

# Examining the Production Performance of Vegetables for Business Development in Bangladesh

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## Summary

Production of vegetables is a key factor in ensuring a continuous supply of raw materials for the development of agribusiness in horticulture. It is often argued that vegetable production in Bangladesh has comparative advantages, but despite these opportunities, agribusiness in horticulture is not flourishing commercially, especially for vegetables. This article, therefore, examines why the horticulture sector has not developed as a business in Bangladesh, in relation to fresh vegetables. This article analyzes the present conditions for fresh vegetable production from the point of view of the supply side for developing agribusiness. Primary data collection was carried out in four districts in Bangladesh, namely Dhaka, Gazipur, Jessor, and Thakurgaon, in order to estimate financial performance, as well as to identify constraints that exist at the levels of both production and marketing. This study shows that the domestic supply of vegetables is limited by the seasonal nature of production, as well as the unavailability of production inputs on time. Furthermore, high production costs also discourage farmers from producing vegetables in a large scale. However, the utilization pattern of locally produced vegetables suggests that domestic vegetable production has the potential to support the development of business in horticulture.

## Introduction

Bangladesh is one of the major horticultural countries in South Asia (Ali, 2000: 1). Agriculture, including horticulture, is the largest single sub-sector of the economy, accounting for about 13 percent of the country's GDP (Government of Bangladesh, 2006: 67). Several studies have pointed out that there is considerable potential for growing horticultural crops in Bangladesh (FAO, 1997; Ateng, 1998; Bouis, 2000; Shahabuddin and Dorosh, 2002; Alam, 2005). Farmers who are engaged in the production of vegetables often earn higher incomes than those engaged in the production of cereal crops alone (Weinberger and Lumpkin, 2005: 10). Vegetables like egg plant, radish, cabbage, cauliflower, and pumpkin gave returns at least three times higher than rice (Ateng, 1998: 12). In addition, the economic returns in terms of domestic resource cost<sup>1</sup> at export parity also indicate that there is a comparative advantage in the production of vegetables in Bangladesh (Shahabuddin and Dorosh, 2002: 13). Therefore, the natural and comparative advantages of Bangladesh create promising opportunities for the sector (ADB, 2004: 6).

There have been several studies of the possibility of horticultural sector improvement in Bangladesh. Most of them have highlighted the potential of horticultural crops like

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<sup>1</sup> Domestic resource cost (DRC) is a measure of comparative advantage which examines the efficiency of using resources to produce crops at home instead of importing them. A DRC of less than 1 implies that the country has a comparative advantage in their production.

vegetables (see Weinberger and Genova II, 2005; Ali, 2000), and the comparative advantages of horticulture (see Ateng, 1998; Shahabuddin and Dorosh, 2002). Moreover, studies of vegetables have also been conducted by various reputable organizations, emphasizing aspects of marketing (for example, see CARE, 2001; UNDP, 2005). In the agribusiness value chain, one clear tendency is for concentration at the processing stage to promote increasing scale in production units (Humphrey and Memedovic, 2006: 32). Yet, a comprehensive examination of the performance of vegetable production for business development in Bangladesh still remains elusive.

This research, therefore, focuses on the production of vegetables in Bangladesh; given that the fresh produce marketing industry depends on a continuously supply of vegetables in the market. The key question is, therefore, how well the production of fresh vegetables performs in relation to development business in Bangladesh. The paper begins with an overview of production related factors based on a review of the literature and empirical research. Then it describes the scale of the production of vegetables to see the adequacy of supply within the country. Next, an estimation of the financial performance of vegetable production at the growers' level is presented. Following this, the constraints on production that exist at the farmers' as well as the traders' level are discussed, with an emphasis on scale, cost, and technology of production. Finally, some conclusions are drawn.

### **Production Factors and the Present Situation of Bangladesh**

Vegetables in much of Asia and the Pacific region are grown by small-scale farmers who are unorganized and scattered in different locations (Shin, 2001: 28), and this also applies to Bangladesh. Concentration on production is important because low production can affect all the players in agribusiness. At the production level, external factors such as weather and susceptibility to diseases and pests have significant effects on the output and quality of agricultural produce (Siskos *et al.*, 2001: 317). Low production is also a result of limited access to inputs like irrigation, seeds, fertilizers, and credit, as well as of poor cultural practices, poor soil, and low levels of management skills (Acquah and Masanzu, 1997: 10). In addition, the two most important factors affecting the quality of the output are the choice of the right cultivar and the maturity at which the crop is harvested (Hossain, 2004: 12). In addition, a low level of production may ultimately hamper the agro-industry supply chain.

It is also important to know how agricultural commodities are used, either as inputs for processing in other sectors or for consumption. In most agro-based developing countries, businesses frequently face problems such as highly skewed production, untrained labor, shortage of standardized products, and absence of processing and packing facilities. For the horticultural business, Kane *et al.* (2005: 277) have also shown that horticultural products must satisfy stringent quality standards. However, small-scale growers typically cannot produce large volumes of homogenous high value produce.

Continuous production and a sufficient supply of raw materials are essential for establishing business in agriculture. The availability of raw materials, along with price and quality, is the prime concern for this sector, as mentioned by Connor *et al.* (1985: 1138). Gandhi *et al.* (2001: 338) found in their study that agricultural production is a strong and significant determinant of agro-food industrial output, which underlines the importance of raw materials for business development in agriculture.

Holt and Pryor (1999: 8) suggest that a higher proportion of agricultural output goes on to further processing in countries with more developed agribusiness activities, where more than 60 percent of the total agricultural output is used as an input for further economic activities. In contrast, less than 20 percent is processed and nearly two-thirds of production is consumed in the agribusiness of less developed countries. It is also claimed that commercial producers must sell about 75 percent of their agricultural produce to ensure the supply of primary produce to agro-industry. Therefore, the supply of raw materials is one of the crucial factors for developing agribusiness.

Horticultural production has not been as well documented in Bangladesh as cereal crops. Since Bangladesh has been a food deficit country for a long time, the emphasis has been on rice and wheat production for domestic self-sufficiency in food grains (Alam, 2005: 55). Therefore, there has been a decline in the production of some horticultural crops in recent years (Table 1).

For Bangladesh, identifying the constraints on the expansion of vegetables production is important, since the supply of vegetables is quite irregular in most Asian countries, including Bangladesh (Ali, 2000: 4). Only a small proportion of total cropped areas of Bangladesh are under vegetables production. Most of the agricultural production in Bangladesh is concentrated in rice, occupying about 75 percent of total cropped areas (Government of Bangladesh, 1999: 6), whereas only seven percent of the total cropped land is used for horticulture crops, including root and tuber crops (Hortex Foundation, 2005: 1). According to the Hortex Foundation<sup>2</sup> estimation (2005: 1), the area under vegetable cultivation accounts for only 1.79 percent of the total cropped areas. From this small proportion of the land area, Bangladesh produces about 1.63 million metric tons of vegetables annually, of which about 60 percent are produced in winter and the rest in summer (Hortex Foundation, 2005: 1). Therefore, production is not well distributed throughout the year and produce for domestic use is relatively scarce in the off-season.

Analyses of the success of agribusiness can be found in many developed and less developed countries around the world. Many of these analyses have also targeted small producers (Humphrey and Memedovic, 2006: 4). Khushk (2001) has discussed the problems and constraints in vegetable and fruit marketing in Pakistan, using open-ended interviews and survey techniques. For his study, he targeted the vegetables and fruit producers, and the market intermediaries like wholesalers and retailers of these commodities. Similarly, Batt (2003) has analyzed the supply chain for potato marketing using transaction cost and relationship marketing theory. Each of these authors has used the idea of the agribusiness chain, from production to marketing.

## **Objectives**

The aim of the study is to analyze the present condition of vegetable production for agribusiness development, especially for fresh vegetables in Bangladesh. The study explores the potential for horticulture in business development for the domestic market. The specific objectives of the study are, therefore, two-fold: (a) to analyze the current status of vegetables in terms of area, yield, and production; and (b) to examine the major

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<sup>2</sup> It is a non-profit organization established in 1993 under the company act of 1913 with the aim of the development, promotion, and marketing of exportable horticultural produces in Bangladesh.

constraints on production in support of the agribusiness sector in Bangladesh.

## Methodology

The empirical research was conducted in February 2007. This study relies mainly on interviews with a limited number of farmers and supermarket traders. The sample for this analysis consisted of 155 respondents and embraced a wide spectrum of the vegetables sector in Bangladesh. Although there is no established rule of thumb, it is agreed that the sample size should be five times more than the number of variables (Sultan and Tarafder, 2007: 84).

To understand both why farmers concentrate on vegetables and their impact on their economic development, farmers from Dhaka (Savar), Gazipur, Jessor, and Thakurgaon districts of Bangladesh were selected randomly from among those who produce vegetables for commercial purposes throughout the year. It is difficult to find such respondents, since the local farmers are mostly engaged in the production of rice. The farmers were asked to provide information on their production costs, marketing costs, selling prices, and profits. They were also requested to identify constraints on production by choosing between statements on seasonality, varieties, and production cost, according to their priority.

At the same time, information was sought on fresh vegetables production for business development from supermarket traders in the capital city, Dhaka, through random sampling. Since marketing the fresh vegetables through supermarkets is a newly established concept in Bangladesh (Hossain, 2004: 17), these types of stores are available in only a few major cities in the country. Supermarket traders were also requested to respond to six prepared statements on a scale from 1 (strongly disagree) to 7 (strongly agree). Since supermarkets in Bangladesh are high-end formal markets (Martin and Jagadish, 2006: 16), the aim of discussions with these market intermediaries was to provide information about the quality and consistency of the supply of vegetables in the marketing system.

To explore the extent to which agricultural production determines agro-industrial output, estimation with an OLS regression model was used, relating the index of production of the food industry, the index of agricultural production, and gross domestic product (Gandhi *et al.*, 2001: 337):

$$\text{FOODINDEX} = a + b_1 \text{AGRPROX} + b_2 \text{GDPCP} + e$$

where, FOODINDEX = Index of production of food products industry  
AGRPROX = Index of agricultural Production  
GDPCP = GDP per capita at constant prices

The sources of data were the Bangladesh Bureau of Statistics for the index of production of the food industry and the index of agricultural production, and the Penn World Tables for data on the GDP of Bangladesh. Data from the years from 1973 to 2004 were analyzed using statistical tools such as SPSS and Excel.

## Analysis and Findings

### *Production Scale and Utilization Pattern*

In Bangladesh, vegetables lag far behind from rice in the production race. During the

period from 1995 to 2005, rice production increased about five percent, even though the area cultivated increased by less than one percent (Table 1). In comparison, the production of vegetables increased by about four percent during the same period, and a similar trend was also found in the areas used for vegetable cultivation. Surprisingly, the yield per hectare for vegetables remained stagnant during the same period throughout the country.

**Table 1. Area, Production and Yield of Different Crops, 1995 – 2005**

Crop	Area (000 ha.)			Production (000 Mt.)			Yield (Mt/ha.)		
	1995	2005	Change (%)	1995	2005	Change (%)	1995	2005	Change (%)
Cereals	10,683	11,628	0.81	27,703	41,291	4.46	2.6	3.6	3.50
Paddy	9,952	11,000	0.96	26,399	40,054	4.70	2.7	3.7	3.37
Fresh Vegetable	100	150	4.55	640	942	4.29	6.37	6.28	-0.13
Fruits, Excluding Melon	167	208	2.23	1386	1684	1.96	8.3	8.1	-0.22
Roots and Tuber	177.2	306.3	6.62	1903.4	4228	11.10	10.8	13.8	2.53
Pulses	741.4	421.6	-3.92	532	334	-3.38	0.70	0.8	1.30

Source: FAOSTAT Data, 2006. [www.fao.org](http://www.fao.org)

The situation for fresh vegetables reflected in Table 1 is poor in comparison to other crops. Therefore, the production of vegetables showed little significant progress during this decade. Although production was hampered due to the decrease in agricultural land throughout the country, the agriculture sector as a whole appears to be under stress.

The utilization pattern of vegetables produced by the farmers in Bangladesh differs depending on the type of products, varieties, time, and places. It also varies from region to region (FAO, 1997: 7-2). However, about 78 percent of vegetables produced on average are sold by the farmers. Of the remainder, 13 percent are used for consumption, and nine percent are used for other purposes (FAO, 1997: 7-1). The ADB (2004: 64), referring to Tracey-White (2000), also mentioned that more than 80 percent of the total production of vegetables is marketed by the farmers in both the winter and summer seasons, as presented in Table 2.

**Table 2. Utilization of Produced Vegetables by the Farmers**

Crops	Consumed/Given Away (% of Total Production)	Sold (% of Total Production)
Summer Vegetables	19.10	80.90
Winter Vegetables	16.10	83.90

Source: ADB, 2004. p. 64

Both these sources agree that more than 75 percent of the total vegetables produced in the country are marketed by the farmers. This may indicate that the supply of fresh produce is enough from the production side. But the question remains of how much the country is able to produce continuously.

It has been seen that the production of agricultural crops in Bangladesh is dominated by cereals. Statistics from 1973 to 2004 show that the share of vegetables in terms of value of production of total agricultural crops was less than ten percent, although it has declined to six percent in recent years. However, it is necessary to examine the extent to which the domestic production of fresh vegetables is supporting to the agro-food industry. The contribution of agricultural production to agro-food industrial output can be estimated by considering all agricultural crops. The results of the regression analysis of the supply of raw materials from agriculture in the food industry are presented in Table 3. This suggests that agricultural production is a strong determinant of agro-food industrial output, underlining the important role of the supply of raw materials. The value of R<sup>2</sup> seems to suggest that nearly 30 percent of the variance in agro-food industrial production can be explained in terms of agricultural production, with the remaining 70 percent probably due to imports from other countries.

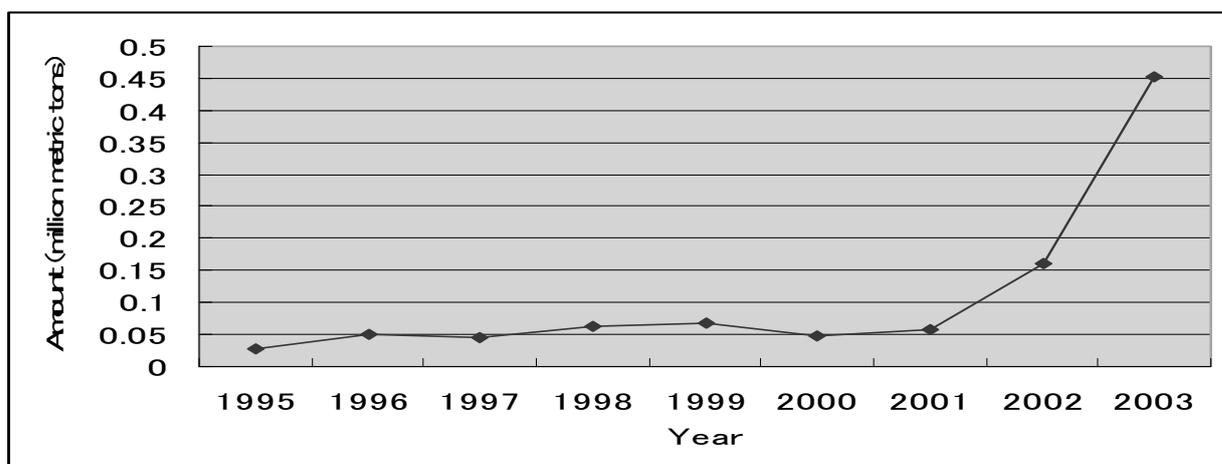
**Table 3. Regression Estimates of Agricultural Production on Agro-industries in Bangladesh: Dependent Variable – FOODINDEX**

	Independent Variables			R	Adjusted R <sup>2</sup>	F-Stat.
	Constant	AGRPROX	GDPPC			
Coefficient	96.593	0.254	0.000	0.541	0.292	5.985
t-Statistics	4.141	1.270	1.912	-	-	-
Significance	**	-	**	-	-	-

\*\* Significance at 99% level.

The analysis also shows that Bangladesh's agro-industry does rely not only on its own production, but also on imports of raw materials from other countries. The responses of most of the supermarket traders indicated that between 50 and 70 percent of the vegetables they sold each year were imported from other countries. The country's import statistics also support this argument. The volume of vegetables imported into Bangladesh is delineated in the following Figure 1.

**Figure 1. Yearly Amount of Vegetables Imported into Bangladesh, 1995 – 2003**



Source: FAOSTAT, 2006. [www.fao.org](http://www.fao.org)

Figure 1 implies that the country's vegetable imports remained more or less on a plateau from 1995 till 2001. However, there was a sharp increase after 2001, and about 45,000 metric tons of vegetables were imported in 2003. However, the opposite trend was indicated by the growers. The vegetable farmers mentioned that they do not produce on a large scale due to unpredictable returns from their sales. Moreover, about 59 percent of the farmers mentioned that sometimes their cost of production is higher than the selling price. FAO (1997: 7-71) also referred to the farmers' identification of the low prices of their products as a marketing constraint.

It is clear from the above discussion that the lion's share of the vegetables produced in the country is marketed by the farmers. However, the problem arises with the inconsistency of the year-round supply of the same commodities in the market. In one sense, the supply of fresh produce in the market is abundant, given seasonal production. Nevertheless, the country is unable to ensure a continuous availability in the domestic market from its own production. It has been reported that buyers as well as consumers expected year round availability of vegetables in the market. To solve the seasonal issues, many of the horticulture crop growing countries are adopting new technologies in production such as using green houses and/or biotechnology for production.

### *Financial Performance*

The cost of production of vegetables varies depending on crop, variety, time, place, and season. During the survey, farmers were asked to identify the major types of production costs on which they usually spend. According to the respondents, the production cost of vegetables can be categorized into eight major categories: land preparation, seeds and seedlings, manure and fertilizer, irrigation, pesticide, labor, lease/rent of land, and other expenses like fencing, shedding, mulching etc. Table 4 shows the allocation of average production costs of different vegetables in the areas of Bangladesh surveyed.

**Table 4. Allocation of Total Production Cost of Some Vegetables, in Percentages**

Item	Palwal	Pumpkin	Bitter Gourd	Okra	Tomato	Egg Plant
Land Preparation	3.58	3.55	4.14	4.95	5.02	3.86
Seed/Seedlings	14.43	2.48	7.40	3.89	4.30	3.33
Manure/Fertilizer	27.74	21.59	20.71	25.82	24.00	27.36
Irrigation	12.08	13.91	5.04	5.31	4.23	6.35
Pesticide	5.42	14.19	12.31	9.90	7.57	9.88
Labor	10.93	18.13	18.51	20.58	29.84	17.38
Lease/Rent of Land	10.60	22.86	14.23	19.19	15.37	25.72
Others	15.22	3.29	17.60	9.61	10.39	6.12

Note: Estimation based on primary data.

The vegetable farmers spent the largest portion of their production costs on manure and fertilizer, followed by labor costs. However, only a very small portion of production costs are due to land preparation, ranging from four to five percent. Expenditure for planting materials like seeds and seedlings in general, is about six percent for all vegetables. The average expenditure for irrigation and pesticides are about eight and ten percent, respectively. Since most of the growers are small and medium scale operators, they usually need to borrow land for cultivation round the year. On average, about 18 percent of total production costs are incurred for land rental fee and/or share-cropping arrangements for cultivation. In this regard, vegetables growers usually borrow land from other farmers in their locality, both large and small, who are not involved in or interested in cultivation.

**Table 5. Benefit-Cost Analysis of Some Vegetables for the Farmers**

Crop	Revenue (Tk/ha)	Cost (Tk/ha)	Benefit (Tk/ha)	Ratio
Tomato	232,308	112,829	119,479	2.06
Egg plant	194,755	98,555	96,200	1.98
Palwal ( <i>Trichosanthes dioica</i> )	285,596	144,035	141,561	1.98
Okra	60,494	34,309	26,185	1.76
Bitter Gourd	833,744	505,373	328,371	1.65
Pumpkin	800,000	536,600	263,400	1.5

Source: Estimation based on primary data.

The marketing cost of agricultural products varies widely across the commodities and geographical regions of Bangladesh (Alam, 2005b: 53). Significant variations in

production, varieties, and quality also increase the marketing cost (Harris-White, 1995). However, the net profit margin of a specific agency is the net earnings, after paying all marketing costs (Khushk, 2001: 81).

A cost-benefit analysis of growers is displayed in Table 5. Farmers' shares in terms of benefit were more than 50 percent from all vegetables except pumpkin. Since pumpkin and bitter melon are more susceptible to fruit fly and beetle, the cost for pesticides incurred is high for these crops. The data presented in Table 5 also indicate that there is a great price variation in production of different vegetables. Farmers received the highest benefits from bitter melon, with an average of Tk. 328,371 per hectare, whereas the lowest benefits came from okra, for which they obtained Tk. 26,185 per hectare. However, tomato, egg plant, and palwal (*Trichosanthes dioica*) are more viable economically than other vegetables.

### *Existing Constraints*

Constraints on vegetable production were identified from the opinions of farmers and end market intermediaries in the agribusiness chain such as supermarket traders. The constraints identified by the supermarket vegetable traders are summarized in Table 6 shown below:

**Table 6. Examination of Vegetable Production Related Constraints Identified by the Supermarket Traders**

Variable	Mean	Std. Deviation	t-Value
Supply depends on seasonality	6.67	0.4879	52.915*
Limited availability of suitable variety	4.33	1.8387	9.127*
Low scale of production in season	2.93	2.3744	4.785*
Purchasing cost of fresh produce is high	3.07	2.2509	5.277*
Quality of fresh produce is not good	2.06	1.9073	4.196*
Lack of technical knowledge of farmers	3.53	1.8073	7.571*

\* at 99% level of significance.

Note: where 1 is "Strongly disagree" and 7 is "Strongly agree".

About 67 percent of the supermarket traders indicated that the supply of vegetables is totally dependent on season. According to them, there is a shortage of products, especially during lean periods; hence they need to import these commodities to fulfill the domestic requirement. The lean period for vegetables, depending on different types, ranges from 24 to 52 days every year (FAO, 1997: 7-23). In Bangladesh, vegetables are mainly in short supply in the summer season, since only 40 percent of total production occurs in this season (Hortex Foundation, 2005: 1). Therefore, vegetables vary in terms of seasonal availability, so the problem lies not in the amount of vegetables produced as a whole, but in the distribution of produce throughout the year.

As the production almost totally depends on season, this may be one of the reasons for an inadequate domestic supply of vegetables in Bangladesh. However, a significant correlation between seasonality and scale of production is found in the constraints identified by the supermarket traders, reported in Table 7.

**Table 7. Pearson’s Correlation Analysis between Seasonality, Variety, Production, Cost, Quality and Knowledge**

	Seasonality	Variety	Production	Purchasing cost	Quality	Knowledge
Seasonality	1					
Variety	0.292	1				
Production	0.534*	0.349	1			
Cost	0.347	0.029	0.241	1		
Quality	0.179	0.217	0.190	0.481	1	
Knowledge	-0.351	-0.251	0.075	0.272	0.258	1

\* Correlation is significant at the 95% level (2-tailed).

Availability of suitable varieties is also a limiting factor, since demand for some varieties like capsicum, lettuce, and Chinese and Thai cabbage is increasing in the urban community, and the production of these crops is very small in Bangladesh. About 47 percent of the supermarket traders agreed that the supply of these crops in the country are insufficient. There is no question about the quality of produced vegetables and the capability in terms of technical knowledge of the farmers in Bangladesh, since all the respondents disagreed with the statements that the “quality of fresh produce is not good” and concerning the “lack of technical knowledge of farmers”. However, vegetables are hard to standardize because quality is difficult to measure objectively and varies within the same lot of produce, and also because consumer preferences are heterogeneous (Farina and Machado, 1999: 267). Respondents disagreed with the statement that the “purchasing cost of fresh vegetables from the farmers is high,” suggesting that they believe that the farmers receive a low return in relation to their efforts.

In terms of responses from the farmers group, about 57 percent of the respondents mentioned “high production costs” for vegetables, whereas only 32 percent mentioned “unavailability of suitable varieties.” Since the price of production inputs like seeds, fertilizers, irrigation, pesticides are increasing every year, they have to spend about 49 percent of total production costs on these items. Table 8 indicates that farmers identified high production costs as the “first problem,” they experienced, followed by the unavailability of suitable varieties. However, more than two-thirds respondents of farmers do not think “seasonal production” is a problem, since they believe that it is a natural process and they have been following these traditionally cultivation practices for a long time.

**Table 8. Reported Production Related Constraints by the Farmers**

Variable	Mean	Std. Deviation	t -Value
Seasonality is problem for production	2.49	0.6889	36.142*
Production cost is high	1.54	0.6878	22.389*
Unavailability of suitable varieties	1.92	0.7593	25.280*

\* at 99% level of significance.

Note: where 1 is “First Problem” and 3 is “Third Problem”.

## Conclusion

It is important to develop business based on growing vegetables to encourage the farmers, since horticultural crops have comparative advantages in Bangladesh. Cost-benefit analysis of these crops also suggests that production of vegetables is economically viable for the country. Despite the prevailing opportunity for these crops, the country has not been able to create any successful businesses in this sector. The article, therefore, has tried to examine the opportunities and constraints on production from the point of view of the supply side in the agribusiness industry.

The study finds that the supply of domestic fresh produce is inadequate. Although vegetables farmers sell more than 75 percent of their production in the market, their production is not sufficient to support agro-industry operations. A significant correlation between seasonality and scale of production appears to be a further constraint on the supply of vegetables. The scale of production does not create any problems in the winter season. In addition, there is no doubt about the quality of the fresh produce as well as the technical knowledge of the farmers in production; hence there are opportunities for production. The most challenging factor for horticulture based agro-industry is that the country's own production does not able to ensure the continuity of supply of vegetables equally round the year. Moreover, due to unavailability as well as the high price of agricultural production inputs and the uncertainty of returns from sells, farmers are unwilling to produce vegetables on an extensive scale.

The present study has been limited to only four districts of Bangladesh, as well as excluding the views of other stakeholders in the agribusiness sector. Therefore, cross-national research in other areas with potential for vegetable production and inclusion of more stakeholders in the agribusiness sector is called for to gain further insight into conditions in the sector. Moreover, other features like land use, credit, mechanization etc. can be regarded as useful variables for measuring performance in this type of research. The findings of the study, however, suggest issues for further research that may help the development of commercial agriculture in Bangladesh.

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