



Research Article

Analysis of value chain of sweet potato in two districts of Bangladesh

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Sweet potato plays a significant role in increasing food security and income for the poor farmers of Bangladesh. Sweet potato is mostly grown in the marginal lands of Bangladesh during the period of October to February. It is consumed in different forms e.g. boiled, fries and roasted. Sometimes it is also eaten as a vegetable in curry. The value chain of sweet potato is not well organized in Bangladesh. This study was carried out to analyze the existing value chain of sweet potato in two selected districts of Bangladesh. Quota sampling technique was used to select the samples and primary data were collected through Individual Interview (II), Key Informant Interview (KII) and Focus Group Discussion (FGD) by using structured, open and close ended Questionnaires and check list. Simple descriptive statistics were used to analysis the data. Core value chain actors in sweet potato value chain are input seller, farmers, local trader, retailer and consumers. Mostly farmer cultivates local variety of sweet potato and get a profit around BDT (Bangladesh currency) 30,000 per acre of land. Local trader collects sweet potato both from farmer's field and local market. There are no fixed traders or retailers of sweet potato in the study area. They mostly sell sweet potato along with other vegetables in both urban and local big market. Analysis found that both the trader and retailer gets BDT 3 profit margin by selling 1 kg of sweet potato. No sweet potato processing company was found in Bangladesh though there are huge possibilities and potentials of it in both rural and urban market.

Keywords: Value chain analysis, profit margin, sweet potato, Bangladesh

INTRODUCTION

Sweet potato (*Ipomoea batatas Poir*) is one of the important root crops in Bangladesh as well as in the world. Sweet potato ranks as the world's seventh most important food crop after wheat, rice, maize, potato, barley, and cassava. According to the Food and Agriculture Organization (FAO, 2012), sweet potato was under cultivation in 82,40,969 hectares of land in the world. Considering top 20 sweet potato producing countries in 2012, world's total production was 101,839,463 tons and a majority of which came from China, with a production of 77,375,000 tons (FAO, 2012). Bangladesh produces different varieties of sweet potato but some of the varieties are produced in more quantity

based on consumer demand and easy cultivation technique as well as vine (planting materials) availability. It is cultivated more or less in all the districts of the country. However, the suitable areas of sweet potato cultivation are "char land" located on the both sides of rivers.

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Table 1. Sampling frame for sweet potato value chain study

Criteria	Location		Total
	Jamalpur	Netrokona	
Sweet potato farmers	50	50	100
Input Seller (Vine, Fertilizer, Pesticide etc.)	4	4	8
Sweet potato Retailer	7	14	21
Sweet potato Trader	8	14	22
Sweet potato Consumer	50	50	100
Key Informant (KI)	2	2	4
Focus Group Discussion (FGD)	1	1	2

In Bangladesh sweet potato is the 4th most important source of carbohydrate after rice, wheat and potato. Sweet potato plays a significant role in increasing food security and income for the poor farmers of Bangladesh (Ahmed *et al.* 2015). The area and production under sweet potato was 24,567 hectare and 297,539 tons, respectively in Bangladesh during the year 2011 (FAOSTAT, 2011). The average per hectare production of sweet potato in Bangladesh is 9.8 tons (FAOSTAT, 2011). Most of the sweet potato producers in Bangladesh are smallholder. Smallholder farmers struggle because of their limited access to inputs (e.g. credit, technology, information) while working on low-productivity land located far distances from output markets via an inadequate, high-cost road system (Lunna and Wilson, 2015). The production of sweet potato has decreased from 435,000 MT in 1995-96 to 253,000 MT in 2011-12 (BBS, 2012).

The value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use (Kaplinsky, 2001). Value chain analysis is a powerful tool to identify the key activities and actors within the whole supply system which form the value chain for that product.

The literature on sweet potato value chain in Bangladesh is very scarce. There are hardly any study found that analysis the value chain of sweet potato. Few studies have found (Ahmed *et al.* 2015; Begum *et al.* 2011) that only deals with the profitability of sweet potato cultivation in Bangladesh. There are various market actors involved from the production to final consumption of sweet potato. Analyzing the roles and activities of these actors has become an important issue to the policy maker in taking decision to improve the overall value chain of sweet potato. Keeping all this issues in mind, the present study was undertaken to map and understand the sweet potato value chain and linkages among different actors in the chain with the intent to identify the gaps and opportunities of strategic interventions to develop the value chains in Bangladesh.

METHODOLOGY

The study was conducted at two selected districts of Bangladesh named Jamalpur and Netrokona. Study areas were selected purposively based on the higher volume of sweet potato production. Samples were taken from Shorishabari and Netrokona Sador sub-district of Jamalpur and Netrokona district, respectively by quota sampling method. Quota sampling is a non-probability sampling technique where the researcher finds and interviews a prescribed number of people in each of several categories. The study team randomly selected samples as input seller (vine, pesticide and micronutrient), producer, traders, retailer, Government officials (Department of Agricultural Extension officers, Bangladesh Agricultural Research Institution etc.). Below the samples covered under this survey, using different tools are shown in tabular format (Table 1).

Primary data were collected through Individual Interview (II), Key Informant Interview (KII) and focus Group Discussion (FGD) by using structured, open and close ended Questionnaires and check list. Sweet potato farmers were directly interviewed by enumerators to collect the primary data on sweet potato cultivation and yield. Secondary data were collected from different publications as well from DAE (Department of Agricultural Extension). Mostly tabular analysis was conducted along with calculating average and percentage. Profit margin of sweet potato farmers, traders and retailer was calculated by using the following formula;

$$NP = TR - TC \dots\dots\dots (1)$$

Where,

NP = Net Profit (BDT)

TR = Total Return (BDT) and

TC = Total Cost (BDT)

RESULTS AND DISCUSSION

The core value chain actors

A wide range of market actors present along the sweet potato value chain. The sweet potato value chain actors found in the study areas were input seller, sweet potato

producer, sweet potato trader, sweet potato retailer, sweet potato processor and the consumer.

Availability of inputs

Most of the selected farmers in the study area used local variety of sweet potato for vine multiplication. The study revealed that first time they multiply the vines at their homestead areas and then they use more land to multiply in large scale. There was no nursery found for sweet potato vine multiplication. Farmers were also unaware about the hybrid varieties of sweet potato in the study areas.

The farmers use fertilizer, pesticides (for sweet potato weevil, rootworms, wireworms, white grubs, white fringed beetles etc.) and micronutrient. However, the economic condition of Bangladesh farmers often does not support them to use required quantity of fertilizers due to its high cost (Ali et al. 2009). Most of them don't use the inputs in proper dose and they use very small amount. For that reason the production falls down. Ahmed et al. (2015) found that all the inputs used by the farmers in producing sweet potato are underutilized in Bangladesh.

The labors are not in plenty in the study area. Therefore, during the peak season of weeding and harvesting farmers face shortage of labor. Capital is the scarcest input of all. However, farmers somehow manage it though at a higher interest rate from different micro-finance institutes or local money lenders.

Sweet Potato Producers

The sweet potato producers are defined as the commercial cultivators of sweet potato who later consume a little portion of it and sell the rest. The result found that sweet potato is readily sold to the market (to small traders, large traders, and or trader groups) after three to four month of cultivation. They sale to trader almost 84% of their production whereas 10 % are used for home consumption and 6% are used for livestock feed. Although the production area of sweet potato is decreasing, farmers mostly stated that sweet potato requires few inputs and returns are comparatively high.

Table 3. Profit margin of sweet potato traders at different period of harvesting season.

Variety	Beginning of the season		Pick of the season		End of the season	
	Purchase Price	Selling price	Purchase Price	Selling price	Purchase Price	Selling price
Local (Red Skin and white flashed)	10	12	9	10	12	15
Profit Margin (Percentage)	17 percent		10 percent		20 percent	
Local (White Skin and white flashed)	11	14	7	8	8	11
Profit Margin (Percentage)	21 percent		13 percent		27 percent	
OFSP Variety	11	14	8	11	9	11
Profit Margin (Percentage)	21 percent		27 percent		18 percent	

As a result, some new farmers are showing interest in cultivating sweet potato in the study area. According to Mendoza (1995) when there are several participants in the marketing chain, the marketing margin is calculated by finding the price variations at different segments and by comparing them with the final price to the consumer. The consumer price is then the base or the common denominator for all marketing margins. Study result found that average production cost of sweet potato is BDT 5.5 per kg while the average farm gate price of sweet potato is BDT 7 per kg. Analysis also showed that sweet potato producer got profit of BDT 29,797 per acre of land (Table 2).

Table 2. Economics of sweet potato at farmers' end

Particular	Amount (BDT)
Per Kg cost of production of sweet potato	5
Per kg farm gate price of sweet potato	7
Total cost of production per acre	35,978
Yield (kg)	9,425
Total value	65,775
Profit per acre	29,797

*1 USD = 80 BDT

Sweet Potato Traders

As sweet potato is very much seasonal crop, the study did not find any specialized traders for sweet potato trading in the study area. The available traders found during the study are basically the seller of seasonal vegetables and horticultural crops. During sweet potato harvesting season they come from different locations to purchase sweet potato both from the farmer's field and local market. They mostly sell sweet potato along with other vegetables in both urban and local market. The study found that, big traders like wholesaler (locally known as Arot dar) do not trade sweet potato as the trading volume is low. There is a variation in offering price to farmer which is based on variety of sweet potato and availability. Sweet potato prices have risen overall and fluctuate depending on the time of the year (Bergh *et al.* 2012). Analysis showed that at the beginning of the season trader secured 21% profit margin where as in the peak and late season they got 27% and 18% profit margin, respectively (Table 3).

Table 4. Profit margin of sweet potato retailers at different period of harvesting season

Variety	Beginning of the season		Peak of the season		End of the season	
	Purchase Price	Selling price	Purchase Price	Selling price	Purchase Price	Selling price
Local (Red Skin and white flashed)	15	20	10	13	15	18
Profit Margin (Percentage)	25 percent		23 percent		17 percent	
Local (White Skin and white flashed)	11	14	8	10	9	11
Profit Margin (Percentage)	21 percent		20 percent		18 percent	
OFSP Variety	12	14	10	13	8	10
Profit Margin (Percentage)	14 percent		23 percent		20 percent	

**Most of the retailer sell sweet potato on cash to consumer. Price has been found increasing for last two year, 11% and 18 % respectively in 2011-12 and 2012-13.*

Sweet Potato Retailers

Sweet potato retailers are small entrepreneur who are mainly vegetable retailers. They buy in bulk amount (100-110 kg) from traders and almost all the quantity sell to consumer on daily basis. The retailers of the sweet potato in study areas buy from mainly large traders; sometime they directly purchase from field of farmer. Sometimes farmer themselves play a role of retailer in different “hat” (market) day. Result found that sweet potato retailer got 14% profit margin at the beginning of the season where as they secured 23% and 20% profit margin during the peak and late season, respectively (Table 4).

Sweet Potato Processors

By studying the secondary information, it is exposed that sweet potato processing industries are still not available in Bangladesh. Some organizations and International Non-Government Organization (INGOs) are trying to made different food meals for alternate use of sweet potato. Whether in different country, Sweet potatoes are also processed industrially into fried snacks like sweet potato fries (chips), candy, starch, noodles, and flour (Bergh at. al 2012).

Sweet Potato consumers

Study found that consumer prefer to purchase local (red skin and white flashed) variety of sweet potato because of its taste and traditional practice. Majority of the consumers prefer boiled form of sweet potato followed by burned form. In some areas sweet potato is also used as curry. Daily intake (on an average) of sweet potato from April to June was found to be 299 gm per person at Jamalpur and 166 gm per person at Netrokona. Usually they buy sweet potato from local market. All the respondents at Netrokona and Jamalpur mentioned that their family members also like to eat sweet potato.

Eighty Five percent of the consumers of Netrokona and 76 percent from Jamalpur reported that they know about the nutritional values of sweet potato. The entire sampled

consumer knows that sweet potato leaves can be eaten as leafy vegetable and they love to eat sweet potato leaves. The leaves are collected (small scale) from farmer's own land for home consumption.

Storage

The result of this study found that only nine percent farmers stated that they store sweet potato at home for 1-3 months. Core problem of this storing is insect and fungus attack. Farmers and traders stated that they don't usually store as they don't trade sweet potato in the off season. However survey revealed that about 90 percent farmers and 45 percent traders are interested to store sweet potato in a cheap and healthy way without any post harvest loss.

The supporting function players

The supporting function players for the sweet potato value chain are those who are not directly related to the sweet potato value chain but provide different supports to the value chain actors. The support functions include different services (e.g. credit), research and development, infrastructure, and information. In the study area it was found that there are several NGOs are operating who offers credit support to the farmers. Moreover there are also specialized agricultural bank presents in the study area.

Information service providers

In order to provide information to the farmer, Government of Bangladesh have established DAE (Department of Agricultural Extension) who communicate with the farmers about cultivation process, pesticide use, seed use, sale of improved quality seed etc. DAE officials like SAAO (Sub Assistant Agricultural Officers) carry on such tasks but they are very limited in number compared to the number of farmers in need of guidance. Sometimes, input sellers while selling fertilizer, pesticide and seed are informing farmers but still these input sellers do not have that much capacity to provide services demanded by the farmers.

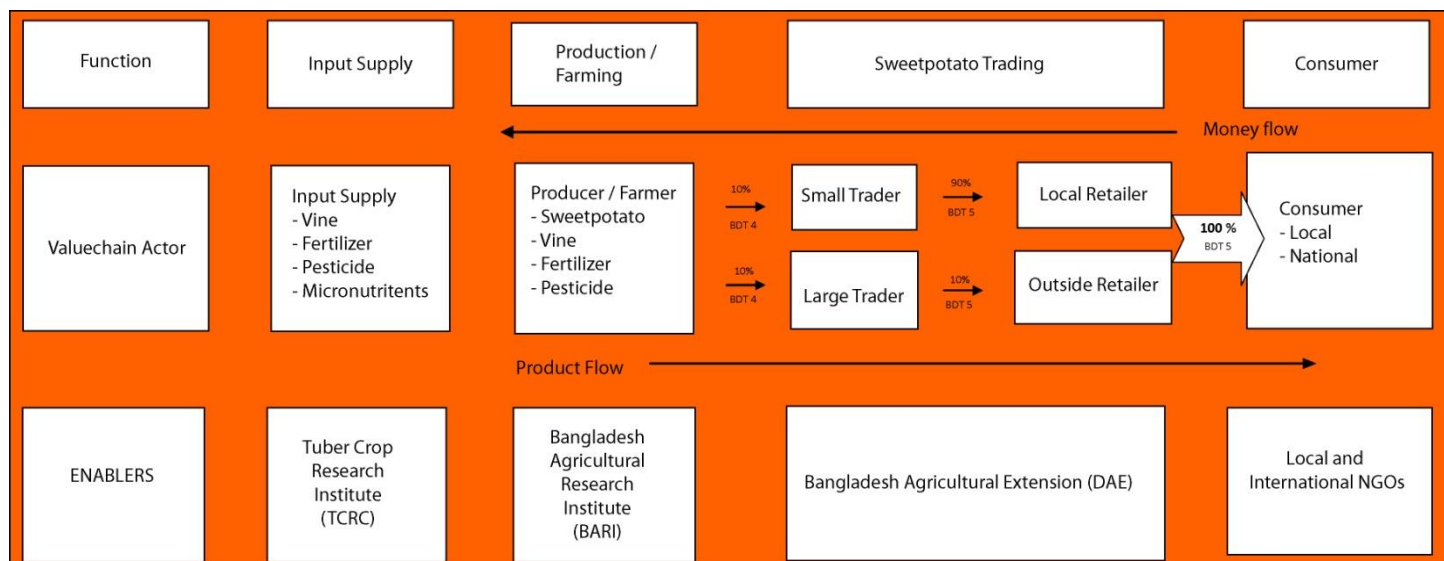


Figure 1. Value Chain Map of Sweet potato in two Districts of Bangladesh

Table 5. Channels in the sweet potato value chain in the study areas

Channel Numbers	Input Supplier	Farmers	Traders	Large Traders	Retailer (Local)	Retailer (outside)	Consumers (Local)	Consumers (National)	percentage
1									40
2									10
3									40
4									10

Financial service providers

Different financial service providers like NGOs, MFIs and specialized agricultural bank etc. are active at field level for financial service. But the sweet potato farmers are not receiving sufficient service regarding finance related issue. Farmers are seen borrowing money from neighbours at the time of cultivation.

The sub-sector map

A subsector is defined as a vertical grouping of enterprises involved in the production and marketing of one well-defined product or several closely related products (Boomgard et al., 1992). According to ILO (2009), mapping a chain means creating a visual representation of the connections between businesses in value chains as well as other market players. The value chain map is a graphical presentation of the value chain actors and other players. Here the regulators, standard setters, law or policy makers, informal rules and norms setters are shown at the top portion. In the middle are the value chain actors – from left to right, at the bottom are the support function players.

Channels in the sweet potato value chain

According to Lundy *et al.* (2004) a market chain is used to describe the numerous links that connect all the actors and transactions involved in the movement of agricultural goods from the farm to the consumer. The study had found very few channels for sweet potato; they are mentioned below both in written and graphical form. It is mention worthy here that consumers are not part of any channel of value chain since they do not add any value. However, they have been shown here only for the sake of clarifying the flow of final product to the ultimate hand.

- Channel 1:** Input Suppliers – Farmers - Traders – Retailers (Local) - Consumers
- Channel 2:** Input Suppliers – Farmers - Traders – Large Trader – Retailers (Outside) - Consumers(National)
- Channel 3:** Input Suppliers – Farmers - Retailers (Local) - Consumers
- Channel 4:** Farmers - Retailers (Local) – Consumers

Cost of different sweet potato value chain actors

In Table 6, the cost of farmers, traders, and retailers are

Table 6. Monetary flow of sweet potato in different level

Sweet potato Actors	Amount of Inputs Purchased (ton)	Price of Inputs Purchased (per unit) BDT	Cost of Purchased Amount BDT	Other cost of operation BDT	Total Cost of Operation (BDT)	Amount of Outputs Sold (ton)	Price of Outputs Sold (BDT/unit)	Total Sales (BDT/ton)	Income (BDT/pe r Ton)
Farmers					3,000	1	7,000	7000	4,000
Traders	1	7,000	7,000	0	7,000	1	12,000	12000	5,000
Retailers	1	12,000	12,000	0	12,000	1	17,000	17000	5,000

Note: The wastage (during caring and transport) in the different level is negligible.

*The farmer, large trader and retailer deal with a large amount of product at a time. Thus this profit only indicates a portion of the profit they earn for 1 ton of sweet potato, not for one transaction.

shown in tabular format to show the monetary flow in the sweet potato value chain. Main value chain consists of these actors. These calculations are shown in terms of 1 ton (1000 kg) sweet potato production and distribution in a year.

CONCLUSION AND RECOMMENDATION

Though sweet potato plays an important role in increasing income and food security of the farmers but, the value chain system was not strength enough in the study area to get the potential benefits out that. Sweet potato is produced and consumed locally while there is demand for it in the capital market of the country. Due to unstructured market management it has not been reckoned as lucrative product for investment. Lack of supply demand synchronization and limited availability and demand for value added products from sweet potato and a lack of knowledge of diversified products are the key drawback to strengthen the existing sweet potato value chain in Bangladesh. The study suggests arranging the linkage between the traders of the capital market and the local traders of the study areas. From the study it has been revealed that there are numbers of constraints exist both at upstream and downstream level of sweet potato value chain. Majority of the farmers are not aware about the food value of sweet potato. At the grower level roughly 14 percent farmers know about the improved varieties of sweet potato. Though 80 percent farmers use fertilizer specially Urea, TSP and MoP but they use it in small proportionate than the recommended dose due to their poor economical condition and mostly for careless farming. Getting quality vines is also a big problem for the farmers. By addressing proper management of crop cultivation, sweet potato farmer can get higher yield and that can add more profit to them.

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REFERENCES

- Ahmed MT, Nath SC, Sorwar MA, Rashid MH (2015). Cost-effectiveness and resource use efficiency of sweet potato in Bangladesh. *Journal of Agricultural Economics and Rural Development*, volume 2 (2), pp. 26-31.
- Ali MR, Costa DJ, Abedin MJ, Basak AC (2009) Effect of fertilizer and variety on the yield of sweetpotato. *Bangladesh J. Agril. Res.* 34(3): 473-480.
- BBS (2012). *Statistical Year Book of Bangladesh. Bangladesh Bureau of Statistics Division, Ministry of Planning, Government of the People Republic of Bangladesh, Dhaka, Bangladesh.*
- Begum MEA, Islam MN, Alam QM, Hossain SB (2011). Profitability Of Some Bari Released Crop Varieties In Some Locations Of Bangladesh. *Bangladesh Journal of Agricultural Research*, 36(1), 111-122.
- Bergh K, Orozco P, Gugerty MK, Anderson CL (2012). Sweet Potato Value Chain: Nigeria. Weven School of Public Affairs. EPAR Brief No. 220
- Boomgard JJ, Davies SP, Haggblade SJ, Mead DC (1992). A subsector approach to small enterprise promotion and research. *World Development*, 20(2), 199-212
- FAO (2012): Food and Agricultural Organization. <http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>
- FAOSTAT (2011). Food and Agricultural Organization <http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>

<http://faostat.fao.org/site/567/DesktopDefault.aspx?PageID=567#ancor>

- ILO (2009). Value chain development for decent work: A guide for development practitioners, government and private sector initiatives. [http://www.ilo.org/empent/Publications/WCMS_115490/lang--en/index.htm] site visited on 25/12/2012.
- Kaplinsky R, Morris M (2001). *A handbook for value chain research* (Vol. 113). Ottawa: IDRC
- Lunaa F and Wilson PN (2015). An Economic Exploration of Smallholder Value Chains: Coffee Transactions in Chiapas, Mexico, *International Food and Agribusiness Management Review*, 18(3).
- Lundy M, Gottret MV, Cifuentes W, Ostertag GCF, Best R, Peters D, Ferris S (2004). *Increasing the competitiveness of market chains for smallholder producers: Module 3: Territorial approach to rural-agroenterprise development*. CIAT.
- Mendoza, G (1995). *A Primer on Marketing Channels and Margins. Prices, Products and People:*

Analyzing Agricultural Markets in Developing Countries. Lynne Reinner Publishers, London, United Kingdom. 498pp.

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