

The Vegetable Supply Chain of Bangladesh: Is it capable to meet the requirements of international trade?

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***Abstract:** The vegetable is an important component of the human food basket and a high value commodity in the global food market. Taking into consideration of the economic importance of vegetable as an export item for Bangladesh, this paper has assessed the capability of the local vegetable supply chain to meet the requirements of international trade. The research approach of this study is to evaluate the capability by comparing the opinions of local traders and exporters. The exporters have evaluated the supply chain capability from the perspective of the requirements of international markets. Local traders have evaluated the supply chain considering the existing capability and practices. The comparison explores the fact that the local vegetable supply chain cannot meet the requirements of international trade because of unacceptable food safety and hygiene standards, inappropriate storage facilities, ineffective transport systems, higher operational cost of supply chain, and inadequate quantity of supply.*

***Keywords:** Supply Chain, Fresh Vegetables, International Trade, Bangladesh, Food Safety*

I. Introduction

The vegetables are important components of the human food basket for their taste, and nutritional and health benefits. A joint study by Food and Agriculture Organization (FAO) and World Health Organization (WHO) recommends consumptions of a minimum of 400grams of fruit and vegetables per day (excluding potatoes and other starchy tubers) for the prevention of chronic diseases such as heart disease, cancer, diabetes, and obesity, as well as for the prevention and alleviation of several micronutrient deficiencies and suggested the development of cost-efficient and effective interventions for the promotion of adequate fruit and vegetable production and consumption (Agudo, 2005). In addition to health impacts, vegetable is a high value crops that can increase income and may contribute to poverty reduction in underdeveloped countries. Some studies have observed that small scale vegetable farming has potential for reduction of poverty. A study in

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Tanzania observed significant positive contribution of vegetable production to household income and thereby reduction in poverty that increased food security, affordability to healthcare and use of educational facilities (Mlelwa, 2013). The study identified lack of adequate transport and logistics as barriers to scaling up vegetable production. The horticultural produce and processed products from developing countries have demand in both domestic and international markets and offers good opportunities for poverty reduction because it increases income and generates employment, and therefore care must be taken that small and poor farmers are not excluded from the opportunities in these market sectors (Weinberger & Lumpkin, 2007). As vegetables have both health and economic effects, these are potential items for trade across the countries. According to COMTRADE and ITC statistics, the export trade of fresh vegetables was US Dollar 69.98 billion in 2016 and US Dollar 58.63 billion in 2012. Within five years between 2012 and 2016, the export market for fresh vegetables expanded by 1.19 times. The changing economic scenario of the world, creating new opportunities for developing countries to export fresh vegetables. The falling value of sterling and attempts to reduce costs, the British fresh vegetable importers are planning to source more fresh produces from developing nations of Africa (Levitt, 2016). Bangladesh is an agricultural country that may produce large quantity fresh vegetables for internal consumptions and export to global markets. However, this country could not perform well in fresh vegetable production and international trade. According to the Food and Agriculture (FAO) statistics, Bangladesh produced 1.36 million metric tons of fresh vegetables in 2014 and was the 18th largest producer. In contrast, the small South Asian neighbour Nepal produced 3.42 million metric tons of fresh vegetables in 2014. In export of fresh vegetables, Bangladesh has almost no existence. It was ranked 82nd in the global export market of fresh vegetables in 2016 and the export was only US Dollar 44.5 million.

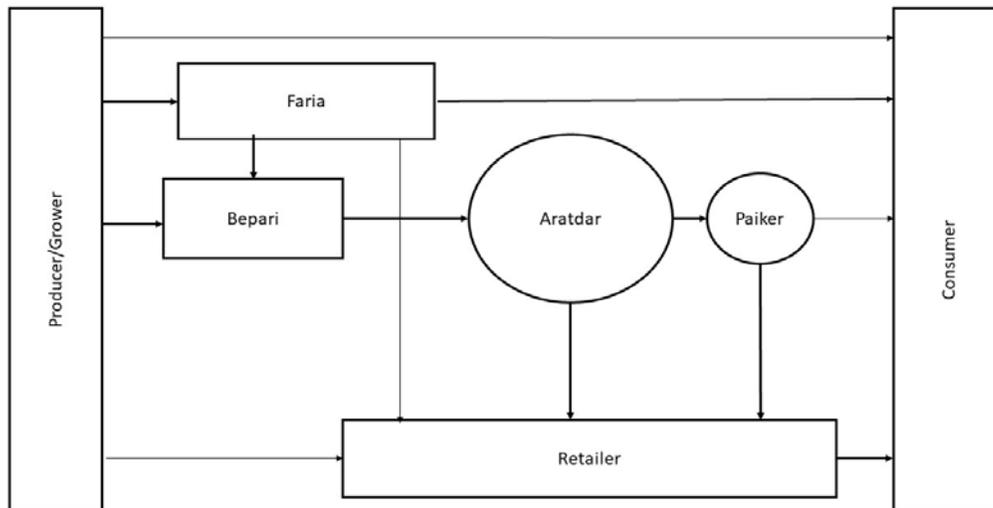
Though a potential country for fresh vegetable produces, Bangladesh could not become a major producer and exporter of the product. The failure of the country in production and export of fresh vegetables is often considered as the consequence of an ineffective supply chain. Lack of access to markets is a major problem for farmers to get economic gains for fresh vegetable produces. The objective of this paper is to analyse the characteristics of the downstream vegetable supply chain of Bangladesh and to analyse whether the existing local supply chain has the capability to meet the requirements of international trade.

II. Literature Review

The downstream of the supply chain is responsible for connecting the producers to consumers. The activities associated at this stage of the supply chain are buying or collecting goods from producers, transportation, warehousing, analysing customer needs and fulfilling customer requirements, locating logistic facilities, and planning other

services necessary to facilitate transfer of products from producers to consumers (Wisner, et al., 2012). The downstream of fresh vegetable supply chain in Bangladesh is composed of five types of intermediaries - Faria, Bepari, Aratdar, Paiker, and Retailer. The Figure 1 shows the downstream supply chain network of fresh vegetable produce in Bangladesh. Farias are small traders who procure products from growers and supply to Beparis, retailers, and consumers. They do business with small capital and procure vegetables of small quantities. Beparis are professional traders procure fresh vegetables in large quantity from growers and Faries, and supply to Aratdars. Aratdars are large business establishments with fixed establishments and works as commission agents to link between Beparis and retailers. Paikars are wholesalers who get supply of vegetables from Aratdars and sale products to retailers or large consumers. Retailers are major supplier of fresh vegetables to consumers. These intermediaries used to perform supply chain functions of transportation, storage, grading, packaging, financing, and risk bearing. As the vegetable trade in Bangladesh is not a formal sector, the financing in this sector, mostly come from the self-financing of the intermediaries (Tasnoova & Iwamoto, 2006). In absence of formal policy insurance systems, all risks related to production and marketing of fresh vegetables are borne by the growers and intermediaries in Bangladesh (Matin, et al., 2008). The fresh vegetable growers are small or marginal farmers and lack the ability to reach customers because of inadequate market information and financial ability to undertake necessary logistics. This situation has enabled the Beparis and Aratdars to exercise control on the supply chain operations of vegetables. The exporters get a supply of fresh vegetables mostly from Aratdars.

Figure 1: Downstream supply chain of fresh vegetables produces in Bangladesh



Various studies have identified some flaws and inefficiencies in the vegetable supply chain structure of Bangladesh. Unstable supply and demand, lack of regulatory control over the market, growers' absolute dependence on local wholesalers for market access, unreliable and expensive transport system are some barriers to the efficient functioning of the supply chain (Karim & Biswas, 2016). Poor pre-packaging, poor handling methods and lengthy ineffective marketing system causes post-harvest losses and shrinkages of vegetables and it often goes up to 40 percent of total produce (Badrud-doza, 2006). Bangladesh has a comparative advantage of vegetables production, but higher transport and marketing costs and ineffective logistic systems are the causes of failure of the country to be successful in international trade of fresh vegetables (Karim, et al., 2011). The vegetable producers and distributors in the country cannot maintain the required safety standard as required by the provisions of Sanitary and Phytosanitary Measures. The second largest producer of fresh vegetables, the India, is a failed exporter mainly because of the inability to meet the food safety standards (Roy, 2008). In addition to food safety standards, adequate air cargo space, easy customs procedures, high standard packaging, availability of good quality fresh vegetables, low cost and fast transport systems, adequate and suitable storage facilities, adequate market information, and lower cost production are the requirements for becoming a successful exporter of vegetables (Sabur, et al., 2004). Multiple independent studies identify serious infrastructure and logistic problems, lack of cold storage and transport facilities, premature harvest, profit mongering of businesses, and the absence of a licensing and monitoring authority for commercial farming are behind unbridled food contamination in Bangladesh (Rahman & Pandey, 2014).

III. Methodology

The objective of this paper is to evaluate the capability downstream supply chain of fresh vegetables to meet the requirements of the exporters. It is a case control study. The exporters of fresh vegetable are case group who evaluates the capabilities of the supply chain from their experiences in international trade. The local traders are control group who evaluates capabilities of the supply chain from their experiences of business in local markets. A comparison of opinions of case and control groups can identify the differences, if any, of the downstream supply chain and useful to assess the capability of the supply chain to meet the requirement of international trade. The definition of case and control groups for this paper is the following.

Group 1 (Case): Firms currently involved in exporting vegetables in other countries.

Group 2 (Control): Firms engaged in trading of vegetables in the domestic market and not involved in exporting vegetables. This group mostly includes the Aratdars and some large Beparies.

The cross-sectional and intra-country survey was conducted at various locations outside Dhaka city and in the Dhaka Metropolitan area. In Group 1, 20 firms already involved in international trading of vegetables, were selected from a sample frame consisting of 104 firms through a lottery. The sample frame was the list of members of the Bangladesh Fruits Vegetables & Allied Product Exporters Association (BFVAPEA). Seven of the selected firms did not respond to requests for interviews. As a result, the final sample size for Group 1 is 13. The sample size of the Group 2 is 50. The interviews are the proprietors or managers of business firms engaged in vegetable trade in local markets. Information available from BFVAPEA helped in deciding on the survey locations. First, major market centres/vegetable market clusters were identified and listed with the help of BFVAPEA. Interviewers collected data from outside Dhaka (i.e., Narayangonj, Gazipur and Narsinghdi), Cox's Bazar and Chittagong, Faridpur, Sirajgonj, Panchagarh and Rangpur. The selection of firms was judgmental, based on information and references available at the locations, as it was not possible to conduct a random survey.

The main method of primary data collection was an experience survey. The interviewers used a semi-structured questionnaire to collect data from experienced people associated with the vegetable trade through personal interviews. In addition to the questionnaires, respondents were asked to discuss their opinion regarding vegetable business operations process informally. In the interviews, business people put forward their opinions and suggestions regarding the operation of the supply chain.

The capability local vegetable supply chain is evaluated for four criteria. The first criterion is the strength of the supply chain. The variables included in this criterion are taste and quality of vegetable produced, production cost, and scale of production. The respondents evaluated the variables giving a weight between 0 and 100. The second criterion is the weakness of the supply chain and variables included here are profitability, post-harvest loss and shrinkage, weather, and crowded market (existence of large number of traders at a business centre). The respondents weighted their opinion on a 0 to 100 scale. The mean value of weights is calculated for two groups separately for each of the variables. The differences in the mean are tested using one-way ANOVA.

Third criterion is a logistics system of the supply chain. It includes facilities for storage of vegetables, transport system, informal payments to local influential stake holders to do business, informal payments to law enforcing agencies and other government agencies, and lack of information about a market where the vegetables may be sold. Fourth criterion is the food safety and hygiene standard of the supply chain. It includes HACCP (hazard analysis and critical control points), standardization, grading of vegetables, pollution control, organic vegetables, and buyers' compliance. The third and fourth criteria are analysed using frequency distribution of the responses.

IV. Findings

The sample size of surveyed firms is 63 of which 13 are exporters and 50 are local traders. All exporting firms are located in Dhaka. The locations of local traders are at Panchagarh (6), Gaibandha (4), Narayanganj (2), Gazipur (5), Faridpur (10), Chittagong (10), Sirajganj (10), and Narashindhi (3). The dominant form of ownership is sole-proprietorship. 12 of the exporters and 38 of local traders are sole-proprietorship. Among the remaining firms 13 firms, 12 of the local traders are partnerships and one exporter is a limited company. The average time lengths of business operation of exporting and local trading firms are 16.3 and 15.5 years respectively. Average number of employees of exporting and local trading firms are 14 and 6 respectively. About 54 percent of exporters and 56 percent of local traders are expecting that their business may expand during the years ahead.

A. Strength of Supply Chain

The strength of the vegetable supply chain is measured by three factors – taste and quality of vegetable produced, low production cost, and scale of production. The exporters and local traders assigned their strength of evaluation on a scale between 0 and 100. Higher the value, the more the respondent agree with the factor. Table 1 presents the summary statistics and One-Way ANOVA values. It shows that exporters do not feel that production cost is low, quantity of production is large enough. However, both groups of respondents have agreed that the taste and quality of the fresh vegetable produced is high.

Table 1: Summary statistics of variables of strength of the vegetable supply chain

	Statistics	Taste and quality of vegetable produced	Low production cost	Large scale production of vegetables
Exporter	Mean	67.7	28.5	36.2
	Std. Deviation	30.6	33.9	32.5
Local Traders	Mean	73.4	50.0	58.4
	Std. Deviation	29.5	32.1	26.7
One-way ANOVA	F-Statistics	0.4	4.5	6.5
	Significance	0.5	0.0	0.0

Source: Estimated from survey data.

B. Weakness of Supply Chain

The weaknesses of the supply chain are analysed by four factors; low profitability, post-harvest loss and shrinkage, weather uncertainty, and unhealthy competition in a crowded

market. The exporters and local traders agree that profitability is not low in the vegetable supply chain. The weight of low profitability is 35.4 and 34.6 for exporters and local traders. The low weight indicates its insignificant impact on the supply chain. The opinions of both groups of respondents are not statistically significant at 0.05 significance level. Local traders consider post-harvest loss and shrinkage, weather uncertainty and crowded market are barrier or weakness of the supply chain. Exporters do not consider them significant weakness for supply chain. The differences between two groups of respondents are statistically significant as evaluated by one-way ANOVA. The difference in weights of both groups is statistically significant at 0.05 significance level.

Table 2: Summary statistics of variables of weakness of the vegetable supply chain

	Statistics	Low Profitability	Post-Harvest Loss and Shrinkage	Weather Uncertainty	Crowded Market
Exporter	Mean	35.4	50.0	40.0	33.8
	Std. Deviation	33.3	35.1	30.8	34.0
Local Traders	Mean	34.6	73.8	63.6	48.6
	Std. Deviation	26.7	25.9	29.9	26.5
One-way ANOVA	F-Statistics	0.0	7.5	6.4	2.8
	Significance	0.9	0.0	0.0	0.1

Source: Estimated from survey data.

C. Logistics

The Table 3 shows the opinion of the respondents about logistical bottlenecks of the vegetable supply chain. The major problem is the lack of storage facilities. 76.9 percent of exporters and 86.0 percent of local traders has identified it as problem of supply chain. Ineffective transportation system affects the exporter more than the local traders. 92.3 percent exporters identify the ineffective transport system as a bottleneck of the supply chain compared to 50.0 percent of the local traders. Transaction costs in the form of informal or illegal payments to different authorities and organisations are not critical bottlenecks to people involved in vegetable trade. Both exporters and local traders do not consider lack of information about the market as a strong bottleneck for the vegetable supply chain inside the country.

Table 3: Logistical problems of the vegetable supply chain

Logistical Bottlenecks	Exporter (Percent)	Local Traders (Percent)
Lack of facilities for storage of vegetables	76.9	86.0
Ineffective transport system	92.3	50.0
Informal payments to local influential people to do business	38.5	36.0
Informal payments to law enforcing agencies and other government agencies	46.2	32.0
Lack of information about market where the vegetables may be sold.	23.1	30.0

Source: Estimated from survey data.

D. Food Safety and Hygiene Factors

The local traders are unacquainted to food safety, hygiene, and environmental issues associated with vegetable supply chain. The Table 4 presents the level of knowledge and practice of supply chain organizations on safety, hygiene, and environmental issues. The HACCAP is the systematic approach to prevent food items from biological, chemical, and physical hazards. The principles of this system are applicable to vegetable items as well. But the local traders do not know or practice it when most of the exporters (61.5%) has knowledge about this system and could not comprehend the importance of it. Exporters of vegetables from Bangladesh understand the importance of standardization, pollution control, and need for buyer compliances. They need to practice those procedures during the export process. However, the local traders or suppliers of the vegetables are not aware of these issues and do not practice the procedures. Hence, vegetable is produced in the country has low safety standard. Organic vegetables are considered as a healthy food item, but local traders do not understand its importance. Local traders has idea to classify produces in grades to some extent, when it is a must element for exporters.

Table 4: Food safety, hygiene, and environmental standard of vegetable supply chain

Safety, Hygiene, Environmental Factors	Exporter (Percent)	Local Traders (Percent)
HACCAP (hazard analysis and critical control points)	61.5	0.0
Standardization	76.9	8.0
Grading of vegetables	100.0	50.0
Pollution control	84.6	20.0
Organic vegetables	76.9	20.0
Buyers' compliance	61.5	4.0

Source: Estimated from survey data.

V. Analysis

The four dimensions of the vegetable supply chain of Bangladesh are analysed in this paper to find if there are differences among the experiences of exporters and local traders regarding the operation of the supply chain. The taste and quality of the produces carried by the supply chain are good enough to meet the requirements of both exporters and local traders. Local traders consider the cost of production is low enough, but the exporters disagree with it. The vegetable market in Bangladesh is a seller's market and the suppliers can cover the cost of the supply chain by selling at a higher price to consumers. The international market of vegetables is competitive and many nations can supply vegetables at low price. It is the reason for which the exporters do not feel the cost of local vegetable production is low enough to be competitive in the global market. Similarly, the ability to increase prices help local traders to make good profits when production is less. So, whatever the cost of product and level of production of vegetables, local traders consider it as no barrier for their business operations. Traders at Narsingdi and Gazipur inform that they can procure any quantity of products at high price if there is a shortage of production and therefore do not consider level of vegetable production as a barrier to get enough supply for their trade. The exporters cannot bear the extra price of low level production and consider the level of production is not large enough to meet the demand of international market.

The profitability of the supply chain is not a concern for local traders and exporters. According to the present system, exporters, used to get supplies of vegetables from Aratdars and Beparis. They only receive good quality products. Hence, the post-harvest loss and shrinkage do not affect the exporters. This is the concern of the local traders because they carry the economic losses associated with it. Climate related fluctuations in supply of vegetables affect the local traders by reducing or increasing the supply of vegetables. Exporters do not bear the burden to procure the produces from the growers, hence are less sensitive to climate related fluctuations. Large number of vegetable traders used to operate at any business cluster. There are 26 Aratdar at a single market in Sirajganj. The existence of large number of traders creates price competition and often raise the procurement costs.

The vegetable is a perishable product and demands specialised storage and transportation facilities for effective management of the supply chain. Unfortunately, appropriate storage facilities are not available in the country, according to requirements of vegetable traders. Consequently, it is difficult for the traders to maintain procured produces fresh and to avoid perishability. Hence, lack of storage facilities is a serious bottleneck for the vegetable supply chain of Bangladesh. In the absence of suitable temperature controlled storage facilities, the traders often use life-threatening chemicals to preserve the products for a long time (Rahman & Pandey, 2014). Studies have suggested to establish cold

chains for the food supply chain in the country. Exporters suffer more than the local traders for the ineffective transport system. Local traders can make-up losses from delays and failures of the transportation system by raising prices, but exporters cannot do it. Many exporters have shown dissatisfaction for delays in transports because of traffic congestions and unavailability of adequate air freight opportunities. An ineffective transportation system can raise the operating costs of export business. It also reduces the quality of export goods. Exporters used to get market information through Bangladeshi diaspora abroad and business houses owned by migrants of this country are importers of local vegetables. So, they do not need information from other sources for success of their export business. Local traders used to supply vegetables to fixed market locations and do not change their distribution plan. Hence, do not need up to date market information.

Food safety, hygiene and environmental elements are the main concern of the local vegetable supply chain to meet the requirements of international market. According to definition of US Food & Drug Administration (FDA), HACCAP “*is a management system in which food safety is addressed through the analysis and control of biological, chemical, and physical hazards from raw material production, procurement and handling, to manufacturing, distribution and consumption of the finished product*” (FDA, 2017). The understanding and practice of HACCAP procedure in food production and distribution system of a country may improve acceptability of food items of that country in the global market. Local vegetable traders have no idea about the application of HACCAP in their operations. It has reduced the acceptability of vegetable exporters in many countries. Bangladesh failed to continue potato exports to Russia because of the importing country had imposed restriction on the ground that the production and supply system of this country cannot meet the health and safety standards (Ahsan, 2015). According to the Sanitary and Phytosanitary (SPS) agreement, all countries have rights to take Sanitary and Phytosanitary (SPS) Measures for protection of human, animal and plant life and health. Countries have standard measures to ensure that food is safe for consumers and to prevent the spread of pests or diseases among the population, animals, and plants. All governments accept the fact that some trade restrictions may be necessary to ensure food safety and animal and plant health protection. Hence, the failure of the local vegetable supply chain to follow the HACCAP procedure and to address pollution prevention may restrict the access of fresh vegetable produces in global market. The global vegetable market also requires the standardization and grading of products because it ensures uniform definitions for determining levels of quality and works as a common language for global trading. This is also an acute weakness of the local vegetable supply chain.

The vegetable supply chain of Bangladesh is not capable to meet the requirements for international trade. Its production cost is not competitive and unable to supply the

required quantity of fresh vegetable produces for international market. Ineffective transport and storage facilities are the reasons for quality decline. Safety and hygiene standard of the supply chain is not equivalent to international standard.

VI. Conclusion

Bangladesh is an agricultural country with high potential to become a major producer and exporter of fresh vegetables. However, the country has failed to become a significant producer of these produces. There is huge demand for vegetables all over the world and its consumption has been increasing because of proven health benefits. The opinion of the vegetable traders has explored the fact that the causes behind the failure is inadequate infrastructure, lack of training among growers and traders, and informal and unregulated market. The policy makers should give attention to scale up vegetable production of the country for local consumption and export market. Many studies in Africa have shown evidence that small scale vegetable farms can improve the financial status of poor urban and rural households. Hence, the vegetable supply chain in the country should be reorganized to meet the global standard for health and hygiene standard of the people of the country, poverty reduction, and export earnings.

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