasonal difference in cultivation. However, at present the value chain is under developed. In the domestic market, most potatoes are sold by growers directly to consumers (either to institutional buyers- school, police, army, monasteries or individual buyers- civil servants, urban dwellers, etc). Only a small quantity is sold through middlemen, local wholesalers or retailers/grocery shops. For the export market the potatoes generally flow from producers- through auction yards to Indian traders. Especially in Eastern Bhutan, the local traders and middlemen/cooperative are not involved in the process of product delivery.

Potato producers face a number of challenges: shortage of labour, inadequate access to quality seeds, fertilisers and chemicals, attacks by PTM and late blight diseases, and crop damage by wild pigs are the main factors that limit the growth of the potato subsector in Bhutan. Access to certified seed is very limited and most farmers buy seed from another area or exchange their seeds with their neighbors. Farmers frequently plant the smallest tubers as seeds and either eat or sell the bigger ones since during the time of harvest demand is higher for medium and large size potatoes. An economic analysis seems important to compare the use of small tubers with use of medium and large tubers as seeds under the agronomic practices currently practised by farmers. To enhance the access of potato growers to inputs/service market the private sector need be encouraged to get involved in agri-business.

Production of potatoes being largely rain-fed; some years there is a bumper harvest while in other years there is much less production, depending on rainfall. There are seasonal fluctuations in supply of and demand for potatoes, which are reflected in the price. This, coupled with limited on-farm storage facilities, often results in low prices during the peak production periods. Poor road infrastructure and disregard for standards such as weight per bag and rough handling of produce result in high postharvest losses.

There are three broad issues which need to be addressed by the value chain supporting agencies:

1. To bring down the cost of production and increase the yields
2. To reduce the post harvest losses
3. To strengthen market linkages

To address the first issue, extension services as well as inputs/service market need to be strengthened. There is a strong need to build farmers' capacity of and enhance their access to certified potato seeds, fertilisers and technical advice. Such capacity includes training and financially empowering farmers through credit facilities.

Similarly, to reduce postharvest losses and cut down the cost of transport the improvement of the road network, establishment of collection centers and awareness creation about proper handling of potatoes seems necessary.

To strengthen market linkages assistance is needed to organise potato growers into groups/cooperatives so that they can assure a bulk supply of the required grade to buyers. Some incentives may be required to get registered transport companies and agro-trade houses involved in selling Bhutanese potatoes.

Based on the findings of the current study, this set of recommendations is made both for improving production practices and the process of delivery to market. For the effective implementation of these recommendations, it is suggested that significant investment is made in developing infrastructure and promoting value chain linkages through partnership with various government departments/units and concerned private sector organizations, like BCCI, BEA and RSTA.

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