

Potato Value Chain in Bangladesh: Information and Knowledge Gaps of Smallholders

Khairul Islam | DNET | khairul[dot]helal[at]gmail[dot]com

Harsha de Silva, PhD | Consultant Lead Economist, LIRNEasia | harsha[at]lirneasia[dot]net

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Abstract

Potato has been cultivated in Bangladesh for more than a century, and has recently occupied an important place in the country's list of major food and cash crops. Over the years, the sector has been thriving with new opportunities. The value chain analysis was conducted considering the huge potential of the sector and to identify bottlenecks hindering its growth. The value chain analysis the study attempts to analyze the systemic issues faced within the whole process—from farming to exporting—with particular focus on knowledge and information gaps. The study identifies bottlenecks the sector is facing, relationships and linkages between and among the actors, the flow of products and the changes in value and in the information and knowledge flow. It is evident from the study that potato production in Bangladesh has marked significant growth over the last few years, despite the fact that, in peak seasons, growers face enormous difficulties with their surplus production due to cold storages capacity constraints leading to unfavourable pricing. The paper addresses some systematic information-related problems faced within the value chain and offers some possible solutions to farmers in the use of inputs and also to cold storage operators and farmer associations to coordinate the uneven use of even the small amount of such available facilities.

Contents

Abstract.....	2
Contents	3
Abbreviations	4
Prelude	5
Methodology	6
Introduction.....	8
Overview	8
Potato Production	15
Yield and Yield Variation	17
Potato cultivation.....	19
Potato Varieties and Grades	19
State Support	20
Mapping the Value Chain	20
Product Flow and Value Chain Actors.....	20
Information Flow in the Value Chain	22
Price Information.....	23
Input and Know-how Information.....	24
Financial Assistance	24
Transaction Costs	33
Identified Issues in the Value Chain.....	34
Lack of Knowledge of Farmers on Quality Inputs and Their Usage	35
Lack of Knowledge of Farmers on Variety, Grading, Processing and Export Market	36
Lack of Knowledge of Farmers on Post-harvest Techniques	37
Lack of Information on Available Space in Cold Storage	37
Conclusion.....	38
Appendices.....	39
Appendix 1: Selection of Most Potential Export Oriented Agricultural Value Chains	39
Appendix 2: List of Respondents	46

Abbreviations

BADC	Bangladesh Agricultural Development Corporation
BARI	Bangladesh Agricultural Research Institutes
BBS	Bangladesh Bureau of Statistics
BDT	Bangladeshi Taka
CIC	Community Information Center
DAE	Department of Agricultural Extension
DAM	Department of Agricultural Marketing
FAO	Food and Agriculture Organization
FAOSTAT	Food and Agriculture Organization Statistics
FGD	Focus Group Discussion
ICT	Information and Communication Technology
KBE	Knowledge Based Economy
MMS	Multimedia Messaging Service
MSEs	Micro and Small Enterprises
MT	Metric Tonne
NGO	Non-Governmental Organization
SMEs	Small and Medium Enterprises
SMS	Small Message Service
TCRC	Tuber Crops Research Centre
TVC	Television Commercial
USD	United States Dollar
VAT	Value Added Tax

Prelude

The research was envisaged *to identify the bottlenecks to increased production of high quality potatoes in Bangladesh that holds a huge potential to cater to the expanding market.*

The specific objectives of this Knowledge Based Economy (KBE) research were to:

- Achieve an in-depth understanding of how innovations related to Information and Communication Technologies (ICTs) are used (and may be used) to improve the efficiency and inclusiveness of the potato value chain in Bangladesh; the specific focus was on increasing the participation (inclusiveness) of small players, especially micro and small enterprises (MSEs), and small and medium enterprises (SMEs) within the value chain through various forms of value addition and reduction of various forms of transaction costs.
- Develop recommendations for improving the efficiency and inclusiveness of agricultural value chains including through the application of ICTs, but not limited to them; specifically, identify and differentiate between the roles that shall be played by the private sector vs. the public sector in providing such services to MSEs and SMEs.
- Based on the in-depth understanding mentioned above, contribute to improving indicators related to measuring progress toward inclusive knowledge-based economies.

In order to carry out KBE research in the Bangladesh agriculture sector, two value chains were selected through desk research. The following criteria were used to select the two most potential export-oriented agricultural value chains:

Goods that

- a) have potential for value addition,
- b).have high participation (or potential for participation) by small actors including MSE/ SMEs,
- c. have high export potential, and

d. have potential for increased productivity.

After a rigorous desk research followed by a short-listing and ranking exercise¹, potato came out as one of the two most potential value chains and was analysed further afterwards. This report describes the in-depth analysis of the potato value chain.

Methodology

The study adopted the value chain analysis method to unfold the industry dynamics, its market actors and different service provisions, constraints and opportunities. The overall research was carried out through desk research and in-depth interviews and Focus Group Discussions (FGDs).

The desk research involved reviewing the existing literature on the sector. The initial desk research helped develop a general understanding of the overall sector. It resulted in identifying different market actors and nodal points within the value chain which, in turn, helped select in-depth interview respondents. They included industry experts, concerned government and research agencies, value chain actors and industry associations. A snow-balling approach was adopted to develop the entire value chain. The process started with identifying and interviewing end market factors such as exporters, then gradually moving up the value chain to the input supplier level. In all, 72 interviews were conducted with different value chain actors, key informants and service providers. The list of respondents is given in Appendix 2. Three different geographical locations were selected as potato producing clusters representing the diversified nature of varieties and yield. The areas were Munshiganj (historically large scale potato producing district), Comilla (agriculturally progressive district producing potato on a moderate scale) and Rangpur (joined recently in large scale potato production). Three FGDs were carried out with potato farmers in these three different areas to capture the overall production scenario. Primary data was collected during the first quarter of 2011. Desk research was continued along with interviews and FGDs throughout the study period to validate field findings with available facts and figures. The overall research applied the following approaches:

¹ See Appendix 1 for selection summary

1. Mapping the core processes in the value chain,
2. Identifying the actors,
3. Identifying the services that feed into the value chain,
4. Mapping the relationships and linkages,
5. Mapping the flow of products including the geographical flow,
6. Mapping the changes in the value and form of the products,
7. Mapping the information and knowledge flows,
8. Mapping the number of actors and employment, and
9. Identifying the transaction costs and ways to reduce them.

The report begins with a brief description of the Bangladesh potato sector followed by mapping the value chain including the information and knowledge flows at different tiers. It also summarizes the constraints and opportunities and possible solutions to address them. As the key focus of the study is to identify the knowledge gaps, it is reflected from the very beginning of the research.

Introduction

Overview

Potato has been cultivated in Bangladesh for more than a century and has recently occupied an important place in its list of major food and cash crops. It is a subsidiary food item consumed as a vegetable in Bangladesh, while in many countries of the world it constitutes the staple food. After the introduction of cold storage facilities in the late eighties, it has turned out to be one of the most promising crops as it can now be consumed throughout the year. Potato consumption in Bangladesh is next only to two major cereals—rice and wheat, and low-income households consume cheap potatoes more than other vegetables (Moazzem and Fuzita, 2004)². The present per capita consumption of potato is still much lower (about 24 kg per year) than in many other countries. However, the data is based on the production of potato and the population of the country and not on the basis of food intake (Hussain, 2008), and it also excludes exports. However, since the overall export volume is still very low compared to the total production, it may not impact the data very significantly.

² Moazem G.K. and Fuzita J (2004), The potato marketing system and its changes In Bangladesh: from the perspective of A village study in Comilla district, *The Developing Economies*, XLII-1 (March 2004): 63–94

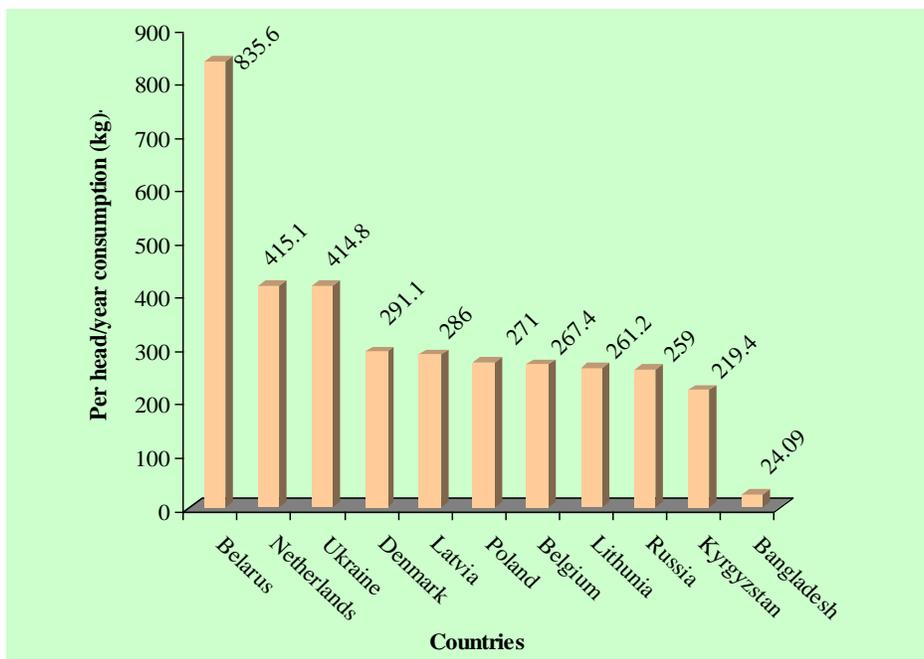


Figure1. Per head per year consumption of potato in Bangladesh (24.09 kg) compared to some other countries of the world³.

The overall global production of potato has increased over the last few decades despite production in developed countries experiencing a steady decline. According to FAO data, in 1991 the volume of global potato production was 268 million tonnes whereas production reached 325 million tonnes in 2007. The global potato sector has been undergoing many changes since the early 1990s. Before 1990s, most potatoes were grown and consumed in Europe, North America and countries of the former Soviet Union. However, since then, there has been a dramatic increase in potato production and in demand in Asia, Africa and Latin America, where output rose from less than 30 million tonnes in the early 1960s to more than 165 million tonnes in 2007. FAO data shows that in 2005, for the first time, the developing world's potato production exceeded that of the developed world. China has now become the biggest potato

³ Hussain, M.M. 2008. Prospects of potato in Bangladesh. in Bangladesh Potato Campaign 2008. MOA, FAO & CSD, Dhaka, Bangladesh

producer, and almost a third of all potato is harvested in China and India. Currently, Bangladesh is ranked 12th in the global potato production list in terms of quantity.⁴

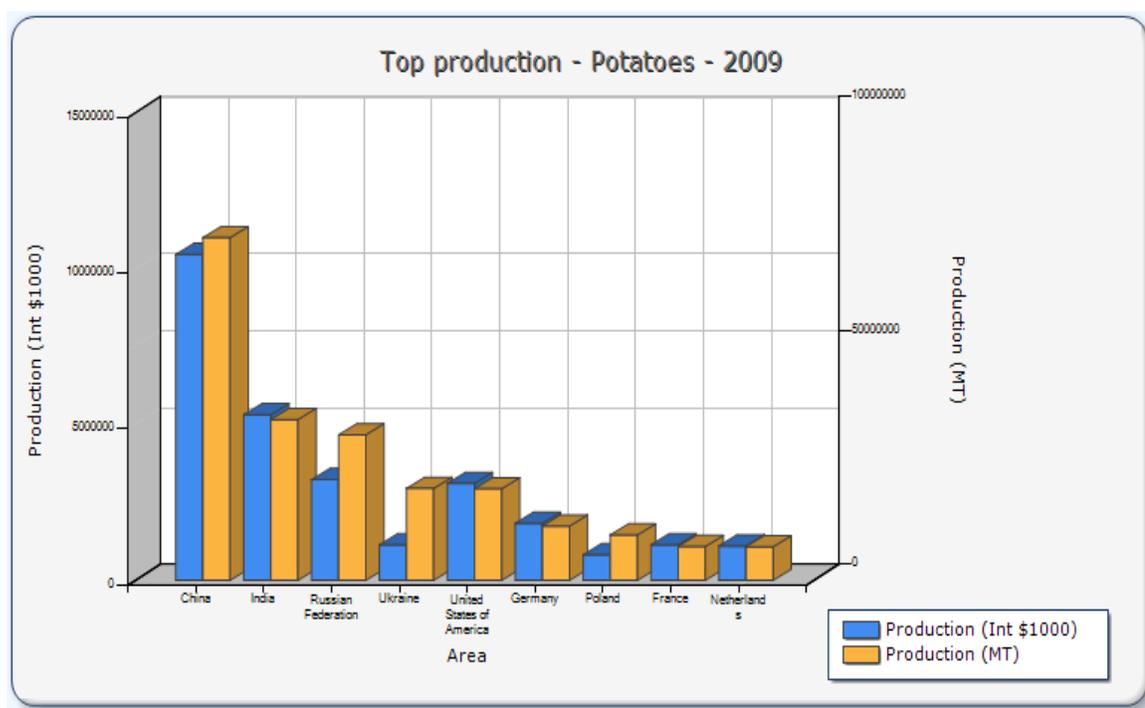


Figure 2. Top potato producing countries of the world in 2009 (Source: FAOSTAT)

Potato consumption, especially fresh potato, is decreasing in many countries, especially in developed regions. Currently, more potatoes are processed to meet the rising demand from the fast food, snack and convenience food industries. The major drivers behind this development include growing urban populations, rising incomes, the diversification of diets and lifestyles that leave little time for preparing the fresh product for consumption.

Potato, till today, is consumed round the year in Bangladesh, mostly as a fresh vegetable. Activities towards promoting potato as a partial supplement to rice (rice is the major staple food) has not yet resulted in any significant success. The underlying reasons are the traditional food habits of Bangladeshi people and the high price of potato in recent years. Generally, the price

⁴ FAOSTAT

remains reasonably low during the peak harvesting period and rises high when loading potatoes in cold stores is completed. The stated situation indicates that there is little scope for a significant increase in per capita consumption of fresh potatoes in the near future. However, the total in-country human consumption of fresh potatoes is likely to increase, at least, in proportion to the rate of population increase, thereby maintaining the same per capita consumption. Increased production exceeding human consumption as fresh produce can be expected if the processing and exports of potatoes increase significantly.

The main export market for fresh potato is the developed world, and according to 2008 FAO statistics, the top ten potato importing countries are Belgium, the Netherlands, Spain, Italy, Russia, the USA, Germany, the UK, France and Portugal. Bangladesh started the export of potato in the 1980s, and so far the highest amount of potato exported from Bangladesh was about 16,500 tonnes last fiscal year (2010-11). Major export markets of Bangladesh potato and potato products include the Republic of Korea, Italy, Singapore, Malaysia, the UK, India and the UAE. The opening of new markets in Russia, Vietnam and Sri Lanka facilitated the recent growth in exports. (Source: DAE).

Figure 3 and 4 illustrate the country-wise import and export of potatoes in 2009. Figure 5 shows the quantity of fresh potato exports from Bangladesh in 1999 - 2008.

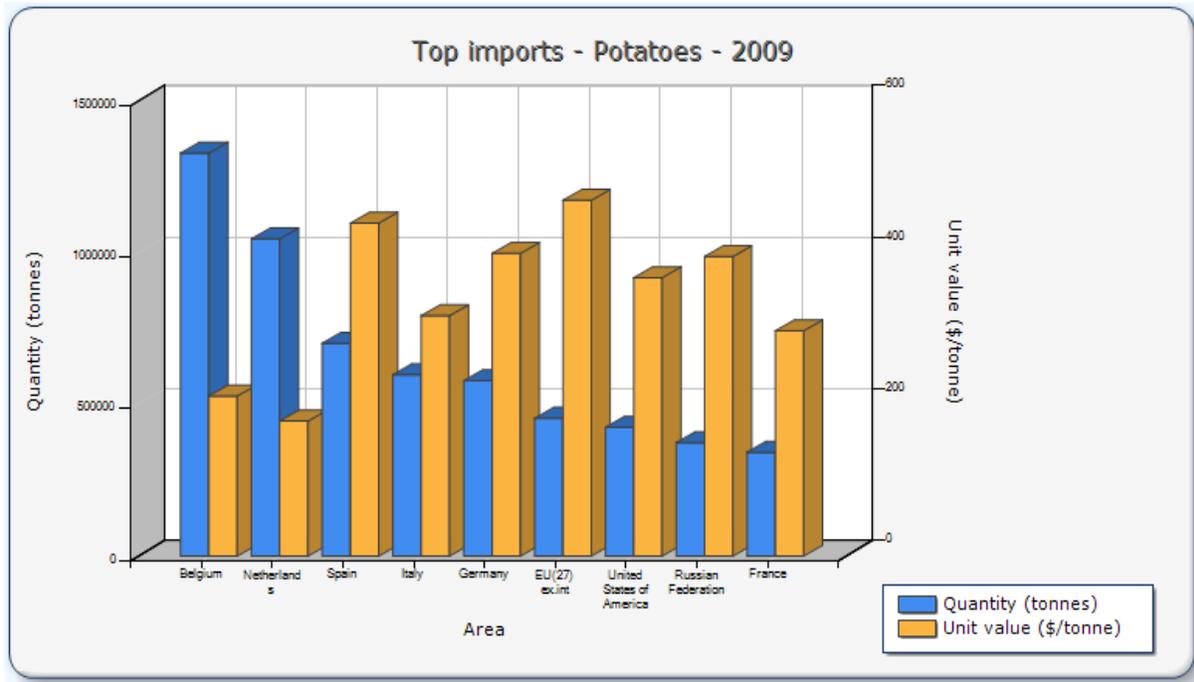


Figure 3. Top potato importing countries in 2009 (Source: FAOSTAT)

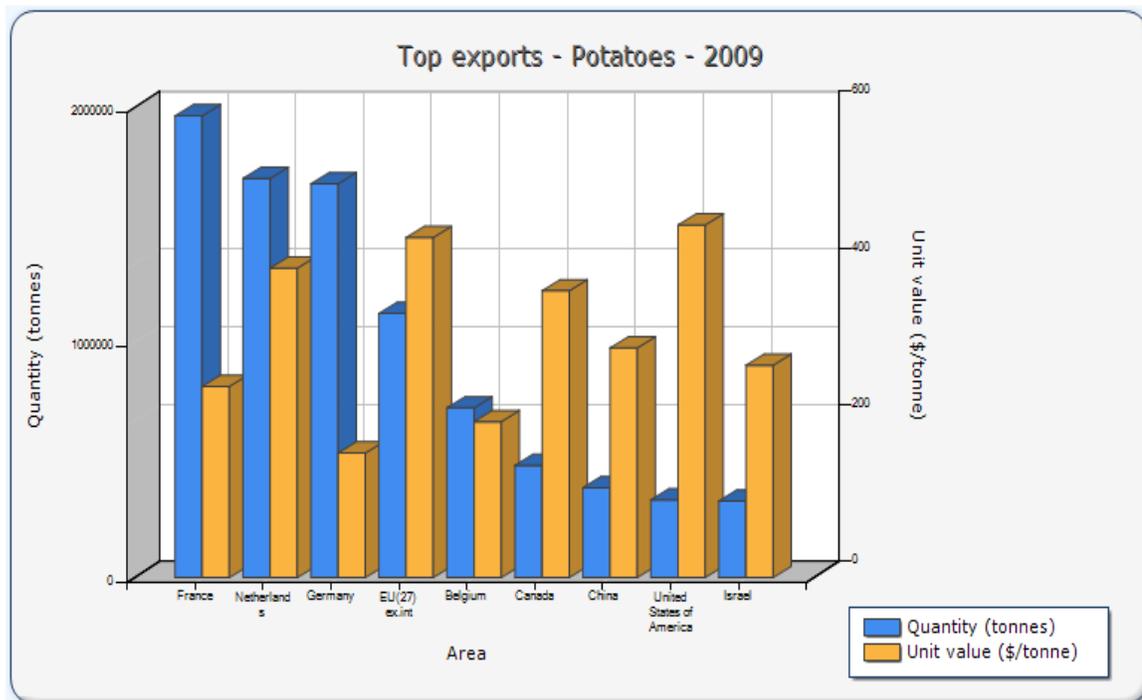


Figure 4. Top potato exporting countries in 2009 (Source: FAOSTAT)

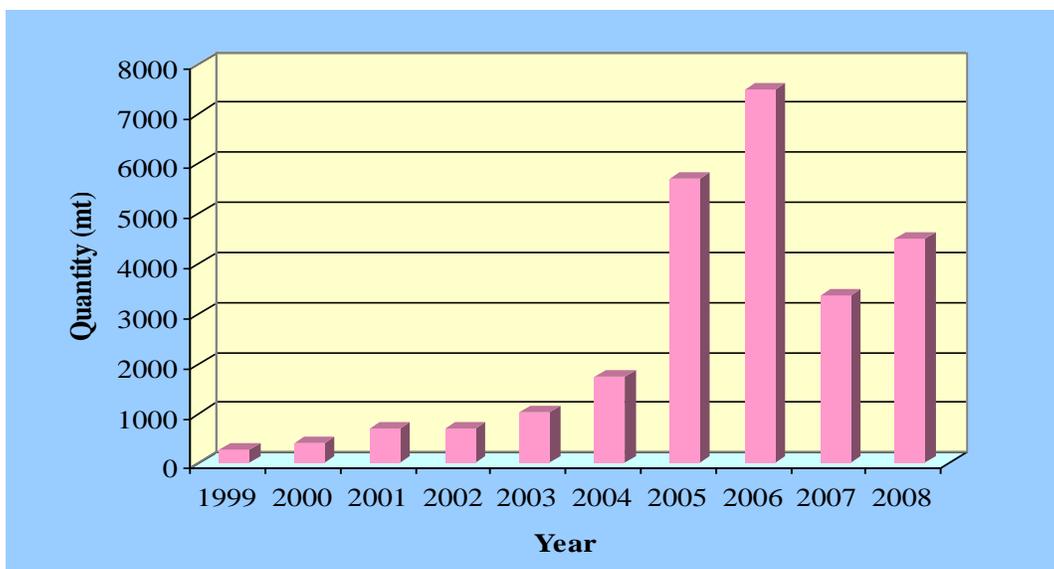


Figure 5. Quantity of fresh table potato exported from Bangladesh in 1999-2008 (Source: DAE)

Figures 3 and 4 show that Belgium and the Netherlands are the top importing countries but they also are in the list of top exporting countries. The unit value of the Netherlands' exports is higher than that of its imports, which may explain the value addition there. However, in the case of the unit value of imports into Belgium is a little higher than that of exports. Similar features can be observed in the case of a few other countries as well. For example, Germany's per unit import value is much higher than per unit export value. Since FAOSTAT categorizes only potatoes and potato flour, it is not very clear how it considers other value added products under potatoes. However, it is clear that a number of countries import and also export potatoes either in the same form or in other value added forms. An examination of these country-wise trade policies may provide satisfactory leads to resolve this dilemma.

Potato is a very popular crop for farmers in Bangladesh, irrespective of land holding size. The main reasons as found during the FGDs with farmers were its higher profitability, short growth duration, the next crops requiring less fertilizer, scope of intercropping/relay cropping, etc. Figures 6, 7 and 8 show the potato production and area coverage, yield and export trends in Bangladesh.

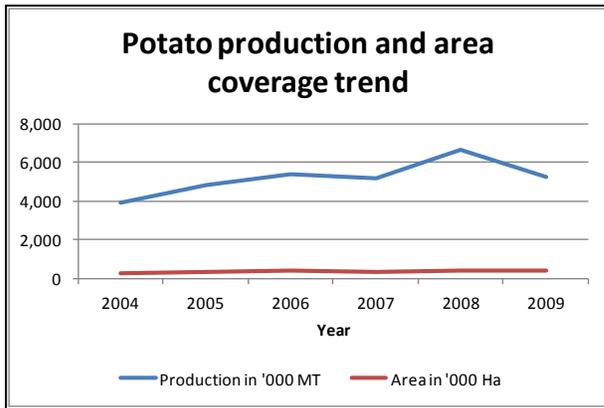


Figure 6. Potato production and area coverage trend in Bangladesh (Source: FAOSTAT)

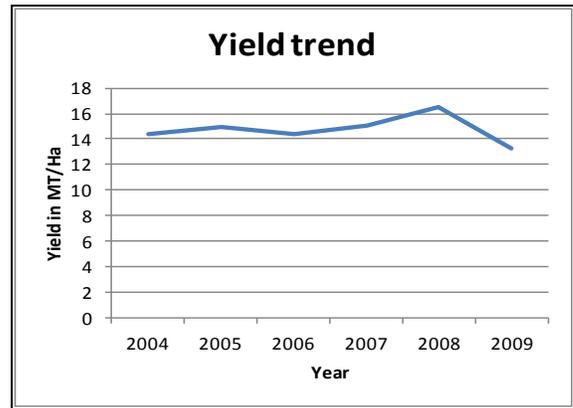


Figure 7. Yield growth trend of potato production in Bangladesh (Source: FAOSTAT)

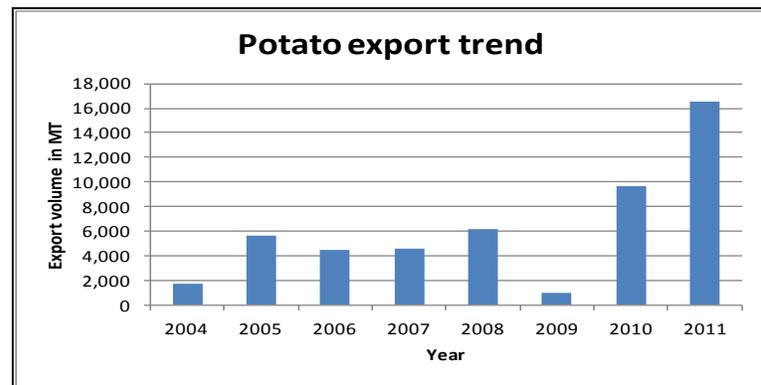


Figure 8. Potato export trend in Bangladesh (Source: FAOSTAT and DAE)

These Figures show that in 2004 - 2008, the compound annual growth rate was 11.22% for production and 2.76% for yield; for export volume it was 29.12 %. Besides, the growth of the area under cultivation was 8.29%. However, there was an overall setback in 2009. As opined by industry experts, there was a potato glut in 2008 and consequently, farmers were compelled to sell their produce at low prices. In the following year, many farmers did not cultivate potatoes or invested less in cultivation which resulted in lower yields (Figure 7). However, the export volume has steadily increased during the last couple of years. As government provides cash incentives to exporters on the export value, it has been working as a catalyst to increase exports. Till last fiscal year, potato exports were entitled to receive a 20% cash incentive if the shipment was made between February and April. In other months, the incentive was halved to 10% to boost supply in the local market. From the current fiscal year, potato exports are entitled to a 20% cash incentive throughout the year. Figure 8 shows that exports have jumped to 16,500 tonnes in 2011.

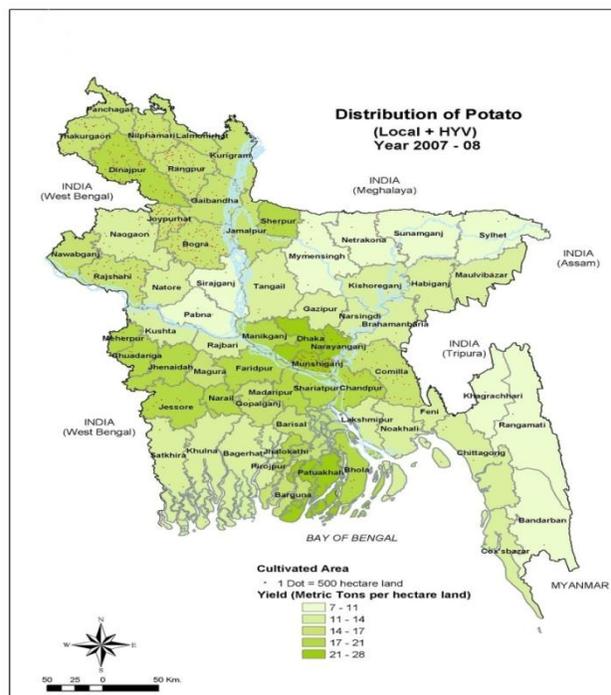


Figure 9: Potato cultivation by districts in 2007-08 (Source: World Food Programme)

Potato Production

According to DAE, potato is grown in all the districts of Bangladesh⁵ (Figure 9). Among them, the highest area of concentration is in Bogra—65,300 Hectares (ha) and 61,667 ha in 2007-08 and 2008-09 and contributing to 10.13% and 13.29% of the national total respectively. This is followed by Rangpur (52,720 ha in 2007-08 and 53,700 ha in 2008-09), Dinajpur (42,430 ha in 2007-08 and 37,558 ha in 2008-09), Joypurhat (38,870 ha in 2007-08 and 36,075 ha in 2008-09), Munshiganj (36,045 Ha in 2007-08 and 32,714 Ha in 2008-09), and Rajshahi (35,000 ha in 2007-08 and 31,550 ha in 2008-09).

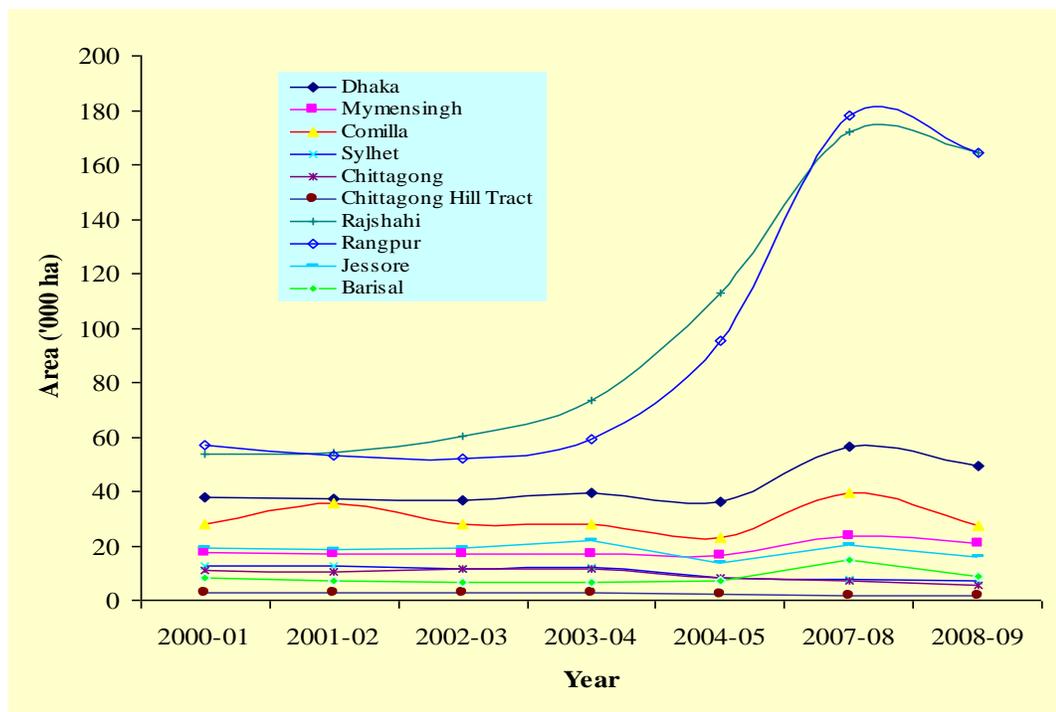


Figure 10. Area under potato cultivation in different regions of the country in 2000-01 to 2008-09 (Source: Field Service Wing, DAE)

⁵ Field Service Wing of DAE

The lowest area coverage is reported to be in Rajbari (96 ha in 2007-08 and 137 ha in 2008-09). The Dhaka region, particularly Munshiganj, which is generally known as the potato production belt of Bangladesh, is gradually losing its importance in terms of area coverage in potato whereas regions like Rajshahi and Rangpur are gaining momentum. According to the DAE's data, the highest area concentrations under potato in 2007-08 were in Rangpur and Rajshahi (178,114 and 172,091 ha, respectively), showing a steep rise in area under potato cultivation from 2004-05 to 2007-08 (Figure 10). The expansion of the potato cultivation area in the northern districts, namely, Rangpur, Dinajpur, Thakurgaon and Rajshahi is mainly due to the availability of land at a relatively lower lease value leading to lower costs of production.

Yield and Yield Variation

Potato is a short duration crop in Bangladesh and its yield is relatively low y mainly owing to climatic limitations. The current national average yield of potato in Bangladesh is about 15 MT/ha, as compared to that of more than 40 MT/ha in many potato growing countries of the temperate region (Figure 11). In the potato growing countries of the temperate region, potatoes are grown during a long growing period in summer with long sunny days and a moderate cool temperature, resulting in high accumulation of photosynthate in the tubers, ultimately leading to high yields.

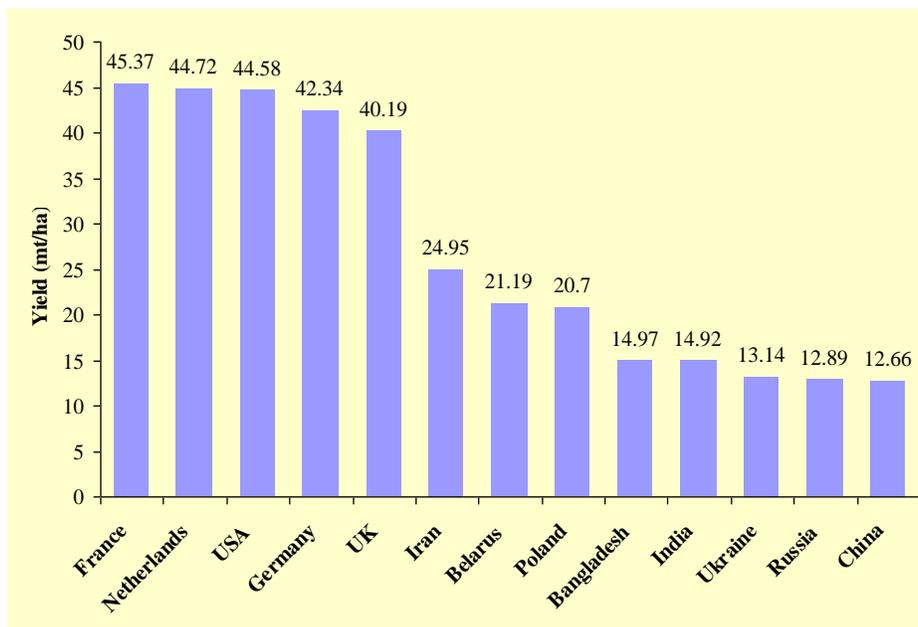


Figure 11. Yield of potato in Bangladesh compared to some other top potato growing countries of the world in 2007. (Source: FAOSTAT)

Potato yields vary widely among the potato growing areas of Bangladesh. Table 1 shows the yields in different regions of the country from 2000-01 to 2008-09, as reported by the Field Services Wing of DAE.

Table 1. Yield of potato in different regions of the country from 2000-01 to 2004-05 and from 2007-08 to 2008 -09

Region	Yield (MT/Ha)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2007-08	2008-09
Dhaka	23.25	22.77	23.35	23.81	25.55	25.83	25.43
Mymensingh	8.84	9.27	9.35	9.57	10.22	13.83	13.68
Comilla	16.27	12.59	16.26	16.33	16.61	18.80	17.95
Sylhet	9.17	9.34	9.10	8.30	8.90	9.71	9.62
Chittagong	13.60	11.53	10.90	11.80	11.60	14.53	14.03
Chittagong	8.11	8.08	7.92	8.22	9.42	14.82	12.92

Region	Yield (MT/Ha)						
	2000-01	2001-02	2002-03	2003-04	2004-05	2007-08	2008-09
Hill Tract							
Rajshahi	7.23	7.69	9.69	11.31	12.79	15.48	12.09
Rangpur	10.38	8.77	13.21	13.96	15.11	17.96	14.21
Jessore	14.47	16.59	16.50	16.93	18.06	17.38	14.56
Barisal	11.19	10.08	10.14	9.97	10.85	20.72	18.04
National (Average)	12.59	11.98	13.75	14.39	15.08	17.75	14.54

Source: Field Services Wing, DAE

Interestingly, the yield of potato in Munshiganj district (falling under Dhaka region) is higher than that of a few temperate countries of the world like Belarus, Poland and Iran (Table 1 and Figure 11).

Potato cultivation

Potato is cultivated in the winter season. The first fortnight of November is the right time for plantation. However, in certain north-western areas, farmers even plant potato in October to harvest the crop early. Mulching⁶ is frequently done over the rows with water hyacinth, straw, etc. to preserve soil moisture and to prevent the growth of weeds. As the potato plants become mature and the tubers are fully formed, the leaves become gradually yellowish and then brownish, and finally the plants die. It is always better to harvest the crop after these signs are evident in the field. Most varieties are harvested in this country during February-March. Collection of the tubers is usually done manually using a spade or other devices.

Potato Varieties and Grades

⁶ In agriculture and gardening, mulch is a protective cover placed over the soil to retain moisture, reduce erosion, provide nutrients, and suppress weed growth and seed germination; Source: Wikipedia

Diamante is the most widely grown potato variety in most of the potato growing districts followed by Granola, Cardinal, Multa, Binella and Felsina. Other varieties grown in different potato growing zones are Asterix, Patronese, Provento, Ultra, Heera and Dheera. However, among them, mostly the Granola variety is currently being exported because of its appearance, taste and size. There are two different grades for exportable potato (Granola): Grade A: 4-6 tubers/kg and Grade B: 7-10 tubers/kg. The bigger the size of the tubers, the higher the price. The average C&F value per MT of potatoes in 2007 was USD 240 and in 2008, it was USD 250 for Singapore and USD 265 for Malaysia. It is important to mention that, during peak harvesting season (February-April), the wholesale price of potato in the local market is as low as USD 80 per MT and it rises up to USD 280 per MT during November-December.

State Support

The potato sector receives a considerable amount of state patronage for exports. The export of potato now enjoys 20% cash incentive on export value in order for Bangladeshi potato to become competitive in the global market. However, farmers do not receive the incentive directly but exporters do. But exporters become more price-competitive in the global market and can export more due to the cash incentive. With increased volumes of exports, the demand for potato increases in the local market and farmers usually get a better price.

Mapping the Value Chain

Product Flow and Value Chain Actors

From production to consumption, export and processing of potato, different actors are involved in the potato sector. Among the public sector organizations, the Tuber Crops Research Centre (TCRC) of the Bangladesh Agricultural Research Institute (BARI) and Bangladesh Agricultural Development Corporation (BADC) are involved in research, technology development, variety development, seed production and promotional activities in potato. Private companies, individuals and NGOs are involved in the production and marketing of potatoes. The following

diagram shows the core process involving different actors in the potato value chain. The subsequent sections describe the role of different actors in the process.

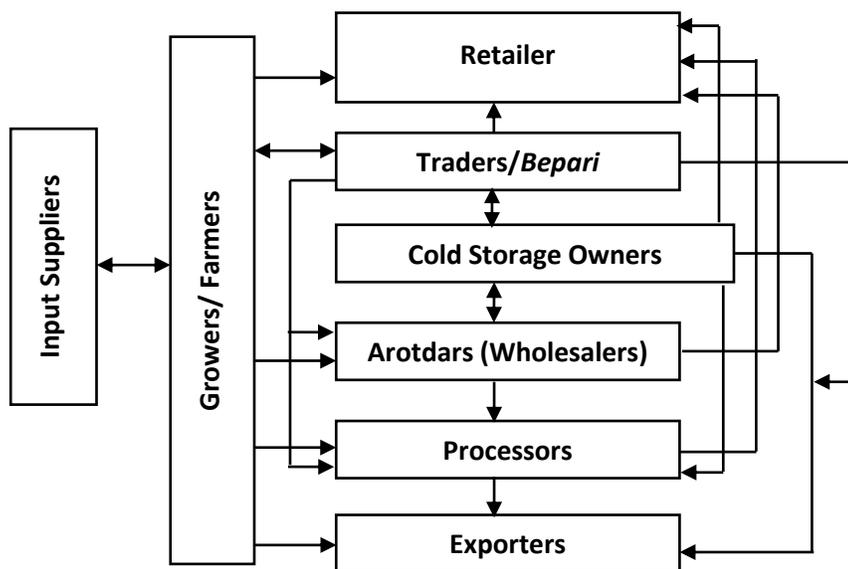


Figure 12. Core Process and Value Chain Actors

Input Suppliers

Four major inputs are required in potato cultivation. These are seed, crop protection materials, fertilizers and irrigation. Among them, seed is the most important and vital input. Considering potato production in about 400,000 ha of land in 2007-08 and a seed rate of 1.5 MT/Ha⁷, the annual requirement of seed potato in Bangladesh is about 600,000 MT. But, the supply of high quality seed potatoes in the country is only about 6% of the total requirement; of which, BADC's

⁷ Standard rate recommended by DAE

locally produced seed potato is 1%, private sector's locally produced seed potato is 2% and private sector's imported seed potato is 3% (Figure 10). The balance 94% is farmers' retained seed potatoes, which were harvested in preceding season from table potato crop of the potato growers and preserved in cold storage.

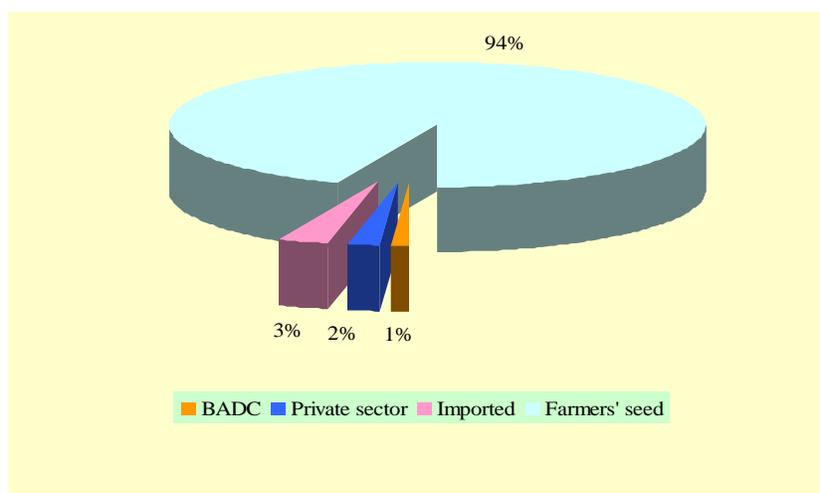


Figure 13. Supply of quality seed potato (6%) in Bangladesh from different sources, compared to farmers' seed (94%) in 2008-09. (Source: Hussain, 2008)

In general, the application of the seed rate is higher than recommended. Farmers have a common perception that a higher seed rate would result in higher yields and also loss through failed germination of seed can be offset this way.

There is no special type of fertilizer as such for potato only. Fertilizer used in other agricultural crops is also used in potato production. Common fertilizers are urea, MOP, TSP, NPK and organic fertilizers. Apart from organic manure, the rest of the fertilizer is sold in input retail shops that are available in all village markets. But adulteration of fertilizer is commonplace and farmers suffer from increased production costs due to over application of them. Use of organic fertilizer is generally lower than the recommended dose of 10 MT/ha⁸. The limited availability of organic manure like cow dung, farm manure and compost is the main reason for the lower dose of organic fertilizer.

⁸ Recommended by DAE

Crop protection materials include fungicides, insecticides and bactericides. Application of such materials is very common among potato farmers for curing and also protecting their crops. There are many companies and many brands of such crop protection materials. For example, there are as many as 103 brands of registered fungicides in the country recommended against the late blight disease of potato⁹. Farmers use different types of crop protection materials (fungicides, bactericides, insecticides) at least 4-5 times during the whole cultivation process. Not all the products are of good quality and farmers very often complain about them. These crop protection materials are marketed by private companies and sold through dealers and retailers in all village markets.

Irrigation is another essential input for potato cultivation. On average, farmers apply irrigation three times in a cultivation period. Well-off farmers have their own irrigation pumps and engines on their land. Small farmers usually buy water from other neighbouring farmers who have irrigation facilities.

Potato Growers

Potato growers or farmers usually play a unitary role—producing potato and selling them through traders and cold storage owners. However, a small portion of growers play the dual role of producer and trader. Most growers are, however, smallholders. Of the 12 million farm households in Bangladesh, about 80% are small farmers (land holding less than 0.2 ha) and some of these farmers are landless¹⁰(BBS, 2007). No specific data is available of the number of potato growers as such. Potato is considered a vegetable and according to BBS, the number of vegetable growers in 2008 was 1,260,000.

Traders (Bepari)

⁹ List of Registered Agricultural & Public Health Pesticides in Bangladesh. Plant Protection Wing, DAE, Khamarbari, Dhaka. 2008. 67 p

¹⁰ BBS 2007

Traders, locally called *Bepari*, are non-licensed business people in the production areas. The number of traders varies from 10-15 in each rural aggregation market. They handle a relatively large volume of potato and some amounts of other agricultural commodities. Some of these traders are potato growers as well. They purchase potato from the growers and sell it to cold storage owners, *arotdars* and also retailers.

Arotdars

Arotdar, a Bangla term, is a commission agent who has a fixed establishment in the market place. The number of *arotdars* also varies from 15-25 in rural aggregation markets. Usually, *arotdars* deal in other agricultural commodities as well. Like traders, some *arotdars* also produce potato. They conduct their business in aggregation markets and sometimes in the premises of the cold storage. They let sellers bring their merchandise into their premises where buyers also visit to buy. Thus they offer a physical platform for buyers and sellers to negotiate. They have a few hired laborers or part-time or full-time salaried persons to perform various functions such as weighing, sorting, grading, cleaning, etc. *Arotdars* charge a commission from the buyers if a transaction takes place. Sometimes, they also become buyers of the goods brought to their premises. They are licensed traders with warehouses. In general, *arotdars* distribute commodities in a large geographic area between the points of production and consumption.

Cold Storage Owners

Cold storage owners are entrepreneurs who own one or more cold storage facilities generally for storing potatoes. Cold storage saves potatoes from spoilage and ensures a year round supply of table potatoes in the market. Farmers' seed potatoes are also preserved in cold storage. Most cold store owners are also involved in potato trading. They buy and store potatoes during the potato harvesting season, and sell the stored potatoes mostly to the traders at a later stage.

The number of cold storage plants in Bangladesh was only 77 in 1975, and in 30 years the number increased to 340 due to the increase in potato production in the country.

Considering the total cold storage plants and production of potato in the country, at present, nearly 25-30% of the total potatoes produced in the country can be preserved in the cold storage. But still, in some areas of the country and in some poor production years, a certain portion of the cold storage space remains unutilized (Figure 14). Poor flow of information is another reason for this underutilization.

Table 2. Utilization of space in some cold storage plants in different areas of Bangladesh in 2009 (Figures in parenthesis are the number of cold storage plants.)

Area	Utilization of cold storage space (%)
1. Munshiganj (45)	89
2. Chandpur (6)	80
3. Comilla (7)	88
4. Bogra (6)	84
5. Joypurhat (4)	47
6. Rangpur (8)	100
7. Lalmonirhat (2)	79
8. Nilphamari (4)	78
9. Dinajpur (4)	74
10. Thakurgaon (2)	100
11. Rajshahi (8)	99
12. Kushtia (1)	47
13. Jessore (3)	71
14. Khulna (1)	81
15. Chittagong (3)	27
Bangladesh (105)	90

Source: Bangladesh Cold Storage Association

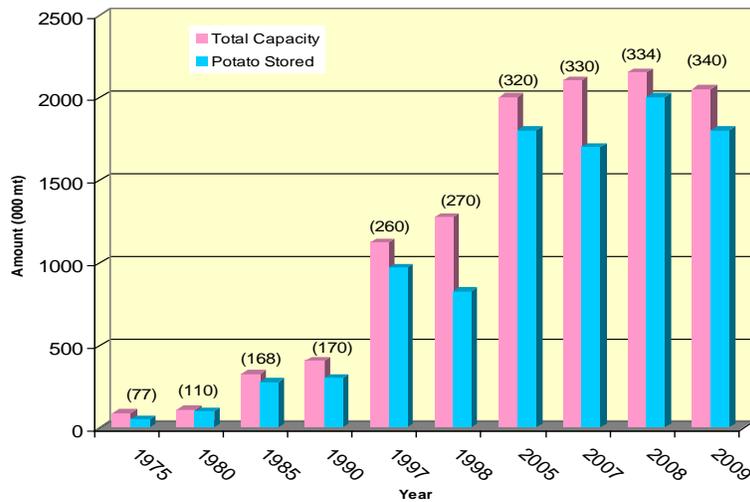


Figure 14. Number of cold storage plants and quantity of potato stored in Bangladesh from 1975 to 2009 (Source: Bangladesh Cold Storage Association, Dhaka).

Most of the cold storage space is normally utilized by potato traders, although in some areas, potato growers are the major clients of cold stores such as in the northern part of Bangladesh. In most of these areas (e.g., Rajshahi, Bogra, Rangpur), cold storage owners organize the production of potatoes providing credit support and each of the growers in such organized production takes lease of a large area of land for potato cultivation.

The cold storage facilities are not uniformly distributed throughout the country. The pressure of the clients for the storage of potatoes (traders and growers) is therefore not similar in all areas. As a result, the cold storage charge per bag of potatoes is also not the same in all areas, e.g., the charge is USD 3 per bag in Rangpur and USD 2 per bag in Bogra. Cold stored potatoes start coming out from May and continue till the next harvest. Usually, most of the cold stores become empty by December-January since after May, there are only cold stored potatoes and no fresh harvests. However, the cold storage charge is levied once for the whole season.

Another approach of the cold storage owners in some areas is to appoint agents, who bring the potatoes of the growers or traders to the cold stores for preservation, and in return get an amount of say, USD 0.15 per bag as commission. The potato traders and growers in some areas receive

loans from cold storage owners for the storage of their potatoes where stored potatoes work as collateral. The study found that cold storage owners take loans from banks at around 14% interest and disburse them to the potato traders and growers at a relatively higher rate of interest (say 18%).

The supply of non-cold stored potatoes remains high during and immediately after the peak period of harvest (February-May). Normally, cold stores start releasing potatoes in June or July, and continue releasing up to November or December, depending on the market situation. A part of the potatoes released in October and November is used as seed.

Processors

The present state of potato processing in Bangladesh is not very encouraging, but it can be considered as transitional. A few years back, four potato flake industries were established in the country. But none of them are in operation now, mostly due to lack of operational capital. Constant increases of potato prices in the wholesale market forced them to shut down their plants for indefinite periods. As per the capacity, each factory could utilize about 50,000 MT of fresh potatoes as raw material every year. Figure 15 shows that the potato wholesale price has doubled within five years since 2005. It shows the wholesale price increase since 1955 though the intervals in the horizontal axis are not uniform. But it clearly shows that the price increase has been significantly high in recent years.

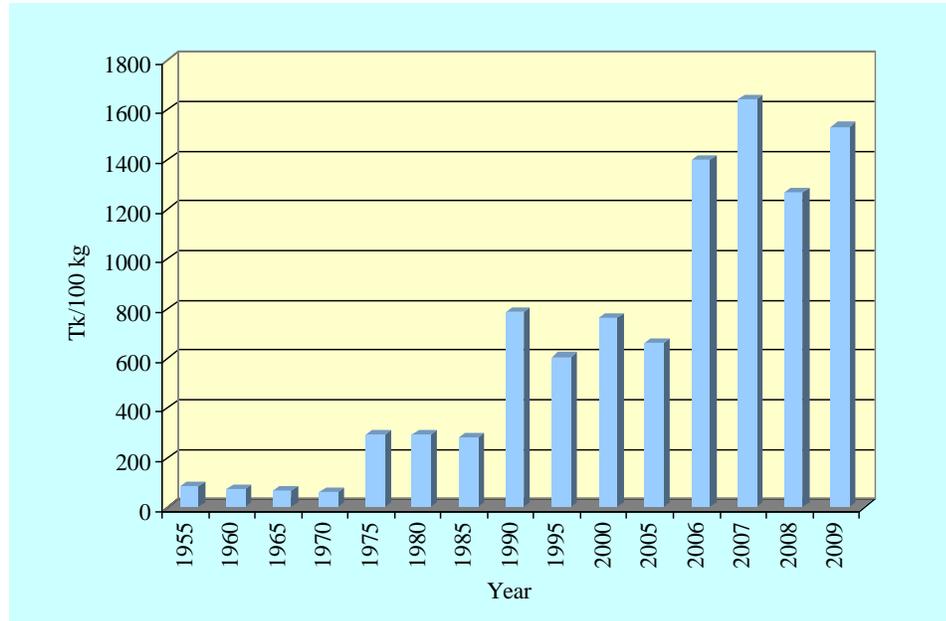


Figure 15. Average wholesale price of potato in Bangladesh (2009 price is up to June)
(Source: DAM)

A number of processing companies are now making frozen French fries, chips and other snacks using potato as a raw material. Some of these processing companies are Bombay Sweets & Co. Ltd., Ejab Foods Ltd., Ispahani Ltd., Zoha Chips Factory and Crisp Factory of Bhai Bhai Group. As regards the use of potato by different processing companies, there exists a significant domestic market for French fries of around 80-100 thousand MT per year. Moreover, the size of the global market for flakes and starch, growing at a rate of 10% yearly, is over USD 20 billion (The Financial Express, 7 May 2008). As reported, most of the existing potato varieties of Bangladesh, including the widely-grown varieties, are not suitable for industrial use. In most cases, potato processors are handicapped by a lack of processing-type varieties.

The range of quality snacks, frozen food products and ethnic snacks produced by different food companies consists of more than 25 items including potato, corn, cereal-based products, nuts and pulses. Some of these food companies in Bangladesh (such as Bombay Sweets & Co. Ltd., Ejab Foods Ltd.) have sister organizations for the production of raw materials. They mainly cultivate agricultural products either under their own management and/or under the contract growing

system. They provide potato seed to their contract farmers to ensure quality output, monitor and supervise the production and also undertake training programmes for the farmers to enhance productivity. Their demand is much more than what they are currently producing under contract arrangements. They meet the rest of the demand by procuring from the open market, either from traders or cold stores.

Exporters

Currently, there are only a few, around 8-10 established private companies that export fresh or processed potatoes, mostly to Singapore, Malaysia and the UAE and very recently to Russia, Vietnam and Sri Lanka. Some of these companies are Agriconcern, Surovi Agro Industries Ltd. (a sister organization of Supreme Seed Co. Ltd.), Alpha Agro, Eusum Agro Ltd., BRAC, Global Agro Resources Incorporation, etc. All of these exporters have started and are gradually expanding their own contract farming system in order to ensure quality and grade demanded by buyers.

Retailers

Retailers are the marketing actors between traders/*arotdars* and consumers of potato. They generally buy potatoes from *arotdars*, traders and sometimes from cold store owners and sell directly to consumers. Retailers dealing in potatoes, in general, also sell different types of vegetables and spices and they exist in every agriculture consumer market.



Information Flow in the Value Chain

The field investigation shows that the erratic information flow in the value chain is hampering the growth of the sector. After a review of the general information on the sector, farmers, among other actors, were asked a wide range of questions regarding the flow of information relating to planting, growing, harvesting, post-harvest processes, marketing and different services. The core inquiry was into how and from whom they source their information and how easily available and accessible the information is. The dynamics of this uncovered information flow consisting of financial assistance, inputs, price and technical know-how is mapped in the following diagram.

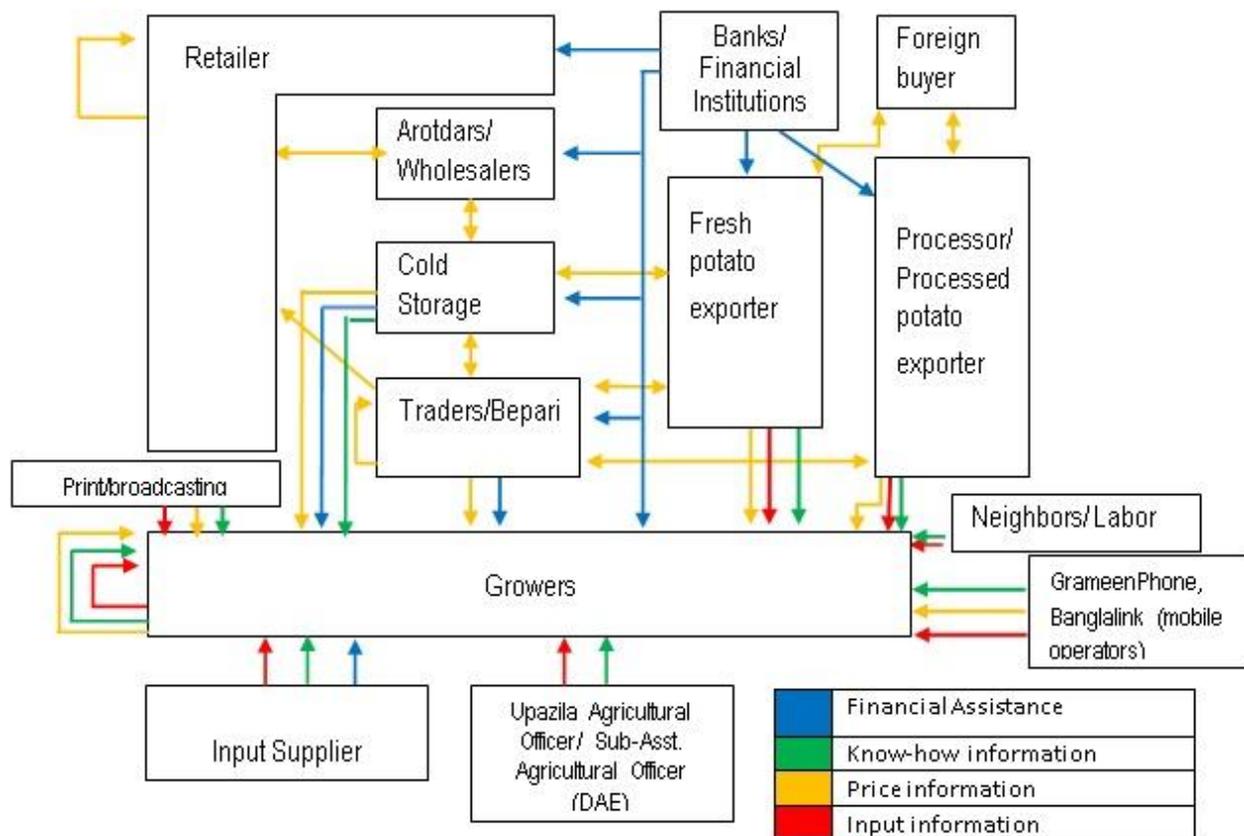


Figure 13. Information flow in the value chain

Price Information

Farmers receive price information from a variety of sources. They mostly get their price related information from their immediate buyers such as traders and cold store owners. Fresh or processed potato exporters provide price information to their contract growers. Bigger growers tend to explore more sources for precise price information. Price negotiations by small growers seem to take place at the local market place; however, big growers negotiate over the phone but the deal is not completed until the buyer physically verifies the potatoes for weight, size, uniformity, and injury status. Most farmers now see the advantage of knowing the potato market price in the Karwan bazaar and the Chalk bazaar, the major retail and wholesale markets in the capital city, to enhance their bargaining power. Besides, wider expansion of telecommunication

networks in the country and the growing use of mobile phones have enabled the farmers to cross-check price information and price levels at different key market places throughout the country.

However, mobile operator Banglalink has introduced an Interactive Voice Response (IVR)-based service called ‘Banglalink Krishibazaar’. It allows customers to record their own advertisements of agro-goods or browse through by listening to other advertisements recorded by other callers to get the necessary information. Callers can also call up the trader instantly by pressing "8" and finalize the deal. Information about the products is available by category, price, location, etc. making the process easier.¹¹ The Grameen Phone has been facilitating online marketing over the last few years. Anyone with Internet connectivity can visit the website¹² and check the market price of different products. Those who want to upload their merchandize on the site need to have a Grameen Phone subscription number.

Input and Know-how Information

Farmers obtain information regarding seeds from input retailers and also from extension officers. From the same sources, they also receive information regarding crop protection material and fertilizer and their use. Farmers also share information among themselves on different inputs and technical issues. Besides, print media and broadcasting media also provide information occasionally. The growers under contract arrangements receive input-related and technical information from the contracting companies/exporters. Cold store owners provide particularly post-harvest-related information to farmers such as sorting, grading, etc. Besides, Grameenphone, the leading mobile operator, has established more than 500 Community Information Centres (CIC) with Internet connectivity in the semi-urban and rural areas of Bangladesh. By visiting the CICs, farmers can access a web portal named www.ruralinfobd.com, which is rich in agriculture-related information. On the other hand, Banglalink offers the ‘Krishi Jigyasha 7676’ service which provides suggestions and answers to any queries related to agriculture, vegetable and fruit farming, poultry, livestock, fisheries, etc.

¹¹ www.banglalinkgsm.com

¹² www.cellbazaar.com

To avail themselves of this service, Banglalink subscribers need to dial 7676, talk and get expert advice on the problem.

Financial Assistance

Financial assistance flows in four forms:

- Some traders offer loans to their known growers with whom they have a continuous relationship,
- Input suppliers sell on credit to their known farmers,
- Loans are given by commercial banks and NGOs (microfinance),
- Loans are given by cold store owners.

Transaction Costs

In order to simplify the discussion, it is important to define transaction costs. In economics and related disciplines, a transaction cost is a cost incurred in making an economic exchange (restated: the cost of participating in a market).¹³ Apparently, it is very difficult to estimate the transaction costs as many variables are present. Farmers use various sources to get information and knowledge (Figure 13). Sometimes, they use a number of sources to get information on a particular issue before making a decision. Hence, the transaction cost also varies from farmer to farmer and also according to the type of information. For example, a farmer can receive input related information from other farmers, input retailers, government extension offices, private companies doing contract farming, exporters, etc. In certain cases, farmers may use a single source to make purchase decisions and in other cases, they may use several sources. If a farmer buys an input from an input retailer, then the transaction cost would only be his/her transport cost to the shop in the market, may be around BDT 10 (it may also vary, if the farmer makes any other purchases when he/she goes to the market). On the other hand, the transaction cost would be higher if a farmer needs to get information from a government extension officer. In many cases, the transport cost to the office would be around BDT 50-100. However, mobile

¹³ Source: Wikipedia

communication has reduced transport costs significantly. If the farmer has the mobile number and can access the extension officer, he/she can talk over the phone which would bring down the transaction cost to less than BDT 10. However, it does not reflect the total transaction costs as it shows only the transportation costs or phone call costs, and not other variables such as time and effort costs. In a nutshell, transaction costs for farmers mostly include the cost of information and the effort and time to find the solution provider, in particular, the associated cost of transport all of which varies from transaction to transaction. However, all these transaction costs have decreased significantly now considering transportation cost to be the cost of using mobile phones. Once a person knows the source of his/her information, he/she can make phone calls and can talk for a few minutes for less than BDT 10. Mobile phones are also available now in rural areas. However, as mentioned in the previous sections, there are a few specific services by a few mobile operators in Bangladesh where transaction costs for making different decisions or deals are very straight forward. For instance, in ‘Banglalink Krishibazaar’, a farmer can record his/her product details with a service charge of BDT¹⁴ 1 per minute (excluding VAT). If the farmer is able to record his complete product profile in two minutes and later someone buys his products from the seller’s place, then the transaction cost of selling his goods would be only BDT 2. In Banglalink ‘Krishi Jigyasha’, when a farmer speaks to an expert and gets answers to his/her queries, he/she has to pay BDT 2 per minute for a Banglalink subscriber and BDT 5 for other operators’ subscribers. However, this discussion only narrowly tried to identify transaction costs and cannot be concluded as the basis for estimating such costs. A thorough research is required to measure the associated transaction costs of any economic exchange.

Identified Issues in the Value Chain

The overall field investigation identified a series of constraints besetting the value chain and hindering its growth. Not all the identified constraints are discussed in the report as the focus of

¹⁴ BDT=Bangladeshi Taka, 1 USD≈74 BDT (www.xe.com)

the study is to identify the information and the knowledge gaps in the value chain related to small holder farmers. Therefore, only the constraints pertaining to small holder farmers have been analyzed in this section.

Lack of Knowledge of Farmers on Quality Inputs and Their Use

As mentioned earlier, the price of potato has almost doubled during the period 2005-09 with some significant negative consequences. Bangladeshi potato has become expensive or less competitive in the global market; its export volume even after a huge production rise during last few years cannot be increased; because of increased prices, all four potato flakes industries are non-operational when they could have produced huge amounts; and, inadequate cold storage facilities creates a glut of potato after harvest and consequently the price comes down to a very low level with farmers making low profits or even losses in a good or bumper production year. Hence, continuous increases in potato prices have made the potato industry vulnerable.

However, a primary cause of increased prices seems to be the lack of knowledge of farmers of identifying quality inputs and their application. It is true that the input cost has increased during this period but the use of excess inputs in all categories (seeds, crop protection and fertilizer) increase production costs several fold. Farmers use poor quality seed and in excess of what is required. They use the same crop protection material repeatedly as they do not know the right product and how to apply it. Because of this lack of knowledge, they very often buy inferior quality products which do not work well and then they buy a different product. It is not different in the case of fertilizer as adulterated fertilizer is very common in rural markets and farmers buy them as they cannot recognize the difference. As a result, they have to apply more fertilizer to achieve the desired yield.

Hence, this is clearly an extension failure. The limited number of government extension workers can hardly reach all the farmers. Exporting and/or processing companies have started contract farming whereby they provide inputs and also technical know-how. But their outreach is too low to cater to the large number of farmers. In this situation, the use of mobile phones could very likely to minimize the limitations of physical distance. Banglalink's 'Krishi jigyasha 7676'

seems to be a very appropriate solution in this regard. The use of SMS or MMS in communication can also add value. Along with improving the extension services, it makes sense to make farmers aware of how to identify better quality inputs and also their use. Quality seed, crop protection and fertilizer companies can arrange promotional campaigns within their marketing plans which would also promote their own brands. This can be done through arranging road shows, poster-billboards, TVCs and demonstrations besides mobile phones.

Lack of Knowledge of Farmers on Variety, Grading, Processing and Export Market

Potato should be large, uniform in size, attractive in appearance and free from injuries for export and processing industries. Granola is the most appropriate variety for the purpose. Because of the limited cold storage space, it is unlikely that the price will remain fair after the harvest. Hence, farmers should plan their varieties in such a way so that they could find alternative markets other than the traditional consumer ones. In Rangpur regions, the farmers mostly grow the granola variety. The introduction of contract farming by a number of exporters and/or processing companies in this region has enabled the farmers to know about the demand for the granola variety. On the other hand, Munshiganj, being a very old and one of the leading potato growing regions, is still growing other varieties but not granola.

There is another aspect of grading potatoes after harvest. Diamant and Cardinal, two other most popular varieties, can also yield rather bigger size potatoes if graded after harvest. Since the price after harvest remains low because of a glut, farmers can grade their potatoes, separate the bigger ones of uniform size for export and thus can earn a better margin. Lack of knowledge of the farmers of the requirements of exporters limits their scope to increase income.

Exporters, in this context, can promote the varieties they require and make the farmers aware of the need to grade their harvest. Contract farming has shown positive results as exports have steadily increased in the last few years. Hence, by expanding the contract farming system, exporters and/or processing companies can educate the farmers on varieties and grading.

‘Banglalink krishibazaar’ can also provide a platform for buyers and sellers to get to know about product quality, grade and price.

Lack of Knowledge of Farmers on Post-harvest Techniques

Since potato is harvested manually with a little spade, a few potatoes can always get damaged. Some of the harvest may also be affected by disease. Hence sorting, curing and grading are essential before preserving them in cold storage. Farmers’ lack of knowledge of these matters results in wastage and rotting in the preservation process. As cold storage owners and also farmers stated, approximately 5% preserved potatoes goes bad. This ultimately affects their net return on production.



Picture 2. Women harvesting potato

Cold storage companies can educate farmers on these issues. Before harvesting, they can educate potential customers through an information campaign. In this way, their customers (farmers) will suffer little or no loss and the cold storage operators can create a better image of a win-win service.

In addition, CICs of Grameenphone or ‘Krishi jigyasha’ of Banglalink can also provide such information to the farmers.

Lack of Information on Available Space in Cold Storages

As mentioned earlier, only around 25-30% of total production can be stored in around 340 cold storage plants all over Bangladesh. The current export volume is only a meagre portion of the total volume. The result is an obvious glut during and immediately after



the harvest when the price sometimes falls even below the production cost. Unfortunately, even in this situation, around 10% of cold storage space remains unfilled in some areas while in other areas, farmers stand in long queues for few days for access to cold storage. A clear information asymmetry prevails here.

Picture 3. Queue in front of a cold storage plant

In this situation, informing farmers on unfilled space in the cold stores can help. Then, the farmer can take his/her potatoes to the particular cold store where space is available. Transportation cost is a decisive factor in the distance the farmer can travel. Hence, it is important that the farmers get information regarding the unfilled cold storage space within a convenient distance. Cold store owners can provide such information to the farmers through a variety of means such as announcements through a public address system (a very popular means in rural areas) in production clusters, market places, etc, banners, “word of mouth”, and so on. An ICT based solution could be to register farmers in the surrounding areas on their respective mobile phone numbers. Farmers can register themselves with the cold stores prior to harvesting. After harvests, an unfilled cold store can send SMSs to the registered farmers informing them of the space available to store potatoes.

Conclusion

Potato consumption has increased globally and marks a shift from the developed world to the developing. Bangladesh has also showed significant growth in terms of production, yield and consumption in the last decade. However, the sector is still struggling to become price competitive in the global market and thus export the surplus. Increased production costs have not only made Bangladeshi potato less competitive in the global market but also prevented small farmers from reaping sufficient profit or even cover their investment costs. Lack of sorting, grading and standard post-harvest practices also lead to economic loss for the farmers. Appropriate post-harvest techniques can reduce wastage and rotting during the preservation period. There are only limited preservation facilities available in Bangladesh for potatoes but still a significant part remains unused. These are all rooted in the poor knowledge of the farmers and also the weak flow of information to them. Increased knowledge of agriculture inputs and their proper application can certainly reduce the farmers' cost of production. This would affect the entire value chain positively as the exporters will also be in a better situation regarding price competitiveness. With knowledge and information regarding post-harvest techniques, farmers can also increase their profit by reducing waste. If the information is available to a farmer on which cold storage has provisions for preserving potato, he/she can save him/her from losing money in a period of glut. The study analyzed all these aspects from the information and knowledge gaps perspective and tried to identify the root causes. Addressing the issues can certainly improve the information and knowledge flow scenario and can ultimately lead to a vibrant and competitive potato sector in Bangladesh.

Appendices

Appendix 1. Selection of most promising export oriented agricultural value chains

Introduction

In recent years, Bangladesh's economy has earned recognition from many spectators as vibrant and with high potential. During the last couple of decades, the economy has experienced quite a

rapid expansion with a spectacular surge in the Ready Made Garments (RMG) sector. Bangladesh exported more than \$18 billion worth of goods and services in 2009 where the contribution of the RMG sector alone was almost 75%. Although its foreign trade still remains very concentrated in only a few sectors, there are clear signs of progress in many areas. Agricultural commodities are climbing up the ladder and trying to diversify the product list of export items. Although RMG exports take a lion's share of export earnings, its value addition remains quite low – approximately 30% – while the value addition of exported agricultural commodities is almost 100%. The following four major criteria were used to select the two most potential value chains:

- . Goods that
 - a) have potential for value addition,
 - b. have high participation (or potential for participation) by small actors including MSEs/SMEs,
 - c. have high export potential,
 - d. have potential for increased productivity.

Identifying an initial list of value chain commodities

The list was largely derived from the Food and Agriculture Organization Statistics (FAOSTAT). There are several categories including quantity of export, the value of the export earnings of individual commodity, and unit value that are considered by FAOSTAT for the ranking. However, the commodity Shrimp and Prawn is added separately for the sake of grouping of the leading agro-commodities and for further assessment. Table 1 shows a total of 20 value chains that have been considered in this exercise.

Table 1. List of main exported agro-commodities (2008 estimate)*

Rank	Comm	Quantity	Flag	Value	Flag	Unit value
1	Shrimp**	43435***		447785		8004
2	Jute **	369372	R	162195	R	350

3	Tobacco,	9490	R	30438	R	2518
4	Vegetables fresh	7574	R	15915	R	1866
5	Tea**	8259	R	14403	R	1304
6	Cotton Waste	26746	R	9753	R	365
7	Rice Milled	5445	R	4537	R	833
8	Nuts, nes	6707	R	3918	R	584
9	Arecanuts	6290	F	3377	F	537
10	Potatoes Flour	1971	F	2925	F	1484
11	Pastry	1943	R	2834	R	1459
12	Rice Husked	3352	R	2523	R	753
13	Veg.in Tem.	1104	F	2493	F	2258
14	Vegetable Frozen	1159	R	2272	R	1960
15	Food	1121	F	1981	F	1767
16	Flax Fibre Raw	5461	F	1791	F	328
17	Breakfast Cereals	2061	R	1741	R	845
18	Potatoes	6194	R	1553	R	224
19	Cotton	135	F	1275	R	9444
20	Fruit Juice Nes	3078	R	1256	R	408

Source: FAOSTAT, 2008; and ITC 2008

F : FAO estimate

R : Estimated data using trading partners database

* FAOSTAT data differs from that of ITC (which has been used in latter part of this report in different situational analysis) due to adopting different methods of data collection.

** ITC

*** BBS Yearbook of Agricultural Statistics of Bangladesh 2009

As the table suggests, shrimp stood as the top commodity in terms of export earnings in 2008 with \$447.7 million followed by jute which earned \$129.4 million in the same period. Tobacco, with \$23.8 million earnings, was positioned third from the top while vegetables, tea, and cotton waste stood in close proximity in the earning list with \$14 million, \$10.7 million and \$9.7

million respectively. Besides, there are other commodities such as potatoes with a moderate contribution have also been listed some of which, although seemingly insignificant, have huge export potential in terms of other indicators which we will explore in the latter part of the report.

Selecting 4 – 6 value chains for further assessment

Based on Table 1, each value chain has been assessed comparatively against the two most important following criteria – participation of actors in the value chain and export potential of those commodities. Through a short-listing matrix exercise, the initial list is narrowed down to a fewer value chains to assess against all the criteria.

Table 2. Leading value chains in terms of participation and export earnings

Rank	Commodity	Export earnings Value in 2008 (1000 \$)**	Participation of persons (000)*
1	Shrimp	447785	32
2	Jute	162195	154
3	Tobacco	30438	115
4	Vegetables (including Potato)	15915	1260
5	Tea	14403	431
6	Potato	4537	4537***

Sources:

* BBS Yearbook of Agricultural Statistics of Bangladesh 2009

**Source: ITC 2008

*** included in vegetables and can be considered the same number

Figure 1 shows the results of the short-listing exercise.

Figure 1. Results of the short-listing exercise

Participation of actors	High	Rice	Vegetables Potato Tea	Shrimp Jute Tobacco
	Medium	Cereals	Mango	
	Low			
		Cotton Waste Fruit Juice Nes Sesame seed	Pastry Nuts, nes Arecanuts	
		Low	Medium	High

Export potentials

Using the matrix, six value chains have been identified and selected for additional assessment. These include shrimp, jute, tobacco, vegetables, tea and potato. These products fall into the categories that either have a large participation of actors (including SMEs and MSMEs) or have high export potential as indicated in the recent export data (Table 1). The remaining value chains either have limited export earning potential or low participation of actors.

Finalized value chains selection

For selecting the final value chains, we have discussed a couple of important factors affecting the selection. Firstly, we have looked into the domestic production of those six commodities and compared their productivity with that of two leading world producers – India and China (Table 3). Besides, four years’ export data of the commodities has been given with their compound annual growth rate (Table 4). Table 5 illustrates the analysis ending with a value chain ranking exercises.

Table 3. Productivity

Rank	Commodity	Domestic Production	Productivity (hg/ha)		
			Bangladesh	China	India
1	Shrimp (kg)	117.31 Million Lbs	565*	700	660**
2	Jute	848715 MT	20184	26666	22790
3	Tobacco	40265 MT	13741	21381	14054
4	Vegetables	1100000 MT	70512	170618	130082
5	Tea	53400 MT	10171	9527	16986
6	Potato	6648000 MT	165373	147574	193080

Source: FAOSTAT 2008

* FAO fisheries statistics

**Aquaculture Authority News 2002, Ministry of Agriculture, Government of India

Table 3 shows that in almost all the commodities [we..Bangladesh is?] are lagging behind India and China. However, in the case of potato [we? are more productive than China but less than India, which certainly shows the potential to improve. The same is evident in the case of tea. In vegetables [we?] are lagging far behind both the countries. In tobacco Bangladesh is far behind China but close to India. In jute and shrimp Bangladesh is behind but not too much.

Table 4. Five year exports of top commodities in value (USD thousands) and their Compound Annual Growth Rate (CAGR) over a four- year period

Rank	HS	Commodity	CAGR	2008	2007	2006	2005
1	0306	Shrimp	8%	447785	612632	482589	354883
2	5303	Jute	10%	162195	196794	141390	121911
3	2401	Tobacco, unmanufactured; tobacco refused	23%	30438	20893	14346	16320
4	0709	Vegetables fresh or chilled	-34.6%	15915	50948	37834	56925

5	0902	Tea	-8.9%	14403	13864	9046	19087
6	0701	Potatoes	-4.8%	1553	1136	2042	1803

Source: ITC trade competitiveness map

Table 4 shows that Bangladesh has positive growth in shrimp, jute and tobacco but negative in the other best three.

Before we come to a conclusion, it is important to mention that shrimp has become a much more political and environmental issue these days as its production is creating environmental hazards and also large shrimp growers driving away small farmers from their own land. On the other hand, from an ethical point of view, tobacco is not an industry to patronize. Hence, we would not consider shrimp and tobacco in the final ranking grid.

Based on the overall analysis, the four value chains, i.e., vegetables, tea, jute and potato were ranked on a scale of 1 to 10 indicating the strongest correspondence between a value chain and an individual criterion. The results of this ranking exercise are as follows (Table 5):

Table 5. Value Chain ranking exercise

Indicators	Vegetable	Tea	Jute	Potato
Value addition	5	6	8	7
Participation	8	6	6	8
Export	4	5	6	4
Productivity	6	5	7	6
	23	22	27	25

Scale 1 – 10 (10 is high)

The ranking exercise clearly demonstrates that jute and potato are ahead of other competitors while all four criteria are considered. **Hence the finally selected value chains for in-depth study are jute and potato.**

Appendix 2: List of respondents

Sl no	Type of Actor	Name	Address
1	<i>Input supplier</i>	Jasim Gazi	Katakhali, Munshiganj
2		Mosharraf Member	Katakhali, Munshiganj
3		Kamrul Hasan	Chor Kewa, Munshirganj
4		Babu	Munshirhat, Munshirganj
5		Javed Bepari	Chor Kewa, Munshiganj
6		Shawkat Hossain	Katakhali, Munshirganj
7		Harun Gazi	Katakhali, Munshiganj
8		Md. Nasir Uddin	Sourav Enterprise Daudkandi Bazar, Daudkandi, Comilla Mobile: 01712197160
9		Md. Ikbal Hossain	M/s Rony Traders Daudkandi Bazar, Daudkandi, Comilla Mobile: 01926756935
10		Md lokman Hossain	Daudkandi Bazar, Daudkandi, Comilla Mobile: 01676416233
11		Md Abul Kalam	Abdu Miah Store Daudkandi Bazar, Daudkandi, Comilla Mobile: 01676416233
12		Md Abdus Sattar	Madhaia, Chandina, Comilla Mobile: 01718546211
13	<i>Farmer</i>	Krishna Chandra Hawlader	Chor Hadrabad, Munshiganj Pourashava, Munshiganj Mobile: 01815462627
14		Md. Khokon Matbar	Chor Kewa, Guetkandi, Munshiganj
15		Khoka Molla	Munshiganj Pourashava, Munshiganj Mobile: 01811503822
16		Abdul Hafiz	Tengar chor, Munshiganj

17	Amin Uddin	Chor Hadrabad, Munshiganj Pourashava, Munshiganj
18	Abdul Khaleq	Chor Hadrabad, Munshiganj Pourashava, Munshiganj
19	Ramiz Miah	Chor Hadrabad, Munshiganj Pourashava, Munshiganj
20	Fazal Shekh	Chor Kewa, Guetkandi, Munshiganj
21	Najrul Islam	Muktarpur, Munshiganj
22	Md Ahsan Habib	Muktarpur, Munshiganj
23	Abdur Rafiq	Muktarpur, Munshiganj
24	Md Jamal Hossain	Muktarpur, Munshiganj
25	Kabir Hosen	Muktarpur, Munshiganj
26	Abu Saleh	Chor Hadrabad, Munshiganj Pourashava, Munshiganj
27	Wali Miah	Joy Debpur, Chandina, Comilla 01817598303
28	Dr. Nurul Islam	Joy Debpur, Chandina, Comilla 01917664246
29	Md Ibrahim	Joy Debpur, Chandina, Comilla
30	Hasan	Joy Debpur, Chandina, Comilla
31	Kalu miah	Joy Debpur, Chandina, Comilla
32	Mohammad Ali	Joy Debpur, Chandina, Comilla
33	Siraj Miah	Joy Debpur, Chandina, Comilla
34	Hosen Miah	Joy Debpur, Chandina, Comilla
35	Abu Taher	Joy Debpur, Chandina, Comilla
36	Shohid Miah	Joy Debpur, Chandina, Comilla
37	Khorshed Alam	Joy Debpur, Chandina, Comilla
38	Abdur Razzak	Nircintopur, Chandina, Comilla

39		Zoynal	Nircintopur, Chandina, Comilla
40		Md. Wali Ullah	Nircintopur, Chandina, Comilla
41		Monir Hosen	Nircintopur, Chandina, Comilla
42		Tazul Islam	Nircintopur, Chandina, Comilla
43		Topon Das	Batabaria, Chandina, Comilla
44		Md Liton	Batabaria, Chandina, Comilla
45		Bulu Das	Batabaria, Chandina, Comilla
46	<i>Intermediaries</i>	Khoka Mullah	Chor Kewa, Munshiganj Mobile: 01811503822
47		Abdur Rahman	Chor Kewa, Munshiganj
48		Abdul Jabbar	Chor Kewa, Munshiganj
49		Abdus Sobhan	Chor Kewa, Munshiganj
50		Shohel	Muktarpur, Munshiganj
51	<i>Cold storage owner</i>	Abdul Latif Sarker	River View Cold Storage Gen. Assistant Muktarpur, Munshiganj
52		Mr. Shib Sankar	Shaha, Manager Shobhan Ice & Coldstore Ltd., Tongibari, Munshigonj
53		Md Mafiz Uddin	Executive Director Chandina Farmland and Cold Storage Ltd Chandina, Comilla
54		Mostafa Azad Chowdhury	Director, Kishan Himagar Limited, Motahar Group, Choto Monthona, Rangpur, Mobile: 01712 099561
55	<i>Dhaka market wholesaler</i>	Abdul Haq	Haq Banijyalay Shyam Bazaar, Lalkuthi, Dhaka
56		Abu Hanif	Mohanagor Arat Shyam Bazaar, Lalkuthi, Dhaka

57		Nazir hossain	Munshinganj Arat Shyam Bazaar, Lalkuthi, Dhaka
58	<i>Processor</i>	Masudul Kabir	Secretary Bombay Sweets & Co. Ltd Red Crescent Concord Tower (10 th Floor) 17 Mohakhali C/A, Dhaka 1212 Mobile: 01730010228
59		Sirajul Islam	Potato Flakes (BD) Ltd house# 384, Road # 28 new DOHS, Mohakhali, Dhaka 1206 Tel: 8821751 Mobile: 01720542837
60	<i>Association</i>	Mozammel Haque Chowdhury	Secretary, Bangladesh Cold Storage Association, BC SA Bhaban, 38 Purana Paltan, Dhaka 1000. Mobile: 01712 025996
61	<i>Exporter</i>	Anwarul Haque	Managing Director Blue Moon International, 4/7 Iqbal Road Mohammadpur Dhaka-1217 Mobile: 01552448748
62		Estiaque Ahmed Dhaka -1213 Mobile: 01817291717	Managing Director Ejab Group, asal Centre (9th Floor)0 34, Dakal Ataturk Avenue, Banani,
63		Mr. Mozammel Hoque Choudhury,	Secretary Bangladesh Cold Storage Association, BC SA Bhaban 38, Purana Paltan, Dhaka
64		Engr. Md. Abdur	Razzaque Miah, Mech. & Refrigeration Engineer, Bangladesh Cold Storage Association, BC SA Bhaban, 38 Purana Paltan, Dhaka 1000
65	<i>Others</i>	Dr. Meer Musharraf Hossain	Senior Consultant, Action for Enterprise, House 3 A 4, NAM Villa, Road 6, Gulshan 1, Mobile: 01714 4093481
66		Dr. Anisur Rahman	Supply Chain Knowledge Management Expert, Hortex Foundation, Dhaka. Mobile: 01720 010936
67		Md. Fozlul Haque	Director (Field Services Wing) Dept. of Agricultural Extension,

			Khamarbari, Farm gate, Dhaka-1215, mobile: 01720 634666
68		Abdul Awal	Director, Rural Services, Katalyst, House 20, Road 6, Baridhara, Dhaka. Mobile: 01714 069255
69		Tamanna Sultana	Group Manager, Rural Services, Katalyst, House 20, Road 6, Baridhara, Dhaka. Mobile: 01730 338542
70		Md. Abu Taher Khan	Upazilla Agriculture Officer, Upazilla Krishi Office, Chandina, Comilla, Mobile: 01817 511400
71		Aman Ashraf Faiz	Head of Communication Channels, Grameen Phone, Boshundhara, Baridhara, Dhaka. Mobile: 01711505800
72		Debashis Roy	Head of CSR, Grameen Phone, Boshundhara, Baridhara, Dhaka. Mobile: 01711500261