

**VALUE CHAIN ANALYSIS OF POTATO IN SELECTED AREAS OF
BOGRA AND MUNSHIGONJ DISTRICTS OF BANGLADESH**

DISSERTATION

**Submitted in partial fulfillment of the requirements for the Degree of
Masters in Procurement and Supply Management**

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Certification of Dissertation

The undersigned certifies that he has read and hereby recommends for acceptance by BRAC Institute of Governance and Development, BRAC University a dissertation titled “ Value Chain Analysis of Potato in Selected Areas of Bogra and Munshigonj districts of Bangladesh” in partial fulfillment of the requirements for the degree award of Masters in Procurement and Supply Management.

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Declaration

I, Mohammad Anwar Hossain, hereby declare that the contents of this dissertation are the results of my own study and findings, and to the best of my knowledge, they have never been presented elsewhere for a Diploma, Degree or any other professional awards in any Institution of Higher Learning.

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Supervisor's Declaration

This report has been presented as a Dissertation in partial fulfillment of the requirements for the award of *Masters in Procurement and Supply Management* of **BRAC Institute of Governance and Development, BRAC University, Bangladesh.**

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Dedication

I humbly dedicate this dissertation to my beloved daughter *Ms. Adiba Anwar Nondita* and my lovely wife *Makbula Rashid* for their endless love and support.

Abstract

Potato plays a significant role in increasing food security and income of the farmers of Bangladesh. It is an important vegetable for its commercial and nutritional value in the world as well as in Bangladesh. The value chain of potato is not well organized in Bangladesh. This study was carried out to analyze the existing value chain of potato in two selected districts of Bangladesh viz. *Bogra* and *Munshiganj*. It's an attempt to assess the existing potato value chain with the help of primary and secondary data. Primary data were collected from the potato growing area of Kahaloo upazila under Bogra district and Sadar Upazila of Munshiganj district. Potato value chain actors were selected from both the upazilas. Twenty farmers, forty traders and three cold storage owners were selected through simple random sampling, purposive sampling, and simple random sampling procedure, respectively. Simple descriptive methods were used to analyze the data. The primary data were collected through the direct interview method with the help of pretested questionnaires during the month of February to April 2016. In the production and marketing system of potato, many value chain actors were involved such as farmers, *Faria*, *Bepari*, wholesaler, retailer and cold storage owner. Marketing of potato produced in Kahaloo Upazila was moved from the hands of producers to the hands of consumers through five separate chains. Highest sales price per 40Kg of potato received by retailer was Tk. 818.50 and the lowest sales price received by farmer was Tk. 480.38. In the value chain, highest value (33.13 percent) was added by wholesaler and lowest value (14.23 per cent) was added by *Faria* of the total value addition. Comparison of price fluctuation of potato in Bogra and Dhaka market was relatively correlated. The present study found some problems of the existing potato production and marketing system. Potato growers did not get fair price due to lack of economic storage facilities, existence of stronger middlemen, inefficient transportation facilities, and lack of proper marketing information and urgent requirement of money immediately after the potato harvesting period by the farmers. Based on the findings of the present study, it was recommended that institutional credit, timely supply of inputs, application of modern production and postharvest technologies and stability of price should be ensured along with the provision of storage, transport and market facilities.

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Acronyms and Abbreviations

AAFC	Agriculture and Agri-Food Canada
BADC	Bangladesh Agricultural Development Corporation
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BBS	Bangladesh Bureau of Statistics
BCSIR	Bangladesh Council of Scientific and Industrial Research
BKB	Bangladesh Krishi Bank
BRAC	Bangladesh Rural Advancement Committee
CDP	Crop Diversification Programmers
CIS	Cool Insulated Sustainable Roofing System
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
EPB	Export Promotion Bureau
FAO	The Food and Agriculture Organization of the United Nations
FYM	Farm Yard Manure
GAP	Good Agricultural Practices
GTZ	German Agency for Technical Cooperation
Ha	Hectare
HYV	High Yielding Varieties
IQF	Individually Quick Frozen
Kg	Kilogram
MgSO ₄	Magnesium Sulfate
Mound	Measuring unit (equals to 40 Kgs)
MT	Metric Ton
MP/Mop	Muriate of Potash
MRL	Maximum Residue Limit/Minimum Risk Level
MV	Modern Varieties
NAM	National Agricultural Marketing
NGOs	Non-government Organizations
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares (regressions)
OM	Organic Matter
PBS	Palli Bidyut Samities (Rural Electric Societies)

Acronyms and Abbreviations (contd.)

PDB	Power Development Board (Bangladesh)
PKSF	Palli Karma-Sahayak Foundation (Bangladesh)
R&D	Research & Development
RDA	Rural Development Academy
SMEs	Small and Medium-Sized Enterprises
SRDI	Soil Resource Development Institute
TK	Taka (Bangladeshi Currency)
TCRC	Tropical Crops Research Center (Bangladesh)
TSP	Triple Super Phosphate
USAID	United States Agency for International Development
USD	United States Dollar
USA	United States of America
UZ	Upazila (sub-district : administrative unit of Bangladesh)
VCA	Value Chain Analysis
ZnSO ₄	Zinc sulfate

CHAPTER ONE

Introduction

1.1 Background of the Study:

Potato (*Solanum tuberosum*) has been cultivated as an important food crop in Bangladesh. Every year the country produces a huge amount of potato. In Bangladesh, potatoes are by far the leading vegetable, with production of about 8.60 million MT in 2013, compared to other fresh vegetables of about 13.22 million MT (BBS, 2014). Per capita potato consumption is 23 kg in Bangladesh, 32 kg in China and 15 kg in India (Reardon *et al.*, 2012). A relatively high yield and low cost of production of the crop with the introduction of modern technologies have perhaps provided an incentive to the farmers to increase the area as well as production of potato and thereby raise the marketable surplus of potato in Bangladesh. But due to lack of proper storage and marketing facilities farmers do not get fair price even sometime they cannot afford to recover the production cost. The growers have to sell major part of their produces immediately after harvesting at a very low price due to lack of storage facilities and cash need of the farmers. Farmers are compelled to sell potato in a very low price at peak harvesting time in most potato growing areas of Bangladesh. Side by side, it has been observed that in some areas potato price is very high during off season and even in the peak season. If farmers fail to sell their produce at an incentive price they are likely to discontinue its production, which may adversely affect the economy of the country. So, it is very important to make the market efficient for the sake of both farmers and consumers. Value chain analysis of potato marketing can be used for identifying the various issues related to production and marketing problems of potato and help to identify probable solutions.

The present study intends to find out the major shortcomings of the existing potato production and marketing systems to identify interventions for sustainable increase in production and value added activities. It is widely believed that potato growers do not get fair price due to lack of storage facilities, existence of middlemen, transportation facilities, and lack of proper marketing information and urgent requirement of money immediately after the harvesting of potato by the farmers. The seasonal character of potato arrivals is greatly influenced by the farmer's failure to reliant them owing to its semi perishable nature which leads to post harvest market glut. Thus, there is a strong need for an efficient marketing system in order to accelerate and sustain potato production and thereby promote agricultural growth in the country. Marketing efficiency to producers whose role is crucial for the benefit of ultimate consumers.

1.2 Research questions:

The main research questions of the study are:

What are the current production trends, status of marketing (both local and export markets), major constraints in the supply chain of potato and what are the steps to be undertaken to overcome the current constraints to sustain the productivity of potato in the country?

The sub-questions are:

- a) What are the existing considerations in potato production and marketing in Bangladesh and what are the major constraints that limit the potato industry in the country?
- b) What are the measures to be suggested for interventions to sustain the productivity of potato?

1.3 Objectives of the study:

The objectives of the present study are as follows:

- (a) To conduct a full value chain analysis of potato ;
- (b) To determine the constraints of production and analyse different market channels of potato ;
- (c) To identify opportunities of upgrading the respective value chain, particularly in the form of local value addition (processing, packaging and transportation) ;
- (d) To analyse market dynamics of potato (local and export markets) and to draw recommendations for better marketing, and
- (e) To determine the potential benefits and risks of suggested value chain upgrading strategies.

1.4 Justification of the Study:

Every year the country produces a huge amount of potato. Increasing the productivity of the crop due to adoption of modern high yielding varieties and improved production and postharvest technologies, the area of production and yield have been boosted up since few decades. But due to lack of adoption of demand driven modern production technologies, absence of proper storage and marketing facilities farmers do not get fair price even sometime they cannot afford to recover the production cost. Sometimes the growers are compelled to sell major parts of their produces immediately after harvest at a very low price due to lack of storage facilities and cash need of the farmers. Farmers are forced to sell potato in a very low price at peak harvesting time in most potato growing areas of Bangladesh. It is reported that in some areas potato price is very high during off season and even in the peak season. If farmers fail to sell their produce at an incentive price they are likely to discourage for production of potato, which may adversely affect the economy of the country. So, it is very important to make the market efficient for the sustainable production of potato in the country that will restore the interest of both farmers and consumers.

Value chain analysis of potato can be used for identifying the constraints of production and marketing of potato and help to identify probable solutions for sustainable improvement of potato industry in Bangladesh.

1.5 Limitations of the Study:

Some limitations were observed during the study period and these are as follows:

Firstly, this study was restricted to a limited area, the area where more quantity of potato was grown. Secondly, the researcher had to work with small size of samples because of the constraints of time and other resources. However, the data were analyzed quite exhaustively but a large sample might have strengthened the findings. Thirdly, there were the limitation of time and financial resources, all data and other necessary information were collected within the shortest possible time. Fourthly, a very important limitation of the study was that for collecting necessary information the researcher had to depend solely on the memory of the potato growers and traders because they did not keep written records of their on-farm activities perform during production, postharvest management and marketing. Therefore, growers and value chain actors were interrogated within the limits of their memory to recollect the correct answers to the questions put forward to them. Fifthly, the processors of potato are not included in this study although they are important actors in the potato value chain. If they were included obviously, it would add more value in this study. Moreover, during data collection some difficulties were faced in eliciting answers from a number of both potato traders and cold storage authorities. Initially they hesitate in providing actual information in the fear of enhanced income taxes which was especially true for the latter. However, they were ultimately convinced to report the facts. To minimize all vocal errors, various limitations were handled paying conscious attention during the study period.

CHAPTER TWO

Review of Literature

The information available in the literature pertaining to the basic concepts of value chain, guiding principles of agricultural value chains, benefit of value chain in agricultural sector, markets and marketing, market channel, market performance, measuring value chain, developing value chain towards the benefit of the poor, value chain governance and upgrading of value chains and status of potato production and marketing of potato in Bangladesh have been reviewed and presented in this section.

2.1. Definitions and Concepts in Potato Value Chain Analysis: Industry chains are classified as either 'supply' or 'value' chains. The following definitions within the general term 'industry chain' are used:

Supply chain: Supply chain is the entire network of entities, directly or indirectly interlinked and interdependent in serving the same consumer. It comprises of vendors that supply raw material, producers who convert the material into products, warehouse that store, distribute, distribution centers that deliver to the retailers, and retailers who bring the product to the ultimate user. Supply chains underlie value-chains because, without them, no producer has the ability to give customers what they want, when and where they want, at the price they want.

Supply Chain Management: Supply Chain Management is the management of material and information flow in a supply chain to provide the highest degree of customer satisfaction at the lowest possible cost. Supply chain management requires the commitment of supply chain partners to work closely to coordinate order generation, order taking, and order fulfillment. They thereby create an extended enterprise spreading far beyond the producer's location.

Value chain: Interlinked value-adding activities that convert inputs into outputs which, in turn, add to the bottom line and help create competitive advantage. A value chain typically consists of (1) inbound distribution or logistics, (2) manufacturing operations, (3) outbound distribution or logistics, (4) marketing and selling, and (5) after-sales service. These activities are supported by (6) purchasing or procurement, (7) research and development, (8) human resource development, (9) and corporate infrastructure.

A value chain is the full range of activities required to bring a product from conception, through the different phases of production and transformation. A value chain is made up of a series of

actors (or stakeholders) from input suppliers, producers and processors, to exporters and buyers engaged in the activities required to bring agricultural product from its conception to its end use (Kaplinsky and Morris, 2001). Bammann (2007) has identified three important levels of value chain.

Value chain actors: The chain of actors who directly deal with the products, i.e. produce, process, trade and own them.

- Value chain supporters: The services provided by various actors who never directly deal with the product, but whose services add value to the product.
- Value chain influencers: The regulatory framework, policies, infrastructures, etc.

The value chain concept entails the addition of value as the product progresses from input suppliers to producers and consumers. A value chain, therefore, incorporates productive transformation and value addition at each stage of the value chain. At each stage in the value chain, the product changes hands through chain actors, transaction costs are incurred, and generally, some form of value is added. Value addition results from diverse activities including bulking, cleaning, grading, and packaging, transporting, storing and processing (Anandajayasekeram and Berhanu, 2009) as shown in Figure 1 for the case of a typical agricultural value chain.



Figure 1. Typical agricultural value chain and associated business development services.

Source: Adapted from Anandajayasekeram and Berhanu (2009).

2.1.1. Market chains versus value chains: The terms production chain, supply chain, market chain and value chain are often used interchangeably, but in fact there are some important differences (Table 1). In its simplest definition, the terms production chain, supply chain, market

chain are synonymously used to describe all participants involved in an economic activity which uses inputs and services to enable a product to be made and delivered to a final consumer. A value chain is understood as a strategic network between a numbers of independent business organizations. According to Hobbs *et al.* (2000), a value chain is differentiated from a production/supply chain because participants in the value chain have a long-term strategic vision, disposed to work together, oriented by demand and not by supply, shared commitment to control product quality and have a high level of confidence in one another that allows greater security in business and facilitates the development of common goals and objectives.

Table 1. Enterprise relations: production chain versus value chain

Factors	Production market chain	Value market chain
Information flow	Little or none	Extensive
Principal focus	Cost / price	Value / quality
Strategy	Basic product (commodity)	Differentiated product
Orientation	Led by supply	Led by demand
Organizational structure	Independent actors	Independent actors
Philosophy	Competitiveness of the enterprise	Competitiveness of the market chain

Source: Hobbs *et al.* (2000).

The goal of a value chain is to optimize performance in that industry using the combined expertise and abilities of the members of the chain. Successful chains depend on integration, coordination, communication and cooperation between partners with the traditional measure of success being the return on investment (Dunne, 2001; Bryceson and Kandampully, 2004).

2.1.2. Major concepts guiding agricultural value chain analysis: There are four major key concepts guiding agricultural value chain analysis (Anandajayasekeram and Berhanu, 2009; Kaplinsky and Morris, 2000). These are effective demand, production, value chain governance, and upgrading.

2.1.2.1. Effective demand: Agricultural value chain analysis views effective demand as the force that pulls goods and services through the vertical system. Hence, value chain analysis need to understand the dynamics of how demand is changing at both domestic and international markets, and the implications for value chain organization and performance.

Value chain analysis also needs to examine barriers to the transmission of information in the changing nature of demand and incentives back to producers at various levels of the value chain (MSPA, 2010).

2.1.2.2. Production: In agricultural value chain analysis, a stage of production can be referred to as any operating stage capable of producing a saleable product serving as an input to the next stage in the chain or for final consumption or use. Typical value chain linkages include input supply, production, assembly, transport, storage, processing, wholesaling, retailing, and utilization, with exportation included as a major stage for products destined for international markets. A stage of production in a value chain performs a function that makes significant contribution to the effective operation of the value chain and in the process adds value (Anandajayasekeram and Berhanu, 2009).

2.1.2.3. Value chain governance: Governance refers to the role of coordination and associated roles of identifying dynamic profitable opportunities and apportioning roles to key players (Kaplinsky and Morris, 2000). Value chains imply repetitiveness of linkage interactions. Governance ensures that interactions between actors along a value chain reflect organization, rather than randomness. The governance of value chains emanate from the requirement to set product, process, and logistic standards, which then influence upstream or downstream chain actors and results in activities, roles and functions.

According to Raikes *et al.* (2000), trust-based coordination is central for goods and services, whose characteristics change frequently, making a standardized quality determination for the purposes of industrial coordination difficult. This applies to the manufacturing industry as well as agri-food chains. It is possible to identify in one industry several coordination forms used by different firms where the choices rely on the trust existent between the firms. Value chains can be classified into two based on the governance structures: buyer-driven value chains, and producer-driven value chains (Kaplinsky and Morris, 2000). Buyer-driven chains are usually labor intensive industries, and so more important in international development and agriculture. In producer-driven value chains which are more capital intensive, key producers in the chain, usually controlling key technologies, influence product specifications and play the lead role in coordinating the various links. Some chains may involve both producer and buyer driven governance.

2.1.2.4. Value chain upgrading: Upgrading refers to the acquisition of technological capabilities and market linkages that enable firms to improve their competitiveness and move into higher-value activities (Kaplinsky and Morris, 2000).

Upgrading in firms can take place in the form of process upgrading, product upgrading, functional upgrading and chain upgrading. Upgrading entails not only improvements in products, but also investments in people, knowhow, processes, equipment and favorable work conditions. Empirical research in a number of countries and sectors (e.g. Humphrey and Schmitz, 2000;

Humphrey, 2003; Humphrey and Memedovic, 2006) provide evidence of the importance of upgrading in the agricultural sector.

2.1.3. Market and marketing: Market can be defined as an area in which one or more sellers of given products/services and their close substitutes exchange with and compete for the patronage of a group of buyers. A market is a point, or a place or sphere within which price making force operates and in which exchanges of title tend to be accompanied by the actual movement of the goods affected (Backman and Davidson, 1962). The concept of exchange and relationships lead to the concept of market. It is the set of the actual and potential buyers of a product (Kotler and Armstrong, 2003). Conceptually, a market can be visualized as a process in which ownership of goods is transferred from sellers to buyers who may be final consumers or intermediaries.

2.1.3.1. Marketing efficiency: Efficiency in marketing is the most used measure of market performance. Improved marketing efficiency is a common goal of farmers, marketing organizations, consumers and society. It is a commonplace notation that higher efficiency means better performance whereas declining efficiency denotes poor performance. Most of the changes proposed in marketing are justified on the grounds of improved efficiency (Kohls and Uhl, 1985).

2.1.3.2. Marketing channel: Formally, a marketing channel is a business structure of interdependent organizations that reach from the point of product or origin to the consumer with the purpose of moving products to their final consumption or destination (Kotler and Armstrong, 2003). This channel may be short or long depending on kind and quality of the product marketed, available marketing services, and prevailing social and physical environment (Islam *et al.*, 2001).

2.1.3.3. Marketing Performance: Market performance can be evaluated by analyzing costs and margins of marketing agents in different channels. A commonly used measure of system performance is the marketing margin or price spread. Margin or spread can be useful descriptive statistics if it used to show how the consumer's price is divided among participants at different levels of marketing system (Mendoza, 1995).

Marketing costs: Marketing costs are the embodiment of barriers to access to market participation by resource poor smallholders. It refers to those costs, which are incurred to perform various marketing activities in the transportation of goods from producer to consumers. Marketing costs includes handling cost (labor, loading and unloading, costs of damage, transportation and etc) to reach an agreement, transferring the product, monitoring the agreement to see that its conditions are fulfilled, and enforcing the exchange agreement (Holloway *et al.*, 2002).

Marketing margin: It is a commonly used measure of the performance of a marketing system (Abbot and Makeham, 1981). It is defined as the difference between the price the consumer pays and the price that is obtained by producers, or as the price of a collection of marketing services, which is the outcome of the demand for and supply of such services (Cramers and Jensen, 1982; William and Robinson, 1990 and Holt, 1993). The size of market margins is largely dependent upon a combination of the quality and quantity of marketing services provided the cost of providing such services, and the efficiency with which they are undertaken and priced. For instance, a big margin may result in little or no profit or even a loss for the seller involved depending upon the marketing costs as well as on the selling and buying prices (Mendoza, 1995). Under competitive market conditions, the size of market margins would be the outcome of the supply and demand for marketing services, and they would be equal to the minimum costs of service provision plus “normal” profit. Therefore, analyzing market margins is an important means of assessing the efficiency of price formation in and transmission through the system. There are three methods generally used in estimating marketing margin: (1) detailed analyses of the accounts of trading firms at each stage of the marketing channel (time lag method); (2) computations of share of the consumer’s price obtained by producers and traders at each stage of the marketing chain; and (3) concurrent method: comparison of prices at different levels of marketing over the same period of time (Mendoza, 1995; Scarborough and Kydd, 1992).

2.1.3.4. Measuring value chain: A fundamental aspect of global value chain research is how ‘value’ itself, is conceptualized and measured. According to Gereffi (1999) profit, value addition and price markups are indications of income shares across value chain actors. Value-added shares can be calculated for different links in the chain. A second way to calculate value added is to look its distribution by each value chain actors of vegetable market and decomposing for each actor to get approximations of each value-added share. Marketing margin is the difference between the value of a product or a group of products at one stage in the marketing process and the value of an equivalent product or group of products at another stage. Measuring this margin indicates how much has been paid for the processing and marketing services applied to the product(s) at that particular stage in the marketing process (Smith, 1992).

2.2. Benefit of Value Chain in Agricultural Sector: It is an innovation that enhances or improves an existing product, or introduces new products or new product uses. This allows the farmer to create new markets, or differentiate a product from others and thus gain an advantage over competitors. In so doing, the farmer can ask a higher premium (price) or gain increased market share or access. Adding value does not necessarily involve altering a product; it can be the adoption of new production or handling methods that increase a farmer’s capacity and reliability in meeting market demand. Value-added can be almost anything that enhances the

dimensions of a business. The key is that the value-adding activity must increase or stabilize profit margins, and the output must appeal to the consumer (AAFC, 2004).

2.3. Developing Value Chain Systems towards the Benefits of the Poor: In recent years, the pro-poor growth approach has become one of the key concerns of developmental organizations. The focus of the approach lies in the promotion of economic potentials of the poor and disadvantaged groups of people (OECD, 2006). The main aim is to enable them to react and take advantage of new opportunities arising as a result of economic growth, and thereby overcome poverty (Berg *et al.*, 2006). The promotion of value chains in agribusiness aims to improve the competitiveness of agriculture in national and international markets and to generate greater value added within the country or region. The key criterion in this context is broad impact, i.e. growth that benefits the rural poor to the greatest possible extent or, at least, does not worsen their position relative to other demographic groups. Pro-poor growth is one of the most commonly quoted objectives of value chain promotion. In recent years, the need to connect producers to markets has led to an understanding that it is necessary to verify and analyze markets before engaging in upgrading activities with value chain operators. Thus, the value chain approach starts from an understanding of the consumer demand and works its way back through distribution channels to the different stages of production, processing and marketing (GTZ, 2006).

2.4 Review of Empirical Studies

2.4.1. Value chain approach: There are a number of studies that have employed the value chain approach to agricultural commodities. Fitter and Kaplinsky (2001) used a value chain analysis to examine inter-country distributional outcomes of the global coffee sector by mapping input-output relations and identifying power asymmetries along the coffee value chain. Their study showed that returns to product differentiation taking place in the face of globalization do not accrue to the coffee producers. They also found that power in the coffee value chain was asymmetrical.

At the importing end of the chain, importers, roasters and retailers compete with each other for a share of value chain rents but combine to ensure that few of the rents return to the farmer or the producer country.

Value chain study conducted on off-season vegetables by USAID (2011) in Nepal indicated that the subsector faces some challenges such as unavailability of quality planting materials, lack of knowledge among the producers of the proper usage of fertilizers and pesticides as well as poor soil fertility management, lack of irrigation facilities, labor shortage, postharvest loss due the perishable nature of vegetables, limited access to reliable market information, unorganized

market center, limited collection centers, and lack of proper packaging and transportation facilities. The study recommended short-term and long term infrastructural and institutional innovation to reduce the above challenges.

Ponte (2002) also used a value chain analysis to examine the impact of deregulation, new consumption patterns and evolving corporate strategies in the global coffee chain on the coffee exporting countries in the developing world. The study concluded that the coffee chain was increasingly becoming buyer-driven and the coffee farmers and the producing countries were facing a crisis relating to changes in the governance structure and the institutional framework of the coffee value chain.

Horticulture value chain study conducted in Eastern parts of Ethiopia identified different problems on the chain (Bezabih, 2008). The major constraints of marketing identified by the same study include lack of markets to absorb the production, low price for the products, large number of middlemen in the marketing system, lack of marketing institutions safeguarding farmers' interest and rights over their marketable produces (e.g. cooperatives), lack of coordination among producers to increase their bargaining power, poor product handling and packaging, imperfect pricing system and lack of transparency in market information communications.

Dereje (2007) used value chain approach to study the competitiveness of Ethiopian coffee in the international market. The study indicates that Ethiopian farmers have low level of education, large family size with small farmland and get only 3% of the retail price in the German market. Thus, policy intervention was suggested to improve farmers' performance.

Value chain study conducted on mango by Dendena *et al.* (2009) indicated that the subsector faces some challenges. Among others: highly disorganized and fragmented industry with weak value chain linkages, long and inefficient supply chains, inadequate information flows and lack of appropriate production are explained as the major problems. The study recommended institutional innovation to reduce the above challenges.

2.4.2. Determinants of marketable surplus: The study of marketable surplus turned out to be very vital for agricultural based countries because the transition of smallholder farmers towards commercial production is determined by it. Getachew (2009) has noted that the transition of the small-scale sector towards commercial production will ultimately be determined by the ability and willingness of producers to provide a commodity. Similarly, Mamo (2009) argued that the development of markets, trade and the subsequent market supply that characterize commercialization are fundamental to economic growth.

There are a number of empirical studies on factors affecting the marketable surplus of agricultural commodities. Ayelech (2011) identified factors affecting the marketable surplus of fruits by using OLS regressions. She found that fruit marketable supply was affected by; education level of household head, quantity of fruit produced, fruit production experience, extension contact, lagged price and distance to market.

Abay (2007) applied Heckman two-stage model to analyze the determinants of vegetable market supply. Accordingly, the study found out that marketable supply of vegetables were significantly affected by family size, distance from main road, number of oxen owned, extension service and lagged price.

According to Wolday (1994) marketable supply of agricultural product could be affected by different factors including the size of land holding, the output level, family size, market access, price, inputs, formal education, oxen number, accesses to extension and credit services, distance to market, time of selling, access to labor and age. In sum, empirical evidences indicate that marketable supply approach has become an important framework to analyze economic agents in agricultural sector. In this study an attempt was made to identify factors affecting the marketable supply of vegetables.

2.4.3. Determinants of market channel choices: Regarding factors affecting channel choices of the households, different researchers used multinomial logit and probit for categorical marketing system for different agricultural commodities.

A study by Ferto and Szabo (2002) identified variables influencing producers' decision for channel choices. The analysis was based on a survey among three supply channels of fruit and vegetable producers in Csongrad, Hungary in respect the choice of marketing channels which are wholesalers, marketing cooperative and producers' organization channel. A multinomial logit model was applied to reveal on the determinants influencing these choices among various supply channels. Farmer's decisions with respects to supply channels were influenced differently by transaction costs, and producers sell to wholesale market were strongly and negatively affected by the farmer's age, information costs, and negatively by the bargaining power and monitoring costs. The probability that farmers sell their product to marketing cooperative is influenced by the age and information costs positively, whereas by the asset specificity and bargaining power negatively.

Rao *et al.* (2010) confirmed that educational level of the operator, off-farm employment, own means of transportation and age of operator had positive effect where as household size was

negatively associated with supper marketing channel choices. In second stage second stage of treatment model, off-farm employment and own means of transportation affected income of vegetables growers positively. Furthermore, dummy variable for channel choices were positive and significant. This indicated that supplying vegetable to supermarket channels rendered better income gain over spot marketing channel. On the other hand, ownership of livestock negatively influenced income of vegetables growers supplying traditional or spot marketing channel. Jari and Fraser (2009) identified that market information, expertise on grades and standards, contractual agreements, social capital, market infrastructure, group participation and tradition significantly influence household marketing behavior. The study uses multinomial regression model to investigate the factors that influence marketing choices among smallholder and emerging farmers.

Bongiwe and Masuku (2012) identified that age of the farmer, quantity of baby corn produced and level of education were significant predictors of the choice to sell vegetables to NAM Board market channel instead of selling to other-wholesale market channel. The age of the farmer, distance from production area to market, membership in farmer organization and marketing agreement were significant determinants of the choice to use non-wholesale market channel over other-wholesale market channel. The study uses descriptive and multinomial logistic regression analyses to investigate factors that influence market channel choices.

Mamo and Degnet (2012) identified that gender and educational status of the household head together with household access to free aid, agricultural extension services, market information, non-farm income, adoption of modern livestock inputs, volume of sales, and time spent to reach the market have statistically significant effect on whether or not a farmer participates in the livestock market and his/her choice of a market channel. The study uses binary logit and multinomial logit to explore the patterns and determinants of smallholder livestock farmer's market participation and market channel choice using a micro-lever survey data from Ethiopia.

Akter (1973) conducted a study on potato marketing in Comilla Sadar Upazila of Bangladesh and he found some structural and functional features of potato marketing. Sabur and Gangwar (1984) carried out a study on production and price structure of potato in Bangladesh and showed that the growth rate of potato in terms of production, area and productivity during the proliferation period. The study also showed that the growth rates in terms of area, production and productivity for the western districts were higher than those for the northern districts.

Sabur (1986) conducted a study on marketed surplus of potato in two districts of Bangladesh and found that production and marketed surplus of potatoes moved in same direction and land

under potatoes was the most important factor determining the marketed surplus. He showed that the average production cost per hectare was Tk.29637.57 which was the lowest medium farmers and net returns and benefit cost ratio were calculated at Tk.30947.82 per hectare and 1: 2.25 respectively which were the highest for medium farmers in both the areas. Regional Agricultural Research station, Jamalpur under the Farm Research Division of BARI, Joydebpur conducted a research on "Improvement of existing fanning system through holistic approach". They summarized the findings in a report (1992-93). They found that the yield per hectare of HYV potato was 9.25 tones and cost per hectare was Tk. 17,000.00. They observed that the net return depended largely on the harvest price of potato.

Islam (1987) carried out a study on potato preservation in cold storage in Bangladesh including the marketing aspects. He found that price spread per tones of potato appropriated by traders was higher in the case cold stored potato than that of non-stored potato.

Sarkar (1990) conducted a research on potato marketing in Bangladesh. His study expounded that only few growers store their potato in cold storage plants due to high storage charge. His study revealed that communication system should be developed to transport potato from production area to the terminal market to strengthen the economic condition of the potato growers. Storage facilities should be improved at the primary and secondary markets by establishing public as well as private cold storage plants at different points of potato marketing channel. His study emphasis on the improvement of ordinary storage in scientific manner as well as innovation of low-cost storage technique which would not only ensure timely availability of quality seed but also better price at reduced storage costs throughout the year by enlarging storage period at farm level.

Siraj *et al.*, (1992) studied seed marketing in Bangladesh under the Dutch Executing Agency of crop Diversification programmers (CDP). They undertook the study on some selected areas which were traditionally known as potato producing areas and they showed that potato was a profitable winter crop. They observed that the per hectare net return of HYV potato was higher in Dinajpur region than in Jessore region in 1990-91. They also found that lack of capital and high costs of production were two major problems faced by HYV potato growers.

Saklayan (1999) investigated that the potato marketing in selected areas of Munshigonj district. This study was mainly based on Sadar Upazila and Tongibari Upazila of Munshigonj district. The sample included 30 farmers and 30 market intermediaries of Munshigonj Sadar Upazila and Tongibari Upazila. He found that the marketing cost per quintal of potato incurred was Tk 43.46 and Tk 44.36 for farmers of Munshigonj Sadar Upazila and Tongibari Upazila respectively. The

marketing costs incurred per, quintal potato were Tk 60.95, Tk 56.87, Tk 133.60 and Tk 37.81 for Beparis, Paikers, cold storage owners and retailer of Munshigonj bazar respectively. The marketing costs incurred per quintal were Tk 45.42, Tk 61.21, Tk 134.64 and Tk 37.32 for Beparis, Paikers, Cold storage owners and retailers of Tangibari bazar respectively. The net margins of per quintal potato of Beparis, paikers, the cold storage owners and retailers of Munshigonj bazaar were calculated at Tk 21.73, Tk 21.50, Tk 19.57 and Tk 23.28 respectively. The net margin of per quintal potato of Beparis, Paikers, the cold storage owners and retailers of Tongibari bazar were calculated at Tk 30.02, Tk 26.91, Tk 25.62 and Tk 21.94 respectively.

Kawsar (2001) carried out a study entitled "An Economic Analysis of Diamant Potato Production in Some Selected Areas of Bangladesh". The study was mainly designed to analyze the socio-economic characteristics of farmers and to estimate the costs and returns of Diamant variety of potato and to determine the factors affecting yield and returns. One hundred thirty nine farmers were purposively selected from 5 Upazilas of five districts Bogra, Comilla, Munshigonj, Rangpur and Thakurgaon. Findings showed that Diamant potato production is profitable considering the selected farm categories both in East and North Bengal. Per hectare gross margin was the highest for Rangpur whereas net returns were the highest for Munshigonj. Both gross margin and net return were higher for North Bengal. On the other hand, medium farmers obtained the highest amount of gross margin and net return.

Hossain (2004) investigated that the potato marketing in selected areas of Bogra district. This study was mainly based on Sadar Upazila of Bogra district. The sample included 30 farmers and 30 intermediaries. Production cost, yield, marketing cost, marketing margin and net margin of potato farmers and intermediaries were calculated in this study.

Saiyem (2007) investigated the potato marketing system and price behavior in selected areas of Rangpur district. The samples include 60 sample farmers and intermediaries. In this study production cost, yield, marketing cost, marketing margin, net margin and price behavior of potato farmers and intermediaries were estimated.

Hajong (2011) found many intermediaries are involved such as Farias, Beparis, Paikers, retailers and cold storage owners in the production and marketing system of potato. The farmers distribute their production for family consumption, gift and kind payment to relatives, seed and maximum portion for sell. Again some potatoes were damaged and loss during storage. Storing of potato in the cold storage plants certainly reduces the excessive losses of potato but all farmers can not avail the facility of cold storages due to several reasons, such as high cold storage charge, uncertainty of future market price, financial insolvency, bad communication and inadequate

transport facilities and lack of any provision in getting compensation for damage of potato in the cold storage plants.

The aforesaid reviews reveal that studies were undertaken exclusively on the marketing aspect of potato. Systematic research study report on value chain analysis of potato is meager in Bangladesh. So the existing research has been undertaken to make an in depth study to provide knowledge in the field of potato production and marketing. The findings of the study might help farmers, value chain actors and consumers to take decision in production, trading and consuming potato.

CHAPTER THREE

Methodology

3.1 Introduction: This chapter presents a detail description of the methods adopted at different stages of the study. Methodology is an indispensable and integral part of any research. This chapter presents the methodology followed in the study, which included the selection of the study area, selection of samples, preparation of survey schedule, method of data collection, period of survey, editing and tabulation of data and analytical techniques. The tools and methods used and followed for the study with considering the specific objectives of the study are given below.

3.2 Selection of Study Area: As the selection of the study area is an important step and it largely depends upon the objectives of the study. Therefore, careful thought was placed on the selection of the study area. In order to make an assessment of the value chain of marketing of potato, the study was conducted in selected areas of Bogra & Munshigonj district. Both *Bogra & Munshigonj* district are the leading zone in respect of potato production in Bangladesh. *Kahaloo & Munshigonj Sadar Upazila* especially are the leading potato producing area of Bogra & Munshigonj district respectively. The study area has some favorable characteristics like topography, soil and climate condition for producing potato.

The following factors were considered in selecting the study area: Bogra & Munshigonj are the high yielding and widely potato producing districts of the country. All kinds of value chain actors needed for the study are available in these two selected areas where easy accessibility and good communication system exist. Farmers are well known to produce potato and preserve it in traditional and cold storage methods. There is huge number of potato growers with different farm sizes. Therefore, the availability of potato growers and traders in the district of Bogra and Munshigonj were the main criteria for selecting as the study area for the present study.

3.3 Selection of Period of Study: The present study covered 6 months from November 2015 to April 2016. Data were collected during the period from February to April, 2016 through face to face interview with potato growers, potato traders, and cold storage owner using structured survey schedule. For collecting supplementary data the researcher personally visited the area.

3.4 Selection of Samples and Sample Technique: Twenty potato growers, forty other value chain actors (potato traders, *Faria*, *Bepari*, wholesaler and retailer) and three cold storage owners were selected from the study area in the following manner.

3.4.1 Selection of Potato Growers: The potato growers of the selected areas were considered as major part of the study. A list of potato growers of the selected areas was prepared through a preliminary survey. Considering the limitation of time and fund, the sample size for potato grower was fixed at 20, taking from the selected villages' i.e. *Dhaper Hat*, and *Bibir pukur*. Out of 20 selected growers, 10 were from *Bibir Pukur* and 10 were from *Dhaper hat* in *Kahaloo* upazila of *Bogra* district through simple random sampling technique by using random number table for the present study.

3.4.2 Value Chain Actors of Potato: Forty value chain actors of potato from each of two retail markets *Raza Bazar* and *Foteh Ali Bazar* were selected from *Sadar* upazila. In addition, two *Haats* such as *Bibir Pukur Haat* and *Dhaper Haat* were chosen from *Kahaloo* upazila of *Bogra* district by applying purposive sampling technique for the present study.

In the selected areas 20 potato farmers and 60 intermediaries were considered as the population of the study.

Table 2. Different Actors and Size of Sample

Value Chain Actors	Sample Size
<i>Growers</i>	20
<i>Faria</i>	15
<i>Bepari</i>	15
Wholesaler	15
Retailer	15
Total	80

3.4.3 Cold Storage Plants: Three cold storage plants comprising about 20% percent of the total number of cold storage plants located in the study area were selected through simple random sampling technique by applying lottery method for the present study. Three out of twenty three plants from *Bogra* district were selected through simple random sampling technique.

3.5 Preparation of the Survey Schedule: Three separate types of interview schedules were prepared for collecting necessary data from different types of samples. An interview schedule contains questions about the production, storage, marketing and disposal of potato at the grower's level. Another interview schedule was prepared for collecting data from potato traders and including question related to buying, storage and selling of potato. The third type of interview schedule was prepared for obtaining data from owners and/or authorities of the selected plants relating to potato preservation, pattern of plant utilization, expenditure incurred for it and revenue earned from cold storage plants for the year and various problems encountered by the

cold storage plants. All the schedules were pretested and finally prepared after careful modifications. Interview schedules were prepared on the basis of specific objectives of this study.

3.6 Data Collection: Relevant data were collected from the selected samples through face to face interview. Before taking actual interviews the whole academic purpose of the study was clearly explained to the sample farmers, traders and cold storage owner. Initially, they were hesitated to answer the questions; but when they were assured that the study was purely an academic one and it would not affect any way, they were convinced to cooperate with the researcher. At the time of interview, the researcher asked questions systematically and explained the questions whenever it was felt necessary. Farmers were requested to provide correct information as far as possible. Many of the respondents did not any records of their businesses and activities. This problem was confronted by memory recalling technique. Data were also collected from potato traders like *Faria, Bepari*, wholesaler and retailer. In addition to primary data, secondary data were also collected from various publication like journals, different organization like Department of Agricultural Marketing of Bangladesh and website searching.

3.7 Tabulation and Analysis of Data: The first step was taken to scrutinize the data of each and every schedule to find out any inconsistency or omission in the data collection and to avoid irrelevant information. The data were edited carefully to eliminate possible errors contained in the schedules while recording information. Processed data were transferred to excel spread sheet and compiled with a view to facilitating tabulation. Information was collected initially in local units. After checking them these were converted into quantitative form by using suitable scoring. Necessary tables were prepared by summarizing the data. The collected data were analyzed according to the objectives of the study. Inconsistencies in the data were removed. Analysis was done using the concerned software Microsoft Excel version.

3.8 Analytical Technique: An agribusiness study could be judged by the appropriate analytical technique. Data were analyzed with the purpose of achieving the objectives of the study. The probable techniques used were as follows:

3.8.1 Gross return and net return of the farmer: Gross return was calculated by multiplying the total volume of output of an enterprise by the average price in the harvesting period (*Dillon and Hardaker, 1993*). It consisted of sum of the volume of main product and by product. The following equation was used to estimate gross return:

$GR = \sum Q_m P_m$, Where:

GR = Gross Return from Product; Q_m = Quantity of Product

P_m = Average Price of Product

Net return was calculated by deducting all costs (variable & fixed) from gross return.

To determine the net return of potato production the following equation was used in the recent study :

$$\pi = \text{Gross Return} - (\text{Variable Cost} + \text{Fixed Cost})$$

Here,

$$\pi = \text{Profit per cycle; Gross Return} = \text{Total Production} \times \text{per unit price of potato}$$

Variable costs,

(i) Production cost of potato

Fixed costs,

(i) Land use cost; (ii). Interest on operating capital

Marketing cost of potato

(i) License fee; (ii) Loading and unloading; (iii) Power and electricity charge; (iv) Telephone charge; (v) Market toll ; (vi) Transportation ; (vii) Grading ; (viii) Storage cost ; (ix) Personal expenses ; (x) Unofficial payment .

3.8.2 Marketing margin and net margin of value chain actors: The marketing margin and net margin of different value chain actors were estimated by the following formula:

- Marketing Margin (Tk/40 Kg)=Sales Price (Tk./40 Kg)-Purchase Price (Tk/40 Kg)
- Net Marketing Margin (Tk/40 Kg) = Marketing Margin (Tk/40 Kg) – Marketing Cost (Tk/40 Kg)
- Value Addition (%) = $\frac{(\text{Sales Price}-\text{Purchase Price})}{\text{Purchase Price}} \times 100$
- Interest on Operating Capital = Amount of Operating Capital X Interest Rate (%) X Time Required (in years)÷2
- Variable cost of potato production was considered as operating capital

3.9 Problems Encountered in Collecting Data: Though the respondent potato growers were available in the village, collection of required data was not an easy task. The researcher of the study had to face certain problems during data collections, which are noted below:

- Education of the respondents was a pre-requisite factor for having accurate data. Since most of the respondents were not well educated they were suspicious of outsiders and therefore, they were likely to be less co-operative;
- Some respondents did not keep any written records of the farming activities. Therefore, the researcher had to depend upon their memory;
- Respondents from all categories were often unable to recall the exact information, say, income, sales volume, cost, total production etc. Reliability of data therefore, posed some confuting ;

- There was the limitation of time and personnel and inadequate information about potato production and marketing aspects and for this reasons data and other necessary information had to be collected within the shortest possible time;
- Since the respondents remained busy at their work, they were not always available at home. For this, frequent visits were made to get information from them;
- Cold storage owner and maximum value chain actor was avoiding information about their loan and tax.

3.10 Report Writing: Report has been written on the basis of analyzed data. Microsoft Excel has been used for preparing tables and for collection. Microsoft Word has been used for preparing the report.

CHAPTER FOUR

Results and Discussions

4.1 Present Status of Potato Cultivation in Bangladesh: Potato is one of the main agricultural crops in Bangladesh. It is both a vegetable as well as cash crop. In Bangladesh potato occupied the first position among all the vegetables in respect of area and production. Potato is an important cash crop and a multipurpose food crop of Bangladesh (Siddique and Hossain, 1988). It is used not only in human diet but also in other purposes. It is used for making gum, starch for adhesives and other purposes, in textile and paper industries, for processing ink, dyes, toys, soap and for leather processing. Glucose and dextrose are prepared from potato for use in medical treatment. Lactic acid, alcohol and some other chemicals are now being produced from potato. In terms of nutritional potential, it ranks first among the 10 major food crops in calories production per unit area of land. It is also considered as an excellent source of vitamin B and C.

In Bangladesh potato is still considered merely as a vegetable, i.e. as a complementary food with rice and wheat but not as a staple food it is regarded as one of the world's leading food crop (Akter, 1973). In Bangladesh, although the principal use of potatoes is to make potato curry along with fish, meat, and eggs, there exists a great diversity in the consumption of potatoes. Notable among potato-based food items are the boiled potato, fried potato, mashed potato, baked potato, potato chop, potato vegetable mix, potato Singara, potato chips, French fry etc. In recent years, bakeries and fast food shops have started preparing a wide variety of potato-based food delicacies.

It is now well recognized that to meet the demand for food for increased population, dependence on rice and wheat has to be reduced and the food habit of the masses have to be diversified. The land and climatic condition of Bangladesh with abundant water and humid temperature is ideally congenial to the cultivation of potato. The area, production and yield/ha of potato have increased significantly during the last three decades (Fig.-2).

In the year 2012-13, production of potato in Bangladesh was 8.20 million tons and in the following year it was 8.60 million tons (BBS, 2014). At present national average yield of potato is only 19 tons/ha which is very low as compared to French (40.19 tons/ha), USA(43.67 tons/ha) and the Netherlands (41.67tons/ha).The poor yield of potato in Bangladesh is due to use of low quality seed potato. According to BADC (2014) present supply of seed potatoes in the country is comprised of Farmers own seed (93%), public sector supply (4%), private Sector supply (2%)

and imported seed (1%). Major table varieties grown in Bangladesh are Diamant, Cardinal, Granula, Asterix, Binella, Multa, Patrones, Arinda, Lady Rosetta etc.

Export of potato from the country is increasing significantly (Table 1) in recent years. Table-1 shows that during 2008-09 about 407 MT of potato was exported with a value of 0.68 million USD. In the following year, the export volume increased to 9,687.0 MT with a value of 3.45 million USD and the growth rate was estimated (+ 407). During the year 2013-14, both the volume and value of potato export increased to 103,000 MT and 33.82 million USD respectively. The major three importing countries of Bangladesh potatoes are Malaysia (43%), Singapore (24%), Sri Lanka (13%). Cardinal, Diamant, Asterix, Granola are the major varieties that have demand in export market.

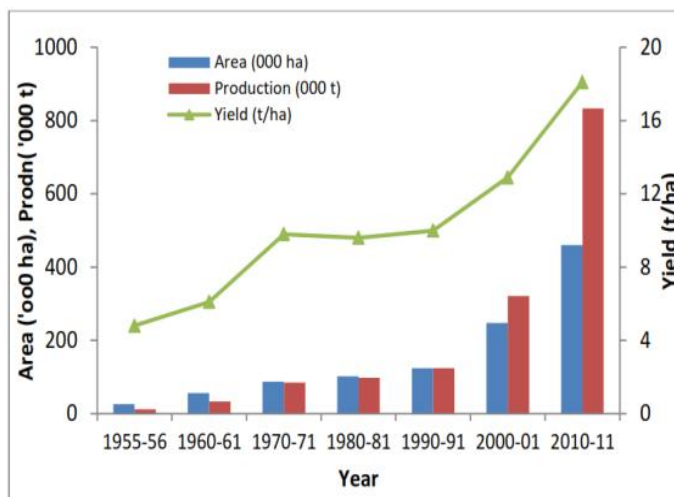


Figure- 2 Area, production and yield of potato in Bangladesh

Table -3: Trend of potato export from Bangladesh

Year	Quantity of Export (MT)	Export value (Million USD)	Export growth on value (%)
2008-09	407.0	0.68	-
2009-10	9,687.0	3.45	(+) 407
2010-11	34,891.0	15.98	(+) 363
2011-12	34,232.0	8.50	(-) 47
2012-13	41,830.0	10.93	(+) 29
2013-14	103,000	33.82	(+) 210

Source: Plant Protection Wing, DAE and EPB, 2014

4.2 Potato Production in the Study area: Kahaloo, Bogra & Munshiganj Sadar Upazila are the largest potato production areas of the country. Figure-2 indicates that the potato production in the study area (Kahaloo, Bogra & Munshiganj Sadar Upazila) is also increasing gradually year to year.

Table - 4: Acreage, production and yield/ha of potato at Kahaloo & Munshiganj Sadar Upazilas

Year	Area (ha)			Production ('000' MT)			Yield/ha (MT)		
	Kahaloo Bogra	Sadar Munshigonj	Mean	Kahaloo Bogra	Sadar Munshigonj	Mean	Kahaloo Bogra	Sadar Munshigonj	Mean
2007-08	5,668	4,820	5244	66,599	70,709	99741	11.75	14.67	13.21
2008-09	5,956	4,916	5436	67,779	77,476	107361	11.38	15.76	13.57
2009-10	6,152	5,706	5929	73,516	93,293	120062	11.95	16.35	14.15
2010-11	7,978	4,436	6207	97,731	74,303	129426	12.25	16.75	14.50
2011-12	8,426	5,068	6747	106,926	87,322	150121	12.69	17.23	14.96
2012-13	9,016	4,974	6995	123,700	87,244	156338	13.72	17.54	15.63

Like Bangladesh potato production in the study area also increasing gradually year to year. At Kahaloo, Bogra & Munshiganj Sadar Upazila, during the year 2007-08, acreage, production and yield/ha of potato was 13,210 ha, 99,741 tons and 5.24 tons respectively, while it has been increased during 2012-13 to 15,000 ha, 156338 tons and 6.99 tons respectively.

4.3 Stakeholders' profile

4.3.1 Land details and characteristics of stakeholders: Table-5 shows that average ages of the farmers of study area was 48 years and the main occupation of the farmers is farming and on average they have been in farming operations for 21 years. Average land area per farmer was 0.91 ha. The cultivated land area per farmer was 0.72ha. The area under potato cultivation per farmer was 0.45ha while the average share of potato cultivation area out of total cultivated land area was 38.7%.

Table - 5: Land details and characteristics of farms and farmers

Characteristics	Bogra	Munshigonj	Average
	Mean	Mean	
Age	48	52	50
Main occupation	Farming	Farming	Farming
No. of years in farming	21	24	22.5
Total land area (ha)	0.91	0.97	0.94
Total cultivated area (ha)	0.72	0.69	0.71
Vegetable cultivation area (ha)	0.45	0.63	0.57
Share of potato area out of total cultivated area (%)	38.7	39.63	39.17

4.3.2 Educational Background and Characteristics of Actors in Supply chain: Most farmers who took part in the survey are male. About 40% of the respondents have higher secondary education followed by secondary education (34.2%), and the rest are either uneducated or have junior education (17.2%) and 2.9% are illiterate (Table-6). Collectors and wholesalers businesses are managed by male and involvement of females are very rare. On average among the collectors about 50% have higher secondary education followed by junior education (33.3%); among the wholesalers 67% have secondary education (Table-6) followed by higher secondary education (33.3%). Retailers have primary, secondary and higher secondary education.

Table-6: Educational background of potato supply chain actors at Kahaloo & Munshigonj Upazilas

Education category	Farmer		Traders		Wholesalers		Retailer		Total	
	N	%	N	%	N	%	N	%	N	%
Illiterate	1	5	0	0	0	0	0	0	1	2.9
Primary (1-5 years)	2	10	0	0	0	0	0	0	2	5.7
Junior (6-8 years)	3	15	2	33.3	0	0	1	33.3	6	17.2
Secondary (9-10 years)	6	30	1	16.7	4	66.7	1	33.3	12	34.2
Higher Secondary (11-12 years)	8	40	3	50.0	2	33.3	1	33.3	14	40.0
Total	20	100	6	100	6	100	3	100	35	100

The collaboration and mutual integration among supply chain actors are weak. About 31% of the collectors have junior education followed by secondary education (26%), and the rests are either higher secondary (26%) or have primary education (19%). On average 5.7 % of the wholesalers have primary education, 17.2% have junior level of education and 34.2% have secondary education while 40.0% have higher secondary education. On average 33.3% retailers have junior, secondary and higher secondary education.

4.4 Agronomic practices in the study area

4.4.1 Land and soil: Potato is grown mostly in medium high to high land with loamy to sandy loam soil.

4.4.2 Seed rate : 1.5- 2.0 t/ha (whole tuber); 1.2 -1.5 t/ha (cut tuber).

4.4.3 Time of sowing: 15 to 30 November is the optimum time but sowing may be done in October to December.

4.4.4 Sowing method: Ridge to Furrow method

4.4.5 Fertilizer application: Cowdung 10 t/ha (at final land preparation), (i) Urea 350 kg/ha (50% at the time of planting + 50% at 30-35 days after planting), (ii) TSP 100 kg/ha, (iii) MP 210 kg/ha, (iv) Zypsum 84 kg/ha, (v) Micronutrient deficient in soil like $ZnSO_4$ and Boric acid may be fertilized @ 12 and 5 kg/ha, respectively as basal dose. Zn fertilizer is not allowed to mix with Phosphatic fertilizer.



Fig-3 : Applying fertilizers in potato field



Fig.-4 : Irrigating potato field

4.4.6 Irrigation: Irrigations are made for potato cultivation depending on the soil type. Sometimes, pre-sowing irrigation may be required. Normally irrigation at 8-10, 40-45 and 60-65

days after sowing could be applied. Irrigation water should be maintained 2/3rd depth of the furrow.

4.4.7 Major diseases and insect pest: In the study area the respondents informed that the yield of potato is greatly reduced due to attack of several insect pest and diseases, including several viruses which contribute to the degeneration of seed stocks. Among the diseases, Late blight (*Phytophthora infestans*), Stem canker and Black scurf (*Rhizoctonia solani*) are the most important disease of potato. Major viruses of potato are Potato Leaf Roll Virus Disease (PLRV) and Mosaics (Potato Viruses X, S and M) diseases. Potato leaf roll virus (PLRV) and potato virus Y (PVY) are the important potato viruses which are transmitted by aphid. For better tuber crop production, good quality of seed materials needs to be supplied to the farmers. So, emphasis should be given to produce disease and insect free seed. Major insect pests of potato are Cutworm, Potato tuber moth, Aphid, Whitefly, Leafhopper and Potato aphid: *Macrosiphum euphorbiae*.

4.4.8 Post-harvest loss at farm level: Potatoes are semi perishable commodity and contain more than 70% of moisture. They undergo a lot of physical, chemical and physiological changes during the whole process of harvesting, curing, storage, handling, transportation and marketing, resulting in a deterioration of quality and loss in weight with time. The post-harvest losses of potato at different stages of post-harvest operations at farm level in the study areas are shown in Table7.

Table-7: Post-harvest loss at farm level

Particulars	Quantity (MT)			% loss of total production
	Bogra	Munshigonj	Average	
A. Production	15,630.00	20,280.00	17,955.00	-
1. Harvesting loss	898.72	1,166.09	1,032.41	5.75
a. Insect damage	203.19	263.64	233.42	1.30
b. Rotten loss	250.08	324.48	287.28	1.60
c. Cutting loss	140.67	182.52	161.60	0.90
d. Remain under soil	132.85	172.37	152.61	0.85
e. Other loss	171.93	223.08	197.51	1.10
2. Curing loss	257.89	334.61	296.25	1.65
3. Sorting loss	218.82	283.92	251.37	1.40
B. Pre-storage losses (1+2+3)	1,375.43	1,784.62	1,580.03	8.80
4. Home storage loss	1,219.14	1,581.84	1,400.49	7.80
C. Total loss (B+4)	2,594.57	3,366.46	2,980.52	16.60

Average harvesting loss was found to be 6.8 % of total production and the losses are comprised of insect damage (1.30%), rotten loss (1.90%), cutting loss (1.50%), potato remained under soil during harvesting (0.90%), and other losses (1.20%) such as off size, green potato etc.



Fig.-5 : Potato harvesting by women.



Fig.-6 : Potato harvesting in the field .

Potatoes in the study areas were harvested manually using country ploughs or spades. No mechanical harvester is used to harvest potatoes. The harvesting loss of potato is found to be 5.57%, which is similar to that reported by Hossain and Miah (2009 FAO). Harvested potatoes were bagged from the field and the bag kept in the shade at home for several days for curing. Sometimes, potatoes were bagged from the field and transported directly to the market or cold storage without curing. This may cause heat stress in the potato and deteriorate it rapidly. In other areas potatoes were spread on the floor and kept in the shade for one to two weeks. After curing, potatoes were sorted and sometimes graded and bagged. Average curing and sorting losses were found to be 1.65 and 1.40%, respectively. The average pre-storage loss in the study areas was 8.62%.

4.5 Value Chain Analysis of potato

4.5.1 Potato Supply Chain Map and Actors: Supply chain map of potato was developed based on information gathered during interview with the informants of the study. Based on the secondary information a “map” of the sub-sector has been developed to graphically present all the actors in the value chain. In potato production and marketing, there are several actors involved in the supply chain e.g. input suppliers, farmers, processors, traders, exporters and retailers etc. The potato supply chain represent the overall market position where growers, traders, suppliers, processors are present (Figure-7). The accumulative roles of various actors constitute the pillars of the potato supply chain, because their presence or absence has important

implications on the growth of the crop. The potato market is dominated by a few large traders and wholesalers and the farmers often get into a relatively disadvantage position. The chain of actors through which the transaction of goods takes place between producer and consumer is known as supply chain which plays an important role in achieving the marketing objectives of the produce.

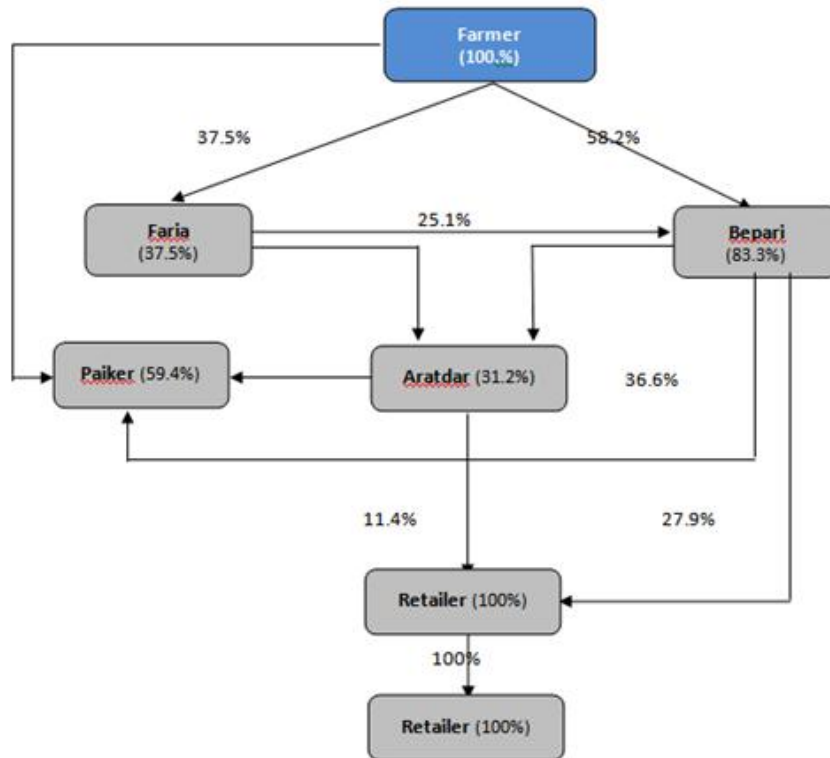


Figure-7: Potato Supply Chain in Selected Area

Considering that potato is an important vegetable in Bangladesh, the product moved from the sellers to consumers through the same chains i.e. through some market actors like Faria, Bepari, wholesaler, retailer and cold storage owner. The study revealed that there had a movement of potato from the point of production to the point of consumers through some actors forming a chain in the potato market in the study area. The assembly traders procure potatoes from fields and also from farmer's field. Pre-harvest sale system is also in place by resource poor farmers who takes loan from the traders. Some big growers within easy reach of wholesale/distributing markets are also found selling potatoes to the urban retailers through commission agents (aratdars).

Growers living around urban areas sell in the retail markets directly to consumers. The assembly traders purchase potatoes from different rural assembly markets/growers' premises and transport the lot to the assembly traders through commission agents. These assembly traders also purchase

potatoes directly from the growing areas on behalf of traders or cold storage owners on commission basis. The commission agents normally play the role of middlemen. Sometimes they play a dual role one as wholesalers and the other as aratdars.

The cold store owners purchase and store potatoes on their own and also provide service as middlemen for storing potatoes (table potatoes for the off-season and seed for next season) of traders and growers in their cold stores. The consumers in general buy potatoes from urban and rural retail markets. Hawkers rarely move with potatoes to consumers as they do for other vegetables whereas corner shops in city/town areas sell potato as a regular item to consumers.

The study revealed that the growers sell 85.52% of their production, consume 5.37 % and 9.11% preserve in cold stores as seed or table potatoes. In case of local varieties the growers for own consumption and seed purpose keep 30%. Most farmers utilize 270-450 man-days to produce potatoes. Family labour constitutes between 20-80% of all labour employed in potato cultivation. In general, potato supply chain is fragmented. Many intermediaries like local traders Bapari/Faria, local commission agents, wholesalers/aratdars, and urban and rural retailers are involved in the supply chain.

A common supply chain of potato is shown in Figure-7. The supply chain map shows various channels currently operating in different scales and degrees in the market.

Channel - 1: The assembly traders procure from producers and sell to wholesaler /commission agents and wholesalers are found to sell those to the retailers.

Channel - 2: The assembly traders/wholesaler procures potato & store in cold storage and sell to retailers.

Channel - 3: The producer keeps the produce in cold storage and sells to traders/wholesalers and wholesalers sell to retailers.

Channel - 4: The exporter procures from producer and exports it to foreign market through ocean vessels.

Channel – 5: The processor receives the potato for processing and then export through sea transport.

Marketing participants are producers, rural assembler, wholesalers/commission agents, cold storage owners/petty retailers. Several middlemen are functioning in the market. Usually movement of potatoes from farm to market is done by boat, cart, van, truck and head load etc. Farmers interviewed stated that soil condition is critical due to excessive use of chemical fertilizers and lack of soil testing facilities makes it difficult for the farmers for getting higher yield. There exist poor linkages between the value chain stakeholders. Better integration of

research and extension activities can improve the productivity, lower unit production costs; reduce financial risks associated with production and raise growers' net income.

4.5.2 Supply Chain of Stored potatoes: The marketing chain refers to the sequential arrangements of various marketing intermediaries involved in the movement of products from producers to consumers. In the chain of potato marketing in Bangladesh, the product moves from the producers-sellers to ultimate consumers through a number of market intermediaries. In the context of Bangladesh, the work of different intermediaries often overlaps. For example, wholesaler (Bepari/Paiker) sometimes performed retail business. In the present study, different marketing chains of potato were identified. The supply chain of traditionally stored potatoes is illustrated in Fig 3. Bepari (Big trader) and Faria (Petty trader) bought potatoes from farmers. The share of the cases where potatoes were purchased by Beparis (58.2%) was higher than the one by Farias (37.5%). Bepari, Paiker and Faria play a crucial role in the process of traditionally stored potato marketing in the study areas. Bepari bought a large amount of potatoes from farmers (58.2%) and directly sold to Paiker (36.6%), retailers (27.9%). Retailer purchased 1.3% potatoes directly from farmers, 11.4% from Aratdar and 59.4% from Paikers. Similarly, Faria bought potatoes directly from farmers (37.5%) and sold them to Bepari (25.1%) and a small portion (12.4%) to Aratdars. Paiker bought 3.0% directly from farmers, 19.8% from Aratdars and 36.6% from Bepari. Retailers sold their whole quantity (100%) of potatoes to consumers. Thus consumers bought 100% of farmers' potatoes from retailer through a number of chains. For cold stored potato marketing, Bepari and Paiker bought potatoes from cold storage (farmer/Stockiest). The share of purchasing potato by Bepari (73.2%) was higher than the Paiker (24.4%). Paiker also bought some potatoes (1.8%) from Bepari. Aratdar bought all of his potatoes of Bepari) from Bepari and sold 42.1% to the Paiker and 29.3% to the retailer.

Table-8: Quantity of potato stored and sold at farm level in the study areas

(Figures in kg)

Particulars	Quantity (Kg)			% of total quantity		Average
	Bogra	Munshigonj	Average			
A. Quantity stored (as table potato)						
1. Home storage	260	348	304	12.66%	14.33%	13.57%
2. Cold storage	1794	2,080	1937	87.34%	85.67%	86.43%
Total Quantity Stored	2054	2428	2241	100.00%	100.00%	100.00%
B. Quantity sold to						
1. Big trader (Bepari)	4977	5728	5352.5	46.90%	45.74%	46.27%
2. Wholesaler (Paiker)	2633	2598	2615.5	24.81%	20.75%	22.61%
3. Petty trader (Faria)	2213	2376	2294.5	20.85%	18.97%	19.83%
4. Retailer	790	1821	1305.5	7.44%	14.54%	11.29%
Total Quantity Sold	10613	12523	11568	100.00%	100.00%	100.00%

Paiker sold maximum amount (68.1%) of potato to retailer and a very small quantity to directly to consumer (0.2%). Retailer sold his whole quantity of (100.0%) but 99.8% of the channel of potatoes to the consumers. The average losses at traders' level for traditional and cold stored potatoes were 12.45 and 8.65%, respectively. Average post-harvest losses in the household level was 5.15%, respectively of purchased potato. This loss comprised rotten loss and processing loss. Total losses of traditional stored potatoes including consumers' loss were found to be 26.65% where for cold stored potatoes it was 22.40%. Total losses excluding consumer losses for traditional stored and cold stored potatoes were found to be 25.20 and 18.60%, respectively.

Table-9 : Average disposal pattern of potato at farm level in the study areas

Particulars	Quantity (Kg)	% of total quantity
Family consumption	335.0	2.14
Gift to others	160.0	1.03
Used as seed	2994.0	19.16
Stored for sale	2126.0	13.60
Sale	10015.0	64.07
Production (per farm)	15630.0	100

4.6 Disposal Pattern of Potato: Disposal pattern of potato at farm level is shown in Table-9. Farmers consume 2.14% of total potatoes and provided gift to relatives 1.03%. A major portion (64.07%) of the potatoes was sold during the harvesting period. Another 13.60% of the potatoes were stored in cold storage for sale. About 19.16% of the potatoes were stored in cold storage to use as seed in next season.

4.7 Marketing Costs and Price Spread: The producer stated that selling potato directly to market/consumer gives better price remuneration and this may be due to the absence of middlemen between producer and consumer. It appears that the grower's share is higher in case of fresh potato as compared to cold stored potato. The price of potato is lower during January to June. From July it starts to increase gradually with time and becomes maximum in the month of December. Such wide price fluctuations are mainly due to the seasonal character of production and supply (Figure - 10).

The seasonal fluctuation may, however, be reduced by using early and late varieties, arranging regular supply to the urban areas and setting up of short-period cold storage facilities. The transportation system plays an important role in the marketing of potato.

Due to the absence of adequate and quick transport facilities the cost of marketing increases. Careless handling or delay in transit causes serious damages and loss, which also increases the marketing cost of the produce.



Figure-8 : Potato harvesting



Figure-9 : Irrigation into potato field

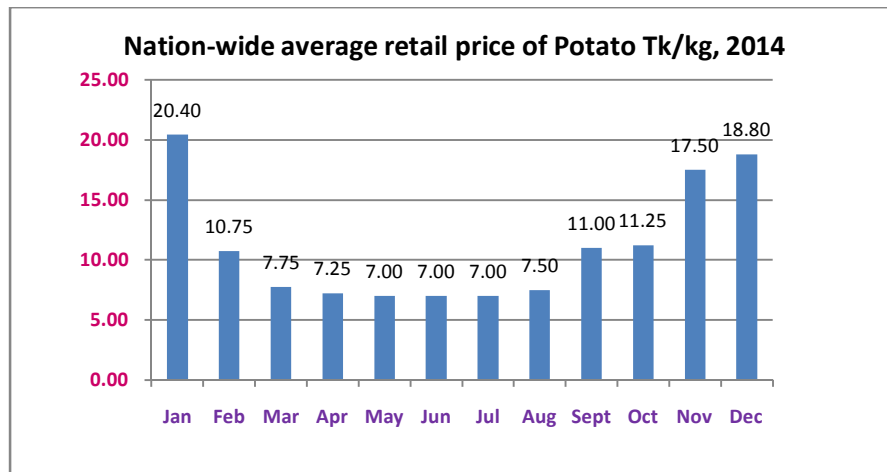


Figure-10: Monthly price of potato at survey area

4.8 Value Chain Analysis of Potato: The value chain analysis revealed that application of manure and fertilizers in potato field constitute highest cost (Tk. 32,351/ha) about 24.96% of total costs of production. A breakdown of fertilization cost/ha has been presented in Figure-11. The second highest cost of Tk.27,791.0/ha incurred for labor costs (21.40%) followed by seed cost of Tk.23,301.0/ha (17.97%). A breakdown of the labour cost indicated that in harvesting tubers on average growers incurred highest cost of Tk.10068.0 (36.24%), followed by earthing up of Tk.8214.0/ha (29.6%), seed tuber planting cost was Tk. 3661.0/ha (13.17%), pesticides application cost of Tk. 2617.0/ha (9.41%). The tillage cost was Tk.10, 638.0 (8.21%), cost of agro-chemicals (pesticides and fungicides) was Tk.5,800.00/ha (4.47%) while irrigation cost was Tk.3488.0/ha (2.69%) only. The cost of inputs such as seeds, fertilizers and agro-chemicals were high and in some cases respondents reported that fertilizers are adulterated which needs urgent attention. It should be noted that low yield rate and low margin of profit of farmers is a reflection of improper and inadequate application of fertilizers and poor quality of agro-chemicals, which limit the use of such inputs.

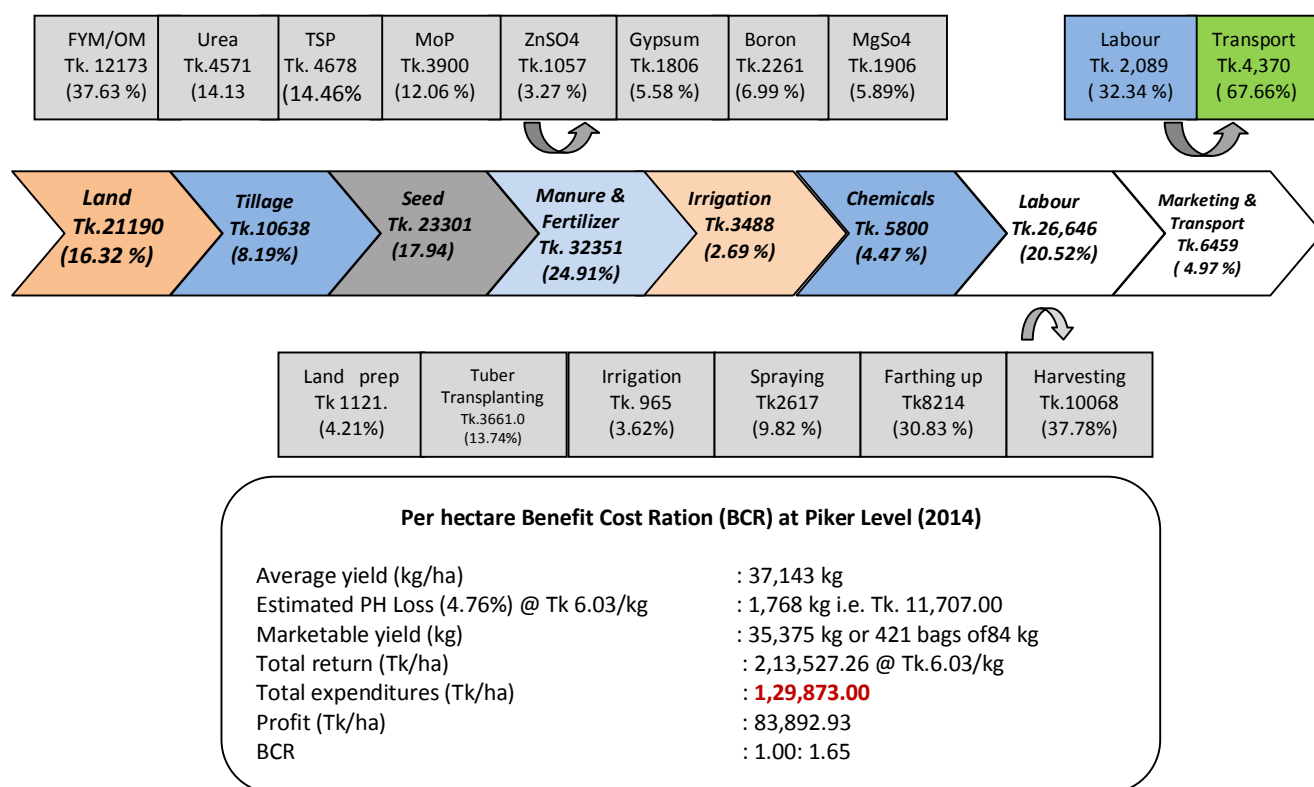


Figure-11 : Value chain analysis of potato at Bogra

The Value Chain Analysis (VCA) for potato production in Bogra indicates that the farmers are producing potatoes at a cost of Tk. 1,29,634.33/ha and with an average marketable yield rate of 35.37 MT/ha, this translates to a production cost of Tk. 3.66/kg. The average selling price of potato was Tk. 2,13,527.26 /ha (Tk. 6.03/kg). The profit of potato/ha was calculated as Tk.83, 892.93 i.e. Tk. 2.37/kg.

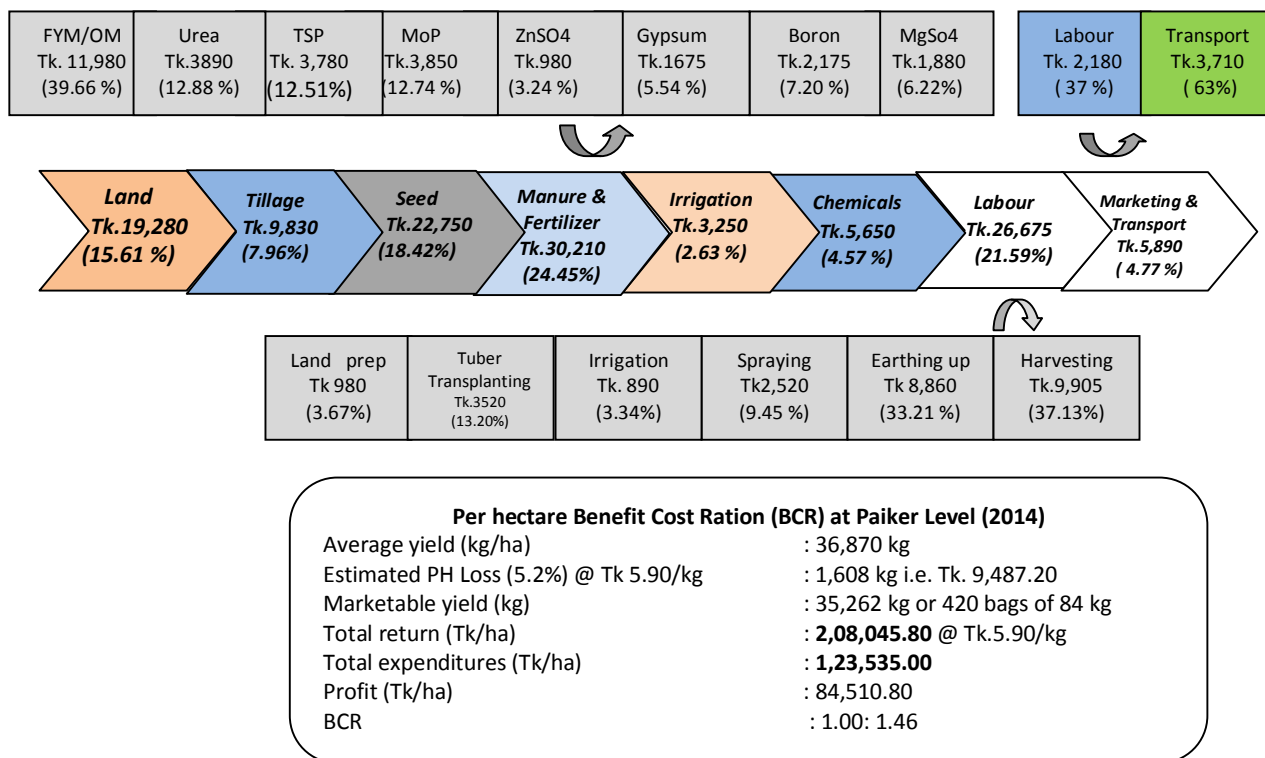


Figure-12: Value Chain Analysis of Potato at Munshigonj

The Value Chain Analysis (VCA) for potato production in Munshigonj indicates that the farmers are producing potatoes at a cost of Tk. 1,23,535.00/ha and with an average marketable yield rate of 35.26 MT/ha, this translates to a production cost of Tk. 3.50/kg. The average selling price of potato was Tk. 2,08,045.80/ha (Tk.5.90/kg). The profit of potato/ha was calculated as Tk.84,510.80 i.e. Tk. 2.29/kg.

4.9 Storage of Potato: The cold stored potatoes start coming to markets from July and remain available in the market till December. Potatoes are kept in cold stores throughout the country. Farmers also store potatoes in their premises on katcha floor (C.I.S. roof on bamboo poles with bamboo sidewalls). The growers in parts of their dwelling houses also store potatoes. The home-stored potatoes are sold between February and June. Cold Storage owners- provide space and get fee. February- mid May is the best storage time. There are 320 cold storages in the country and the competition is unhealthy and capacity of storage is about 2.0 million tons of which 1.3 million tons is for potatoes and 0.5 million tons are for seed potatoes and the rest is for other crops. BADC stores only 10,000 tons of potato seed. Storage charges are about Tk.1.5 /kg. Table potato and seed potatoes are stored in same chamber of temperature at around 8°C which is not recommended for seed potato because the tuber needs temperature around 4°C. Storing of potato seeds at higher temperature results in quality deterioration of seed potatoes and adversely affects potato production which needs urgent intervention.

There is a bright prospect for increased production because of its favourable growing season. But during last 3/4 years potato price was found to prevail at un-remunerative level during the lean period causing heavy loss to growers, traders and cold-storage owners. The situation in current year is quite different. To maintain potato price at reasonable level demand creation at various level through popularization of its diversified use is necessary. For this publicity is needed to motivate the people to consume more potato as a staple food to increase domestic demand.

4.10 Major constraints identified in potato supply chain: There were many constraints which were faced by farmers and actors in the value chain of potato. The problems that are faced by the selected farmers and actors in the production and marketing of potato and the solutions to these problems as suggested by them are discussed below:

The major constraints of potato supply chain and BDS and need for Interventions were identified and summarized in Table-10 & 11.

Table -10: Identified major constraints and proposed services or facilitation activities

Sl.#	Constraints	Target Group	Proposed Services or Facilitation Activities
1			
1.1	Lack of quality seeds and improved production technique of potato.	Farmer	A one-off facilitation activity for awareness addressing all aspects relating to potato production, post harvest management, storage, transportation and processing.
1.2	Inadequate knowledge and skills on soil, fertilizer, seeds and disease and pest management.		
1.3	Lack of knowledge of seed treatment		
1.4	Inadequate knowledge on harvesting, post-harvest handling, storage and transportation.		
1.5	Limited research and poor dissemination of research findings.	Farmers Traders, processors and exporters Researchers Extension agents	Develop appropriate and demand driven technology
1.6	Insufficient extension services on Good Agricultural Practices (GAP), ineffective extension messages and poor delivery system. There exists serious gaps between technology generation and adoption and these gaps are a factor to low yield, quality and shelf life.	Farmers Traders, processors, exporters Extension agents	Dissemination of improved technologies to the users.
2			
2.1	Inadequate market information	Farmers, Small traders, Processors	Provision for collection, collation and dissemination of market information.

Sl.#	Constraints	Target Group	Proposed Services or Facilitation Activities
2.2	Lack of poor marketing initiative and market linkages.		Identifying appropriate markets, initiating appropriate marketing and promotional activities and creating direct market linkage for the small farmers, traders and processors with the urban markets.
2.3	Control Brown rot disease for export market access	Traders, exporters	Conduct research and apply appropriate control Measures.
3			
3.1	Prevalence of sales of poor quality and adulterated inputs (fertilizers and pesticides) by the input supplier	Farmers	Developing awareness on use of quality inputs for vegetable cultivation
3.2	Lack of product (input) knowledge of the local retailers.	Farmers Input suppliers	Developing capacities, provide knowledge and information on products and their appropriate usage
3.3	Inadequate knowledge and skills in adhering to the use of recommended pesticides and ignorance of environmental concerns as demanded by importing countries. This has affected the safety of consumers and the environment. High residue levels may reduce the competitiveness of Bangladeshi produce in the international markets.	Farmers	Developing awareness about the harmful effects of indiscriminate use of pesticides.

Sl.#	Constraints	Target Group	Proposed Services or Facilitation Activities
4			
4.1	Lack of easy access to financial market by the stakeholders leading to poor or no benefits from economy of scale.	Farmers Traders Processors	Facilitating easy access to capital and working capital through linkage with financial markets and credit providers appropriate to potato production and post-harvest processing.
4.2	Inability to provide adequate collateral	Traders Processors	
5			
5.1	Lack of organized packing house, market shed for post-harvest operations, trading potatoes within the easy accessibility of the farmers	Farmers, Traders	Stimulating private sector to provide packinghouse facilities as well as market shed facilities for business purpose in specific production areas.
5.2	Lack of adequate storage facilities resulting in sales of potatoes by the farmers and traders' during the harvesting season at a lower cost.	Farmers Traders	Stimulating private sector to provide multipurpose storage and packing house/ warehouse facilities as a business.
5.3	Lack of awareness on the quality safety and environmental issues.	Farmers Exporters	Creating awareness on food quality and safety regulations.
6			
6.1	Absence of collaboration among farmers and traders leading to poor bargaining power and loss of potential bulk discounting in terms of buying inputs and sales of potato access to financial markets etc.	Farmers Traders	Facilitating the formation of producers' and small traders groups

Akther (2012) reported that inadequate capital, diseases and pest attacks, shortage of good quality seed, lack of availability of adequate inputs and high cost of inputs. Marketing problems were related to transportation cost, lower price of potato, shortage of marketing facilities, high cold storage charge and dominance of value chain actors etc. are the major constraints faced by the potato growers. Side by side she also reported that Inadequate good transport, Inadequate capital, storage facilities, market facilities, marketing information and high cold storage charge are the major constraints faced by the value chain actors in the study areas. And for improving the marketing suggested for making provision for adequate and easy loan from institutional sources against the security of their produce, improving transportation system and well market information services through newspaper, radio & television broadcasting to reduce the uncertainty of potato prices. The findings of the present study are more or less in agreement of the findings of Akther (2012).

From the present study, major constraints of business development services were identified and suggested some interventions presented in Table-11.

Table-11: Constraints of Business Development Services (BDS) and Need for Interventions.

Business Development Service	Constraints related to Service Providers	Interventions Needed
<p>Facilitating awareness campaign on appropriate production and post-harvest technology through training on -</p> <ul style="list-style-type: none"> • Soil, fertilizer and pest management following the codes of GAP to update knowledge and skill. • Harvesting, post-harvest operations and storage of potatoes. • Adaptive research on quality seed production and use by private sector and dissemination of technology with proper linkage of research extension and NGOs. 	<ul style="list-style-type: none"> • In-adequate training centre/ institutes at local level • Formal training facilities are very much limited and in-adequate • Producer's organization/associations are not skilled and organized enough to provide such services • Commercial training markets are not studied systematically • In-adequate skilled trainer/resource persons in specialized subjects. 	<ul style="list-style-type: none"> • Logistic and technical aid is needed to establish such training facilities in private sector. • Develop standardized training materials (manual, booklets, leaflets and flip charts etc.) • Develop capacity of existing private sector organizations training centers. • Training of trainers for providing need based in hand training. • Facilitate organizing training in collaboration with the existing local institutes for update skills and technical knowledge. • Facilitate conducting research for seed production of potato and other vegetables by private sector seed companies.

Business Development Service	Constraints related to Service Providers	Interventions Needed
<ul style="list-style-type: none"> • Access to market information about market size, clusters of market and potential for export market through publishing booklets, magazines, books and journals etc. • Identifying appropriate markets, initiating proper marketing and promotional activities and creating direct market linkage for the stakeholders for local as well as export markets. • Affordable, appropriate and effective post harvest and processing technology through training to farmers, traders and exporters on grades and standards of potato and knowledge of packaging. 	<ul style="list-style-type: none"> • Institutional weakness in both public and private sector for collection and dissemination of market information due to shortage of resources and technical skills. • The enterprises are small in size and do not have capacity and skill for individual market study 	<ul style="list-style-type: none"> • Facilitation is needed for capacity building of the potential private service providers in publication of market information related to prices and information on assemblages of potato in important markets. • Providing farmers the information of market demand and price of produces. • Develop skills and capacities of SMEs in identifying alternative markets, forecasting demands and coordinates with the stakeholders. • Awareness campaign is necessary among the exporters on modern technology of post-harvest management and quality assurance to reduce losses and improve quality. • Developing awareness among the stakeholders (producers, traders and processors) on appropriate post harvest and processing technologies of potato. • Forming SMEs association and developing capacities to create direct market linkage with domestic and export markets. • Help in participating in trade fairs/ exhibition which will expose the stakeholders about the present scenario of product development/ diversification and market demand.
<ul style="list-style-type: none"> • Developing awareness on quality inputs for potato 	<ul style="list-style-type: none"> • Insufficient knowledge on quality inputs (seeds, 	<ul style="list-style-type: none"> • Facilitation is needed to develop awareness on the

Business Development Service	Constraints related to Service Providers	Interventions Needed
<p>cultivation</p> <ul style="list-style-type: none"> • Applying more organic fertilizers and for using pesticides properly. 	<p>fertilizers and chemicals).</p> <ul style="list-style-type: none"> • Inadequate implementation of regulations on quality standards. • The services are not adequately meeting the need and are not reaching the entire sub-sector. • Lack of adequate manpower and resources and awareness about its impact and also priority. 	<p>use of quality inputs and encouragement should be provided for using quality inputs properly.</p> <ul style="list-style-type: none"> • Capacity building of private sector service providers through awareness campaigns, holding workshops, trainings and using mass media to provide knowledge and information on products and their appropriate usages. • Facilitation is essential for capacity building of private sector high lighting importance of using organic fertilizer, its market size and demand.
<ul style="list-style-type: none"> • Easy access to financial market by the stakeholders. Commercial bank requires securities that most SMEs do not have which has limited to them to only low self-financing production and business levels. 	<ul style="list-style-type: none"> • Limitation of Commercial Banks is high to entertain SMEs for enterprise development. • NGO credit providers do not have much scope to provide credits with low interest rate that what they are providing at present. • Money lenders also cannot provide credit money with low interest rate. • Credit recovery is a problem for the credit providers of SMEs development. • Government is receiving soft loans from donors, and relending this farm at much higher rates hindering the viability of SMEs. 	<ul style="list-style-type: none"> • Facilitating easy access to capital and working capital through linking with financial markets and credit providers. • Facilitating access for production and marketing credit facilities with a view to bringing about an overall improvement in the sub-sector. Alternative options such as (i) establishment of rural banks; (ii) increasing reaches of and accessibility to BKB; (iii) establishing a small Farmer Development Fund; (iv) Expansion of PKSF; and (v) establishing a specialized Agribusiness Specialized Micro Credit Institution to provide flexible- financing to promote Agribusiness SMEs.
<ul style="list-style-type: none"> • Establishing packing house, market shed and adequate storage facilities. 	<ul style="list-style-type: none"> • Inadequate capacity of the both public and private service providers to 	<ul style="list-style-type: none"> • Stimulating private sector to establish packing house, warehouse, market shed and

Business Development Service	Constraints related to Service Providers	Interventions Needed
<ul style="list-style-type: none"> • Creating awareness on the quality and environmental issues. As internal quality control system actors invoked in the chain. • Good quality packaging for easy export market access. 	<ul style="list-style-type: none"> • establish packing house, market shed and storage facilities for perishable. • Lack of capacity to co-ordinate matters related to produce quality, produce inspection, quarantine control, laboratory and monitor the level of MRLs of the produce. • In-adequate capacity and facility to address the issue as demanded. 	<ul style="list-style-type: none"> • storage facilities as a business with technical support and helping in easy access finance. • Facilitating institutional capacity building for implementation of food safety issues and measures and that should take place in public and private sectors including, NGOs and civil society. • Logistic and technical supports to stakeholders for development of packaging materials from local raw materials. Exporters should be motivated to use standard packaging for easy market access with attractive price in export market.
<ul style="list-style-type: none"> • Strengthen support for exports of potatoes and potato products 	<ul style="list-style-type: none"> • Provide technical and financial support to exporters. 	<ul style="list-style-type: none"> • Support private entrepreneurs in developing cool chain management and shipment of quality (Brown Rot disease free) products through sea shipment.
<ul style="list-style-type: none"> • Uninterrupted supply of electricity to stakeholders 	<ul style="list-style-type: none"> • The PDB and PBS are lacking of generating power against demand in various sector. • Efficient system of load shading management as well as distribution of electricity in priority sectors is absent. 	<ul style="list-style-type: none"> • Private sector companies for generation and distribution of electricity to be encouraged to improve the situation.
<ul style="list-style-type: none"> • Capacity building through formation of Associations among the producers and traders. 	<ul style="list-style-type: none"> • Weak organizational capacity and mostly entrusted with individual interests of office bearers ignoring the general members case. • The associations do not have either adequate experience and skill or sufficient knowledge and skills on organizational 	<ul style="list-style-type: none"> • Awareness campaign is needed among the farmers/ traders/ exporters to be member of the association. • Capacity building of the association on management of association and business or entrepreneurial skills.

Business Development Service	Constraints related to Service Providers	Interventions Needed
	management.	

4.11 Short listing of services for interventions: On the basis of information collected from the potato supply chain actors and key informants, the BDS were narrowed down for priority interventions. The prioritization was made considering four indicators such as, unmet market demand, potential for market growth, potential for employment generation.

Table – 12: Priority Business Development Services for Project interventions

Areas	Services Required	Service Providers	Target (Beneficiaries)
1. Knowledge, skill and technology dissemination.	<ul style="list-style-type: none"> • Improve production technology of potatoes following GAP and introducing contract farming. • Improved post-harvest handling, grading, packing and cool chain management of potatoes for urban and export market. • Strengthening cold storage management for quality assurance of potatoes. • Strengthening service providers for; <ul style="list-style-type: none"> - Soil testing and fertilizer management - Quality seed tubers • Pesticides • Multipurpose cold storage operation 	<ul style="list-style-type: none"> • DAE & local NGOs. • DAE, BADC, local NGOs, Agriconcern, • Producer organization, DAE, BADC & local NGO. • SRDI, DAE, Fertilizer Association. • BADC, TCRC, Agriconcern, (Potato Seeds) and Seed Growers/ Merchants associations; • Pesticide Association/ Pesticide companies. • Ejab Group (Himadri Ltd.) technical assistance 	<ul style="list-style-type: none"> • Farmers, Traders and Exporters. • Traders, farmers and Exporters. • Staff of the respective organizations, Traders, Farmers. • Farmers, Traders/ Dealers.

Areas	Services Required	Service Providers	Target (Beneficiaries)
		in setting up of multipurpose cold storage/potato seed storage	
2. Market information	<ul style="list-style-type: none"> • Data base for: <ul style="list-style-type: none"> - Making available the latest price and trends of potatoes; - To generate information on whole sale prices, arrivals and trend in various market of the country for potatoes; - To determine the market size, clusters, market potential (local and export); - Establish a nationwide communication network for speedy connection dissemination of market data for its efficient and timely utilization. 	<ul style="list-style-type: none"> • Consultants (National and International) • Hortex Foundation 	<ul style="list-style-type: none"> • Traders and Exporters. • Exporters, Farmers and other beneficiaries in the value chain.

4.12 Potentials of Contract Farming: The existing weak linkage between vegetable/potato processing industries and growers is one of the key reasons for low productivity of desired quality product resulting in uncertainty in availability of adequate raw materials throughout the year. A majority of marginal farmers with small size of land holding do not have adequate resources and technology to improve their productivity. There are three-basis alternative for procurement of agricultural raw materials by food processing industries or for export;

- a) Buy from the market
- b) Own production (Captive cultivation)
- c) Contract production

Buying directly from the market may not be desirable because of uncertainty in quality, traceability and availability of the raw materials as per demand in time. Side by side, land captive cultivation may not be feasible and economical due to shortage of owned land and large overhead expenses in the long run. So, the most suitable method for procuring agricultural raw materials is to source directly from the farmers through contract productions. The importance of “Contract farming” has increase with the development of vegetable exports and emergence of super market and processing factories.

The advantages of Contract farming;

- (a) Increasing of productivity by transfer of modern production and post harvest technologies from R & D.
- (b) Availability of desired quality raw materials through use of specified planting materials and traceability.
- (c) Assured supply of raw materials at reasonable mutually agreed price.

On the other hand, industry needs the requisite quality and quantity of raw materials over a longer period of time at reasonable prices. The industry has the access to the modern technologies and to the inputs, which it can transfer to its contract growers. There are successful evidences of contract farming by PRAN, ACI and SQUARES for vegetables, BADC and private seed companies for seed. The experiences of these interventions can be evaluated and used for the development of a comprehensive model for vegetable production under contractual arrangement for local and export markets. Hortex Foundation can provide valuable services in this regards.

Following initiatives towards implementation of contract farming shall be mutual advantage to both processing industry and growers;

- i) Formulating policy for a judicial system for enforcement of contracts to be involved at the Local Government level (Union, Upazila/District) and administration level for arbitration and speedy addressing of disputes. The contract between a company and a grower should be binding and enforceable by both the parties. The contracting industry should provide desired variety of seed, pesticide, and fertilizer with technical assistance on credit to farmers or producing SMEs. There should be a buyback guarantee of the produce on a pre determined quality of produce and its price. The farmer should not supply the produce to any other company or individual, except the rejected quantity by the contracting industry or exporters, as per arrangement.
- ii) An appropriate financing system to provide short finance (crop loans) to growers for seed and other inputs may be arranged by the contracting industry or exporters from the Bank.

- iii) Assistance in promoting good agricultural practices may be arranged through service providers e.g. Hortex Foundation, Bangladesh Fruits Vegetables and Allied Products Exporters Association, PRAN RFL Group, Squares Agribusiness, ACI Agribusiness etc. for the contract growers.

If the industry provides suitable planting materials and inputs along with modern production technology as per international standards such as Good Agricultural Practices (GAP) and assures the farmers of buying the produce at the mutually agreed price and Government should take initiatives to solve major bottlenecks of air shipment or alternate shipment through sea vessels, the contract farming system can work wonders for mutual benefit of the processors, exporters and farmers.

4.13 Gender in potato value chain: A substantial number of women are involved in various activities related to potato production, postharvest handling and marketing. Women do almost all the works of seed sowing, plantation, treatments of seeds, irrigation, harvesting etc. in the fields adjacent to homestead area. They are involved in harvesting, cleaning, curing, sorting, grading and packaging. Women are often not involved in marketing of potato, factory work or skilled functions. Mostly traditional technologies are used. Factors leading to women's participation in post-harvest operations are willingness of women to contribute to their respective family income, pressure from their respective families and both willingness and pressure from their families.



Fig.-13 : Women are collecting potato in the field.



Fig.-14: Women are sorting potato on the road.

There exists a gender divide with regard to the participation in the decision making process of different agricultural activities at the family level. As to the cultivation of crops, sowing of seeds, plantation of seedlings, weeding, harvesting, management and control of pests, application of different inputs, hiring of labor, marketing and selling of crops, choice is made unilaterally by men. However, as to the post-harvest handling of crops, women appear to be the dominant actor and in other areas, women's participation in decision-making process is at very low ebb. Besides, a good number of respondents reported about joint participation of both men and women in decision-making with respect to selection of crops, cultivation of crops, sowing of seeds,

weeding, plantation of seedlings, harvesting, hiring of labor, marketing, sorting, processing, drying and selling. But the participation of women is very low in comparison with that of men. Participation of women in decision-making process is mainly ascribed to women's affiliation to community-based organization, supply of capital from women, existence of women's own savings and women's literacy. The survey evinces three factors that inhibit women's participation in the decision-making process in respect of agricultural activities and these are lack of education, lack of own property and conservative attitude of the family. All technologies in regard to the post-harvest operation are suitable to women because of their involvement within the homestead area and light physical labor. The technology relative to harvesting of crops is not suitable to them, as it demands their involvement in the far away from their homestead area. Women are discriminated against in terms of wages and division of labor. An indiscriminate wages distribution is prevailing among men and women. The women are always paid wages less than that of men, even when doing similar job.

CHAPTER FIVE

Conclusions and Recommendations

5.1 Recommendation for Interventions

Potato industry is facing some crucial challenges related to development of services, capacity building, market access, technology information, and policy advocacy. In order to strengthen the capacity and dynamism of the industry the following priority intervention areas are recommended for consideration:

Illustrative Interventions with Market Assessment

Facilitation Activity-1; Improved Farmers knowledge and skill on Good Agricultural Practices for Quality Potato Seed Production and Value addition

Skill development and capacity building, addressing all aspects relating to potato production following the codes of Good Agricultural Practice (GAP) will improve quality of production and add value. This will also increase knowledge and skill of the farmers on contract production and processors/exporters to get supply in time.

Related Constraint

Lack of information, knowledge and skill on; a) Improved cultivation technique for ensuring higher yield; b) Soil, fertilizer and pest management for vegetables production; c) Quality seed production, collection and preservation; and d) Improved harvesting and post harvesting process at the farmer's level.

Description of the Service

During field study it was observed that the general awareness and skill regarding improved production technology of potatoes is one of the critical constraints of the crop. By addressing this issue could profoundly improve growth, profitability and income, especially under contractual arrangement, in potato cultivation and marketing. This demand a service for skill development to the supply chain actors relating to:

- 1 organized contractual arrangement for production and timely supply.
2. Improved production techniques
3. Soil, fertilizer and pest management
4. Quality seed production, preservation and use
5. Improved-harvesting techniques and post-harvest management of potatoes
6. Linkage with processors and exporters and farmers.

Related Sub-sector Constraint

The potato supply chain actors, in general, do not have appropriate and adequate knowledge and awareness on various aspects of potato production, post-harvest handling, grading, packing and cool chain management and processing. This lack of knowledge on quality standard is forcing the farmers to get less return as compared to the potential. Under the prevailing circumstances, farmers do not see much potential of producing more potatoes for their income. As a result, the processing industry or exporters are not getting quality supply in time. Although, there is a success story for quality potato production through contractual arrangement with a buy back guarantee in Bangladesh, however this approach need to be implemented for value addition in major potato growing areas in Bangladesh.

Demand-side

1. The farmers for increasing their livelihood from potato cultivation look for skill development services. The field study as well as interview from the key informants shows that there is a strong demand for this service. Moreover, the various limited awareness programs of DAE and NGOs on potato cultivation shows that the demand for improving income potential from its cultivation is strong. It may be mentioned here that although limited work has been done at the production level, the post-harvest and processing side of the potatoes has been ignored by both the government and the NGOs. Currently both the farmers and processors mostly rely on their indigenous knowledge and experience or practices. There exists wide scope to improve the knowledge and farmer's profitability.

2. Unavailability of services in the target area

Supply-side (by supplier type)

1. Government:

- a) Lack of adequate manpower and resources and motivation
- b) Inadequate extension services leading to poor awareness and knowledge

2. Private sector:

- a) Resource constraints
- b) Poor demand to transected services

3. NGOs:

- a) Limited awareness program focused on yield and variety of potatoes

Satisfaction with Services

Those who reported to have acquired the services stated that they are generally not satisfied due to their inadequacy.

Awareness of the Services

Awareness regarding the services is minimal

Proposed service provider(s) to Target for Interventions

A facilitator would design, organize and implement a comprehensive program for developing awareness and knowledge on the issues with the participation of the urban super market suppliers and exporters, large input manufacturers and dealers, and service providers.

Financial Sustainability

This is a one-off awareness raising campaign intended to stimulate the demand and supply of BDS under a market environment through private sector providers

Potential Impact on the Potato supply chain

- Increased awareness and knowledge on various important issues relating to production and post-harvest operations of potatoes would provide the farmers with required skill on international standards e.g. Global-GAP.
- Vision and understanding about the potential of potato production and post-harvest management as a highly profitable business.
- Strengthen the overall potato market
- Increase income of the farmers, traders and exporters, and
- Increase engagement of female members in the trade

Illustrative Interventions**Intervention/Facilitation Activity****BDS Providers**

- Department of Agricultural Extension (DAE)
- Bangladesh Agricultural Development Corporation (BADC)
- Bangladesh Rural Advancement Committee (BRAC)
- Rural Development Academy (RDA)
- PROSHIKA
- Ejab Group, and
- Agriconcern

Sustainability

Design and implement interventions leading to service provision at cost

Demand creation to achieve economic volume of transactions for BDS providers

Methodology

1. Needs assessment survey in specific potato growing areas
2. Organizing farmers for contract production
3. Training need assessment
4. Developing “Hand-on, and on the job” Training module
5. Training of Trainers (ToT)
6. Awareness campaign about the service provision to the relevant stakeholders
7. Linkage development with agro-processors, exporters and financial institutions
8. Stakeholder workshops
9. Farmers’ group meeting
10. Communication and motivation through audio-visual medium and tools.

Role of Facilitator (Agro Based SME Cluster & Value Chain Development Project)

1. Stakeholder mobilization and motivation
2. Dialogue meetings at different levels including farmers, suppliers, processors and exporters
3. Capacity building of private sector service providers
4. Hiring service providers to render services to farmers, suppliers, exporters and processors
4. Promotion of best practices
5. Exchange visits.

Exit Strategy

1. Create no undue expectations
2. Create no dependency on facilitator
3. Resist temptation of taking up provider’s role
4. Develop capacities of BDS providers
5. Transfer gradually the facilitator’s functions to BDS providers
6. Communicate transparently the exit strategy and time frame to all stakeholders from the outset
7. Lay out post exit monitoring and follow up plan.

Facilitation Activity- 2: Improved knowledge on harvesting, grading, packing and transportation of quality potatoes

Develop standard practices for grading, transportation and processing of vegetables through pilot programs.

Related Constraint: Deterioration of quality at post-harvest operations and processing level because of lack of knowledge, information, skills, and modern technology.

I. Description of the service

During the field research it was observed that the lack of standard practices in post-harvest operations and processing of potato are the critical constraints in maintaining quality of potatoes. Lack of standard is profoundly affecting the growth, profitability and income potential especially to the large number of farm households who are engaged in vegetable cultivation and marketing. The constraints are related to:

1. Harvesting and post harvest handling
2. Transportation, through cool chain management
3. Processing and storage practices.

II. Related Supply Chain Constraint

The potato supply chain actors, in general, do not have any standard related to the various quality issues with respect to post-harvest operations, processing and storing. This lack of standardization is hampering the market in general and is forcing the farmers to demote from growing potatoes. Under the prevailing circumstances, farmers do not see much potential of producing potatoes more than a meager supplementary income.

III. Market Information regarding the service

Existing Providers of the Service

The existing providers of adoptive research are:

1. Department of Agricultural Marketing (DAM)
2. Bangladesh Agricultural Research Institute (BARI)
3. Bangladesh Agricultural University (BAU)
4. Bangladesh Agricultural Development Corporation (BADC)
5. NGOs.

Market Size and Penetration of the Service

The use of the findings has the potential for usage to a large number of producers and processors and would benefit all the actors in the potato value chain directly or indirectly (Potato Processing Plants.”). It is believed that a number of farmers would also start growing potatoes on a commercial basis if they see it as a potential source of business through this systematized standardized knowledge and information of cultivation and post harvest handling techniques of potatoes.

Frequency of use of the service

The service will be a one-time facilitation activity for dissemination of the standard practice for increasing potential benefit the selected program areas.

IV. Constraints and Opportunities in the Market for the Service

Demand-side

The farmers for increasing their livelihood from potato cultivation look for such service. The field study as well as interview from the key informants shows that there is a strong demand for this service. Moreover, the various issue-based researches on vegetable varieties, higher yield, etc, and their acceptance by the farmers show that the demand for skill development on production and post harvest management is strong.

Supply-side (by supplier type)

- a. Focus on high-yielding modern varieties (MV) of potatoes in general, standard post harvest handling, transportation and storage.
- b. Lack of adequate resources.

1. NGOs:

- a) Limited research focus on yield and variety improvement for longer shelf life (TCRC, BARI).

Satisfaction with Services

Those who reported having acquired the limited services stated that they require scientific justification and standardization of the practices for both high yield and increased income through processing for export.

Awareness of the Services

Awareness regarding the services is minimal.

Proposed service provider(s) to Target for Interventions

The facilitator would design, organize and implement a comprehensive pilot program with a standard package for post harvest operation, storage and transportation of potato local markets, exporters and processors.

Financial Sustainability

This is a one-off research work to scientifically justify each practice in both post harvest handling and processing levels.

Potential Impact on potato production

Standardized practices through pilot programs would increase skill and knowledge on various important issues relating to post harvest handling and processing of potato.

- a. Improve the quality of both fresh and processed potatoes

- b. Enhance demand both at home and abroad
- c. Organize and strengthen the overall potato markets

Illustrative Interventions

a. Intervention/Facilitation Activity

Facilitator

1. Public sector organizations (DAE,BADC & BARI)
2. BRAC
3. PROSHIKA
4. Private firms/associations/societies etc.

Reasons/Justification

DAE,BADC & BARI ,BRAC, PROSHIKA Agricultural Universities, BCSIR, BARI etc. who are experienced on such activities may undertake the collaborative and comprehensive partnership program.

Sustainability

This would be a one-off program designed to strengthen the sub-sector

Methodology

1. Select specific and potential vegetables production sites and organize farmers and exporters
2. Understanding and documenting current practices
3. Undertake scientific validation of existing and potential new practices
4. Promotion of standardized practices through demonstrations, group meetings and capacity building of the actors,
5. Exchange visits of relevant actors to speed up the dissemination/ extension process

Exit Strategy

Since this is a one-off facilitation activity undertaken by the facilitator and should have a clear exist strategy. The primary strategies are to

- (a) Create no undue expectations
- (b) Create no dependency on facilitator
- (c) Resist temptation of taking up provider's role
- (d) Develop capacities of BDS providers
- (e) Transfer gradually the facilitator's functions to BDS providers

- (f) Communicate transparently the exit strategy and time frame to all stakeholders from the outset
- (g) Lay out post exit monitoring and follow up plan

Facilitation Activity – 3: Support SMEs/Farmers Association for Market linkages

Creating direct market linkage for the small farmers, traders and processors with the urban markets as well as export markets through formation of SMEs' Association.

Related Constraint

Control of potato market by a few large traders, processors and wholesalers in Bangladesh; thus making the small farmers and traders looser and demotivating them to take vegetables as a primary business.

Description of the Service

The potato market in Bangladesh is characterized by an unstable demand due to poor linkages with major markets in the urban areas. This makes the entire market extremely volatile. Creating opportunities and access to alternative markets can be considered as one of the critical factors contributing to overall benefit to the SMEs

This service would primarily include:

1. Exploring major urban markets and market actors
2. Developing regular flow of information amongst the market actors
3. Searching new markets both at home and abroad
4. Forging linkage between actors

Related Supply Chain Constraints

In general, there is no adequate market linkages and market access to large urban markets for potatoes especially for the SMEs. As a result, the market tends to be unstable for them. Lack of market information, lack of diversified and competitive market, lack of appropriate transportation and storage are some of the major weaknesses of the market affecting the linkage, market access and absence of coordination amongst the market actors. These constraints are likely to pose even a greater impediment especially when it comes to scaling up the potato production and sales. The lack of adequate linkages and coordination has not only made the market volatile and uncertain but has also de-motivated the SMEs in taking up potato production solely as a viable business venture.

Description of the Service

Existing Providers

The existing providers of linkage and coordination include:

1. Large traders
1. Wholesalers
2. Processors

Market Size and Penetration

During the field study it was observed the prime trade of potato is located largely in town areas. The processors, wholesales/traders of vegetables of town/urban areas have been found to be lacking adequate facilities for accessing large urban markets. Lack of linkage with large urban market makes these traders solely dependent on only a few vegetable marketers and small local retailers in town/urban areas. However, the field research and interviews with key informants in study areas suggest a strong demand of vegetables in both large urban markets in the country and good potential to export to other countries; weak market linkage have contributed to become erratic and unpredictable.

Almost all the producers and traders have complained about this erratic demand of vegetables and lack of access to alternative markets. During the survey, it was found that exporters were found to very desperate about improved packaging, quality improvement of produces and air cargo- space in expanding their export markets and entering the upstream market segment. Many requested the survey team to provide such facilities and service. Frequency of use of the Service The service is required not only during the potato harvesting but almost throughout the year for sales of potato to the urban and export markets. Only a few major processors and wholesales have access to and use the existing market linkage facilities. The rest are dependent on the local processors, wholesales and traders.

Constraints and Opportunities in the Market for Services

Demand-side

1. The processors and traders in general and the small processors and traders in particular look for the service for their profitability.
2. The potato market seems to be controlled by only a few wholesalers and traders. As a result many SMEs are reluctant to get this from those large traders with an assumption that the information supplied by them will not be appropriate for them.
3. Due to the supply of low quality produce and poor packaging, the demand in urban super market and upstream export market is low; this hinders the expansion of market.

Supply-side (by supplier type)**1 Private Sector**

a) The potato processors use the service to their own benefit because of the competition.

The large traders provide the service with a high profit margin gained from the purchase of potato from the SMEs and selling it to the urban markets, thus making it difficult for the SMEs to do business comfortably.

Opportunities:

1. Opportunities for large traders/wholesales, with a fair trade attitude, to enter the market and provide embedded services in terms of creating market linkages
2. Organizing new markets Set standard in terms of quality vegetable delivery to large urban and exports markets

Satisfaction with Services

The farmers, traders and the processors, especially the small and medium enterprises showed dissatisfaction regarding the services particularly for erratic and unpredictable nature of service and inaccessibility

Awareness of the Services

Awareness regarding the services in general is quite high

Proposed service provider(s) to Target for Interventions

A facilitator would design, organize and implement a comprehensive program 1) organizing associations of the SMEs working on potato, 2) creating linkages between the SMEs' association and urban potato markets, creating a competitive and alternative market options and setting quality standards.

Financial Sustainability

A one-off facilitation role will be required with a view to encouraging the private sector to enter into the market so that the linkage is created. Once the linkage is established the private sector (mainly the large processors) would start providing this service through the mark-up between purchase and sales price from the producers to resellers in urban markets

Potential Impact on the vegetable Sub-sector

1. Market linkage and market access would provide the processors, wholesales as well as the farmers especially the SMEs the better environment
2. Opportunities to produce and sell potatoes more profitably

3. Strengthen the overall vegetable market in the target area
4. Increase sense of security among the SMEs
5. Increase sustained source of regular income to the sub-sector actors.

5.2 Conclusions

Potato is extremely important for the growth and sustainability of the agricultural sector, as well as for national economy of Bangladesh. It is directly contributing to the employment generation, food security, and nutrition and poverty alleviation of the country. Despite limited capacity and skill potato has displayed a noticeable advancement during the last decades. However, the government has not recognized its contribution as well its importance duly by the private sector. To harness the potential of this important crop, some interventions are urgently needed related to technical and managerial skill, input supplies, market and technology information and certain policy issues. An intensive investigation and analysis of potato supply and value chains have been done in the foregoing sections of this report and constraints, service provisions to remove these constraints and potential service providers are also identified. Based on the findings, some important priority Business Development Services are to be undertaken for development of potato industries in Bangladesh. An integrated approach by private and public partnership can bring a significant improvement in this sub-sector.

CHAPTER SIX

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Appendixes
Survey Schedule

Appendix – 1

Production, Postharvest management and Storage of potato in Bangladesh.

A. Survey Schedule for Potato Farmers:

Serial No.

Date :

1. Location :

District :; Upazila :

Union/Pourashova :; Village :

2. Name : Age : Years, Family Size:

3. Educational Qualification (put \surd mark) :

Illiterate (00) Primary (01) Secondary (02) Higher Secondary(03) Above Degree(04)

4. Status of cultivated & other lands :

Type of Land	Area (decimal)	Type of Land	Area (decimal)
a. Own cultivated land		f. Orchard	
b. Rented in land		g. Pond	
c. Rented out land		h. Homestead	
d. Mortgaged in land		i. Barren land	
e. Mortgaged out land		j. Other	

5. How many years have you been working in potato cultivation ? years.

6. Have you got training on potato cultivation ? (put \surd mark) Yes No

If 'Yes', how many times ?

7. What was the source of potato seeds ? (put \surd mark)

BARI (06) BADC/BADC dealer (05) Seed selling centre (04)
 Own stock (03) Neighboring farmer (02) Open market (01)

8. Technological & extension services :

Source of technological support	DAE	BARI	BADC	NGO	Other
Type of technological support					

9. Family income in the year 2014 – 2015 :

Source of income	Income (Taka)	Source of income	Income (Taka)
a. From crop		d. From business	
b. From livestock		e. From service	
c. From fishery		f. From other sources	

10. Information on potato cultivation in 2014 2015 :

Potato Variety	Area of land (decimal)	Total production (mound)	Price at harvest (Tk./mound)	Total value (Taka)
a. Local				
b. HYV				

11. Cost of inputs for potato cultivation (plot):

Variety	Area (decimal)	Land preparation	Seed	Manure	Fertilizer	Weeding & earthing-up	Insecticide	Irrigation	Other cost	Total Cost
Local										
HYV										

12. Disposal pattern of fresh potato in this year (Kg.) :

Total production	Family consumption	Given to relatives	Sold	Stored as seed potato	Stored as food potato	Other

13. How did you harvest potato ?
(put ✓ mark)

a. With spade (01)
c. With machine (03)

b. With plough (02)
d. Other –specify (04)

14. How much damaged potato was found during harvesting?

Type of damage	Amount of damaged tubers (Kg.)	Cause of damage
a. Damaged by insect pest & vertebrate		
b. Rotten potato		
c. Cut potato		
d. Remained in the soil (unharvested)		
e. Other damage (if any)		

15. After harvesting did cure the potato ? (put \surd mark) Yes No

If 'Yes', how did you cure the harvested potato ? (put \surd mark)

Keep in the field as a heap, Duration

Keep in the sun, Duration

Keep in the shade, Duration

16. How much potato was lost during curing? kg.

17. Before selling did you sort and grade the potato ? (put \surd mark) Yes No

If 'Yes', how much potato was rejected ? kg.

18. Information on potato buyer and amount sold during this year (2014-2015) :

Buyer	Place of selling	Amount sold (Kg)	Price (Tk/kg)
Stockiest			
Whole seller			
<i>Bepari</i>			
Retailer			
Consumer			

Field, home, local market, Upazila market, whole sell market, district market etc.

19. Last year how did you store potatoes ? (put \surd) Traditionall
y Cold storage Both

20. Information on storage of potato in 'Traditional Storage' system (at home)

Storage method	Type of potato (food/seed)	Amount stored (kg)	Storage period	Storage cost (Tk)	Amount damaged (kg)	Causes of damage

21. Is there any cold storage in your Upazila/District ? (put \surd mark) Yes No

If 'Yes', what was the distance from your home ? km.

22. Information on storage of potato in cold storage :

Type of potato	Amount stored	Storage period	Storage cost (Tk.)				Amount loss (Kg)	Causes of damage
			Transportation	Storage charge	Other charge	Total cost		
Food								
Seed								

23. How much potato damage occur during transportation? :

Type of potato	Means of transportations	Distance (Km)	Amount transported (Kg)	Amount lost (Kg)
Field to home				
Home to market				
Home to cold storage				
Cold storage to home				
Field to cold storage				

24. Please suggest, how can we reduce postharvest losses of potato ?

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Signature of interviewer

Name :

Survey Schedule

Appendix – 2**Production, Postharvest management and Storage of potato in Bangladesh.****B. Survey Schedule for Cold Storage (potato):**

Serial No.

Date :

1. Location of cold storage :

Name of cold storage:

District :; Upazila :

Union/Pourashova :; Village/Road:

2. Name of the interviewee: Age : Years,

3. (a) Relation with cold storage : Owner/Manager/Supervisor/Staff

(b) Relevant experience of cold storage managementyear.

4. Educational qualification (put \surd mark):

<input type="checkbox"/> Illiterate (00)	<input type="checkbox"/> Primary (01)	<input type="checkbox"/> Secondary (02)	<input type="checkbox"/> Higher Secondary (03)	<input type="checkbox"/> Above Degree(04)
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5. Have you got training on cold storage management? (put \surd mark) Yes No

If 'Yes', how many times ?

6. When this cold storage was established (year)?

7. What was the installation cost then: Tk.

8. What is the capacity of the cold storage ? :ton/bag.

9. What is the source of electric supply ? (put \surd mark) PDB REB

10. What is the frequency of electricity failure per day (in 24 hours)? :hours.

11. How do you operate the cooling system during electricity failure? :

(a) Operating generator (b) Left without electricity

12. If generator provide back-up electricity, then how long do you operate the generator?

(a) Continuously (until electricity comes) : hours;

(b) Break (interval) hours

13. Statement of monthly average operating cost (Tk.) :

Sl No.	Description of cost	Monthly cost (Tk.)	Remarks
1	Electricity bill		
2	Generator fuel & oil		
3	Machine servicing		
4	Cooling gas (ammonia)		
5	Salary of staff		
6	Labour charge		
7	Other costs (Telephone, Tax etc.)		

14. What is the source of potato storage?

Own production By purchasing Hire basis Other

15. Do you sort/grade potato before storage? (put \checkmark mark) Yes No

If 'Yes', how much potato was rejected during sorting/grading? kg

16. Is there any grading system before storage? (put \checkmark mark) Yes No

17. How much sorted/graded (by farmers/traders) potato stored? kg/bag

18. How much immature potato stored? Kg/bag

19. (i) How are potato kept in cold storage? (put \checkmark mark)

(a) Gunny bags (b) Plastic bag (c) Other (specify)

(ii) How many old were used for potato storage? : quantity/percent.

20. Did you pre-cool the potato before storage? Yes No

If 'Yes', at what temperature and how time? °C, hour

21. Are the bags kept directly on the floor? Yes No

If 'No', what materials do you provide below the bags (stack)? (put \checkmark mark)

(a) Wooden frame (b). Bamboo frame (c) Other (specify)

22. What is layer of bags vertically in each of the bag?

23. When (name of month) do you start store potato?

24. What is the last date of release of potato from cold storage ?

25. Information on potato storage system :

Type of potato	Amount stored (Bag)	Duration	Store temperature (°C)	Relative humidity (%)	Fare (Tk/bag)	Amount of loss (Kg)	Causes of loss
Food potato							
Seed potato							

Weight per bag =Kg.

26. Do you use any chemical during storage? (put \sqrt mark) Yes No

If 'Yes' ,wh at is the name of chemical?

27. How many times do you check the bags ?times

28. Do you invert the bags during storage for proper cooling? (put \sqrt mark) Yes No

If 'Yes' , how many times?

29. Do you refresh the storage with fresh air? (put \sqrt mark) Yes No

If 'Yes' , how many times?

30. Do you pre-heat the potato after end of storage (before delivery) ? Yes No

If 'Yes' , at what temperature and how time?°C, hour.

31. What are the causes of losses in the cold storage ? Please give your answer –

32. What are the problems of potato storage in cold storage ? Please give your answer –

33. What are your suggestions to reduce the post harvest losses of potato? Please give your suggestions –

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Signature of interviewer

Name :

Date :

Survey Schedule

Appendix – 3

Production, Postharvest management and Storage of potato in Bangladesh.

C. Survey Schedule for Potato Traders:

Serial No.

Date :

Type of marketed potato : Traditionally Stored/Cold Stored

Type of markets : Primary/Secondary/Tertiary Market

Type of Traders : *Bepari/Faria/Aratdar/Paikar/Retailer*

1. Name of the Market:

District :; Upazila :

Union/Pourashova :; Village:

2. Name of the trader: Age : Years,

3. Educational qualification (put \surd mark): Year of Schooling years
 Illiterate (00) Primary(01) Secondary (02) Higher Secondary (03) Above Degree (04)

4. How many years are you associated with potato trade ? years

5. How many potato traders are in this market?

(a) Aratdar :, (b) Whole Seller/Paikar:, (c) Faria :, (d) Bepari :, (e) Stockiest :

(f) Retailer, (g) Other:

6. How much and from whom did you purchase potato last month?

Purchased from		Traditional Storage Potato		Cold Storage Potato	
Person	Place	Amount(Mound)	Price (Tk/Mound)	Amount(Mound)	Price (Tk/Mound)
Farmer					
Cold Storage					
Whole Seller					
Bepari					
Faria					
Retailer					

7. How much and to whom did you sell potato last week?

Soled to		Traditional Storage Potato		Cold Storage Potato	
Person	Place	Amount(Mound)	Price (Tk/Mound)	Amount(Mound)	Price (Tk/Mound)
Cold Storage					
Whole Seller					
Bepari					
Faria					
Retailer					
Consumer					

8. Handling of Potato :

Type of Handling	Amount Handled	Amount Lost	Causes of Losses
Storing/Grading			
Weighing & Bagging			
Loading			
Unloading			
Other (Specify)			

9. Transportation :

Mode of Transportation	Distance of Transportation (Km)	Amount Transported (Kg)	Amount Lost(Kg)	Causes of Losses

10. In the last week did you store potato between each lot of buying & selling?

Method of Storage	Amount Stored (Kg)	Storage Time (Day)	Storage Loss (Kg)			
			Weight	Rotten	Other	Total

11. What are the problems do you face during potato business ? Please give your answer –

12. What are your suggestions to reduce losses of potato during different business operations? Please give your suggestions –

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Signature of interviewer

Name :

Date :

Survey Schedule

Appendix – 4

Production, Postharvest management and Storage of potato in Bangladesh.

D. Survey Schedule for Potato Consumers:

Serial No. Date :

Type of Consumer : Household / Restaurant

1. Location :

District :; Upazila :

Union/Pourashova :; Village:

Name of the Restaurant :

2. Name of the Restaurant Owner/manager:
. Age : Years, Sex : Female/Male3. Educational qualification (put \sqrt mark): Year of Schooling years Illiterate(00) Primary(01) Secondary(02) Higher Secondary(03) Above Degree(04)

4. What is your family size ? persons

5. How much of potato did you buy last week? kgs.

6. To Whom Did You Buy Potato? (put \sqrt mark) Grower Retailer Faria Bepari Aratdar Other7. What type of potato did you buy? (put \sqrt mark) Fresh Potato Cold Storage Potato Traditional Storage Potato

8. What was the price of potato? Tk/Kg

9. How did you consume the potato ?

(a) As Vegetable Kg ; (b) Other (Specify) kg

10. How much was the loss of potato found after buying? Kg

11. What were the types of Losses ?

Type of Damage	Amount of Damaged Potato (Kg)
a) Damaged by Insect	
b) Rotten Potato	
c) Cut Potato	
d) Mechanical Injury	
e) Other Damage	

12. Where did you store potato before consumption? - - - - -

13. How much potato damage during temporary storage ? - - - - -

14. What are the main causes of loss of potato during storage? Please give your answer –

15. How much potato was lost/rejected during processing (cutting, peeling etc.)?. Kg

16. What are your suggestions to reduce post harvest losses of potato during different operations?

Please give your suggestions –

.....

Signature of interviewer

Name :

Date :
