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Economics of production and export of vegetables in Bangladesh

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ECONOMICS OF PRODUCTION AND EXPORT OF VEGETABLES IN BANGLADESH

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ABSTRACT

This study focuses on the performance of the production and export of selected exportable vegetables from an economic point of view. It aimed to determine the profitability and its determinants in the production of the non-traditional vegetable French bean, and the traditional vegetables yard long bean and bitter gourd, and also that for the market participants in the export channel in Bangladesh. The empirical investigations include interviews of the vegetable producers, middlemen, exporters in Bangladesh and importers in the UK, to cover the export marketing chain, and an opinion survey of Bangladeshi experts in this field. Two hundred and twenty four producers from eight villages in four districts (Rangpur, Comilla, Tangail and Narshingdi), forty six middlemen in five markets (Dhaka, Rangpur, Comilla, Tangail and Narshingdi), forty exporters from Dhaka, and six importers in the London market were interviewed. Secondary data were also collected from government, non-government, international organisations in Bangladesh and the UK and internet resources.

Financial, statistical and economic analyses were carried out which resulted in a number of findings. The results at the production level indicated that French bean, yard long bean and bitter gourd production were profitable across farmer categories and survey districts on a cash cost and full cost basis excepting French bean in Rangpur and bitter gourd in Comilla on a full cost basis. In regression analyses based on Cobb-Douglas production functions, land preparation, seed, manure and fertilizer, irrigation, farm size, were found as significant factors while pesticide was a negative factor. The average technical efficiency of the producers varied from 41% to 50% indicating a good deal of room for improvement. Contract farming was found to be a determinant of such efficiency in the case of French bean. For the middlemen in the export channel, vegetable based agribusiness was found to be more profitable than the domestic channel, excepting Tangail district due to the non-government organisation Proshika who sold at a higher price. Such business was also found to be profitable for exporters to the United Kingdom, Italy, Saudi Arabia and the United Arab Emirates markets, and for importers in the ethnic market in London. The buyers had a good deal more market power than sellers throughout the marketing chain, and the producers had least market power in comparison to the other market participants. This study also found that a large market potential for fresh vegetables appeared to exist in the UK market.

The study concluded that vegetable production is mostly taking place in a traditional way for local consumption, and exports mainly deal with relatively narrow niche markets. Contract farming, producers' training, the formation of a cooperative society for the producers, increased production of quality seed, institutional support for organic farming, multipurpose cold storage and processing plant, cool chain management, development of a packaging industry, a code of practice for the market participants, competitive airport costs, arrangements for private cargo flights and foreign airlines for air cargo space, and the establishment of a production and export-oriented, integrated organisation for fresh and processed agro-products are among the recommendations for the government and the private sector to facilitate expansion into quality export markets and ensure the future success of this sector.

DEDICATION

This work is dedicated to my father Mr. Md. Reazuddin and mother Mrs. Rahima khatun whose inspiration and support have been sources of motivation all along. Their continuous good wishes and encouragement have cheered and enabled me to complete this major study.

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LIST OF SYMBOLS AND ABBREVIATION

£	pound sterling
ANOVA	Analysis of variance
AEZ	Agro-Ecological Zone
AEZ^1	Agro-Export Processing Zone
AEZ^2	Agri-Export Zone
APEDA	Agricultural and Processed Food Products Export Development Authority
BB	Bangladesh Bank
BADC	Bangladesh Agricultural Development Corporation
BARI	Bangladesh Agricultural Research Institute
BCR	Benefit Cost Ratio
BEPZA	Bangladesh Export Processing Zone Authority
BG	Bitter gourd
BRAC	Bangladesh Rural Advancement Committee
DAE	Department of Agricultural Extension
EP	Export Policy
ERD	Economic Relations Division
EPB	Export Promotion Bureau
FB	French bean
FOB	Free on Board
GDP	Gross Domestic Product
gm	Gram
GNI	Gross National Income
GOB	Government of Bangladesh
IFOAM	International Federation of Organic Agriculture Movements
kg	Kilogram
Khas land	Government land
km	Killometre
KSA	Kingdom of Saudi Arabia

L/C	Letter of Credit
MOA	Ministry of Agriculture
MOC	Ministry of Commerce
MT	Metric tonne
NAP	National Agriculture Policy
NGO	Non Government Organisation
P	Probability value
POA	Plan of Action on National Agriculture Policy
PRSP	Poverty Reduction Strategy Paper
sq	Square
TK	Bangladeshi currency (Taka) , one GBP = Taka 99.20 in October 2003
UAE	United Arab Emirates
UK	United Kingdom
US$	United States Dollar, one US$ = Taka 58.44 in October 2003
YLB	Yard long bean

Chapter I

General Introduction

1.1 Introduction

Bangladesh is a country with much dependence on agriculture and 84% of the rural people are directly or indirectly engaged in agricultural activities. Agriculture is also the largest source of employment of labor in this densely populated country. Increasing exports of agricultural commodities is one objective of the National Agriculture Policy (NAP) and crop diversification is one of the major components of crop production policy (Ministry of Agriculture, 1999). Although Bangladesh exports are heavily dependent on ready-made garments which constitute about 74% of the total exports, the government has recently incorporated the diversification of exports in its export policy and poverty reduction strategy paper (Ministry of Commerce, 2003; ERD, 2005). Export of fresh and processed agricultural products is an important dimension of export diversification of the country. Additionally, horticultural products, especially fruit and vegetables, have become a fast growing part of world agricultural trade (Aksoy, 1992).

Vegetables, being the largest and fastest growing sector of horticulture of the country, have a good deal of potential in terms of production and export. Emphasis has been given on increasing exports of agricultural commodities and creating opportunities for agro-processing and agro-based industries, but no specific policy interventions are suggested in the NAP (Ministry of Agriculture, 2004). Therefore, this study involves an investigation of the current situation in the production and export marketing of vegetables focusing on non-traditional French bean and traditional yard long bean and bitter gourd, the factors affecting it's performance and future potential. This study also focuses on the export chain between Bangladesh and the UK, the largest importer of Bangladeshi vegetables for the last eight years.

1.2 The geography and economy

Bangladesh is an agrarian country that lies in the northeastern part of South Asia between latitude 20°34" and 26°38" north, and between longitude 88°01" and 92°41" east. The country is bounded by India in the west, the north and the northwest, Myanmar in the south west and the Bay of Bengal in the south (Rashid, 1991). The area of Bangladesh is 147570 km^2. Its net cropped, total cropped and irrigated area were 19,824 and 35,076 11,358 thousand acres respectively in 2001-02. The irrigated land was 57.3% and 32.4% of net and total cropped area respectively while cropping intensity was 175.5% in 1999-2000. The labour force employed in agriculture was 68.5% of the total, based on the 2001 census,and the population was 129.2 million with an average annual growth rate of 1.48% (Bangladesh Bureau of Statistics, BBS, 2000)

According to the World Bank, by 2005, the population of Bangladesh was 138.1 million and the density of people per square kilometre was 1,061. Its gross national income and per capita income were 55 billion and 400 US$ respectively in 2003. The average annual percentage of growth of GDP for the years of 1990-2003 was 4.9, and the percentage growth of gross domestic product per capita was 3.5 over the year of 2002-2003. The contribution of agriculture to GDP was 22% in 2003, down from 23% in 2001 (World Bank, 2003, 2005). The World Bank (2005) further revealed that the percentage of the population under the national poverty line was 49.8 and the international poverty line (below US$ 1 a day) was 36.

The UNDP (2004) reported that Bangladesh had been upgraded from the 'low human development' group to be classified as a 'medium human development' country, with life expectancy at birth (years) and adult literacy rate (%) at 61.1 and 41.1 respectively in 2002. The GDP per capita annual growth rates (%) in 1975-2002 and 1990-2002 were 0.9 and 3.1 respectively which indicates the steady and remarkable domestic growth during the latter period. The percentage shares of exports of goods and services to GDP in 1990 and 2002 were 6 and 14 respectively which further indicates the increasing development trend in exports.

Annual exports in the year of 2004-05 and 2003-04 were US$ 8,654.5 million and US$ 7,603 million respectively with an annual increase of 1.04%, indicating a rising trend (EPB, 2005). It also shows that the export share of ready-made garments (RMG) was more than 74% for both years. Additionally, the exports of primary agro-products for the years of 2004-05 and 2003-04 were US$ 635.91million and US$ 542.15 million respectively with an annual increase of 17.29%, while those for vegetables for the same period were US$ 43.33 million and US$ 24.70 million respectively with an annual increase of 75.4%. The export share of primary agro-products was 7.35% while that of processed agro-products were nearly 8% of total exports. These together constitute the second largest export sector next to RMG in Bangladesh (EPB, 2005). Moreover, the production and export shares of Bangladeshi fresh vegetables as a proportion of world fresh vegetables were 0.65% and 0.45% respectively in 2003 (Bangladesh Bureau of Statistics,; 2005 and Export Promotion Bureau, 2005; FAO, 2005,). Emphasis has been given in the Bangladesh government National Agriculture Policy (NAP), the Export Policy (EP), the Plan of Action (POA) on the National Agriculture Policy and other recommendations to developing the exports of agricultural products including vegetables.

The South Asia Enterprise Development Facility (SEDF), being an international organisation, is working on the development of the agribusiness sector in Bangladesh. Using a country map for this sector, it identified, and highlighted the potential areas of the agribusiness sector in 2003. It then proposed the following activities to be dealt with in developing the sector (SEDF, 2003):

(1) Production, processing, packaging, domestic marketing and export of vegetables and fruit;

(2) Aromatic and long grain rice production, packaging, domestic marketing and export;

(3) Different crops' seed production, processing and domestic marketing;

(4) Spice production, grading, packing and marketing;

(5) Flower and ornamental plant production, packing, processing, domestic marketing and export;

(6) Commercial use of multipurpose cold storage facilities;
(7) Tea production, processing, domestic marketing and export;
(8) Jute and jute products production, processing, domestic marketing and export;
(9) Fish and shrimp production, processing, domestic marketing and export;
(10) Poultry rearing, hatching, egg producing and marketing;
(11) Beef fattening, Black Bengal goat rearing, beef and mutton production, processing, domestic marketing and export;
(12) Dairy products processing and marketing;
(13) Leather and leather products processing and export;
(14) Production of medicinal plants, marketing of medicine as well as vitamins for humans, livestock, poultry and fish.

It emphasized the role of government institutions and the private sector and suggested the development this sector through an integrated institutional approach. As far as the researcher knows, no such government organisation is currently functioning for the improvement of export quality production and promoting export markets for agro-products in an integrated way.

Although, fresh and processed agricultural products are being exported in significant quantities, they mostly have access to the ethnic markets, not the supermarkets who are the main market players in the developed countries. Market access to supermarkets and other upstream export markets requires maintenance of high quality standards during production and export. Presently, Bangladesh cannot meet the international quality standards for some items or make linkages with the upstream markets due to lack of institutional, regulatory and physical facilities at the production and export marketing level. A study of the existing production and export marketing process for any of the exportable agricultural products could provide a basis for exploring the export of such products to the ethnic as well as supermarkets and the factors influencing their success. Therefore, vegetables, a fast growing agro-product category in respect of production and export, has been chosen for this research.

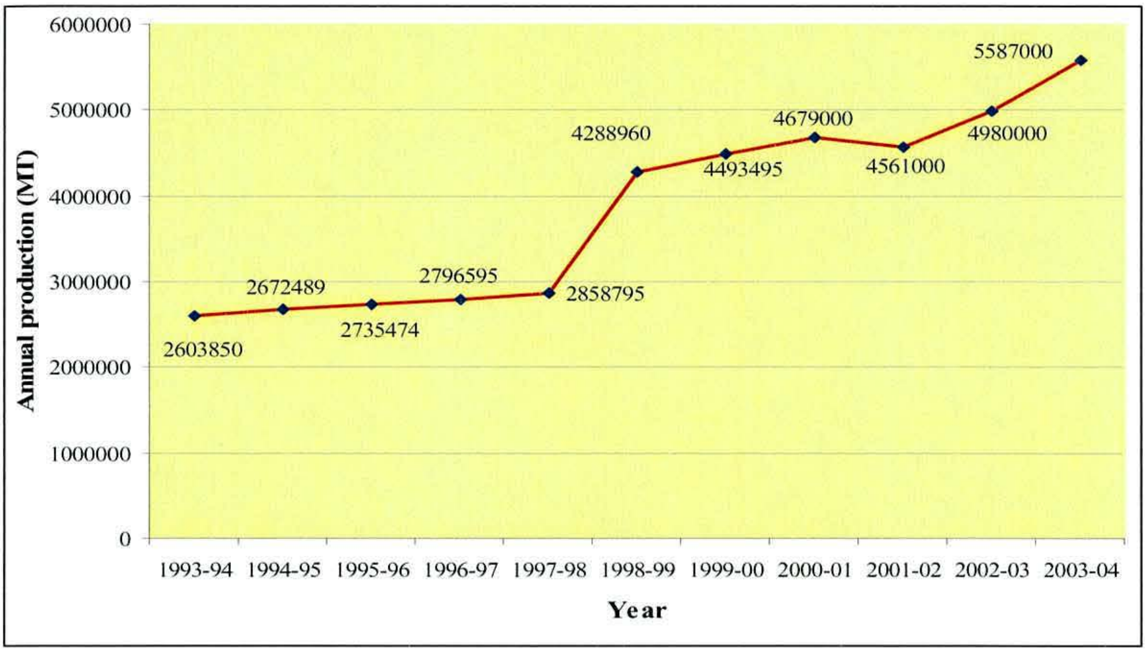
1.3 Production and export status of vegetables in Bangladesh

Bangladesh, long considered a "basket case", has recently emerged as an agricultural success story (World Bank, 2003). It has recently become self sufficient in cereals, the main staples. Furthermore, agro-products have emerged as the second largest export sector, but production, processing, packaging, and export marketing have not yet been developed as far as expected. Furthermore, the National Agriculture Policy (NAP) focused on exploring the opportunities for increasing agricultural exports (Ministry of Agriculture, 1999), and Export Policy (EP) has incorporated various provisions for providing physical facilities and incentives to create opportunities for promoting the exports of agricultural products, especially vegetables (Ministry of Commerce, 2003). But export-oriented, vegetable-based agribusiness has not yet been sufficiently developed to meet the international market demands.

FAO (2002) reported that the annual growth rate for vegetable production in Asia and the Pacific for the decade 1991-2001 was 4.4% while the rates of China, India, Pakistan and Bangladesh were 8.6%, 3.4%, 4.4% and 3.0% respectively. The average percentage of irrigated to agricultural land in the Asia and Pacific region was 18.4% in 1990-2000, but for the countries mentioned above was 39.5%, 37.1%, 82% and 47.2% respectively. The significance of this has in the importance of irrigation to vegetable production in Bangladesh.

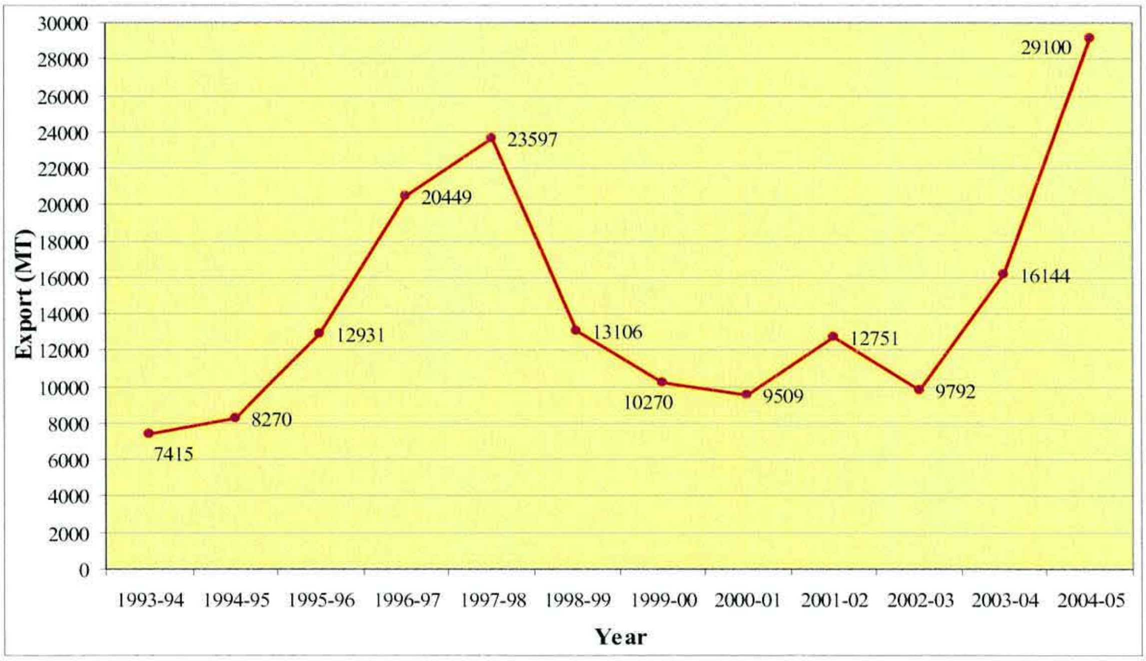
Figure 1.1 shows the increasing trend of tuber (potato) and non-tuber vegetable production which indicates a more than doubling of production in ten years. However, as Figure 1.2 shows most of this production has been to meet local demands.

Figure 1.2 is based on information from the Export Promotion Bureau (EPB), and illustrates the export volume of vegetables which has been fluctuating over the last twelve years but still seems to show an increasing trend.



Source: Different issues of Bangladesh Bureau of Statistics (BBS), Note: Average value

Figure 1.1 Vegetable production in Bangladesh (MT)



Source: Annual reports and statistics section of Export Promotion Bureau (EPB). Note: Average value

Figure 1.2 Export of vegetables in Bangladesh (MT)

Table 1.1 Annual production and export of fresh vegetables (non-tuber) in Bangladesh

Year	Production of fresh vegetables (MT)	Export quantity of vegetables (MT)	Export value of vegetables (US$)	Export share to production
1994-95	1204119	8270	8691000	0.69
1995-96	1243919	12931	14508000	1.04
1996-97	1288730	20449	24909000	1.59
1997-98	1305615	23597	32467000	1.81
1998-99	1527015	13106	17679000	0.86
1999-00	1560175	10270	14001000	0.66
2000-01	1553000	9509	12787000	0.61
2001-02	1567000	12751	15313000	0.81
2002-03	1594000	9792	13240000	0.61
2003-04	1680000	16144	24700000	0.96
2004-05	NA	29100	43330000	NA

Source: Different issues of BBS and EPB

Table 1.1 reveals the export shares of production for the last ten years which is very small, less than 1% in recent years, while that for Thailand ranged from 5.9%- 9.4% for 1994 to 1997 (FAO, 2001). Although Bangladesh is deficient in vegetables according to the nutritional requirements, it does produce surpluses, to some extent, during the peak harvesting season. Moreover, people do not tend to consume sufficient vegetables according to nutritional recommendations, even when they have the purchasing capacity.

These statistics further reveal that there may well be ample scope to increase export quantities since a relatively small increase in production would suggest a large expansion in potential available for export.

PRAN has become a leading private company in the agro-processing sector, producing and exporting processed agro-products, mainly canned fruits and vegetables, aromatic rice, pickle, juice, jam and jelly to many countries, including the UK. However, it has not yet gained access to the supermarket food chain in the developed countries. It has obtained international food quality certificates namely ISO 9001, HACCP, Halal and the vegetarian sign (PRAN, 2005). Eurasia, another agro-processing company, exports some processed foods, including vegetables. A few other exporters are also involved in the export of processed vegetables from Bangladesh, but the export of processed vegetables is at an early stage. Currently export earnings in this sector are mainly coming through export of fresh vegetables.

Bangladesh exports fresh vegetables to Asia, Europe and North American countries, especially the United Kingdom, Italy, France, United Arab Emirates (UAE), and some other Middle Eastern countries and the USA (Export Promotion Bureau, 2005). Export of fresh vegetables has emerged as a newer dimension of export-oriented agribusiness in Bangladesh. Most of the vegetable exporters, including the Bangladesh Rural Advancement Committee (BRAC), are exporting fresh vegetables in bulk to different destinations by air and BRAC and a few other exporters are exporting fresh vegetables to supermarkets in some countries.

Soil and climatic conditions and cheaper labour are advantages for the production of various types of traditional and non-traditional vegetables. Presently, vegetables cover 6.06% and 3.43% of the net and total cropped land respectively (BBS, 2003). Vegetables being high value crops, have developed as one of the major crop groups for domestic consumption and the export market. The present study aims to a conduct research on the profitability of the production of three exportable vegetables, namely French bean, as non-traditional, and yard long bean and bitter gourd as traditional vegetables, and the export marketing of exportable vegetables. It is hoped that the findings of this study would assist in appropriate policy formulation in respect of export quality production of vegetables and expanding exports into the upstream as well as ethnic export markets.

1.4 Justification of the study of the production and export of vegetables in Bangladesh

Improvement of the production and export of vegetable sector is necessary for poverty reduction, creation of employment opportunities, improvement of nutritional status, promotion of foreign exchange earnings and the setting up of export-oriented and importsubstituting agro-based industries which could ultimately improve the socio-economic condition of rural households. Consequently, expansion of vegetable export trading could encourage the expansion of production and a possible improvement in profitability, which will be helpful for the small and medium farmers in the rural areas.

Alam (2002) performed a profitability analysis for number vegetables at the production and internal marketing level, while Shaha (2000) analysed the profitability of marketing of fresh vegetables. Both of them recommended the improvement of this sector but did not address the sector from a world perspective since the export of vegetables. The production, export and import status of vegetables has so far not been studied in Bangladesh. Vegetables are mostly produced in a traditional way and export is also being carried out in an old fashioned mode. This type of traditional production practice and export would not be able to compete with the other leading exporter countries who have access to the supermarkets and wholesale markets, and may even lead to a loss of market share in the existing ethnic markets. It is, therefore, rather important to look into the financial and economic potential of the production and export of the exportable vegetables.

Vegetable producers do not have easy access to modern technologies and management practices, credit, marketing, storage, and transportation. Vegetable farming systems, market linkages between producer and exporter, cool chain management of such perishable commodities, storage, technical efficiency and the adoption status of the producer are also important issues in addition to profitability and its determinants at the production level, which are to be addressed here. The latest information on the existing export marketing systems along with quality production and trade between exporter and importer countries is also a concern to develop the vegetable sector in Bangladesh. This study, thus, aims to address all of these issues at the production and export marketing level, based on which recommendations could be made to develop the vegetable sector to be more competitive in the world market.

Export market demands not only specific Asian vegetables but also various vegetables, including organic vegetables, to meet the demands from the consumers of different communities in the developed countries. It might, be therefore, sensible to produce many varieties of vegetables in Bangladesh and export to different international markets. Therefore, apart from the financial and economic analysis at production and export level, this study will also attempt to gauge the opportunities in the export market, and the constraints making Bangladeshi vegetables less competitive in the ethnic market and responsible for poor access to upstream markets. A large number of people of Bangladeshi origin are living in the UK, USA, Canada, Europe, and Middle Eastern countries. Many prefer to consume Bangladeshi vegetables which is expressed in extra demand in both the supermarkets and the ethnic markets in the above countries.

Islam *et al.*, (2003) recommended the establishment of three specialized agro-export processing zones (AEZ[1]) and focus on niche markets, targeting particular consumers for Bangladeshi products. Presently, most of the vegetables are exported to niche markets involving importers originally of Bangladeshi origin, but these markets have a limited market share compared to the supermarkets in the developed countries which capture the lion's share of the market.

The Hortex Foundation (2000) emphasised the importance of maintaining total quality management (TQM) from production to the export market level. It also suggested that government should ensure an open sky policy to increase air space for a constant supply of export quality vegetables. An open sky policy implies that the foreign airlines would be exempted fully or partly from paying the royalty to the Bangladesh government for use of the Bangladeshi airport. FAO (2005) studied the vegetable production and market linkages of agricultural products in developing countries where the farmers are linked to domestic and export markets through different market participants. The experiences of different countries in the field of production and export marketing of vegetables need to be consulted.

Detailed research from the producer to the importer level right through the export chain is designed to determine the production and export performance of Bangladeshi vegetable. Due to time and fund constraints, the production level study was limited to three vegetables, namely French bean, yard long bean and bitter gourd. The middlemen and exporters in Bangladesh and importers in the UK were considered in order to cover the whole export chain Therefore, this study attempted to address a multiplicity of ways and means to gather the relevant information in order to draw useful conclusions regarding Bangladeshi vegetables from an export point of view.

Against this backdrop, the study was carried out in Bangladesh as the exporter country and to a lesser extent, in the UK as an importer country providing more useful information from the seller and buyer side. The study aimed to make recommendations across a broad spectrum so that Bangladeshi vegetables might have access to both ethnic markets and supermarkets in the near future.

1.5 Objectives of the study

1.5.1 Overall aim of the study

A broad-based study of the profitability of the production and export of vegetables in Bangladesh is the aim of this research. The specific objectives of this research are shown below:

1.5.2 Specific objectives of the study

1. To determine the profitability of production of selected exportable vegetables, namely French bean, yard long bean and bitter gourd in Bangladesh and the factors affecting their production.
2. To measure the profitability of vegetable exports from Bangladesh and the factors affecting their export.
3. To suggest appropriate policies that would encourage and expand the production and export of vegetables, contributing to the national economy of Bangladesh.

1.6 Hypotheses of the study

Linked to the three specific objectives there are three hypotheses:

1. The production of selected exportable vegetables namely French bean, yard long bean and bitter gourd in Bangladesh is profitable and the key factors having an effect on production can be determined.
2. The export of vegetables from Bangladesh is profitable and they have potential for expansion in the international market, once certain constraints are overcome.
3. Vegetables of Bangladesh have scope for expansion in terms of production and export to contribute to the national economy, but this is dependent upon appropriate policies.

1.7 Horticultural potential areas in Bangladesh

Bangladesh is an agro-based country where vegetables are the main horticultural crop. The total vegetable production area was 1,211 thousand acres in 1999-2000 which was 3.4% of total cropped land, while the production was 4,493 thousand MT (BBS, 2000). By 2003/04 the total area of vegetables land expanded to 1312 thousand acres with production of 5587 thousand MT (BBS, 2005).

Vegetables are an important export commodity among the exportable agro-products, constituting shares of 0.32% and 0.50% of total exports in 2003-04 and 2004-05 respectively. Figure 1.1 shows a map of estimated high potential, potential and non-potential areas for production of horticultural crops. Vast areas are considered suitable for vegetable production, but some of the areas are considered as more suitable for commercial vegetable production for the domestic as well as the export markets. These areas are in the south east, north east and parts of the south of the country, although given their relative level of accessibility, some of the merely potential areas might actually be equally feasible

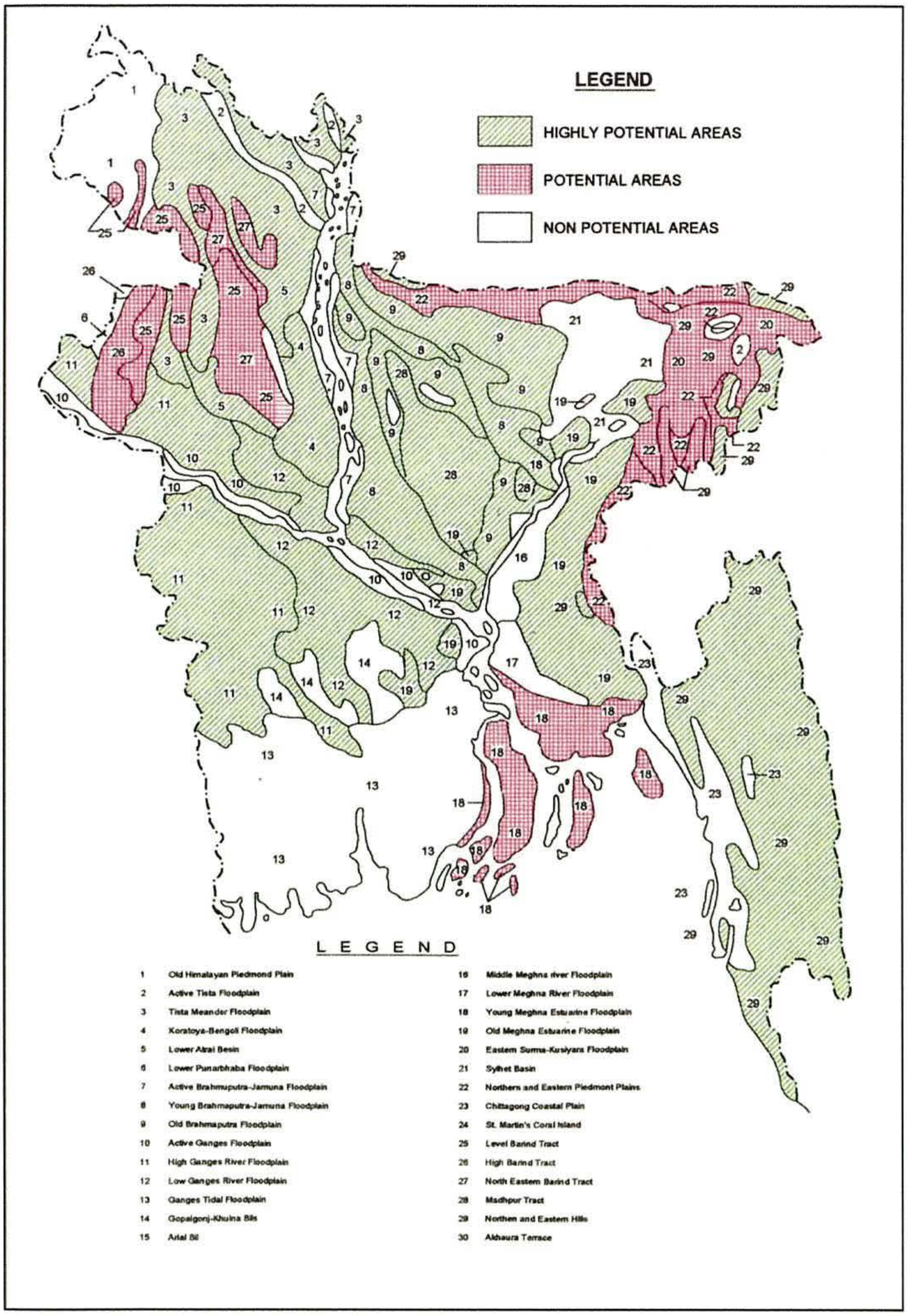


Figure 1.3 Map showing the potential areas for horticultural crops in Bangladesh

Source: Bangladesh Agricultural Research Institute (2002).

1.8 Survey districts in Bangladesh

The first part of the study aims to determine the profitability of the three selected vegetables, so districts were selected randomly and purposively in areas where these vegetables are being produced commercially for domestic as well as the export market. The purpose of selecting the survey districts was also to address the three sample vegetables in each district. Figure 1.2 presents the map of the four survey districts in Bangladesh where the sample vegetable producers were interviewed in 2003, showing the districts Rangpur, Comilla, Tangail and Narshingdi in three administrative divisions. Considering soil and other properties, Bangladesh is classified into 30 agro-ecological zones (AEZ) for the development of agricultural production. Note that sometimes an administrative district fell into more than one AEZ (FAO, 1988).

Brief information about the survey districts is given below:

1.8.1 Rangpur

This district is situated in the northern part of Rajshahi division with an area of 2,308 sq.km, a population of 1.24 million and an average household size (H/H) size of 4.3 according to the 2001 census (BBS, 2002). This district fell into the AEZ 3 where the soils are low in organic matter content on higher land and moderate in the lower parts. The fertility level is low to medium and soils have a good moisture holding capacity. According to the survey in 2003, the major crops of this district are rice, potato, palwal, brinjal, black gram, bitter gourd, Indian spinach, cucumber, sweet gourd and banana. It is famous as a major crop cultivation area of the country, and this includes vegetables.

1.8.2 Comilla

This district is situated in the western part of Chittagong division with an area of 3,085 sq.km, a population of 4.59 million and household size was 5.5. This district fell in AEZ 19 where organic matter content of the soils is moderate, moisture holding capacity is medium, and general fertility level is medium. During survey the major crops of this district were identified as yard long bean, rice, French bean, bitter gourd, potato, lady's finger, snake gourd, cauliflower, cabbage, brinjal, and tomato. This district is also famous for production of cereals and vegetables as well.

1.8.3 Tangail

Tangail is situated in the northern part of Dhaka division with an area of 3,414 sq.km, population of 3.25 million, and average household size 4.4 in 2001. This district fell in AEZ 8 where the organic matter content is low in ridges and moderate in basins. The major crops in this district are yard long bean, rice, French bean, potato, wheat, snake gourd, bottle gourd, cucumber, pineapple and banana.

1.8.4 Narshingdi

This district is situated in the North-eastern part of Dhaka division with an area of 1,141 sq.km, population 1.89 million and households averaging 4.8. It fell in AEZ 16 where the soils are loamy on the ridges and the general fertility level is medium. The major crops in this district were identified as yard long bean, rice, French bean, bitter gourd, teastle gourd, country bean, egg plant, cauliflower, cabbage, and bottle gourd and the area is famous for vegetable production.

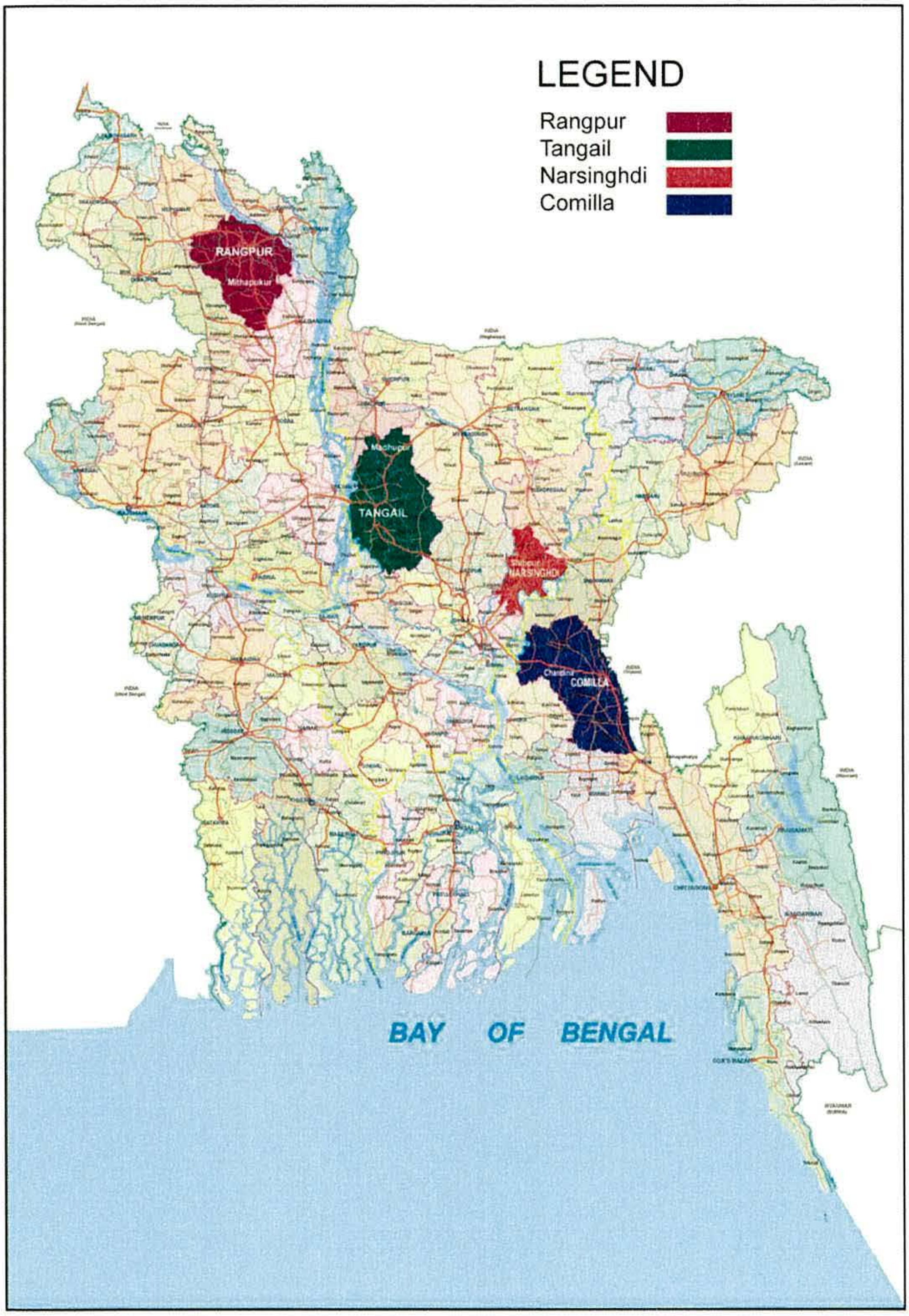


Figure 1.4 Map showing the survey districts in Bangladesh

1.9 Plan of thesis

The presentation of this thesis is in seven chapters and is briefly discussed below:

Chapter II deals with the literature review along with the basic concepts in connection with this research. Other research activities concerning production, and the internal and export marketing of vegetables of different countries including Bangladesh are reviewed. Research findings on production function, technical efficiency of farmers and market power of the various market participants are also discussed.

Chapter III encompasses the methodology adopted to conduct this research. The method of collection of primary data in Bangladesh and the United Kingdom, through social survey methods is described. The selection method of the respondents; producers at the vegetable production level and market participants in Bangladesh and the UK is also stated. Design of the data collection instrument, the data collection process and organisation of data entry is discussed. Moreover, the detailed analytical techniques for financial, statistical and economic analysis are presented, followed by some discussion on secondary data collection. Limitations of the field survey are also covered in this chapter.

Chapter IV presents information on the agricultural inputs and credit distribution system in Bangladesh. There follows a detailed financial analysis of production economics of the three sample vegetables, French bean, yard long bean and bitter gourd. The financial performance of the sample vegetable production was calculated to determine the return on costs involved by farmer category as well as by survey district. Logarithmic regression analysis was also performed using three models to estimate the determinants of output of the vegetables. Cobb-Douglas production functions were derived and the model to plot the effects of manure and fertilizer on output and also the district effects. The technical efficiency estimation of the sample vegetable producers and its determinants are also presented in this chapter.

Chapter V first covers the status of production and export of vegetables in the government policy and projects production and consumer requirements of vegetables in Bangladesh for the next twenty years. The roles of the Hortex Foundation, and market participants in the domestic and export market chain, and the emergence of supermarkets are discussed. Financial analysis for middlemen and exporters in Bangladesh and importers in the UK involved in the vegetable export marketing chain from Bangladesh is presented in this chapter. The profit margins for each level of market participants are calculated and compared. The degree and impact of the market power of the producers and the other market participants is derived and discussed. Estimation of producers' share is carried out with particular regard to market efficiency. The export market potential of Bangladeshi vegetables is also discussed.

Chapter VI comprises a discussion of the findings of the results of the production economics and market analysis of the three sample vegetables, conclusion and policy recommendations. This chapter also addresses some contemporary issues prevailing at the production and export market level, namely, contract farming, commercial vegetable production, organic farming and direct domestic support to the producer. The findings on the profitability of the export of vegetables are reviewed here and the export market potential of Bangladeshi vegetables considering return and market power, as well as estimated market potential, are briefly outlined. A discussion on ensuring export quality through cool chain management, packaging, incentives, and air cargo space for the exporters follows. With a view to the promotion of the Bangladeshi vegetable sector in particular and of agro-products in general, emphasis to the establishment of an appropriate organisation and implementation of regulatory measures is given.

Specific recommendations are made separately for production and export marketing in this chapter for the formulation of appropriate policy. Suggestions for further research in this field are made.

Chapter II

Basic Concepts and Review of Literature

2.1 Introduction

The present study addresses the profitability analysis at production level of exportable vegetables in Bangladesh and also their the export market potential. Production economics plays a unique role in farm management which develops principles, important for good farm management. Therefore, the logical analysis of production economics is applicable in the farm production sector (Doll and Orazem ,1984). Production economics will be applied to determine the cost-return position, technical efficiency and its determinants of the production of the sample vegetables in Bangladesh in this research.

Agricultural marketing for farm products is different from food marketing. Traditional agricultural marketing theory suggests that opportunities for the farmers are limited and so they are being encouraged to improve their marketing of farm products, and some commentators advocate the application of modern business marketing techniques at the farm level (Ritson, 2002). The theoretical concepts of agricultural and business and export marketing can be applied to measure the export market potential of produce such as vegetables.

An attempt has been made here to review the basic concepts in connection with the economics of production and agricultural marketing to provide a better understanding for this research. Furthermore, literature on previous research on the production of vegetables in Bangladesh and other countries where vegetables are being produced on a large scale for local consumption and export as well is reviewed. The literature related to the internal and external marketing of vegetables in Bangladesh and elsewhere is also considered subsequently.

The literature related to economic analysis in respect of the production function, estimation of the technical efficiency of producers at the farm level and measurement of market power and market potential along the marketing chain is also reviewed. This literature review will form the basis for carrying out the present study.

2.2 Basic concepts

Doll and Orazem (1984) suggested that the study of production economics helps to clarify the concepts of costs, return, output response to inputs and the use of resources to maximize profits or minimize costs. Heathfield and Wibe (1987) stated that the production function is the core concept in the economic theory of production. The production process is the means of transforming certain inputs in to certain outputs. On the other hand, the law of returns to scale refers to the effects of a change in the scale of inputs upon output in the long run when the combinations of inputs are changed in some proportion. If the inputs are increased in the same proportion, and the output increases in exactly the same proportion then the production trend is one of constant returns to scale. But, if, in order to get the equal increases in output, the increasing use of inputs in larger proportion, is required, then there are decreasing returns to scale in the production process, and vice versa for increasing return to scale (Jhingan, 1999)

Heathfield and Wibe defined the production function as relationship between inputs and outputs given the current state of technological knowledge. Doll and Orazem (1984) also defined the production function as an input-output relationship. They further describe its implications in the case of agriculture because the rate of at which the inputs are transformed into outputs will vary due to soil type, rainfall amounts, technologies, and animal characteristics.

The production function is written in formal equation form as follows:

$q = f(v_1, \ldots, v_n)$;

where $f(\;)$; denotes the form of production function.

q = output, $v_1, \ldots, v_n$. is the quantity of different inputs

The additive form of the production function equation is as follows:

$q = a_0 + a_1 v_1 + a_2 v_2 + ... + a_n v_n$;

where, $a_1, \ldots, a_n$; are the output coefficients of different inputs

The Cobb-Douglas production function is a linear (in logarithmic form) homogenous production function of degree one which takes into account two inputs namely labour and capital and is expressed by the following equation:

$$Q = A\, L^{\alpha}\, C^{\beta}$$

where Q = output, L= labour, C = capital, A = a constant, often called the technical change constant, α and β are positive coefficients of labour and capital respectively.

This production function was proposed by Cobb-Douglas with ¼ contribution of capital and ¾ contribution of labour to increase the output.

So, the equation mentioned above will be as follows:

$$Q = A\, L^{3/4}\, C^{1/4}$$

The sum of the coefficients of labour and capital shows return to scale, in this case the Cobb-Douglas production function equation shows constant return to scale Heathfield and Soren (1987).

Economists have extended this production function to more than two inputs to overcome the short comings of this function. The equation for the Cobb-Douglas production function form incorporating 'n' inputs is as follows:

$$Y = \beta_1 X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4}, \ldots, X_n^{\beta_n} e^{u}$$

Transforming the above equation into log for linear regression purposes, we obtain the following log-linear equation:

$$LogY = \log\beta_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \ldots\ldots + \beta_n \log X_n + u$$

where Y = output

$X_2, X_3, X_4\ X_5, X_6, X_7, X_8, \ldots, X_n$. are the quantities of different inputs

u = disturbance term, e = base of natural logarithm

β_1 = constant, $\beta_2, \beta_3, \beta_4, \ldots, \beta_n$ are the coefficients or elasticities of output Y with respect to the independent variables of $X_2, X_3, X_4, \ldots, X_n$ respectively.

Colman and Young (1989) mentioned that economic efficiency provides a theoretical foundation to measure producer performance which is often useful for policy purposes. The concept of such efficiency measurement basically comes from Farrell (1957) who introduced the distinction between technical efficiency and allocative efficiency. Technical efficiency of a producer indicates that maximum output is obtained from a given set of inputs, whilst allocative efficiency means that, given input prices, factors are used in proportions which maximise producer profits. Furthermore, the economic efficiency is the product of technical efficiency and allocative efficiency. Technical efficiency as a measure of producer performance is estimated for agriculture policy formulation in the case of agricultural production. The stochastic frontier production function is used to estimate technical efficiency (Russell and Young, 1983)

According to Dixie, FAO (1997) defined marketing as, "The series of services involved in moving a product (or commodity) from the point of production to the point of consumption". FAO described the functions involved in agricultural and food marketing: the exchange function is buying and selling, the physical function is storage, transportation and processing, the facilitating function is standardization, financing, risk bearing, and market intelligence and the process of collecting, interpreting and disseminating information relevant to marketing decisions.

Kohls and Uhl (1990) defined agricultural marketing as the "The performance of all business activities involved in the flow of food products and services from the point of initial agricultural production until they are in the hands of consumers". Agricultural marketing as an academic study developed out of a need to expand the previous concentration on farm production economics and management with corresponding work relating to post-farm gate activity. According to Kohls and Uhl, marketing decisions are concerned with the set of variables available to an organisation with which it may influence its market; this is conventionally known as the marketing mix. It is useful to divide the marketing mix into four categories, (1) the nature of the product (2) the price (3) the way it is advertised and promoted and (4) distribution or 'place'

Marketing costs are defined as the costs that are incurred when commodities move from farm gate to the final market, whether they are moved by the farmers, intermediaries, wholesalers, exporters, retailers, cooperatives or marketing boards. The more perishable the product, the greater the marketing costs (FAO, 1997).

Casavant *et al* (1999) defined the market price as, the mutually agreeable price at which buyers and sellers exchange a good or product. They pointed out that the price of an agricultural commodity relates to the supply side factors such as input prices, technology, and prices of alternative products. On the demand side important factors are income, tastes and preferences, population of consumers, price and availability of substitute goods. Market prices also depend upon the degree of competition amongst buyers and sellers.

Casavant *et al* characterized perfect competition as referring to a market or industry with four general characteristics: (1) a large number of buyers and sellers; (2) homogeneous products; (3) freedom of entry and exit; and (4) perfect information

A market is said to be perfectly competitive where there are large number of buyers and sellers, no one of which is large enough to influence the price through its action alone; products of like quality will not be differentiated only by brand name or advertising; firms are free to enter or leave the market without significant technological, legal or financial obstacles; and all buyers and sellers have equal knowledge of all prices and factors that affect market conditions.

Kohls and Uhl (2002) further explained that monopoly and monopsony are the extreme opposite of perfect competition. A monopoly is a single-seller market while monopsony is a single-buyer market. Monopolists enjoy freedom in pricing their products. They are 'price makers' rather than 'price takers', but they cannot set both price and quantity, only one of these. With oligopoly (few sellers) or oligopsony (few buyers), the control of sales is in the hands of a few firms. In such a situation, the leading firms can influence the market price through their output decisions, but will be concerned about the behaviour of their competitors.

Ellis (1992) defined policy as the course of action by government towards an aspect of the economy, including the goals the government seeks to achieve, and the choice of methods to pursue those goals'. David and Trevor (1989) mentioned that any country's policy towards the agricultural sector as a whole or towards any particular interest group such as food consumers, grain producers or fertilizer manufacturers can be characterized as consisting of three main sets of elements: (1) objectives; (2) policy instruments; and (3) rules for operating policy instruments Agricultural policy commonly employs instruments which involve intervention in markets through subsidies, taxes or quantitative controls. These include production and input subsidies, investment grants, input, production and profits taxes, production quotas as well as regulations, land reform and deficiency payments at the farm level.

According to Reed (2001), the exporting countries of an agricultural product often implement trade policies involving export subsidies, export taxes, price supports, and marketing boards. He referred to the Foreign Market Development Program and Market Access Program in the US which provides matching support to the producer, exporter and others to develop international markets for their product. He also discussed the import barriers of the importing countries in the case of international trade of agricultural products. The major import barriers are import tariffs, import quotas, tariff-rate quotas, variable levies, state trading as well as quality and specification regulations like health and safety regulations.

Market concentration or market power is considered as a function of the number of the farms in a market and their market shares. The Herfindahl-Hirschman Index (HHI) is commonly considered as a superior economic measure of market power and is the sum of squares of the market shares of all firms participating in the market, often converted into an index between 0 and 1. The value of HHI decreases if the number of equal sized farms or firms in the market rises while it will be greater if the degree of inequality in farm or farm size is large. The higher the HHI, the more concentration or market power on the less market competition (Compecon, 2002).

Whitely (2003) defined market competition as a process of competitive rivalry which is maximized in oligopoly and minimized in a monopoly market structure. Market power may be defined as the degree to which a firm exercises its influence on price and output in a particular market. Under perfect competition, all participating firms are assumed to have zero market power (Bannock *et el*, 2003).

Sperich *et al* (1994) defined the market potential of a product as the total level of sales possible in a target market for all farms. The market potential of a product may be estimated by using the factor approach. This approach uses a series of factors to discover the size of possible sales in a market. They discussed a few factor approaches to estimate the market potential of any product, such as estimating a firm's sales from the total retail sales as a percentage of the GDP of a country. Another approach is to use national level consumption of a product to project market potential at the local level considering the population of that locality. This method assumes that there will be no differences in tastes and consumption rates in different parts of the country.

2.3 Previous research

There are a number of past studies involving analysis of vegetable production, vegetable marketing institutions for agricultural exports, export of horticultural crops, marketing of vegetables and fruits and others which might inform the present work.

2.3.1 Production of exportable vegetables

Literature dealing with the production status of vegetables in Bangladesh and some other countries is reviewed in the following section.

2.3.1.1 Other countries' experience in vegetable production

Braun *et al* (1987) studied 400 smallholder families producing the traditional and non-traditional export crops in Guatemala in 1983 and 1985. The research was conducted on one group of producers of new export vegetables including snow peas, cauliflower, broccoli and parsley under a cooperative scheme. The actors were identified as (1) a multinational company that provided know-how and initially organized the export channel, (2) a non-governmental organization that stimulated the formation of the cooperative, and provided training, (3) local farmers who formed the cooperative that organized the vegetable production and domestic handling and which later moved toward independent handling of the export marketing and (4) public institutions in Guatemala which provided know-how on agricultural technology and farm level credit. The study indicated that new non-traditional export crops were substantially more profitable to farmers than traditional crops such as maize with returns of the new non-traditional crops 60% higher than traditional vegetables produced for local markets. The new crops have replaced the traditional vegetables and also reduced the area of maize. Joining the export crop scheme gave additional income which increased calorie acquisition of the farmers significantly. They also found that the non-traditional crops had some risks for the small farmers. Such risks were identified as crop failures, price collapses on the export market and breakdown of the marketing institutions. A multinational company, the cooperative and other traders had handled the export channel. Local processing and freezing of fresh produce had been started. Such development reduced the risks for such new crops. An overall 21% increase in agricultural employment was due to participation in the export crop scheme. It was also found that the income gains were the highest among the participants in this scheme.

Jaffee (1990) conducted a research on the area of alternative marketing institutions for agricultural exports along with production processes in Sub-Saharan Africa, particularly Kenyan horticulture. He analyzed the origins, structural characteristics, performance of different agricultural export systems and marketing institutions in Kenya. The analysis focused on Kenyan export-oriented agriculture including the production and export chain firstly for coffee, tea, meat, dairy products, and maize. The next focus was on the Kenyan horticulture export sector comprising fresh and processed fruit and vegetables and cut flowers, along with the production process. He described the linkages between the producers of vegetable and the marketing institutions as follows: (1) Smallholder producers linked through market sales to competing private local trading companies; (2) Smallholder and medium scale producers linked through exclusive contracts to private, public or joint venture enterprises, (3) plantation production and integrated marketing operations by multinational corporations; and (4) Estate production and integrated marketing by parastatal organizations. Jaffee concluded that the Kenyan experience indicates that horticultural produce has an ecological advantage for its production. Such crops can be grown in few northern industrialized countries because of climatic conditions. Secondly, Kenya is located near the equator and so experiences less seasonal variation that gives horticultural growing seasons for a far longer period than the industrialized countries. Thirdly, Kenya has lower labour cost which makes the production cost lower and so makes it more competitive. Lower labour costs also contribute to produce higher quality standards of horticultural product as production, post harvest and processing is more labour intensive.

An FAO (2000) study revealed that vegetable production in Thailand was a growing sector in the field of agriculture. More than half of the heroin consumed over the world was being produced in Thailand; to eradicate poppy growing, the king established a royal project for replacing opium production by producing other cash crops, particularly horticultural crops. The main contributing factors for the success were the introduction of high value crops like vegetables, fruit and flowers, the use of improved varieties, suitable cropping patterns, the provision of irrigation, post-harvest handling facilities with proper harvesting, packaging, grading and infrastructure facilities providing storage, transport and adequate access to markets. Fresh vegetables and dried flowers are now being exported. Vegetable growers are being encouraged to produce vegetables without the use of any chemical inputs. Integrated Pest Management (IPM) and bio-pesticide use are being introduced by the government in this field.

Table 2.1 Production and export status of vegetables in Thailand (tonnes)

Year	Vegetable Production (VP)	Vegetable Export (VE)	Percentage of VE to VP
1994	3222000	302900	9.40
1995	3882000	312900	8.06
1996	4799000	311400	6.49
1997	5374000	301000	5.88

Source: FAO, 2000

Table 2.1 shows the potential and scope for production and export of fresh and processed vegetables of Thailand in the regional markets.

Ashok (2002) reported that India provided subsidies on inputs like fertilizer, power, irrigation, credit and certified seeds in the agriculture sector. In addition, there was a scheme for subsidizing the cost of freight of certain agricultural products, such as fruit and vegetables. Another important export assistance measure that applied to all exports was the exemption from income tax on profits from exports. Following the 1991 economic reforms, India terminated its policy of granting cash incentives to exports but retained the income tax exemptions.

Yuman *et al* (2004) studied policy, production, marketing and international trade of the vegetable industry in China. They reported that it produces more than 60% of the world's vegetable supply. Vegetable production in China has extended tremendously during the past two decades. In 1980, the vegetable growing area was 3 million hectares with a total production of 80 million tonnes while the sown area and total production were 15 million hectares and 400 million tonnes respectively in 2000. Liu *et al* mentioned that China ranks top in the world consumption of fresh vegetables. The production value of the vegetable industry accounts for more than 10% of the total agriculture production value. In line with the reform policy, the vegetable sector has also experienced various stages of liberalisation in production and marketing. The foreign and domestic companies involved in production and processing of vegetables are present in the main vegetable producing areas; they contract the farmers and rent lands, and buy vegetables from the contract farmers. Some companies provide inputs (except fertilizer) and technical support to the farmers and ensure quality standards according to the requirements of the export market. Such companies make a contract with the village committee for the farmers and pay the price to the farmers at a minimum higher than the market price. The producers are contractually bound to supply their vegetables to the companies. Presently, China is exporting a major portion of its vegetables to Japan, South-East Asia and Middle-East and its export share is 1% of its total production.

Kohls and Uhl (2002) mentioned that four major vegetable crops-potatoes, lettuce, tomatoes, sweet corn, and three fruits-oranges, grapes and apples, accounted for more than 45% of the total farm value of vegetables and fruits in 1997 in the USA. New vegetable technologies influence the marketing of these crops. Vegetables can now be produced in nutrient-water mediums in greenhouses (hydroponics). Plant growth stimulants and retardants are being used to influence yields and timing of crops. Controlled-atmospheric storage has extended the season and keeping quality of produce. To overcome the price and quantity risks of such perishable commodities, a number of marketing arrangements have been developed to improve the stability of this industry. The processors use grower supply and price contracts and many large chain stores operate buying offices in the major producing areas to ensure constant supply for their markets. Grower cooperatives, marketing orders and agreements assist in marketing of such perishable and biologically-sensitive commodities.

Wilcockson (2004) reported that total production of vegetables in the UK was 2.9 million tonnes in 2000 which met 71% of the demand of the country. But the vegetable production percentage to total new supply for use in the UK declined to 62 and 59 for 2003 and 2004 respectively (Defra, 2004). He described a few schemes which encourage the integrated farm management (IFM) to produce high quality, safe food at a profit for the producer.

Furthermore, he referred to two main crop assurance schemes for combinable (e.g. cereals) and non-combinable crops (e.g. vegetables) which assure the customer about the way in which the crops are being produced, stored, and transported confirming that certain standards are being maintained. Under the Common Agricultural Policy (CAP), the Arable Area Payments Scheme (AAPS) provided domestic support to the producers of some combinable crops (e.g. about 371 euro/ha for cereals). Such payments were linked to area of crops grown, not the yield. But vegetable crops are not being supported by EU. The Assured Produce Scheme (APS), established in 1997 covers 40 crops, including potatoes, fruit and vegetables, and is supported by the major supermarkets which require their suppliers to be members. This particular scheme confirms that retailer-driven production is carried out by the producer.

Minot (1986) found the most serious constraint on small farm production related to problems of access to production resources (inputs, services and information) and access to markets in the case of less developed countries. As a means of helping overcome these problems, he mentioned that contract farming is generally successful in supplying credit, technical information, and market information to growers. Contract farming accounts for around 22% of the value of agricultural production in the United States and a smaller but growing proportion of the agricultural product in less developed countries. For example, in Kenya, only 12 % of the smallholders are contract growers. Contract farming for the export market is favoured by proximity to these markets and good transportation networks for export commodities and a currency not overvalued relative to foreign currencies. Contract farming is more likely to be accepted by growers if they have alternative market outlets for the commodity. On the other hand, contract farming is more likely to be accepted by buyers if growers do not have alternative market outlets for the commodity.

According to a bulletin from FAO (2001a), contract farming is an agreement between farmers and processing or marketing firms for the production and supply of agricultural products under forward agreement with predetermined prices. The arrangement also involves the purchaser in providing a degree of production support, e.g the supply of inputs and the provision of technical advice. It is further mentioned that such an arrangement is a commitment on the farmer's part to provide a specific commodity in quantities and at specific quality standards determined and also a commitment on the part of the company to support the farmer's production and purchase the commodity. The contract farming system is seen as a partnership between agribusiness and farmers which is becoming an increasingly important aspect of agribusiness. Contract farming has significant benefits for both farmers and sponsors (investors), however, this system has also some disadvantages for both the partners. Advantages for the farmers are: (1) inputs and production services are often supplied on credit through advances by the sponsor; (2) it introduces new technologies and also enables the farmers to learn new skills; (3) farmers price risk is often reduced as many contracts specify prices in advance; (4) contract farming can open up new markets which would otherwise be unavailable to the farmers. Disadvantages for the contract farmers are : (1) farmers face the risks of both market failure and production problems when producing new crops as per agreement of the sponsor; (2) inefficient management or marketing problems can mean that quotas are manipulated so that all contracted production is not purchased; (3) sponsoring companies may be unreliable or exploit through making monopoly position; (4) the staff of sponsoring organizations may be corrupt which leads mismanagement in the allocation of quotas; (5) farmers become indebted because of production problems and excessive advances.

The advantages for the sponsors are: (1) contract farming with small farmers is more politically acceptable than production on estates; (2) working with small farmers overcomes land constraints; (3) production is more reliable than open-market purchases and the sponsoring company faces less risk by not being responsible for production; (4) more consistent quality can be obtained than if purchases were made on the open market. The disadvantages for the sponsors are : (1) contract farmers may face land constraints due to a lack of security of tenure that leads jeopardizing sustainable long-term operations; (2) social and cultural constraints may affect farmers ability to produce managers' specification; (3) poor management and lack of consultation with farmers may lead to farmer discontent; (4) farmers may sell their produce outside contract which results reducing processing factory throughout; (5) farmers may divert inputs supplied on credits to other purposes which results in reduced yields (FAO, 2001a)

Another FAO (2001b) study reviewed the production, export and import of organic vegetables of 12 developed countries including USA, Japan and EU countries and 7 developing countries in central America and Africa. It discussed the world market situation for such vegetables and highlighted the production and export opportunities for the developing countries. There are some opportunities for the developing countries in the field of production and export of organic vegetables, and the FAO paper suggested a number of strategies for such countries: First, (1) a fundamental requirement is know-how concerning organic farming and organic inputs. Organic farming is generally highly labour intensive and requires close management attention to avoid contamination by pests. Conversion of conventional production to organic production takes three years for certified organic produce according to organic standards. Second, (2) establishment of national or regional organic standards and regulations and a reliable independent accreditation and control system. Third, (3) good post-harvest handling (packaging, cold storage), good infrastructure and logistics (including air transport) will enable the fresh organic produce to arrive in good condition in the country of destination. Fourth, (4) for successful export, good relations with an importer, trader or wholesaler in the targeted market is very important because the importer has the up-to-date information on the latest market developments. Fifth, (5) supermarkets, the fastest growing sales outlet for organic produce, prefer to sell fresh organic vegetables year round with a constant quality and regular supply. Even international trade in conventional fresh vegetables shows increasingly the characteristics of buyer-driven global commodity chains that are also important for organic produce as well.

Lampkin *et al* (2004) defined organic farming as an approach to agricultural practice to create integrated environmentally and economically sustainable agricultural production systems. The reliance on external inputs, whether chemical or organic, is reduced as far as possible. The organic agriculture in many European countries is known as ecological agriculture. Organic farming refers to a special type of farming where the soil minerals, organic matter, micro-organisms, insects, plants, animals and humans interact to create a coherent and stable whole. The major characteristics of organic farming include:

protecting the long term fertility of soils by maintaining organic matter levels with soil biological activity and mechanical intervention; nitrogen self-sufficiency through the use of legumes and biological nitrogen fixation, recycling of organic materials including crop residues and livestock manures; weed, disease and pest control relying on crop rotations, natural predators, diversity, organic manuring, resistant varieties, biological and chemical intervention; careful attention to the impact of the farming system on the wider environment and the conservation of wild-life and natural habitats. In this farming system, high value crops such as vegetables, can play a vital role in increasing profitability, with a focus on technical details, and ability to manage resources such as labour in respect of whole-farm profitability. The super markets are retailing both domestic and imported organic products where the sales of fresh fruits and vegetables made up about 32% of the total organic retail markets in 2002-03 in the UK. They mentioned that the supply of organic vegetables in the UK continues to increase, production of green organic vegetables increased by 50% during 2002-03 because the UK producers increased their lands and extended the growing season for certain vegetables.

Lampkin *et al* (2004) further described various grants which are being provided to small and medium sized enterprises involved in production, processing and marketing for organic product in the UK. They stated another important issue namely, organic farming production standards and legislation in Europe as a whole and also for the UK. The EC regulation 2092/91 sets out the legal requirements that all food products sold as organic have to be certified. The UK standards for such products are based on EC regulations. Presently the Department for Environment, Food and Rural Affairs (Defra) and the UK Accreditation Service (UKAS) are jointly responsible for licensing UK organic certification bodies and overseeing their inspection activities in the whole of the UK. The organic producers need to be registered with the licensed certification body. It is further noted that the International Federation of Organic Agriculture Movements (IFOAM) at the international level sets baseline standards and accredits national certification schemes to facilitate international trade. FAO formalized guidelines for the production, processing, labeling and marketing for organically produced foods for international trade, and thereafter, IFOAM revised its standards in 2002.

2.3.1.2 Bangladesh experience

Munshi (2002) conducted research on kharif vegetable cultivation in four villages in Comilla district in Bangladesh from January to October 2000, and analysed the agro-economic status of vegetables in that area. He showed that 59% of farmers in the study area were producing export quality vegetables, while small and medium farmers played the prime role in producing better quality vegetables. The yield of the kharif vegetable was 6.52 t/acre for the sample farmers. The yield for French bean, yard long bean and bitter gourd were 2.03,4.81 and 6.08t/acre while their benefit cost ratios were 1.11, 1.53 and 1.97 respectively. Munshi suggested, for optimum profitability, that methods of application of good quality fertilizer and pesticides should be followed by the farmers according to recommendations, cold storage or refrigerator vans should be used and a marketing bridge should be developed between exporters and farmers. The Export Promotion Bureau (EPB) and Department of Marketing (DAM) may play a dominant role in this field and production and supply of high yielding varieties (HYV) and hybrid seeds have to be ensured for the farmers. Furthermore, government institutions, such as Bangladesh Agricultural Research Institute and Bangladesh Agricultural Development Corporation, non-government organizations (NGOs) such as BRAC and the private sector, are all helping to promote the vegetable seed sector. Munshi recommended that the government should form a coordination committee for supervision, monitoring and evaluation of production and marketing of vegetables. The committee could be comprised of representatives from government, NGOs, stakeholders and farmers organizations at different levels.

Alam (2002) assessed the economics of export marketing of vegetables in Bangladesh with special emphasis on factor analysis at the production level. He conducted his research in 2000 for six sample vegetables in six villages. He reported that the benefit-cost ratios (BCR) for French bean (FB) for small, medium and large farmers were 2.41, 1.95 and 2.87 respectively while those for Yard long bean (YLB) were 2.01,1.87 and 2.34 respectively, on a full cost basis. The BCRs for Bitter gourd (BG) were 2.60, 1.92 and 2.26 respectively. He also calculated the BCR for three other vegetables as well. However, Alam only briefly studied domestic marketing status of vegetables in Bangladesh. He recommended that quality vegetable seeds should be provided to the growers through a government organization and vegetable-based cold storage and processing industries should also be developed by the government with a contract growing system for quality and high value exportable vegetable production. A separate packaging industry should be developed to supply the standard packaging materials for export. He also recommended that exporters should be provided with at least 10% air freight subsidy to compete with the other vegetable exporting countries.

Hortex Foundation (2003) conducted a survey among contract farmers in Chandina upazilla in Comilla district involved in production of FB and potato. It reported that the yields of French bean and potato were 11.24 and 20.55 MT/ha and the benefit cost ratios for FB and potato were 2.16 and 1.43 respectively on a cash cost basis. It also mentioned the higher profitability of high-value crops like French bean compared to potato at contract farmer's level. Apart from traditional production and export practices of vegetables, Hortex introduced some pre- and post-harvest modern techniques like contract farming, and quality packaging in the production and export process through some non-government organizations (NGO) and business organizations, to ensure the export quality of traditional and non-traditional exportable vegetables as demanded by the export market.

Table 2.2 reveals some previous research findings indicating the yield, price, cash cost and BCR (cash cost basis) in recent years that could be compared with the present research findings. The aim is to see the present study's figure is typical or different from other findings. The three studies reveal the much variation of BCR for FB due to yield, price and cost variations.

Table 2.2 Previous research findings on vegetables in respect of survey period, inputs cost, price, yield and BCR in Bangladesh

Name of the researcher/ organization	Survey period	Name of the vegetable	Yield (MT/acre)	Price (TK/MT)	Cash cost (TK/acre)	BCR (cash cost basis)
Munshi (2000)	2000	FB	2.03	14760	20817	1.11
		YLB	4.81	7350	19443	1.53
		BG	6.08	8700	22845	1.97
Alam (2002) (average figure)	2000	FB				
		Small	5.00	15000	17963	4.17
		medium	4.00	15000	15447	3.88
		large	4.4	15000	20304	3.25
		YLB				
		Small	5.8	6250	9630	4.37
		medium	5.16	6250	8849	4.23
		large	6.24	6250	9333	4.48
		BG				
		Small	4.36	7850	13172	2.60
		medium	4.96	7850	11677	3.33
		large	5.4	7850	10335	2.78
Hortex Foundation (2003)	2002	FB	4.55	20000	32969	2.16

Halim and Rahman (2001) pointed out that pesticide use has been gradually increasing since the Green Revolution in Bangladesh to increase crop production. Of the pesticide used, 7 percent is used for vegetables. The rate of use of pesticides in Bangladesh is 0.03kg per hectare compared to 0.3kg in India, 0.4kg in Sri-Lanka, and 0.8kg in Indonesia. In China, Malaysia and South Korea, pesticide use is well over 1 kg per hectare on all crops. Integrated Pest Management and some traditional knowledge may reduce the reliance on heavy applications of chemical pesticides. According to Halim and Rahman, Bangladesh could profitably produce high value organic products without such chemicals.

Hawlader (1996) suggested that the low output/input ratios in the agricultural production systems in Bangladesh are due to the following reasons:
(1) non-adoption of location-specific modern technologies resulting in low yield per unit area; (2) price distortion due to the absence of proper marketing systems; (3) high input

price during peak cultivation period due to the withdrawal of subsidies for agricultural inputs and absence of appropriate distribution networks in the country; and (4) low output price at harvest time.

2.3.1.3 Production function analysis

Haque *et al* (2002) carried out research on the production of country bean, a commonly growing vegetable in Bangladesh, where its production was found to be profitable and the benefit–cost ratio was 2.05 on a full cost basis in the year 2001-02. They also performed production function analysis to measure resource use efficiency and the factors significantly affecting the production of this vegetable. The value of the coefficient of determination (R^2) was 0.79, and the value of the output coefficients of labour and fertilizer were positively significant at the 1% level which had considerable effects on production of this vegetable. The output coefficient of pesticide was significant at the 1% level but negative. This study reflects the profitability and economic potential of such vegetable production in Bangladesh.

Rahman *et al* (2003) carried out another study on the production of cucumber in the districts of Rangpur and Kushtia in Bangladesh in the year of 2002-03 where the production of this vegetable was found to be profitable. They performed production function analysis to estimate the resource use efficiency of the producers and the factors affecting the production of it as well. They found the value of R^2 to be 0.62 and the output coefficient of seed and triple super phosphate (TSP) was significant at the 1% level, and while that of muriate of potash (MP) was significant at the 5% level which had positive effects on production of this vegetable in Rangpur. The estimated output coefficient of urea was significant at the 5% level but negative which indicated that the farmers may nave been losing through using uneconomic quantities of this input, although they may simply be due to multicollinearity. They found insecticides as a significant factor at 1% level which indicated that this input had considerable effects on production of cucumber in Kushtia district, but they did not find fertilizer, seed and labour as significant factors of production of this vegetable. Rahman *et al* also found the ratios of marginal value product to marginal factor cost more than one for seed, and fertilizer which also indicated that the producers used the inputs efficiently and more profit could be obtained by increasing investment for these inputs in Rangpur. These ratios for labour, seed, and insecticides were more than one which also indicated that the farmers in that district could get outputs by increasing these inputs that leads more output. This study reflects the profitability and economical potential of such vegetable production in Bangladesh.

Alam (2002) carried out research on production of FB, YLB, BG, Arum root, lady's finger and pointed gourd in Comilla and Rangpur districts in Bangladesh in 2000. He found the production of these vegetables profitable in both districts, and attempted to estimate factorial effects through normal multiple regression analysis. He found, the output coefficients for seed and seedlings to be positive and significant in the case of FB and YLB cultivation. Ahmad and Baksh, (2005) conducted an economic study on the production of bitter gourd in Pakistan, and performed a production function analysis which indicated that the coefficient for fertilizer was significant in both the survey areas of Faisalabad and Rahim Yar Khan.

Chennareddy (1967) carried out a study to measure farmers' production efficiency for different crops, using a Cobb-Douglas production function in South India. He collected data from the farmers in the rice, and tobacco producing areas, compared the results of regression coefficients of inputs, and also the ratios of marginal value product and marginal factor cost. The output coefficients for land and labour were found significant in the rice zone while that for production expenses was significant in both the zones and the district. Based on the production function analysis, Chennareddy concluded that the farmers in a traditional and technologically stagnant agriculture, are aware of the efficient use of inputs in the traditional way. He recommended that rapid and mass development of agriculture in India could be achieved through the introduction of modern technology consisting of new inputs, agricultural education, special skills and techniques, and competent guidance. He also emphasized the importance of inputs at a fair price, sufficient production credit, favourable market prices and agricultural extension services for the farmers.

2.3.1.4 Estimation of technical efficiency

Rahman *et al* (2003) carried out an economic study in Rangpur and Kushtia districts in Bangladesh in 2002-2003 to estimate the resource use efficiency of cucumber production, and the technical efficiency of the farmers. They used a stochastic frontier production function to determine the technical efficiency of the farmers, using the ratio of farmer's actual output to the technically maximum output at a given level of inputs. They estimated the output coefficients using a logarithmic multiple regression model where the coefficients for seed, triple super phosphate (TSP) and muriate of potash (MP) were significant and had a positive effect on production in Rangpur district. They estimated farm-specific and also average technical efficiency by district for this vegetable. The technical efficiency averaged at the 95% in Rangpur. They also estimated the output coefficients of insecticides, animal power and power tillers were significant which revealed that those factors had a positive effect on production in Kushtia district. They found that the mean technical efficiency for farmers in Kushtia district was also 95%.

Lindara *et al* (2004) conducted a field survey from October to December 2002 among the farmers involved in the spice-based agro forestry systems in Matale in Sri Lanka. According to their stochastic frontier production function using the Cobb-Douglas model, they found hired labour, organic fertilizer, inorganic fertilizer, land size and soil fertility maintenance as significant with positive effects on agro forestry production. They estimated the mean technical efficiency as 84%, although it ranged from 31 to 97%. Lindara *et al* suggested that the estimated mean technical efficiency indicated that the output could be increased substantially if the farmers achieved the highest level of technical efficiency. They performed regression analysis to identify the factors influencing the technical efficiency where visits of extension officers, farmer training, flat land, experience, and species diversity significantly increased technical efficiency whilst education and other income sources decreased the technical efficiency of the farmers.

Parikh and Shah (1994) carried out research to measure technical efficiency of farmers in North-West-Frontier Province in Pakistan in 1988-89, using a stochastic frontier production function. They estimated the farm-specific technical efficiency and also the factors influencing that efficiency and estimated the minimum, maximum and average technical efficiency as 91, 98 and 96 percent respectively. Parikh and Shah performed regression analysis incorporating the socio-economic and demographic characteristics of the farmers, namely family size, age of household head, education of head, off-farm work, value of farm assets, value of non-farm assets, credit, degree of fragmentation, and meetings with extension service as independent variables to identify the significant factors responsible for such technical efficiency. They found that greater family size, education, and credit that improve farmer's liquidity were significant and increased the technical efficiency while land fragmentation was significant but negative.

2.3.2 Internal marketing of exportable vegetables

2.3.2.1 Other countries' experience

Jaffee (1990) carried out research work in the area of alternative marketing institutions for agricultural exports linked with different production systems in Kenyan horticulture. He analyzed different agricultural export systems linked directly or indirectly with the producer, and marketing institutions in Kenya. Jaffee mentioned the following institutional structures in internal marketing within Kenya:
(1) Smallholder producers linked through market sales to competing private, local trading companies; (2) Smallholder and medium scale producers linked through exclusive contracts to private, public or joint venture enterprises; (3) Plantation production and integrated marketing operations by multinational corporations; and (4) Estate production and integrated marketing by parastatal organizations.

FAO (2003) studied the production, and domestic and export marketing status of vegetables in Thailand. Internal marketing acts as a bridge between production and the export marketing level. The middlemen operate and assist the movement of fresh vegetables from the production point to the local and wholesale markets with well organized transport. They, being buyers, also supply credit to the producers and thus assist the farmers at the production level. The Department of Agriculture assists the growers to form groups who also have their own local markets from where fresh produce reaches the central market near the capital city and the wholesale markets in the south. Vegetables are distributed throughout the country from these points; in particular, the vegetables are exported to Singapore and Malaysia from the southern wholesale markets. Another type of marketing exists in Thailand, managed by the companies of importing countries who organize the contract growers for asparagus, okra, extra-fine beans and baby corn and buy vegetables directly from their contract growers. It is suggested that the existing system of internal marketing of such perishable commodities, could be further improved by the introduction of more modern post-harvest technologies in handling operations, off-season production technologies and development of the processing sector.

Yuman *et al* (2004) mentioned that the main marketing policy of China before 1990 was "total procurement" and" total sale" based which meant that total production by the farmers was purchased by the state-owned company and then sold to consumers at a subsidized rate. This system was closed but private traders started marketing from the early nineties when most of the wholesale and open street markets were established. At the end of 1998, markets for agricultural produce totaled about 26000, amongst which the vegetable wholesale market has a dominant role in the domestic marketing system. Most of the wholesale markets deal with both wholesale and retail trade while wholesale and street markets handle about 95% of the total transaction volume of vegetables. Farmers sell their vegetables to the wholesale and retail markets in the rural and even in the metropolis areas. Post harvest losses are very large: the total loss of vegetables accounts for as much as 30% of the total production of China while 2-4% of total production is being processed. The inefficiency of vegetable marketing results in high marketing costs and a big difference between the producer's price and the consumer's price. The retail price is 80-100% higher than the wholesale price, the profit made by the traders is 2-3 times higher than that of the producer, and the producer's price is only a quarter or two fifths of the consumer's price

Duffy and Fearne (2004) analysed the UK supermarket supply networks and their role in the UK retail market. They mentioned nine major multiple retailers namely Tesco, Sainsbury, Asda, Safeway Somerfield, Marks and Spencer, Morrisons, Waitrose and Iceland which dominate the food retailing industry in the UK. The top four, Tesco, Sainsbury, Asda and Safeway accounted for over 62% of the total grocery market in the UK, although Morrision took over Safeway very recently. According to this study, major supermarkets maintain their marketing policies whereby a handful of first tier suppliers are engaged in the marketing chain in each product area to meet the demands of the consumers. These suppliers are typically large pre-packers or processors that have geared up to meet the needs of the supermarkets. The suppliers act as intermediaries maintaining the linkage between the farmers and the supermarkets. The Efficient Consumer Response (ECR) concept was initially employed between the multiple retailers and the large branded manufacturers, but the concepts were then extended to the commodity sectors like fresh fruits, vegetables and meat. The establishment of strong own-label products requires retailers to gain increased control over the supply chain to ensure that product quality and availability are optimized.

The researchers identified the following four types of supply chain in the UK. Supply chain 1 comprises growers or farmers that are members of a cooperative or producer group. These primary producers sell their product to the processor, pre-packer or marketing agent who then supplies to the multiple retailers. The primary producers sometimes sell their produce to the wholesale market. This supply chain is common in the meat and fresh produce sectors. Supply chain 2 comprises the producers who are outside of the supermarket chain because they sell their produce through the wholesale market or agent but do not sell to the multiple retailers directly. This kind of chain represents an extremely small proportion of retail sales. Supply chain 3 comprises large primary producers which pack and market their product and supply to the multiple retailers directly. These farmers sell their produce to the wholesale market as well. Sometimes they purchase output from other farmers for supplying to the retailers. This type of chain is common in the fresh produce sector. Supply chain 4 comprises vertically integrated supply chains where the marketing companies are directly involved in the production, processing, packaging and marketing of their output to the retailers. This type of chain is prevalent in the meat sector and to a lesser extent, in the dairy sector. The supply chain four has emerged as dominant chain in structures where the suppliers work closely and exclusively with the retailers.

Duffy and Fearne concluded that supermarkets have become the dominant market players in the UK food retail chain. They are progressively moving towards more collaborative trading relationships with their suppliers as a source of competitive advantage. The supermarkets obtain advantages from these supply chains which reduce supply chain costs and improve customer service and satisfaction through the effective use of information and the integration of key business processes.

The work of Bourlakis and Weightman (2004) reports that the six key factors of quality, technology, logistics, information technology, the regulatory framework and consumers play a dominant role in the food supply chain management for both domestic as well as imported products in the UK. Among the contemporary food procurement approaches, total quality management (TQM) is a key means of ensuring quality maximisation, and developing a consumer, demand-oriented procurement relationship between buyers and sellers that aims to meet market demand (Allinson, 2004). Francis (2004) noted that out of the nine food supermarkets, Tesco has its own policy to develop new products and maintain supply chain management. The researcher outlined the food product development process that includes new product launch, reformulation, new pack size, re-branding and promotion. The product development process has two sub-processes, namely technical product development and packaging development. Tesco experts supervise the activities in the two sub-processes conducted by the suppliers. The packaging material producer finally delivers the packaging materials to the product manufacturers and these are used to pack the new product ready for distribution. Third party logistics comprises several inter-related activities, mainly freight transport, warehousing, inventory management, materials handling, and related information processing. In the food supply chain, movement, storage and handling of the food products is carried out by the logistics service providers (McKinnon, 2004). The super market maintains the temperature controlled supply chain to make sure the quality of their products satisfies the consumers. Frozen temperatures are -25^0C for ice cream and -18^0C for other foods, cold chilled is 0-1^0C for fresh meat, poultry, most vegetables and some fruits, medium chilled is +5^{0}C for butter, fat, cheeses, exotic chilled is +10-+15^{0}C for potatoes, exotic fruits, bananas (Smith and Sparks, 2003). Tesco, Sainsbury and others switched over from small, single temperature warehouses and vehicles to large multi-temperature warehouses and vehicles for keeping the required temperature for different products. Tesco built large multi-temperature 'composite' warehouses for storage, handling and delivering the products. The composite temperature regimes are frozen at -25^{0}C, cold chilled at +1^{0}C, and exotic chilled at +12^{0}C. The suppliers and manufacturers deliver their product to the composite distribution centre and the product is transported from the composite centre to the retail store by vehicles maintaining three temperatures like the composite distribution centre.

Smith and Sparks (2004) discussed the produce import strategy from importing countries like Spain. Major UK supermarkets started to purchase produce directly from Spain in the late 1990s rather than from UK wholesalers. For example, iceburg lettuce is grown under direct contract between the retailer; the supermarket and the Spain's growing co-operatives. The retailer's quality assurance and technical departments provide the grower with the product specification and transport temperature control requirements from Spain to the UK. The direct delivery system takes only four days from harvesting in Spain to display in the retail store of the UK supermarket. UK Supermarkets procure iceberg lettuce between October and May, soft citrus between December-January, tomatoes and broccoli between January and May, and galia and honeydew melons between June and August.

Boselie *et el* (2003) conducted five case studies on supermarket procurement practices in developing countries in Asia and Africa (Thailand, Kenya, South Africa and Zimbabwe). They discussed the procurement strategies of supermarkets from both developed and developing countries for vegetables with the suppliers small producers and large producers, highlighting timely supply and quality standards, demanded by the those markets. In general, supermarket quality and safety requirements are influencing the types of producers that are willing and able to supply them. The requirement of a large volume of supply along with high and consistent quality standards means that the preferred suppliers of supermarkets are large farmers. However, the five case studies concluded that a group of small producers in a developing country can also remain competitive. They commented that traditional markets are increasingly replaced by supply chains to national and international supermarkets so small producers in developing countries must adjust. Although establishing supply relations with supermarkets is both difficult and costly, coordinated groups of small producers can meet such requirements if well organized.

Furthermore, for some unique reasons, some supermarkets or their suppliers have decided to make partnerships with small producers. Such small producers had to work cooperatively and be tightly coordinated so that they could meet the volume and quality requirements of the supermarket. Producers had to chill the product or deliver rapidly to a chilled facility and had to supply a high quality product on a consistent basis, and in some cases, they provided value added services like washing, trimming, cutting, grading, labelling and packaging the product. On the other hand, the supermarket or their supplier played a significant role in organizing groups of producers and providing expertise and physical inputs that were not available through pre-existing institutions. A key component of these successful operations consisted of communications like telephone and fax.
Boselie *et el* (2003) suggested that both the public and private sectors have a role to play in promoting the participation of small producers in supermarket supply chains in a sustainable manner. Public authorities must provide a policy environment that promotes beneficial partnership between supermarkets and small producers and a legal framework that will protect the economic interests of both parties. They also have to play a role in the development of infrastructure, from road networks to extension services and rural credit institutions that meet the needs of the small producers operating within the supermarket supply chains whilst private sector capacity develops.

2.3.2.2 Bangladesh experience

Alam (2002) described the internal marketing structure for vegetables for both export and internal consumption. Exporters and middlemen play the key roles in the internal marketing of vegetables. The Intermediaries include bapari (middlemen), aratdar, wholesaler or paiker and retailer, involved in both the domestic and export marketing chain. Bapari (middlemen) are agents who purchase vegetables from the farmers in the village or primary markets, and transport and sell to the retailers, paikers or wholesalers and aratdars in the secondary or wholesale markets, in the domestic channel, and to the exporters in the export channel. Aratdars are permanent traders in the wholesale market having their own permanent establishment with staff. They buy vegetables from the bapari and sell to the retailers and sometimes to the paikers, obtaining commission from both seller and buyer. They sometimes provide informal loans to the bapari in advance to procure vegetables from the farmers or other middlemen. Wholesalers or paikers buy vegetables from the bapari through aratdar and sell to the retailers and sometimes to the consumers in the city or big towns. They also purchase vegetables directly from the bapari, and do not have permanent establishment but run their business in the wholesale markets Retailers buy vegetables from the aratdars and sell to the consumers in the cities and large towns. They have got their own shop in the retail markets. The retailers in the primary markets buy vegetables from the farmers and sell to the consumers (Sabur, 1990, Figure 5.11). Alam categorized the internal markets of vegetable in Bangladesh into three types, namely: primary markets which are village level markets are usually held once or twice a week where agricultural commodities like vegetables are sold by the farmers directly to the consumers, retailer or bapari. Usually none of these have a permanent structure for trading. Secondary markets are situated close to river, rail or road networks and banking facilities. Usually the bapari (middlemen) have permanent structures for trading, and sometimes, sell their commodities to the wholesalers and retailers. Terminal markets are also called wholesale markets. Here distribution of commodities to the retailers, consumers and exporters takes place. The key players in such central markets are generally bapari, aratdar, wholesalers and sometimes exporters. Alam further categorized the market participants in the domestic marketing channel into four: bepari, aratdar, paiker and retailer, while in the export channel for bapari, wholesaler or paiker and the exporter.

Rashid (1998) outlined the marketing channel of vegetables through which the vegetables move from the farmer level to the consumer level and in which a number of intermediaries play key role in the chain. He discussed the pricing system prevailing in the domestic marketing chain, and mentioned that the Department of Marketing (DAM) field offices collect farm gate, wholesale and retail prices of vegetables and report on a weekly basis. Comparing different sources of information on prices, he showed that the gap between farm gate and retail prices is quite large while the prices vary from region to region and season to season. Prices are not determined purely by demand and supply in a perfect market, but, rather, are often manipulated by the middlemen in their favour in the marketing chain. Traders sometimes raise prices on unreasonable pretexts like Ramadan when both farmers and consumers are not in a favourable position in the existing pricing system.

2.3.3 Export marketing of exportable vegetables

2.3.3.1 Other countries' experience

Jaffee (1990) carried out a research on different export marketing systems in the field of agricultural, particularly horticultural, crops in Kenya in 1990. The study revealed that among African countries, Kenya has developed one of the most successful horticultural sectors, covering a broad range of fresh and processed agricultural products and achieving double digit rates of growth in trade volume. The exporters of Kenya had started exports of horticultural product during the 1950s and 1960s. Long term relationships with major Europe-based firms have also facilitated the deeper penetration of Kenyan products within the targeted markets. Kenyan joint venture firms have also benefited from the brand name of their trading partners.

Four export commodity systems can be identified in Kenya: (1) the forced cooperation export systems for coffee, meat, pulses, and cotton, (2) the plantation systems for tea, fruit and vegetable processing; (3) the contract farming systems for tea and processed fruits and vegetables; and (4) the competitive export systems for fresh fruit and vegetables. Jaffee also examined the cost-price development situation for French bean in the UK market through three different marketing channels. Currently, the contractual arrangements governing exports of fresh or processed beans vary. In the main market outlets, Kenyan products supplies are channeled to supermarkets, the catering industry, and independent

greengrocery in the UK, France, and Belgium. Most Kenyan exporters, handle relatively large volumes of French beans (10–30 MTs per week) to the major European importers or wholesalers. He concluded that the Kenyan experience in the development of horticultural exports has been achieved through specialization of material and tasks in the production and marketing process. The features of international horticultural markets like brand names and strong patterns of market segmentation have also promoted Kenyan horticultural exports. In the light of Kenyan experience, he recommended that additional inputs, technical, managerial, and marketing skills, capital and modern storage and transport facilities are required for successful horticultural export trade.
Aksoy (1992) studied marketing management in the export of Turkish fresh fruit and vegetables to the EC. He analyzed the marketing management of the exporters of Turkey and the market position of the fruit and vegetables of Turkey in the UK market, making some recommendations for the exporters and the government of Turkey. Especially important were product strategies, research and development, quality control, branding, pricing, and marketing research, distribution, and promotion.

Selassie (1993) identified the major determinants of joint venture formation in the food and agribusiness sector in sub-Saharan African countries. He found that most countries of sub-Saharan Africa have widely adopted the joint venture strategy for acquiring various resources they lack, mainly capital, technology and skills. Broadly, three major determinants were identified as 'country specific', 'industry specific' and 'firm specific' factors. The findings of the study indicate that government policies to promote joint ventures in sub-Saharan African countries were not designed in a manner to attract foreign firms to form such ventures in the agribusiness sector. Foreign firms showed a high preference for wholly owned subsidiaries and joint ventures as a strategy of business participation in these countries, and privately owned firms were also highly preferred as host partners in joint ventures. This study emphasized the formation of joint ventures between host partners and foreign firms as a means of promoting the production and marketing of agricultural products.

Agricultural and Processed Food Products Export Development Authority (APEDA) an autonomous body attached to the Ministry of Commerce in India, is organizing production and export marketing of fresh and processed agro-products in its commodity-wise sixty agri-export zones (AEZ[2]) in different potential areas. It builds links between producers and global markets, provides services and suggestions for joint ventures, and arranges buyer-seller meets. Government and private sectors are investing in these AEZs to produce export quality agro-products by contract farmers, process agro-products to the requirement of the export markets. This organisation fixes the farm gate price of the agro-product based on the report of the Price Commission which produces a report basing on commodity-wise production costs. APEDA acts also as an export market intelligence organisation and leading organisation developing commercial farming and export marketing which is helpful for rural development, agro-industrialization and employment. It can exercise statutory power to develop the agro-product and processing sector in a very specialized way. Investors need to be registered with the APEDA. Contract farmers are being organized by the investors to develop export quality agro-product in the AEZs. This organisation deals mainly the production and export of cereals, horticultural, animal, poultry and dairy products (APEDA, 2005).

Yuman *et al* (2004) studied vegetable industry of China and mentioned that vegetable export of China still account for only about 1% of its total production; however, 5 million tons of vegetable exports in 2003 made China one of the largest vegetable exporters in the international market. The main export categories are fresh and processed vegetables that include garlic, onions, ginger, beans, edible fungi, spinach, lettuce, cucumber, cabbage and eggplant, cauliflower, tomato, peas, potato, radish, and mushroom. Processed vegetables are in the form of pickled, dried and canned vegetables. They reported that, in 2000, China exported vegetables worth US$ 2.03 billion, higher than all other categories of agricultural products.The report reveals that China's total production is about 40% of the world vegetable production while its export makes up only 9% of the world exports. Japan consumes one third of the total exports of China which is exporting vegetable to about 150 countries. Among the exporting provinces, the producers sell their vegetables to the local, domestic and export markets depending on the quality. Foreign investments are being made as sole foreign investment and on a joint venture basis. At the beginning of the century, China had launched a plan for pollution-free agricultural products, two certification schemes for green and organic food to meet the food safety requirements of the importing countries. As a labour-abundant country, China is enjoying the comparative advantages in a labour intensive vegetable trade in both the domestic and international market. Its main export market remains in the East Asia and Middle East countries with Japan the biggest importer.

Kohls and Uhl (2002) mentioned that vegetable marketing systems have been influenced by number characteristics: (1) perishability; (2) large price and quantity variations; (3) seasonality; (4) alternative product forms; (5) bulkiness of product; and (6) geographic specialization of production. They studied that 10 percent of the value of fresh vegetables of USA is lost in the marketing process due to improper storage and handling, spoilage, careless handling by shoppers and theft. The modern food marketing system requires price and supply stability for market planning and merchandising programmes. Many large chain stores operate buying offices in the major producing areas to ensure steady supply. Grower cooperatives and marketing orders and agreements assist in orderly marketing of such perishable crops. It is reported that US horticultural exports are growing faster than other farm products, and are value added products. Horticultural products' share of US agricultural product export increased from 10 percent in 1989 to 18 percent in 1999-2000. Kohls and Uhl emphasized that exports for fresh vegetables are now global with improved transportation and refrigeration. Imports of fresh tomatoes, and cucumbers from Mexico have expanded, as production costs are lower in Mexico. Many US growers feel Mexican imports depress US winter vegetable prices. However, the perishability and special handling needs high marketing costs. The farm-retail price spread for fresh fruit and vegetables increased by 200 percent between 1982 and 1999 while that for processed fruits and vegetables increased by 67 percent. The farmer's share of the consumer's food dollar averages about 18 percent for both fresh and processed fruit and vegetables. Fresh market products generally provide a higher farmer's share than products for the processing market, yet, because of long marketing channels, with a large amount of manual labour involved, the farmer's share is lower for fruits and vegetables than many other fresh farm products.

Shukla (2001) reported on the existing constraints in production, transportation, storage and export marketing of fresh vegetables and fruits of the developing countries. He also discussed the prospects for such export trade to developed countries. He recommended large clusters and dynamic development zones to ensure quality and committed supply of fresh produce to the export markets of the developed countries. He emphasized the importance of pre and post- harvest management, a cool-chain of fresh fruit and vegetables for maintaining the size, colour, and freshness of the produce, otherwise the entry of the perishables to the sophisticated markets of Europe, USA, Japan and others is difficult for the developing countries. He mentioned that each fruit and vegetables are very temperature and humidity sensitive so different chambers with different temperature and humidity are needed to store the fresh produce. He cited the example of Kenya where Del-Monte, carried out a lot of development work: training the farmers, selecting the appropriate varieties, setting up pack houses in the production areas, and organizing marketing networks in Europe. Furthermore, the company did not compromise on the quality and consistency of supply. In the context of the WTO Agreement on Agriculture, Shukla outlined some implications on the economies of the developing countries:
(1) increased foreign competition in domestic market with almost unrestricted imports of foreign goods and services; (2) increases in the number of non-tariff barriers by the industrialized countries; and 3) imposition of stricter phytosanitary conditions.

FAO (2001b) carried out research on world markets for organic fruits and vegetables in the developed countries and export opportunities in the developing countries. It reported that changes in food habits of the consumers in the developed countries are taking place linked the increased health awareness which increases the demand for organic fruit and vegetables. It observed that the sales of organic horticultural products have been expanding rapidly with high organic premia in major organic markets in the USA, European countries and Japan. Organic premia is expressed as a percentage of the price of organic produce over the price of the conventional produce. Organic premia in Argentina are up to 50% while in the UK they range from 70% to 80% which is higher in the case of fresh produce than processed products.

Market analysis in the developed countries, namely Austria, Belgium, UK, Denmark, Italy, Germany, the Netherlands, Sweden, Switzerland, Japan and the USA, and case studies on export potential in some developing countries, namely Argentina, Cameroon, the Dominican Republic, Madagascar, Papua New Guinea and Zambia were conducted by FAO (2001b). Domestic production of organic vegetables and fruit, government support to the organic producer, local marketing and import of this product, market opportunities for the developing countries, accreditation certification, key points for export development and some other issues are discussed in the case of developed countries. It also described the production, domestic and export marketing, production constraints, national standards and regulations on organic production, government's role, economic analysis of conventional versus organic product in the developing countries.

FAO further indicated that, as demand for organic fresh produce is expected to continue to exceed the local production in the developed countries, so imports will be needed to meet the consumers' demands. The study noticed that consumers in some developed countries like Switzerland, Japan, and USA strongly prefer domestic and regional organic products and only accept imports during off-season periods or of products which cannot be grown domestically. Marketing efforts would clearly be linked with the organic importer, wholesaler and retailer. Using the same domestic organic label in the country of consumption would help to make consumers familiar with the imported organic produce.

FAO as a pioneer organization in this field, extends assistance for capacity building in respect of the development of national legislation, certification capabilities, research and extension facilities, and exchange of experiences among the interested countries.

2.3.3.2 Bangladesh experience

Ahmed (1992) considered the export potential of fresh fruit and vegetables from Bangladesh, and made the following major recommendations for developing and expanding this sub-sector. To increase domestic production of good quality vegetables, commercial cultivation has to be developed in suitable, selected flood- free zones in the country, preferably near to the large cities to avoid long distance handling of perishable vegetables and to reduce unnecessary transport costs. Small farmers can be organized into informal groups for efficient disposal of vegetables from the producing areas to the exporting point. Speedy transportation facilities, refrigerated vans and motorized boats may be introduced for carrying highly perishable vegetables. Linkages between growers and exporters of vegetables should be established and contract growing of vegetables should be encouraged to ensure a regular supply of good quality vegetables throughout the year. To cope with the seasonal surplus situation, storage facilities have to be developed and export prospects of processed vegetables explored. He concluded that increased production of export-oriented varieties, efficient handling, grading and sorting, adequate transportation facilities, improved packaging systems and reasonable air freight rates are the main considerations for improving the vegetable marketing and export system. The World Bank recognised (1997) that macro-economic stability was a precondition for rapid growth in Bangladesh. To make agriculture more productive and efficient, they outlined several market-friendly policies for adoption in the areas of fertilizer and seed distribution, food grain procurement and storage, agricultural research and extension, and steam lining of rural finance.

Shaha (2000) described the domestic and export marketing of fresh vegetables for Bangladesh in general. Profitability of the vegetable business at the middlemen and exporters level was analysed which indicated that vegetable trading was profitable in the domestic as well as the export marketing chain. He showed various problems involved in the export marketing of different types of vegetables and recommended that an export, production and marketing centre should be established. He also suggested that physical facilities such as increased air cargo space, separate cargo storage and road communication should be improved. The Hortex Foundation could be strengthened and should have the responsibility of developing and disseminating technology relating to pre- and post- harvest and market intelligence as the "centre of knowledge". This study did not address the analysis of the profitability, constraints and prospects of the production of exportable vegetables in Bangladesh...

A report by Dixie (2002) indicated that Dhaka airport is comparatively expensive. He mentioned that the total airport costs (landing, parking, navigation, and handling) for Delhi airport was US$5,000 while that for Dhaka airport was US$6780 for a Boeing 707, weighing 150 tonnes for the same period. However, the report also revealed that Bangladesh Biman provides air space for about 67-75% of total exports of perishable items like vegetables at a reduced airfreight rate. An acute air space problem exists because the foreign passenger carriers and cargo planes are not interested in carrying perishables for a lower charge in comparison with dry cargo such as garments. Dixie made some recommendations in this context: the Bangladesh government should offer some monetary incentives and operational freedom to the foreign passenger and the cargo carriers to encourage them to increase air space for perishables. The foreign airlines could be exempted fully or partly from paying royalties for using the airport. Reduced rates for landing and aviation fuel could be offered, and self-handling instead of handling by Bangladesh Biman might help. The report also indicated that Bangladesh Biman might lose some of its income from such actions, but the air space problem would be resolved a help to increase the export volume of perishable vegetables.

Chapter III

Methodology

3.1 Introduction

Research design is one of the most important components of any research work in achieving its objectives. A number of traditional and non-traditional vegetables are being produced and exported in Bangladesh, so due importance was given during the selection of the sample vegetables for this study. Traditional vegetables like yard long bean (YLB) and bitter gourd (BG) are being produced in different parts of this country and exported, mostly to the ethnic markets of some European and Middle Eastern countries on a large scale, while French bean (FB) as non-traditional vegetable is being produced and exported on a small scale to the supermarkets and ethnic markets of some European and Middle Eastern countries. FB among the non-traditional, and YLB and BG among the traditional vegetables of Bangladesh were chosen as sample vegetables for this study (see section 1.3). For this study, both primary and secondary data relating to the production and export of exportable vegetables in Bangladesh, particularly French bean, yard long bean and bitter gourd, were collected. Primary data on production and export marketing of vegetable was collected from the four sample groups: farmers, middlemen, exporters from Bangladesh and vegetable importers of the United Kingdom. A field survey was carried out between June 2003 and January 2004 in Bangladesh and in April 2004 in the UK. The farmers, middlemen, exporters and importers are, thus the population of this study. Related secondary data of different countries and international organizations were also collected.

3.2 Selection of survey area

The field survey was carried out among farmers involved in vegetable production, and middlemen, exporters in Bangladesh and importers in the United Kingdom, dealing with the export of vegetables from Bangladesh. Survey areas for these four categories of respondents were selected purposively. The purpose of selection of the survey areas was that the sample vegetables were available in those areas.

A stratified sampling technique is generally applied in order to obtain a representative sample (Kothari, 2001), and this technique was followed for selecting areas for farmers and middlemen. Random sampling for exporters and importers was undertaken during the field survey.

3.2.1 Producer level

Vegetable farmers were considered as respondents at the production level. Some of these respondents, however, were not educated, and none of them maintained records of their crop production details, providing the information in the interview from their memory.

In terms of selection of the survey areas, geographical stratification was used focusing on the horticultural crops growing areas of Bangladesh (Fig 1.1). Based on secondary information, discussion with the official of the Department of Agricultural Extension (DAE) and the production status of the sample vegetables, the four districts, namely Rangpur, Comilla, Tangail and Narshingdi, were chosen (Fig-1.2). Emphasis was given to the districts, upazillas and villages where the sample vegetables are being produced and the respondents could be readily contacted. Moreover, each of the districts lies in different agro-ecological zones.

Each of the survey districts was further stratified into subdistricts (Upazillas) and one upazilla from each survey district was chosen following the same method for districts level. Mithapukur in Rangpur, Chandina in Comilla, Modhupur in Tangail, and Shibpur in Narshingdi were selected (Fig 3.1). In light of discussion with official of upazilla agriculture offices and statistics of the respective upazillas, two villages in each of the four upazillas were then selected. The following survey villages: Durgamoti and Ovirampur from Mithapukur, Sreemontopur and Tulatuli from Chandina, Kuragacha and Lokdao from Modhupur, Khorokmora and Bramondi (south) from Shibpur, were identified. French bean, yard long bean, bitter gourd and other major exportable vegetables were produced in these eight villages.

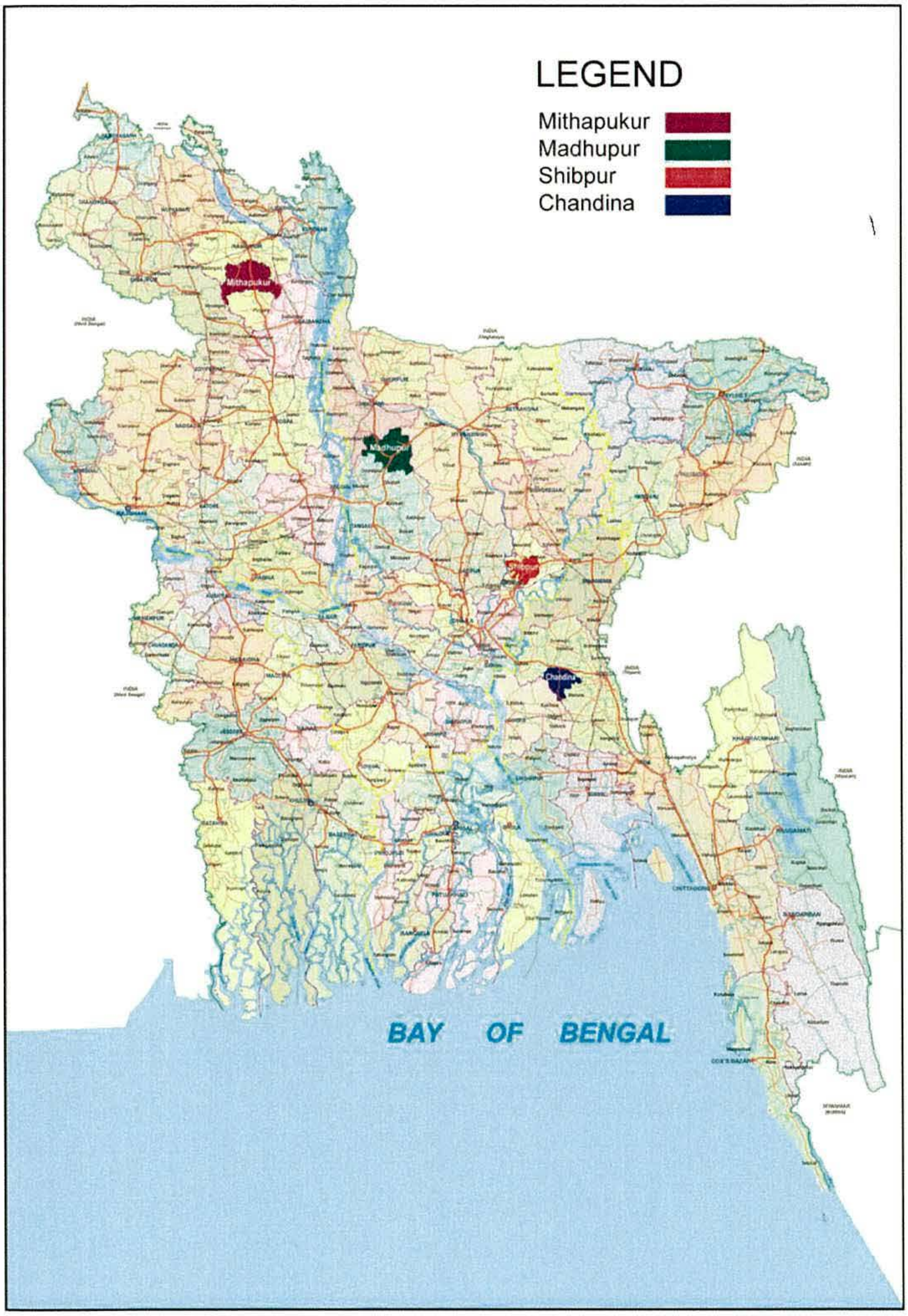


Figure 3.1 Map showing the survey upazillas in Bangladesh

3.2.2 Middlemen level

Based on the marketing chain of the exportable vegetables from farmers to middlemen and thence exporters, one or two primary markets for each of these four survey upazillas and two wholesale markets in the capital city, Dhaka, were selected for middlemen interviews. The middlemen purchase vegetables from the farmers and sell either to the exporters directly in the export channel or to the wholesalers in the domestic channel. Primary markets of the survey districts were Nimshar, Kabila in Comilla, Zigirhat in Rangpur, Modhupur in Tangail and Palpara in Narshingdi district, and the two wholesale markets were Shambazar and Kaoranbazar in Dhaka.

3.2.3 Exporter level

Most of the exporters buy vegetables from middlemen from different primary or wholesale markets, and few buy from the farmers directly. Exporters organize their exports of fresh vegetables by air from Dhaka, also recently from Chittagong and Sylhet. The frozen or canned form of vegetables is not exported in any significant scale. The exporter usually engages a few middlemen as agents to collect export quality vegetables from the farmers at the primary markets. They also buy vegetables directly from wholesale markets from the middlemen.

Dhaka city was selected as the survey area for the exporters, since all exports of French bean, yard long bean, bitter gourd and other vegetables come there during the survey period. Furthermore, the exporters are mostly located in Dhaka city.

3.2.4 Importer level

Bangladesh exports fresh vegetables to different countries of Europe and to the Middle East but on the largest scale to the United Kingdom (UK) (see Appendix III, Table 6). Among the vegetable importing countries, the UK was selected as the key vegetable importing country for this study because of its importance and due to ease of access by the researcher. Bangladeshi vegetable importers in the UK are British people of Bangladesh origin, mostly living in London, and usually supplying vegetables to the ethnic market for Asian, especially Bangladesh origin, people. Bangladesh exporters mostly deal with UK importers based in London. Fresh vegetables imported into the UK from Bangladesh are mostly sent to London by Bangladesh Biman airlines. Bangladeshi exporters consider London as the export market where the most potential exists. Thus, London was selected as the survey area for vegetable importer interviews.

3.3 Sample selection and sampling technique

Farmers and middlemen, exporters and importers were selected from the respective survey areas. The sample selection and sampling techniques were followed differently for different groups of respondents.

3.3.1 Producer level

After deciding on villages, producers of exportable vegetables were randomly selected from the survey villages irrespective of farm size. Two hundred and twenty four farmers in the eight survey villages were interviewed from amongst the farmers who produced the exportable vegetables (including the sample vegetables) in the year 2001-2002. With the help of farmer's leader, local official of DAE and NGO, school teacher, the sample producers were identified. The sample size at the production level was two hundred and twenty four, while the total number of vegetable producers in the survey areas was 1043. The total number of vegetable producers was collected with the help of local DAE officials.

Table 3.1 Statistics on the vegetable producers and the respondents in the survey areas

Survey district	Survey villages	Total vegetable producers	Total Respondents	FB- producers		YLB- producers		BG- producers	
				Total	No. of respondent	Total	No. of respondent	Total	No. of Respondent
Rangpur	Durgamoti	72	17	3	3	18	5	51	9
	Ovirampur	86	17	-	-	40	9	42	8
Comilla	Sreemontopur	318	55	76	21	68	15	78	19
	Tulatuli	172	33	52	14	43	11	29	8
Tangail	Kuragacha	96	28	7	5	50	14	12	9
	Lokdao	52	16	6	5	5	3	16	8
Narshingdi	Khorokmora	103	25	18	8	38	8	47	9
	Bramondi (south)	144	33	12	6	70	13	62	14
All (4-districts)	All (8 villages)	1043	224 (21.47)	174	62 (35.63)	332	78 (23.49)	337	84 (24.93)

Source: Field survey, 2003 and the local offices of DAE, Bangladesh.
Figures in parenthesis indicate the percentage of the respondents to total producer

3.3.2 Middlemen level

Intermediaries include wholesalers, middlemen (bapari), retailers and commission agents in Bangladesh. In this survey, the middlemen (bapari) were identified as respondents who buy vegetables from the farmers and sell to the exporters, aratdars, wholesalers and supermarkets. Emphasis was given to selecting the middlemen who usually linked with the export marketing as well as domestic marketing chain. Therefore, middlemen were sampled randomly among such traders in the respective markets. With the help of middleman's leader, local official of DAE and NGO, other shopkeepers, the sample middlemen were identified. Precaution was taken to avoid bias in selection process rather available middlemen were interviewed from each of the survey markets. The middlemen are not licensed businessmen so it was not possible to identify the total number of them but the middleman's leader gave the idea about the approximate number of them in each market.

Table 3.2 Statistics on the middlemen in the survey areas

Name of the survey district	Name of the market	No.of respondents	All
Dhaka	Shambazar	15	21(45.7)
	Kaoranbazar	6	
Comilla	Nimshar	4	6 (13)
	Kabila	2	
Rangpur	Zigirhat	5	5 (10.9)
Tangail	Modhupur	9	9 (19.6)
Narshingdi	Palpara	5	5 (10.9)
All	Seven markets	46	46 (100)

Figures in parentheses indicate the percentage of the sample

3.3.3 Exporter level

Exporters make air shipment of their vegetables to different importing countries. The exporters were identified randomly amongst the available traders irrespective of their export market, and volume of shipment to avoid any bias. Exporters are licensed traders were noted during survey. The representative of Exporters' Association stated that there were about four hundred exporters in this trade but more than one hundred licensed exporters were active, although the association was maintaining the list of the exporters. The association provided a list of the exporters published by the Hortex Foundation to the researcher. According to the list, appointments were made with individual exporter and thereafter interview took place. Few exporters were interviewed at their association office. The available exporters were selected randomly and interviewed according to the questionnaire.

Forty exporters were interviewed amongst the exporters from Dhaka which was about one third of the active exporters.

3.3.4 Importer level

Vegetable importers in the UK import vegetables from throughout the world. It should be mentioned here that the UK has supermarkets (mostly chain stores), greengroceries and ethnic markets for vegetables along with other commodities. Even though the ethnic markets are segmented for different communities such as Bangladeshi, Chinese, Indian, Pakistani and people of African origin. Importers who are importing vegetables from Asia or Africa, have marketing linkages with these segmented wholesalers or retailers. Presently the Bangladeshi origin importers, mostly located in London, are importing vegetables from Bangladesh and distributing among the retailers of the ethnic markets, but a few importers are also running their own retail out lets. Although the importers are licensed, it was not possible to measure the total number of Bangladeshi origin importers throughout the UK. The Bangladesh High Commission provided a list of vegetable importers but it does not appear up-to-date. However, based on this list and information of a few importers, the detailed address of other importers was collected. These importers do not have any formal association, but their total number in London was about twelve based on their statement. Six of them were randomly selected and interviewed.

3.4 Designing of data collection instruments

Moser and Kalton (1993) stated that social survey data is influenced by the means of its collection, whether by questionnaire or interview schedule. It was decided that the respondents of this survey would be interviewed through face to face interview by the researcher. Questionnaires for four categories of respondents were designed and pre-tested among the respondents.

3.4.1 Producer level

Primary data collection through the face to face interview method was identified as being the most appropriate for this type of field survey at each level of respondents, so that data collection schedules were designed for the farmers, and were pre-tested with a sub-sample. After conducting the pre-test, the questionnaires were modified and the final questionnaires were prepared and used to collect the primary data from the farmer.

The major questions related to owned land, total cultivable land, cultivated land for the sample vegetable, land rent, costs for labour, land preparation, different inputs for the sample vegetable production, total output, farm gate price of the sample vegetables and some major crops, disposal pattern of the vegetables, adoption status of modern technology along with more subjective data. Integrated Pest Management (IPM), linkage with the exporter, marketing, transportation, problems, and suggestions were included in the questionnaire.

3.4.2 Middlemen level

The major questions for middlemen were related to purchase and sale prices of the sample vegetables and also some other major vegetables, their procurement strategy, linkage with the farmers, wholesalers and exporters, marketing costs for transportation, loading, rent, grading, packaging, donations/tips, sorting, credit programmes, volume of weekly procurement of vegetables from the farmers, problems encountered and suggestions for improvements were included in the questionnaire. The schedule was pre-tested among the middlemen in one of the survey sites, and modified on the basis of their comments.

3.4.3 Exporters level

Questions were related to purchase and export prices of the sample vegetables and other major vegetables, procurement strategy, linkage with the farmers, the selected agents or middlemen, the importers, transportation arrangements, storage arrangements, marketing costs for packaging, grading, labour, and sorting, air freight charges, cash incentives given by the government, market intelligence, export destinations, volume of shipments per week, and annually mode of payment by the importer, weekly demand from the importers, problems, and suggestions, were included in the questionnaire. The questionnaire was pre-tested among a few exporters and adjusted accordingly.

3.4.4 Importers level

Questions relating to import and sale prices of sample vegetables along with some other major vegetables, marketing costs related to transport, rents, wages, airport and fees, airport clearance agents' fees, quality control of vegetables including grading, brand, packaging, sorting and variety, monthly purchases and sales of vegetables, customers' choice and preferences, problems, suggestions were included in the questionnaire. The questionnaire was pre-tested with a few UK importers and modified in the light of their suggestions.

3.5 Collection of primary data

To achieve the objective of this study, the primary data were collected from farmers, middlemen, Bangladeshi exporters and UK importers. Nichols (1991) commented that interviewers may organise group discussions of a small group of six to ten respondents during primary data collection in order to learn about the concerns and opinions of the community members.

Moser and Kalton (1993) gave suggestions about data collection methods and the strategy to handle respondents. The interviewer needs to motivate the respondents to cooperate during the interview. Initially he will state his organization, purpose of the survey and its importance. The quantity data was taken in metric units as well as local units but values in local currency were recorded.

3.5.1 Producer level

Prior to commencement of data collection from individual farmers, a farmers' orientation meeting was organised at each survey upazilla, where they were informed about the aim of the survey. The researcher gathered general information about the production and marketing of vegetables of the respective area from each meeting. Among the vegetable farmers of the survey villages, the sample farmers were selected randomly irrespective of farm size and interviewed using the pre-tested questionnaire (see Appendix V).

Plate 3.1 Initial meeting with farmers in Comilla district before data collection

Two trained enumerators were engaged to assist in collecting data from the respondents. The researcher supervised their work from time to time and also collected data by himself. The farmers were usually available in the morning and afternoon, and were sometimes organised with the help of a farmers' leader, NGO worker or DAE field staff in the interview. Each of the farmers were briefed about the identity of the researcher, and the purpose and relevance of the study, before commencing the interview and respondents were encouraged to provide correct information. Most of the farmers provided information very willingly, but a few showed less interests because they were unhappy about revealing their production costs and sale price of their vegetables who were about 5% of the respondents. Data were collected at the farmers level between June and December, 2003.

3.5.2 Middlemen level

The middlemen as defined earlier were interviewed at the primary markets where vegetables were sold both for domestic and export markets. For convenience, the middlemen were interviewed when the researcher went to the district for interviewing the farmers. The primary markets in Bangladesh usually sit twice a week but the wholesale markets of Dhaka city sit every day. The middlemen became very busy with their business during the peak periods of the days, so were informed about the aim of the survey and requested to provide the information in the quieter period. In some primary markets, the DAE staff and NGO workers assisted the researcher to organise the middlemen which was convenient for interview. In the wholesale market, the middlemen's association helped the researcher to organize some middlemen for interview. Informal discussion was held with the leaders of the middlemen's association about export marketing as well as internal marketing of the exportable vegetable. A few were disinclined to provide their business information as a matter of secrecy. Data collection at the middlemen level was held from August, 2003 to January, 2004. Forty six middlemen were randomly selected and interviewed from five primary markets and two wholesale markets (see Appendix VI).

3.5.3 Exporter level

The draft questionnaire was pre-tested with the help of some exporters in Dhaka city, and modified in the light of their suggestions. The offices of the exporters are scattered around the city which was made it difficult for the researcher to locate them. The Exporters' Association and Hortex Foundation provided the addresses. Informal discussion was held with the leaders of the exporters' association about the export marketing as well as internal marketing of the exportable vegetable. The exporters visit the association office so some exporters were interviewed at their association office. The exporters made their shipment at different times to different destinations according to flight schedules, and were often busy with the collection, packaging and shipment of vegetables. In some cases, appointment was made for the interview and staff concerned with vegetable export assisted the exporter in providing the information. The exporters were informed about the aim of the study and its national relevance and were interviewed with the pre-tested questionnaire (see Appendix VII). The exporters maintain their business records. It can be metioned that about 5% of the exporters had shown unwillingness to provide confidential information. Forty exporters were randomly selected and interviewed through face to face interviews from August to December, 2003.

3.5.4 Importer level

The list of the UK vegetable importers who are importing vegetables from Bangladesh was collected from the Bangladesh High Commission in London. Informal discussion was held with a leading importer and the draft questionnaire was pre-tested as well. Issues concerning vegetable imports into the UK and internal marketing to supermarkets, other stores, wholesale markets, and segmented ethnic markets were discussed.

Appointments were made by telephone and the researcher met with importers. Each of them was briefed about the aims and purposes of the survey and was interviewed following the questionnaire. Six UK importers, who are of Bangladeshi origin, were randomly selected and interviewed. According to verbal statement of the respondents, the total number of the importers was about twelve. Since some importers run retail outlets simultaneously it was possible to collect the retail price of the vegetables.

The New Spital fields wholesale market, and a Tesco superstore in London were visited during data collection. The researcher was able to make observations about the packaging and marketing systems of fresh vegetables from different countries of Europe, Asia, Africa and Central America.

3.6 Collection of secondary data

Relevant secondary data was collected from different government, non-government, international and private organisations in Bangladesh. Information relating to production and export marketing was collected from the Ministries of Agriculture, Finance, Planning, and Commerce, other government or semi-governmental institutions, namely: Department of Agricultural Extension (DAE), Export Promotion Bureau (EPB), Department of Agricultural Marketing (DAM), Bangladesh Agricultural Development Corporation (BADC), Bangladesh Agricultural Research Council (BARC), Bangladesh Agricultural Research Institute (BARI), Bangladesh Agricultural University (BAU), Bangladesh Bank (BB), Bangladesh Bureau of Statistics (BBS), Bangladesh Institute of Development Studies (BIDS). International organisations providing information were South Asia Enterprise Development Facility (SEDF), Food and Agricultural Organisation (FAO), Asian Productivity Organisation (APO); Non-government organizations, namely; Bangladesh Rural Advancement Committee (BRAC), Proshika Humane Development Centre (Proshika), Helen Keller International, private organization Pran, East West Seed Company (Bangladesh); government funded projects-Hortex Foundation, Agro-based Industries and Technology Development Project-Phase-II (ATDP-II) and North West Crop Diversification Project (NCDP).

Moreover, some secondary information such as requirements for import of the food and vegetables to the UK was collected from the commercial wing of Bangladesh High Commission in London and wholesale marketing of horticultural products in the UK from New Spitalfields wholesale market office. Some important secondary information of other countries and organisations was collected from the internet and by personal e-mail correspondence.

3.7 Opinion survey

An opinion survey was carried out among experts in the field of production, research, agricultural marketing, export promotion of vegetable, and vegetable based agribusiness. A questionnaire was prepared and was pre-tested. Major questions related to quality standards, demand-led research, farming systems, storage and transportation, market intelligence in respect of production and export of vegetables, constraints, comparative advantage and prospects, joint ventures in respect of production and export of vegetables in general and the sample vegetables in particular, were included in the questionnaire. Expert opinion of scientists from BARC and BARI, an extentionist from DAE, a representative of exporters, and officials from DAM, BADC, EPB, Hortex foundation and SEDF-World Bank was gauged.

3.8 Group survey

Group surveys were conducted among the farmers in each of the survey upazillas. A brief questionnaire was designed and pre-tested. Such questionnaire was different from producers' questionnaire, designed only for collecting the data on monthly labour requirement for major crops in the respective upazilla. Individual farmers were not interviewed for such purpose rather farmers provided the information as a group. Farmers' group meetings were held in each survey upazilla and activity-wise labour requirements for major crops were collected through discussion with the farmers. The information was not limited in the two survey villages. They provided the information as a picture on labour requirement for their own each upazilla.

Plate 3.2 Farmers group meeting at Chandina upazilla

Note: Labour requirement for major crops in each upazilla was collected through farmers' group meeting

3.9 Organization and entry of data

After primary data collection, the completed questionnaires for farmers, middlemen and exporters were scrutinized by the researcher himself to remove obvious omissions, ambiguities, inconsistencies and clerical mistakes. The completed questionnaires for importers in the UK were similarly dealt with.

The collected data from the questionnaires were entered into Excel spreadsheets for analysis. Some data were transferred from Excel to SPSS for descriptive and statistical analysis.

3.10 Data analysis technique

Different analytical techniques were followed for financial analysis of data obtained from farmers, middlemen, exporters and importers. Statistical analysis was performed at the production level. Details of these techniques are provided below.

3.10.1 Producer level

Analysis of financial and socio-economic characteristics was carried out on the basis of farmer categories. Based on own cultivable land, farmers were categorized into large, medium, small and marginal farmers. Total cultivable land includes the land cultivated by the respondents and the land of the respondents cultivated by the other family. Table 3.3 shows the number of farmers in the four categories for each districts surveyed.

Table 3.3 Categorization of the respondents by farm size and survey districts

Farmers Category	Range of own cultivable land (acre)	Rangpur	Comilla	Tangail	Narshingdi	Respondents in each category
Marginal	.05-.49	1	46	6	16	69 (31)
Small	.50-1.49	7	31	25	17	80 (36)
Medium	1.50-4.99	21	10	8	25	64 (29)
Large	5.00-above	5	1	5	0	11 (5)
All	-	34	88	44	58	224 (100)

Figures in parentheses indicate the percentage of the respondents in each category

The primary data were analyzed both financially and statistically. Socio-economic characteristics, income from vegetable crops and its contribution to annual family income, adoption status of modern technology, and linkage between sample farmers and exporters were analysed.

3.10.1.1 Financial analysis at production level

Profitability of the three sample vegetables was estimated by financial analysis where the data on prices for the year of 2002-2003 were used. Cost and return analysis was carried out on the basis of both cash cost and full cost for the various farmer categories at overall and survey district level. Costs of hired and family labour, purchased seed, (and the value of free seed supplied by the Hortex Foundation), land preparation, manure and fertilizer, irrigation, pesticides, and structures (trellis) were considered as variable costs while the cost of rental value of own land, depreciation of equipment, and interest on working capital were considered as fixed costs. Full costs included fixed costs and variable costs, while the variable cost excluding the cost for free seed and family labour was considered as the cash cost which was also termed working capital for production of the sample vegetable.

On the basis of the information provided by the respondents, the average production period for the sample vegetable was determined as four months. The farmer had to spend cash throughout the season in different amounts, so the interest on working capital was calculated for two months, based on the mid-point of the season. Usually the farmers obtained credit from the Bangladesh Krishi Bank, so the interest rate of this bank for agricultural credit during the data collection period was used; this was 10% in 2003.

The following formula was applied to determine the interest on working capital (i_w):

$$i_w = W . i . 2/12 \tag{3.1}$$

where W is the total working capital and i is the current interest rate.
The opportunity cost of family labour was considered to be the local hired labour rate. Depreciation of the equipment was calculated for the production season of four months as the equipment was considered to be used for a whole year while the equipment for irrigation was not used for four months in the rainy season, so was practically used for eight months. Thus, the depreciation for irrigation equipment was estimated for four months out of eight months or half of the year, but for other equipment was calculated for four months or one third of the year. The following formula was followed for calculation of depreciation.

$$D_g = d_g . V_g \times 4/8 \tag{3.2}$$

$$D_e = d_e . V_e \times 4/12 \tag{3.3}$$

where D is the amount of depreciation, d is the depreciation rate, V is the original value of equipment, and subscripts g and e refer to irrigation and other equipment respectively.

The cost for actual land utilized for sample vegetable was calculated and, thereafter converted to total cost per acre for each cost item. The production period for vegetables in Bangladesh needs almost four months (season), therefore, the rental value of own land was calculated for four months using total average rents, and was considered as fixed cost.

The wage for labour for eight hours was found to be different from district to district; therefore, the wage rate for each survey district was considered separately for calculation of family labour cost. On the other hand, the actual wage for hired labour spent by the farmers was used. The following formula was used;

$$L_f = H_f / 8 \times w \tag{3.4}$$

where L is the family labour cost, H is the total hours, w is the wage rate, the subscript f refers to family.

Table 3.4 below presents the average rate for the different districts. The wage for agricultural labour at the private level is not fixed by the government but rather determined by the local people and also depends upon local development and alternate work. The survey districts namely Comilla and Narshingdi are nearer to the capital city which influences the wage rate because the labour has alternate opportunities to work in sectors other than agriculture. The district Rangpur and Tangail are geographically far from the capital city and the labour has least scope to work in other sectors. Therefore, the wage rates in Comilla and Narshingdi are comparatively higher than those of Rangpur and Tangail. The average wage rate was calculated based on the wage rate provided by the respondents in each district. The district wise average wage rate was used to determine the family labour cost in each survey district.

Table 3.4 Average daily wage rate for the family labour by survey district.

Name of the survey district	No. of respondents	Average daily wage rate (TK per day)
Rangpur	34	52
Comilla	88	78
Tangail	44	62
Narshingdi	58	77
Total	224	-

Profitability in cash cost and full cost terms were calculated for the different farmer categories and districts. The cost which the farmers pay in cash for different inputs and activities is termed as cash cost while the full cost includes cash cost, opportunity costs and fixed costs. Gross return was first calculated by multiplying the gross output by the average farm gate price. Profit was then derived by deducting costs from output on the basis of both cash cost and full cost. Benefit-cost ratios were also calculated.

Thus, the following equations were used to determine profitability:

$$P_c = R - C_c \tag{3.5}$$

$$P_f = R - C_f \tag{3.6}$$

where, P is the profit, R is the gross return and C is the total cost, being made up of total fixed cost and variable costs. The subscripts c and f refer to cash and full cost approaches respectively.

And net return is :

NR=GR-TC

Where, NR= Net return (Tk/survey farm/season[1])

GR= Gross return (Tk/ survey farm/season)

TC= Total cost (Tk/ survey farm/season)

and TC = FC+VC

FC= Fixed cost (Tk/ survey farm/season)

VC= Variable cost (Tk/ survey farm/season)

The benefit cost ratio based on cash cost and full cost was calculated as:

BCR = Gross return/ Total costs

The Marketable surplus of the sample vegetables produced by the respondents in the four survey districts was determined in volume using the following equation:

$$S = O - F - T - G \tag{3.7}$$

Where, S= Marketable surplus of the vegetable

O = Total output of the sample vegetable

F = Own consumption

T = Wastage of the vegetables

G= Gifts of vegetables to relatives or friends

Note: (1) Season = 4 months

3.10.1.2 Statistical analysis at production level

The profitability of the sample vegetables FB, YLB and BG, was determined through financial analysis. Statistical analysis was also performed to test the hypotheses: the production of selected exportable vegetables namely French bean, yard Long bean and bitter gourd in Bangladesh is profitable and key factors have positive effect on their production. Descriptive statistics for different categories of farmers and also for survey districts were calculated.

Additionally, production function analysis was carried out to examine the contribution and efficiency of different resources, namely farm size in acre, value for land rent, land preparation, manure-fertilizer, irrigation, pesticide, and labour in hour.

Field (2003) stated that the degree to which a statistical model represents the data collected is known as the fit of the model. He suggested that care should be taken in selecting predictors for a model because the values of the regression coefficients depend upon the variables included in the model.

3.10.1.3 Production function analysis

The Cobb-Douglas production function model was determined in order to estimate the contribution of the resources used for each of FB, YLB and BG. A multicollinearity test was performed to predict the correlation among the incorporated independent variables in the model. The test indicated a multicollinearity problem among the independent variables. In this production function analysis, no model was dropped because of such a statistical problem, rather models were tested using different resources, so less important independent variables were not dropped.

Although multicollinearity is a problem in that separating the contribution of independent variables is difficult, the explanatory power of the equation is not adversely affected. Consequently, although some combination of variables was carried out, partially to overcome this problem, all equations tested are presented here.

Model 1

Actual output as the dependent variable, and actual farm size and production costs-land preparation, land rent, labour requirement, seed, manure-fertilizer, irrigation, pesticide for survey farm as independent variables were incorporated in this model. The equation for this model was as follows.

$$Y=\beta_1 X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} X_8^{\beta_8} X_9^{\beta_9} e^u \tag{3.8}$$

Which can be converted to linear form for regression purposes as :

$$LogY=\beta_1+\beta_2 \log X_2+\beta_3 \log X_3+\beta_4 \log X_4+\beta_5 \log X_5+...+\beta_9 \log X_9+u \quad ; \tag{3.9}$$

where Y= output per actual land;

X_2 = actual farm size; X_3 = land preparation cost; X_4 = land rent;

X_5 = labour required in hours; X_6 = seed cost; X_7 = manure and fertilizer cost;

X_8 = irrigation cost; X_9 = pesticide cost; u = disturbance term;

e = base of natural logarithm;

β_1 = constant; and $\beta_2, \beta_3, \ldots, \beta_9$ are the coefficients or elasticities of output Y with respect to the independent variables of $X_2, X_3, \ldots, X_8$ and X_9 respectively.

Model 2

The second model is similar to the previous model except that the four survey districts are included as dummy variables in view of estimating the regional effects on production. Model 2 is designed to estimate the elasticities of output incorporating four regional dummy variables along the with other eight independent variables included in model 1. The four survey districts Rangpur, Comilla, Tangail and Narshingdi are accounted for 3 dummy variables here.

The equation of the Cobb-Douglas production function model was as follows:

$$Z=e^c X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} X_8^{\beta_8} X_9^{\beta_9} e^{x_{10}\beta_{10}} e^{x_{11}\beta_{11}} e^{x_{12}\beta_{12}} e^u \tag{3.10}$$

We obtain the following logarithmic equation by transforming the production function equation into linear form.

$$LogZ=c+\beta_2 \log X_2+\beta_3 \log X_3+\beta_4 \log X_4+\beta_5 \log X_5+\beta_6 \log X_6+...+\beta_{12} X_{12}+u \tag{3.11}$$

where Z = output per actual land;

X_2 = farm size; X_3 = land preparation cost; X_4 = land rent cost;

X_5 = labour required in hours; X_6 = seed cost; X_7 = manure and fertilizer cost;

X_8 = irrigation cost; X_9 = pesticide cost; X_{10} = Rangpur; X_{11} = Camilla;

X_{12} = Tangail; u = disturbance term;

e = base of natural logarithm;

c = constant; and $\beta_2, \beta_3, \ldots, \beta_{12}$ are the coefficients or elasticities of output Z with respect to the independent variables X_2, X_3, …, X_{11} and X_{12} respectively.

Model 3

The third model is designed to see the combined and individual effect of the independent variables influencing the production but combining variable in an effort to overcome multicollinearity effects. In this model 3, the four variables land preparation, seed, manure and fertilizer and pesticide are combined together while farm size, land rent, labour and irrigation are included individually. In view of estimating the effects of the combined as well as the individual variables, the following equation of the Cobb-Douglas production function model is produced.

$$V = e d_1\, X_2^{d_2} W_4^{d4} W_5^{d_5} W_8^{d_8} W_{13}^{d_6} e^u \qquad (3.12)$$

Which can be converted to log linear form for regression purposes as:

$$Log\, V = d_1 + d_2 \log X_2 + d_4 \log X_4 + d_5 \log X_5 + d_8 \log X_8 + d_{13} \log X_{13} + u \qquad (3.13)$$

where V= output per actual land;

X_2 = farm size; X_4 = land rent; X_5 = labour; X_8 = irrigation;

X_{13} = land preparation; seed; manure and fertilizer; pesticide;

u = disturbance term; e = base of natural logarithm;

d_1 = constant; and d_2 , d_4, d_5, d_8 and d_{13} are the coefficients or elasticities of output V with respect to the independent variables X_2, X_4, X_5, X_8 and X_{13} respectively The production function analysis described above was carried out on both actual land and per acre land basis in the case of the three models for each of the three sample vegetables. The actual land was the land where the respondents produced the sample vegetables while the production per acre was computed based on the production per actual land.

3.10.1.4 Estimation of technical efficiency of sample vegetable producers

Kumbhaker and Lovell (2000) stated that technical efficiency is one of the important measures of economic efficiency of any firm, because the economically efficient firm should be technically efficient for profit maximization. A producer's performance can be estimated using technical efficiency measures.

A stochastic frontier production function is used here, where the ratio of actual production to estimated production divided by the frontier value provides the value for technical efficiency of the producer. The estimated production is calculated by using the Cobb-Douglas production function equation (3.8) for French bean, yard long bean and bitter gourd. The exponential value of the constant, the output coefficients, and the actual values of the eight independent variables are put in to the equation (3.8) to get the estimated production of each vegetable.

The frontier value, the maximum possible output with the same inputs utilized in the production process, was obtained from the highest of the ratios of actual production to estimated production and then each farm ratio was compared to this. Thus the efficiency ratio is :

Efficiency Ratio = actual production/ estimated production

and the percentage technical efficiency is :

Technical efficiency = Efficiency ratio obtained / Frontier value *100

3.10.1.5 Estimation of factors affecting technical efficiency of the vegetable producer

Multiple regression analysis was carried out to estimate the factors affecting the technical efficiency of the producers. Timmer (1971), and Kalirajan and Shand (1989) had suggested that the technical efficiency of farmers is determined by the socio-economic and demographic characteristics of the farmers. Two separate attempts were made to estimate the determinants of efficiency through two models.

The four survey regions of Rangpur, Comilla, Tangail and Narshingdi are included using 3 dummies in the model A to estimate the regional effect on technical efficiency along with other variables while Model B is similar except for the regions.

Model A

Farm size, age, household size, contract farming, education of the respondents, and survey districts are incorporated in this model. Note that contract farming, education and regions were included in dummy form in the equation. The equation for the multiple regression in this model is as follows:

$$P = r + b_1 T_1 + b_2 T_2 + b_3 T_3 + b_4 T_4 + b_5 T_5 + b_6 T_6 + b_7 T_7 + b_8 T_8 + b_9 T_9 + \ldots + b_{12} T_{12} + U \; ; \quad (3.14)$$

P = Technical efficiency; r = constant; T_1 = Farm size; T2 = Age; T_3 = Household size; T4 = Experience in years in vegetable production; T5 = Dummy contract farming; T_6 = Dummy primary; T_7 = Dummy secondary; T_8 = Dummy higher secondary; T_9 = Dummy graduate; T_{10} = Dummy Rangpur; T_{11} = Dummy Comilla; T_{12} = Dummy Tangail; b_1, …, b12 = Co-efficients of the respective variables; and u = disturbance term

Model B

Another attempt has been made to estimate the effect of the independent variables on technical efficiency, where regional effect is not taken into consideration. The equation for the multiple regression in this model is as follows:

$$Q = s + b_1 T_1 + b_2 T_2 + b_3 T_3 + b_4 T_4 + b_5 T_5 + b_6 T_6 + b_7 T_7 + b_8 T_8 + b_9 T_9 + U \quad (3.15)$$

Q = Technical efficiency, and s = constant, T's and b's as above for (3.14)
In model 1 (3.14) the dummy districts are included while these dummies are not included in model 2 (3.15).

3.10.2 Middlemen level

Financial analysis of the middlemen was done to estimate the profitability of the exportable vegetable business both in the domestic and export marketing channels.

3.10.2.1 Estimation of marketing cost

The marketing cost involved for different elements was computed for both the marketing channels. The average marketing cost per metric ton of vegetables incurred by the middlemen was calculated using the equation:

$$AMC = TC / \text{Total sample size} \qquad (3.16)$$

Where, AMC is Average marketing cost per MT, and TC is Total costs incurred for all cost elements per MT

3.10.2.2 Estimation of average weighted purchase and sale price

The average weighted purchase price and sale price in both the domestic and export channels were used for financial analysis rather than a simple average price in case of the group of vegetables.

The following equation was used to calculate the weighted purchase and sale price:

$$\bar{p} = \frac{\sum_{v=1}^{V} p_v \cdot q_v}{\sum_{v=1}^{V} q_v} \qquad (3.17)$$

Where, $\bar{p}$ = Average weighted price

p_v = average price of individual vegetable

q_v = average quantity of individual vegetable

V = Number of vegetables

An attempt has been made to compare the profit margin in both domestic and export channel, the volume of purchased vegetables was used for estimating the average weighted purchase price and similarly the sale volume was used for estimating the average weighted sale price of the vegetables at middlemen level. The profitability of middlemen with reference to sales to wholesaler in the domestic and to exporters in the export market channel was computed.

3.10.2.3 Estimation of net profitability

The marketing margin is the difference between sale price of the farmer and the sale price of the middlemen. The gross marketing margin was computed as the difference between the sale price of the farmer and sale price of the middlemen to the exporter or wholesaler. The net marketing margin or net profit made by the middlemen was calculated using the following equation.

$$NP = GMM - AMC \qquad (3.18)$$

Where, NP is Net profit, GMM is Gross marketing margin, and AMC is Average marketing cost.

Profit as a percentage of the total investment (return on capital) was also calculated using the following equation.

$$ROC = (NP \div I) \times 100 \qquad (3.19)$$

Where, ROC is the return on capital, I is the total investment which includes the purchase price and marketing cost.

The profit made by the middlemen when selling to the exporter and wholesaler was calculated for different markets and vegetables, and compared.

3.10.3 Exporter level

Financial analysis at the exporter level was performed to estimate the profitability of the vegetable export business.

3.10.3.1 Estimation of marketing cost

The marketing cost involved for different cost items was computed for four major export marketing channels. Based on the data collected from the exporters, major export markets, namely London and Rome in Europe; and Jeddah in Saudi Arabia, and Dubai in the United Arab Emirates in the Middle East were identified for estimation of the export potential of the Bangladeshi vegetables. Vegetables were being exported using different passenger airlines. However, Bangladesh Biman was the main carrier of fresh vegetables from Bangladesh to the above destinations. Therefore, the air freight rate for Bangladesh Biman applicable to those destinations was used. The average marketing costs per metric tonne of exported vegetable for each of the four export marketing channels were calculated, and compared. The equation used to estimate the average marketing cost was (3.16) from section 3.10.2.1.

3.10.3.2 Estimation of average weighted purchase and sale price

The average weighted purchase and sale prices were estimated and used for financial analysis instead of the average price of the group of vegetables at the exporter level. These prices were estimated using the equation (3.17) from section 3.10.2.2. The weighted sale prices for four export markets (UK, Italy, KSA and UAE) were estimated at the exporter level. The volume of purchased vegetables was used for estimating the average weighted purchase price; similarly the sale volume was used for estimating the average weighted sale price of the vegetables. But the average purchase and sale prices were used for the individual vegetables FB, YLB and BG.

3.10.3.3 Estimation of profitability

The exporters' marketing margin is the difference between price paid to the middlemen and the sale price of the exporter. The gross marketing margin was computed as the difference between the sale price of the middlemen and the sale price of the exporter to the importer. The net marketing margin or net profit made by the exporter was calculated using equation (3.18) from section 3.10.2.3.

The profitability of the three sample exportable vegetables at the exporter level in the four major export markets was calculated and compared.

Profit as a percentage of total investment or return on capital (ROC) was also calculated using the equation (3.19) from section 3.10.2.3. The total investment or capital includes the purchase price and marketing cost.

3.10.3.4 Sensitivity test

Bangladesh Biman, as the national passenger carrier, dealt with a major portion of the vegetable export business. Considering a 10% increase and decrease of the air freight rate, the sensitivity of the profitability of the vegetables for the four markets was computed.

3.10.4 Importer level

Financial analysis at the importer level was performed to estimate the profitability of exportable vegetables in the import market in London.

3.10.4.1 Estimation of marketing cost

The marketing cost involved for different items was computed for the London market. The same equation as above (3.16) from section 3.10.2.1 was followed to estimate the average marketing cost. The collected data on the costs for transport, salary and wages and airport tax were computed

3.10.4.2 Estimation of average weighted purchase and sale price

The average weighted purchase and sale prices were used for financial analysis at the importer level rather than only a simple average price of the group of vegetables. Equation (3.17) from section 3.10.2.2 was used to estimate these prices. The profitability of importers at the retailer and consumer level were computed and compared. Therefore, similar to middlemen and exporter, the volume of purchased vegetables was used for estimating the average weighted purchase price, similarly the sale volume was used for estimating the average weighted sale price of the vegetables at retailer and consumer level.

3.10.4.3 Estimation of profitability

The importers' marketing margin as the difference between the price paid to the exporter and the sale price of the importer was calculated. The gross marketing margin was computed as the difference between the purchase price of the importer and the sale price of the importer to the retailer or wholesaler, and the net marketing margin or net profit made by the importer was also calculated using the equation (3.18) from section 3.10.2.3.

The profitability of the two sample exportable vegetables at the importer level in the London market was calculated and compared. Profit as percentage of total investment or return on capital (ROC) was also calculated using the earlier equation (3.19) from section 3.10.2.3. Total investment or capital = Purchase price + marketing cost.

3.10.5 Estimation of market potential at export market level

The export market potential was estimated as the total level of sales possible in a target market by all firms. This potential in this study was estimated using a factor approach to discover the size of possible market sales of vegetable at exporter and importer level (see section 2.2, p-25, Sperich *et al*, 1994). This estimation method assumes that all the participating firms will sell vegetables at a constant rate and also the consumers' choice and preferences and rate of their consumption of vegetables will be the same throughout the year.

The market potential at the exporter level was estimated using the following equation:

$$O = O_j \times N \times 52 \qquad (3.20)$$

where, O is the total sales or market potential of firms in a year, O_j is the weekly sale of vegetable, N is number of participating firms in the target market. The market potential of vegetables at the exporter level in Bangladesh and the importer level in London's ethnic market was estimated using the same equation (3.20). In this study, the exact number of active exporters in Bangladesh and the importer in London was not known so the total number of participating exporters was estimated to be three times the number of exporter respondents, and the number of importers to be double the number of importer respondents, based on field survey experience.

3.10.6 Estimation of market power of participants in export marketing of vegetable

The Market power of sellers or buyers is generally estimated by the Herfindahl-Hirschman Index, HHI, (Oligopoly, 2003). The HHI is generally considered a superior measure of market concentration or market power and is the sum of squares of the market shares of all farms participating in the market (Compecon, 2002). Market power may be defined as the degree to which a firm exercises influence on price and output in a particular market. Under perfect competition, all participating firms are assumed to have zero market power (Bannock *et el*, 2003)

The market power of each of the market participants – producers, middlemen, exporters and importers was estimated using the following equation:

$$P = \sum_{m=1}^{M} (I_m \div A)^2 \qquad (3.21)$$

Where, P is the market power of the market participants, I_m is the purchase or sale volume of an individual market participant for a specific period, A is the total purchase or sale volume of all participants in the same market for the same period, and M is the total number of participants.

$(I \div A)$ is the market share of each market participant.

A number of assumptions have been made to compute the total purchase or sale volume of vegetables by the market participants. These are discussed in the next section.

3.10.6.1 Estimation of market power of vegetable producers

Attempt has been made to estimate the market power of the respondents and total number of producers of each of the sample vegetable participated in the local market in each survey Upazilla. The assumed number of sample vegetable producers was not based on government statistics but was estimated from information derived from the respondent farmers and extension officials during survey. Based on survey experience, 50% of the total vegetable producers were assumed to have produced the three sample vegetables in the case of Rangpur, Tangail and Narshingdi while 70% was estimated for Comilla district. The respondents were interviewed from two villages from one upazilla in each district and it was assumed that French bean producers from four villages, and YLB and BG producers from ten villages sold their vegetables to the same local market and competed with each other. The Market power of the producers for FB, YLB and BG was computed separately for the same local market to gauge the degree of competitiveness of the producers for each of the three vegetables.

The ratio of the total number of each sample vegetable respondents to the assumed number of each sample vegetable producer was estimated using the following equation:

$$Y = \{S / R^*(Q^*u)\} / S \tag{3.22}$$

Where, Y = Ratio of the total number of each sample vegetable respondents to the assumed number of each sample vegetable producer

Q = total number of vegetable producers in two survey villages in each district

R = total number of respondents (three sample vegetables) in two survey villages

S = total number of respondents for the specific sample vegetable

u = assumed percentage of producers of the 3 sample vegetable producers to total vegetable producers in two villages. Note that u would be 50% in the case of Rangpur, Tangail and Narshingdi while 70% for Camilla.

Using P, the market power of the respondents of each sample vegetable in the local market as if the respondents were the only producers in the market (Equation 3.21),

Then the market power of the assumed number of the producers of the specific vegetable producers in two villages in the same market = P/Y

It the market power is calculated for only a section of the market, and if the remainder of the market follows the same pattern then the HHI should be multiplied by the proportion of the market which the sample constitutes. Thus: Market power of the assumed number of each sample vegetable producers in four villages in the same market = P/Y/2

Market power of the assumed number of each sample vegetable producers in ten villages in the same market = P/Y/5

3.10.6.2 Estimation of market power of middlemen, exporters and importers of vegetables

The market power of the middlemen as buyers was computed according to the equation (3.21) for each of five local markets namely Dhaka, Rangpur, Camilla, Tangail and Narshingdi while as seller for one terminal market (exporter and wholesaler level in Dhaka). It could be noted that the actual number of buying middlemen in the local market and the seller in Dhaka terminal market was not available so some assumptions were taken on the number of such market participants. Similarly some assumptions were taken on the number of buying and seller exporters and buying importers for estimating their market power. Their assumed number was gauged from the information of the respondents during survey. Therefore the total number of buying middlemen in the local market was assumed to be three times the number of respondents in this category for each market and their market power was consequently computed by dividing the market power of the respondents by three. On the other hand, the total number of selling middlemen in the terminal market was assumed to be five times than the total number of respondents of this category, and their market power was calculated by dividing the market power of the respondents by five.

The number of buying exporter was estimated to be three times the number of the respondents in this category in Bangladesh. Additionally, the number of selling exporter for the UK market was assumed to be double than the number of respondents for the UK market. The same equation mentioned above was followed in calculating the market power of the buyer and seller exporters. The market power of the buyer exporter for each of FB, YLB and BG was computed to compare their market power with that of the middlemen. But the market power for the seller exporter was computed for all vegetables together to compare their market power with that of the importers in the ethnic market of London.

The total number of buyer importers was assumed to be double than the respondents in this category in the London ethnic market, and their market power were computed for all vegetables by dividing the market power of the respondents by two. Thus, market power was calculated for buyers and sellers at each stage of the marketing chain: Producers (sell)- (buy) middlemen (sell)-(buy) exporters (sell)-(buy) importers.

3.11 Problems encountered and potential solution

During data collection, some problems were encountered by the researcher. Attempts were made to overcome these problems within the constraints of the research. The researcher encountered problems of a different nature at the level of farmers, middlemen and exporters in Bangladesh and importers in London.

According to the statistics of the Department of Agricultural Extension (DAE), the sample vegetables were not produced throughout the country so that difficulties arose in identifying the survey districts. The agricultural statistics were studied and consultation with agriculture experts was carried out to identify the survey areas with four districts, upazillas, and eight villages finally identified as survey areas for this research. Although it would have been preferable to collect data from more survey areas the researcher could not do so due to time and resource constraints. However, efforts were made to collect data from four survey districts in different agro-ecological zones using the representative samples.

Since the survey areas were unknown to the researcher it was difficult to assemble the farmers for interview. The farmers were made available for the interview sometimes with the help of DAE, Bangladesh Rural Advancement Committee (BRAC) and Proshika officials. A general strategy was taken to avoid interviewing the farmers at their busy time which varied from district to district. The presence of the officials mentioned above did not motivate the respondents to provide exaggerated information so far as the researcher could gauge. Although precautions were taken so that the farmers did not provide wrong or biased information, there bias is the possibility that some respondents did not answer all questions honestly.

Farmers in Bangladesh do not tend to maintain records for their production costs and returns for any crops. Thus, they provided the information in connection with their production costs and returns from memory. Therefore, the respondents were requested to make a concerted effort to provide correct information for good research. A few respondents felt difficulties in understanding the questions but the researcher explained in further detail where necessary. Farmers were briefed about the questions and financial figures were collected mostly per kilogram, but sometimes in local units such as mounds.

Sometimes, the farmers tended to complain about the NGO officials and bankers, and often explained that they were suffering from price fluctuations of the vegetables and high production costs. In these circumstances, they were informed that the research needed correct and real information on the vegetable sector for realistic findings, necessary for policy formulation by the government. It was gauged that the farmers understood the importance of the research and cooperated accordingly. Efforts were made so that the respondents would provide almost correct information for the sake of good research that would be helpful for the policy makers who would take actions of assistance to them.

DAE officials and sometimes leading local traders helped with introduction to the middlemen and in the collection of data from the survey markets. They were interviewed at their lean period of trading so that they could concentrate in the interview. The middlemen were usually poorly educated and did not maintain records for their business, so that they again provided the data from their memories. A few middlemen hesitated to provide information related to their business due to business secrecy. Attempts were made to help them understand the importance of the research, and consequently they finally cooperated and provided the data as per the questionnaire.

The exporters, however, were busy people and required prior appointment for interviews in most cases. The Exporters' Association sometimes encouraged the exporters to cooperate with the researcher. Although the exporters do maintain their business records, sometimes disinterest was shown in providing financial information due to business secrecy. They were, however, motivated as this research would be likely to be helpful for their trade and for policy makers of the government in the vegetable export sector.

A few exporters or their office staff mistakenly provided incorrect information regarding official charges, particularly air freight charges, government fees or charges that should not vary from exporter to exporter. The researcher examined and collected information including computer scanning and airway bills charged by the airport, phytosanitary certificates and general system of preference (GSP) charges of the government office from each exporter. Some exporters provided air fares per net weight of vegetable while some provided the net weight including carton weight. The airfare for the vegetable weight and carton weight were considered altogether when screening the data, in order to maintain homogeneity in this regard.

Bangladesh exporters were mostly exporting fresh vegetables to British importers who were of Bangladeshi origin supplying the ethnic market. An attempt was made to identify other importers in the New Spitalfield wholesale market in London, but none of them were importing vegetables from Bangladesh at that time. It took much more time to locate the offices of the importers and arrange for interviews. Most of the importers were unhappy with the delayed arrival of Bangladesh Biman in London, as this had a negative effect on their marketing in the competitive conditions of London. They were not very interested in cooperating in this research as they felt that it would not be useful for their business. The researcher had to convince them that their information and suggestions would be valuable for policy making by the government in that sector. They maintained records and provided financial information from their records.

An attempt was made to collect data from one supermarket chain store. Tesco are importers as well as retailers, but they were not prepared to be interviewed, so primary data was not possible. Secondary information was collected on supermarket chain management.

Chapter IV

Economics of Exportable Vegetable Production in Bangladesh

4.1 Introduction

Although cereals are the main crops in Bangladesh, vegetable crop cultivation is being expanded at the rate of 3% annually. "Grow more food" was a popular slogan launched in the early seventies as part of a campaign to feed the people, so for obvious reasons, agricultural development activities were biased in favour of cereal crops for decades. Following the remarkable achievement in raising cereal production and the introduction of diversified agricultural programmes, the Ministry of Agriculture declared its National Agriculture Policy in 1999, incorporating a programme for increasing the area and production of crops other than cereals under the crop diversification programme (Ministry of Agriculture, 1999). The soil and climate of this country is suitable for vegetable production, with a cheaper labour force another advantage for the vegetable sector. At one time, vegetables were grown mainly in the homestead garden in a traditional way at the subsistence level for local, particularly family consumption, but things have changed dramatically with the commercialization of vegetable crops. People are becoming more aware of the food value of vegetables, and their economic importance is increasing due to local and international trading. Many producers are now growing vegetables commercially, applying modern production technology and appropriate inputs, and are profit-oriented and aware about the marketing of their products. Vegetable crops are now not only cultivated to meet local demand but export market demand-led production is extending throughout the country. Exportable vegetables are being produced through contract farmers in different districts of the country. Increasing demand for traditional, non-traditional and organic vegetables in domestic as well as in international markets is encouraging the farmers and traders involved in this field.

In this context, production, processing, transport, storage, supply of inputs, and marketing (domestic and export) could be improved to further promote vegetable based agribusiness.

analysis of production of three exportable sample vegetables, French bean (FB), yard long bean (YLB) and bitter gourd (BG), the socio-economic characteristics of producers, land utilization and analysis of labour and other input usage is presented.

4.2 Socio-economic characteristics of the sample vegetable producers in the survey areas

An attempt was made to identify the socio-economic characteristics of the sample farmers in the designed survey areas. These characteristics might, directly or indirectly, have an impact on knowledge skill, motivation and ability to engage in and expand vegetable production.

4.2.1 Educational status of the sample producers

The formal education levels of the respondents among the eight survey villages in four survey districts are analysed and briefly described below (Appendix 1, Tables 1and 2).

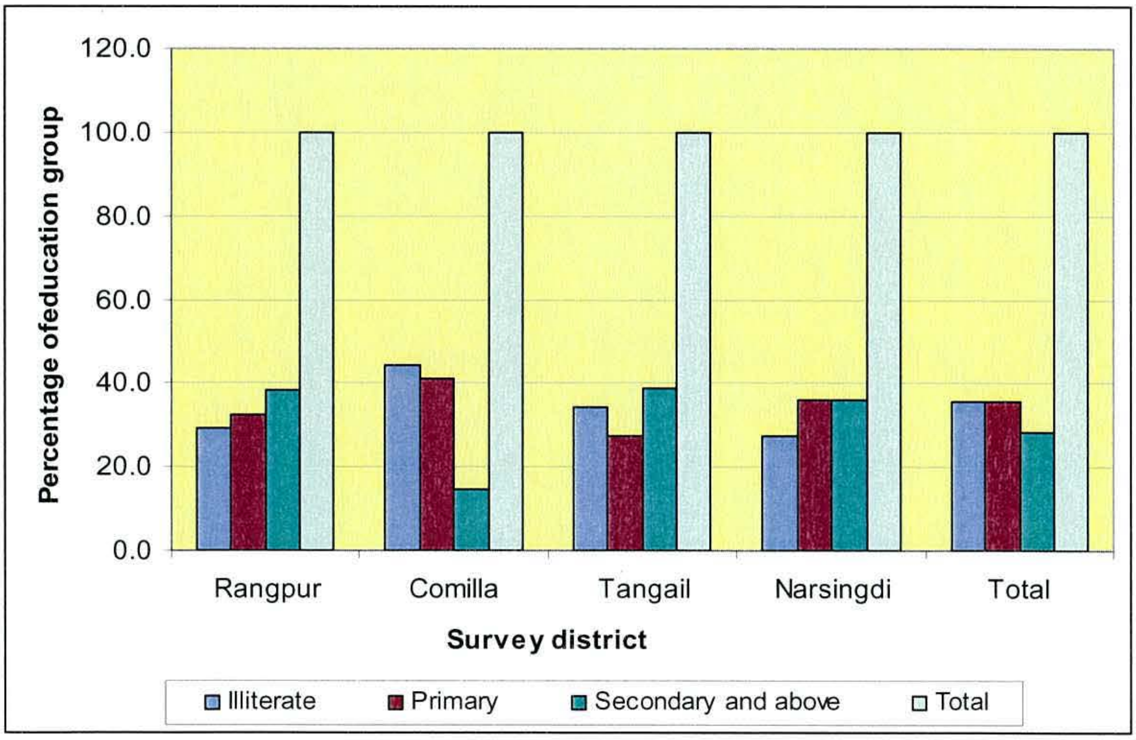


Figure 4.1 Educational status of the producers by survey districts

Formal education develops perception and awareness in the individual that helps in gathering technical and business know how. The respondents in the survey areas who were either illiterate or at primary level accounted for 71.4% while higher secondary and graduate level farmers were only 3.5% in 2003, which indicates that the involvement of highly educated people in vegetable cultivation was at a minimum. Alam (2002) reported that illiterate and primary level farmers were about 68% in his survey areas in different districts of Bangladesh in 2000. It is worth mentioning that three graduate level farmers were found in Sreemontapur and Tulatuli villages in the survey district of Comilla, famous for production of exportable vegetables.

Table 2 of Appendix I and Figure 4.1 reveal the distribution of producers based on education by districts. About 85% of the respondents in Comilla are at the illiterate and primary levels of education followed by Narshingdi farmers with a figure of 64%. On the other hand, the farmers in the secondary and above group range from 36 to 38% in the Rangpur, Tangail and Narshingdi but number only 15% in Comilla in this group. Moreover, Table 3 of Appendix I reveals the distribution of the respondents in three groups of educational level by survey districts. A Chi-square test was performed which indicates that the relationship between education and the survey districts are significant at less than the 5% level.

The extent to which these proportions simply mirror the educational status of all farmers in those areas is not known.

4.2.2 Occupational status of the sample producers

In the survey areas, categorised according to occupation, about 94% of respondents have agriculture as their only occupation and the rest are engaged in business and service, with agriculture as their secondary source of income (Appendix 1, Table 4). On a district basis the table shows that 100% of the respondents in the district of Rangpur and Tangail are fully engaged in agriculture. About 93% in Sreemontopur and 97% in Tulatuli in Comilla while 76% in Khorokmora and 91% in Bammondi (south) in Narshingdi district, of the respondents are engaged in agriculture. Alam (2002) found 78.4% of the respondents had agriculture as their main occupation while 11.3% and 5% had business and service respectively as their main occupation in 2000 in Comilla and Rangpur. Thus the respondents are predominantly dependent on agriculture.

4.2.3 Household size of the respondents in the survey district

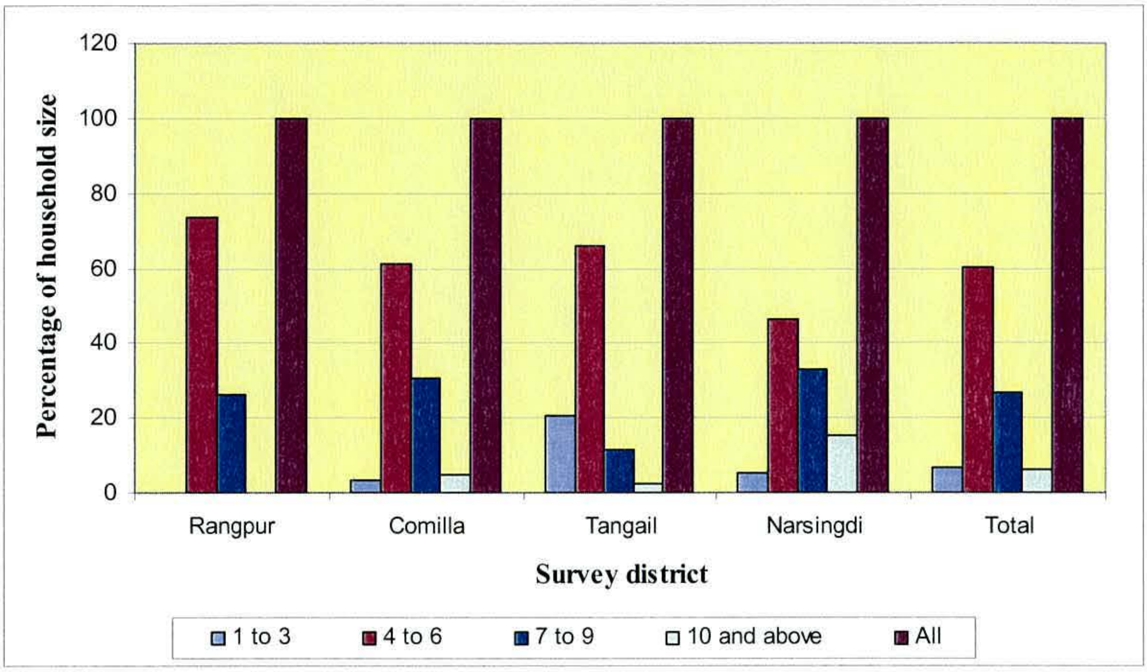


Figure 4.2 House hold size by survey district

The bigger sized families with low income can afford less money for cultivation, particularly with vegetables that involve greater costs. Figure 4.2 shows the percentages by family size in each district where the highest percentage of families fell in the 4-6 groups in each of the districts. The families in the group '10 and above' are about 18% in Narshingdi district which is the highest figure for this group among the survey districts. Moreover, Table 5 of Appendix 1 shows the family size range of the respondents by district where 60.3% of the families fell in the 4-6 member family size and 26.8 in the 7-10 member size and only 6.7% in the 1-3 member family size. The respondents of Rangpur district had no 1-3 sized family while 73.5% had their family in the 4-6 member family size group and 26.5% were in the 6-9 size group, indicating larger families in this district. Furthermore, 77% to 100% of the respondents in these four survey districts had family size in the size group between 4-9. Tangail had 20% families less than four people, Narshingdi had only 47% in the 4-6 group whereas others had at least 61% but it also had 16% above nine people in the family. The overall mean family size is 6.1 and those for the four districts range from 5 to 7.2. The mean family size is the highest in Narshingdi and smallest in Tangail district. Meanwhile, the values of the standard deviations also reveal a wide variation of the family sizes from their mean value in each of the districts. The ANOVA test indicates the variation of the family sizes from the mean value by survey district is significant at the 1% level (Appendix I, Table 5).

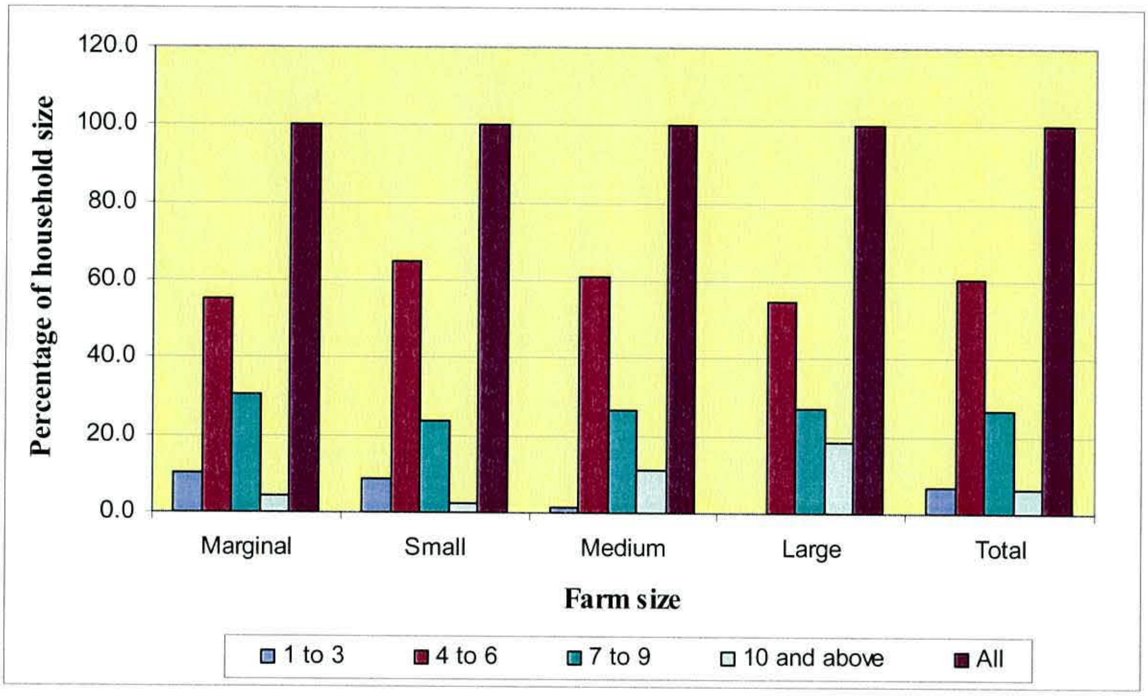


Figure 4.3 Household size by farmer category

Figure 3 shows the percentage of family sizes of the respondents by farmer category[1] where the 4-6 sized families are the highest, followed by the 7-9 sized in all the categories. Table 6 of Appendix 1 shows family size by farm size with 65% of the small farmers having families in the 4-6 member size group while 23.8% were in the 7-9 size group. The table further shows that a figure of 82% to 88% of the respondents had their family size in the range of 4-9 members (Appendix 1, Table 5). It is worth mentioning that the families with 7 or more members are about 45% for large, 38% for medium, 26% for small and 35% for the marginal farmers, indicating the existence of larger families in all the farmer categories. The mean family sizes for the four categories range from 5.5 to 7.2. The one-way ANOVA test shows the variation of the family sizes from the mean value by farm size is significant at the 1% level (Appendix I, Table 6).

Note: (1) Farmer category: marginal = .05-.49 acre, small = 0.50-1.49 acre, medium = 1.50- 4.99 acre and large = 5.00 acre – above.

Family sizes tend to be to be larger in Narshingdi and on larger farms, while Tangail and smaller farms tend to smaller families. Family size is likely to be important for vegetable cultivation due its high labour requirements. Family labour also has a supervisory role in vegetable production and post-harvest protocols which is an extra advantage.

4.3 Land holding and tenure pattern of the respondents in the survey district

4.3.1 Land holding and tenure pattern by district

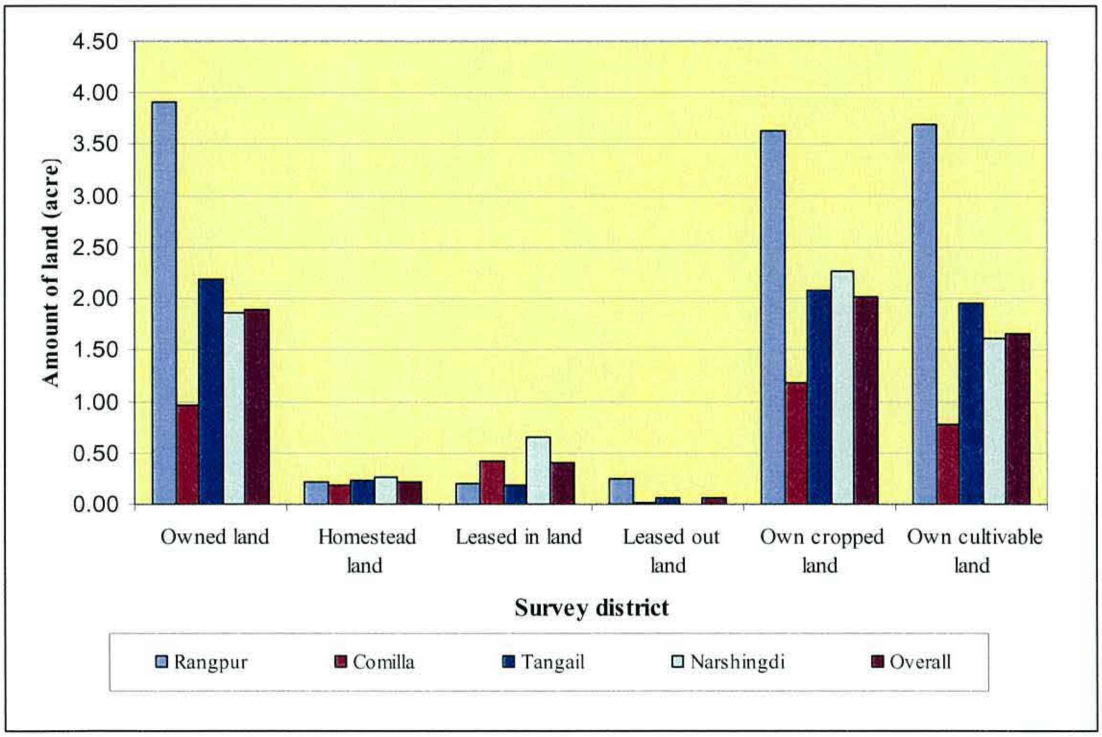


Figure 4.4 Land holding and tenure pattern by survey district

Land ownership of producers is the prime issue, as land availability and cost will influence extent and cost of production of any crops. There is a situation of decreasing availability of cultivable land due to increasing inhabitation, industrialization and other developments.

The land holding pattern of the respondents was analyzed by district and also by farm size. Own cultivable land is owned land minus the homestead land while the total cropped land is own cultivable land minus leased out and plus leased in land. Appendix

1, Table 7 and Figure 4.4 show the land holding and tenure pattern of the respondents by district where the average owned land is the highest in Rangpur and lowest in Comilla, the same scenario exists in case of total cropped and own cultivable land. The leased in land is the highest in Narshingdi followed by Comilla whilst leased out land is zero in Narshingdi and low in Comilla, indicating land scarcity in these two districts. The average own cultivable land is less than total cropped land that tells us that leasing in land is greater than leasing out which also indicates scarcity of own cultivable land of the respondents. The ANOVA test indicates that the variation of total cropped land among the survey districts is significant at the 1% level.

4.3.2 Land holding and tenure pattern by farm size

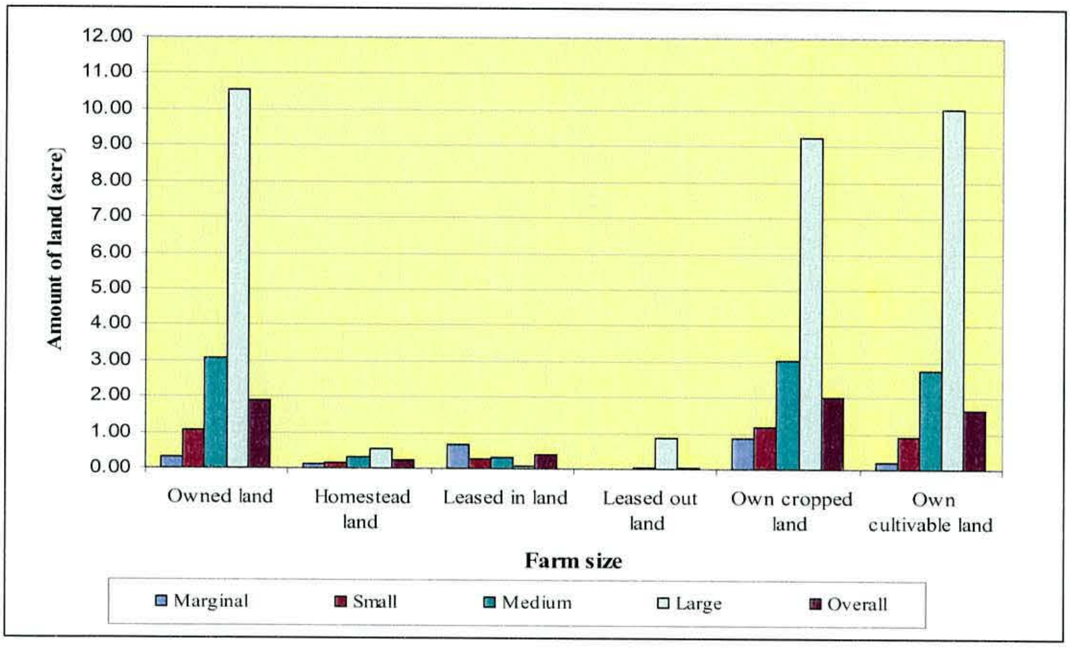


Figure 4.5 Land holding and tenure pattern by farmer category

The land holding pattern of the respondents is also analysed by farm size. The marginal producer had the smallest areas of homestead and total cultivable land while the large producer had the largest areas, but on the other hand, the marginal producer leased in at the highest rate while the large producer did so at the lowest rate. The large producer leased out a relatively large area, whilst all other groups leased out very little (Appendix 1, Table 8 and Figure 4.5).

Note that leased in land for the marginal producer was much higher than own cultivable land, which was not the case in the other three categories of respondents. This indicates that the cost of renting land is likely to reduce the net profit for marginal producers in comparison with the other categories. The total cropped land for marginal and small producers was small which emphasizes the importance of an intensive and high value crop like vegetables for their livelihood.

4.3.3 Categorisation of the respondents by survey area and farm size

The respondents in the four survey areas are categorised by district as well as by farm size. Table 4.1 shows the distribution of four categories of the sample farmers in the eight survey villages. There are no large sample farmers in the village of Khorokmora, Brammondi (South) and Tulatuli while there are no marginal respondents in Avirampur. The table indicates the small proportion of large farmers in the survey areas which is only 5%, whilst 67% of the respondents are in the marginal and small categories. The highest percentages of medium farmers are in the villages of Durgamati, Avirampur and Khorokmora. On the other hand, respondents in Comilla district and to a lesser extent Narshingdi, are mostly in the marginal and small category.

Table 4.1 Categorisation of the respondents by survey district and farm size

Name of the district	Name of the village	Farmers category				
		Marginal	Small	Medium	Large	All
Rangpur	Durgamati	1 (6)	3 (18)	12 (71)	1 (6)	17 (100)
	Avirampur	-	4 (24)	9 (53)	4 (24)	17 (100)
Comilla	Sreemontopur	31 (56)	17 (31)	6 (11)	1 (2)	55 (100)
	Tulatuli	15 (45)	14 (42)	4 (12)	-	33 (100)
Tangail	Kuragacha	5 (18)	15 (54)	6 (21)	2 (7)	28 (100)
	Lokdao	1 (6)	10 (63)	2 (13)	3 (19)	16 (100)
Narshingdi	Khorokmora	9 (36)	1 (4)	15 (60)	-	25 (100)
	Brammondi (S)	7 (21)	16 (48)	10 (30)	-	33 (100)
Overall	Overall	69 (31)	80 (36)	64 (29)	11 (5)	224 (100)

Figures in parentheses indicate the percentage

4.3.4 Categorisation of the respondents by sample vegetable and farm size

Table 4.2 shows the number of vegetable producers interviewed in the survey areas categorised according to their cultivable land. The table indicates the greater involvement of marginal and small farmers in the sample vegetable production than medium farmers. For all crops more than 62% of respondents were in the marginal and small categories with nearly one third in the former. French bean had the largest proportion of these smaller sizes. Large farmers do not seem to be heavily involved in sample vegetable production irrespective of district, although the low figure might simply reflect the relatively low numbers of such farmers. Table 8 of Appendix I reveals the distribution of the respondents cultivating the sample vegetables by farm size. The Chi-square test indicates the relationship between sample vegetables and farmer categories which is not significant. It thus indicates that farm size had no significant effect on cultivation of the sample vegetables (Appendix I, Table 9).

Table 4.2 Categorisation of respondents by sample vegetables considering farm size

Name of the sample vegetable	Farmers category				All
	Marginal	Small	Medium	Large	
French bean	20 (32)	26 (42)	15 (24)	1 (2)	62 (100)
yard long bean	23 (30)	26 (33)	24 (31)	5 (6)	78 (100)
bitter gourd	26 (31)	28 (33)	25 (30)	5 (6)	84 (100)
Total	69 (31)	80 (36)	64 (29)	11 (5)	224 (100)

Figures in the parentheses indicate the percentage

4.4 Labour involvement in major crop production in the survey areas

An attempt was made to determine the major cropwise monthly requirements per acre for different activities through group meetings of farmers in the survey villages under each Upazilla. It is presented in both quantity and percentage terms. The intensity of labour involvement with the sample vegetables can be gauged from such information.

4.4.1 Major cropwise labour requirements in Mithapukur, Rangpur

The major crops in the survey villages in the Mithapukur subdistrict of Rangpur district were identified in a group meeting of villagers, as rice, potato, palwal, brinjal, blackgram, bitter gourd, Indian spinach, cucumber, sweet gourd and banana.
Table 10 of Appendix I reveals the major cropwise labour requirement per acre in quantity terms which indicates that vegetables require most of the labours.

Figure 4.6 shows the labour requirements expressed in percentage terms, for bitter gourd is the highest in the months of January, February and June with 25% to 28% of total monthly labour requirements for that crop. Labour involvement for bitter gourd ranges between 15% to 28% over several months, competing with a number of crops, reflecting competition for labour at certain times. The labour requirement for rice peaks with a figure of 50% in April and for Indian spinach a level of 45% is needed in May, but they do not need labour throughout the year so they are not competing strongly with bitter gourd. French bean and yard long bean are minor vegetables in this area so will not take up a great deal of labour.

4.4.2 Major cropwise labour requirement in Chandina, Comilla

Appendix I, Table 11 reveals the monthwise labour requirements in Chandina, where all crops are vegetables except rice. It indicates that labour requirements in this upazilla are much higher than Mithapukur, and also that is the most labour intensive area among the survey upazillas.

Figure 4.7 shows the monthly major cropwise labour requirements in percentage terms in two survey villages in Comilla where the three sample vegetables are being produced. Yard long bean needed the most labour in the months of March, April, June and July ranging from 28% to 38% competing with other crops as well. Labour for bitter gourd was the highest in the months of May, September, October and November ranging from 37% to 41% of total labour requirements followed by French bean. French bean required the highest percentage of labour in the month of December and January ranging from 22% to 24%.

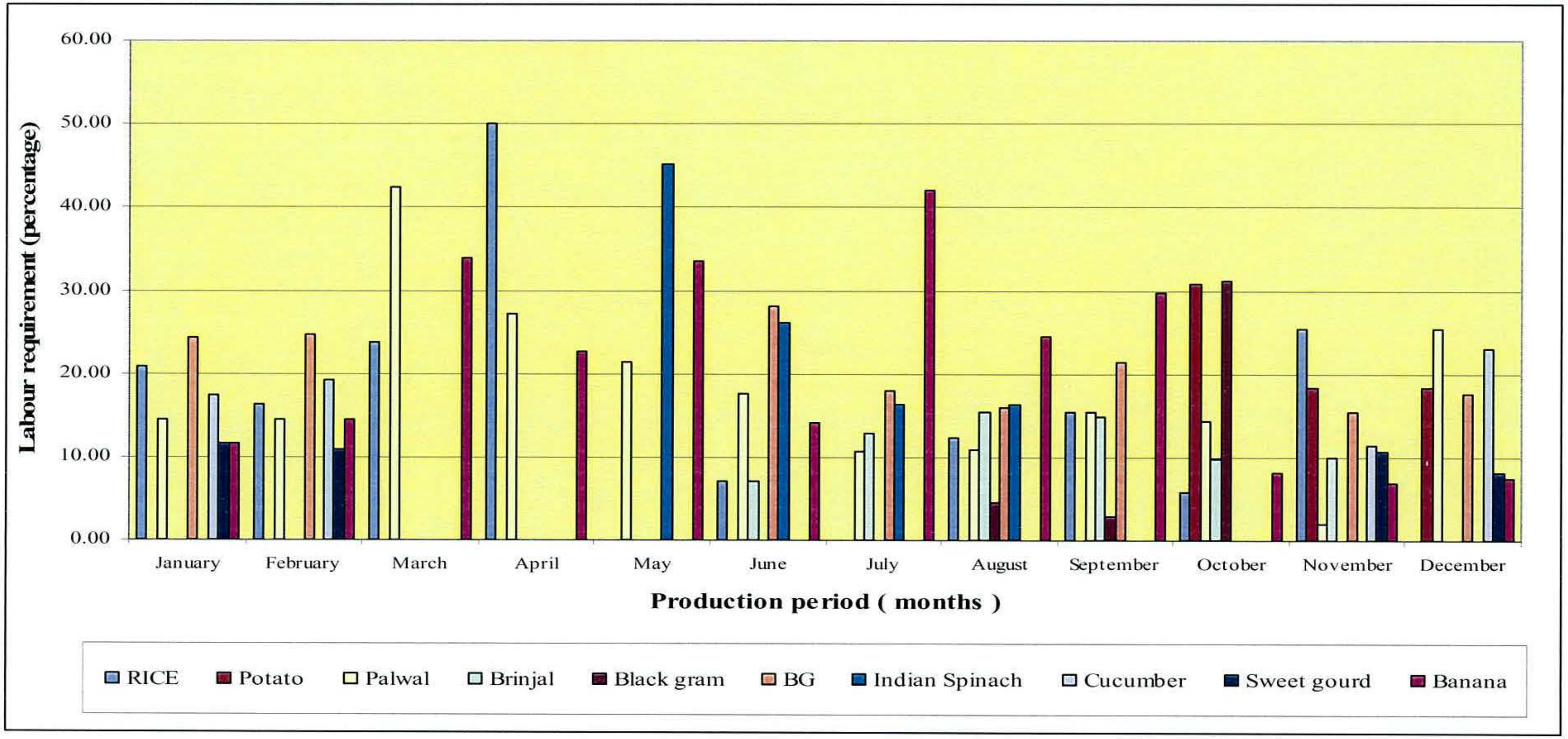


Figure 4.6 Major cropwise labour requirements in Mithapukur (Rangpur)

Note: Labour requirement figure based on farmers' group survey

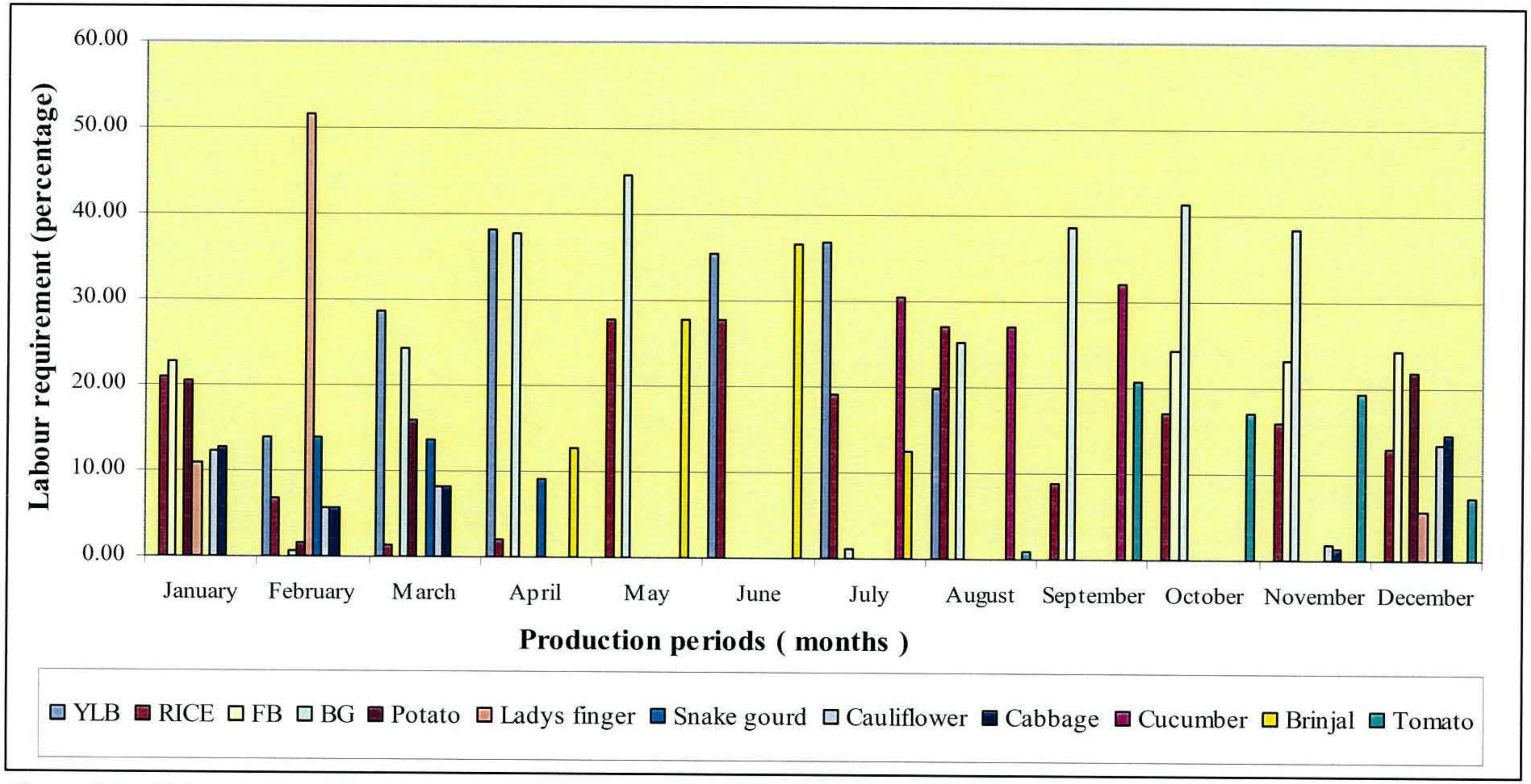


Figure 4.7 Major cropwise labour requirements in Chandina (Comilla)

Note: Labour requirement figure based on farmers' group survey

4.4.3 Major cropwise labour requirements in Modhupur, Tangail

Table 12 of Appendix I indicates the quantity of monthly labour use per acre; vegetables are again majority crops competing with rice and wheat. The overall labour use in this upazilla is comparatively lower than Mithapukur and Chandina. Figure 4.8 illustrates the labour requirements in the survey areas of Tangail district where rice needed the highest percentage of labour, ranging from 20% to 91%. French bean required the highest amount of labour in the months of November, December and January ranging from 28% to 72% but with less competition in November and December with other crops. On the other hand, yard long bean required the highest percentage of labour in the month of March with a figure of 51%, competing with many crops. Bitter gourd is not a major crop in this district.

4.4.4 Major cropwise labour requirements in Shibpur, Narshingdi

Table 13 of Appendix I reveals the monthly labour use where all crops are vegetables except rice. Labour use in this upazilla is comparatively higher than Modhupur particularly, in November, December and January. Figure 4.9 shows the intensity of labour requirements for vegetables in the survey areas of Narshingdi district covering twelve major crops, including eleven vegetables, with only rice as the cereal. Teastle gourd required 100% of labour in the month of June whereas cucumber needed the highest percentage of labour in the months of April and May with figures of 48% and 83% respectively. Yard long bean had the highest percentage of labour in the month of January with a figure of 43%.

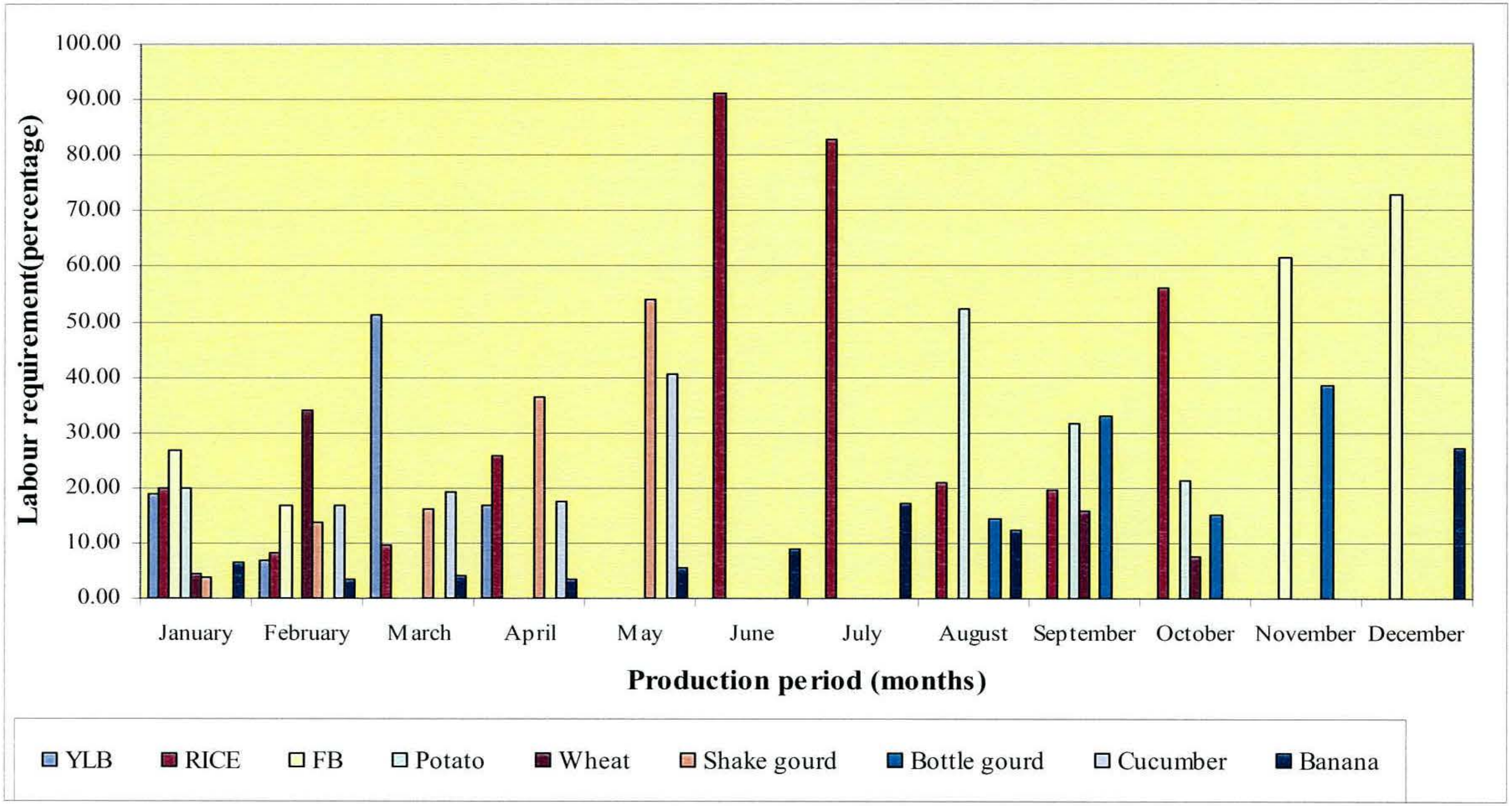


Figure 4.8 Major crop wise labour requirements in Modhupur (Tangail)

Note: Labour requirement figure based on farmers' group survey

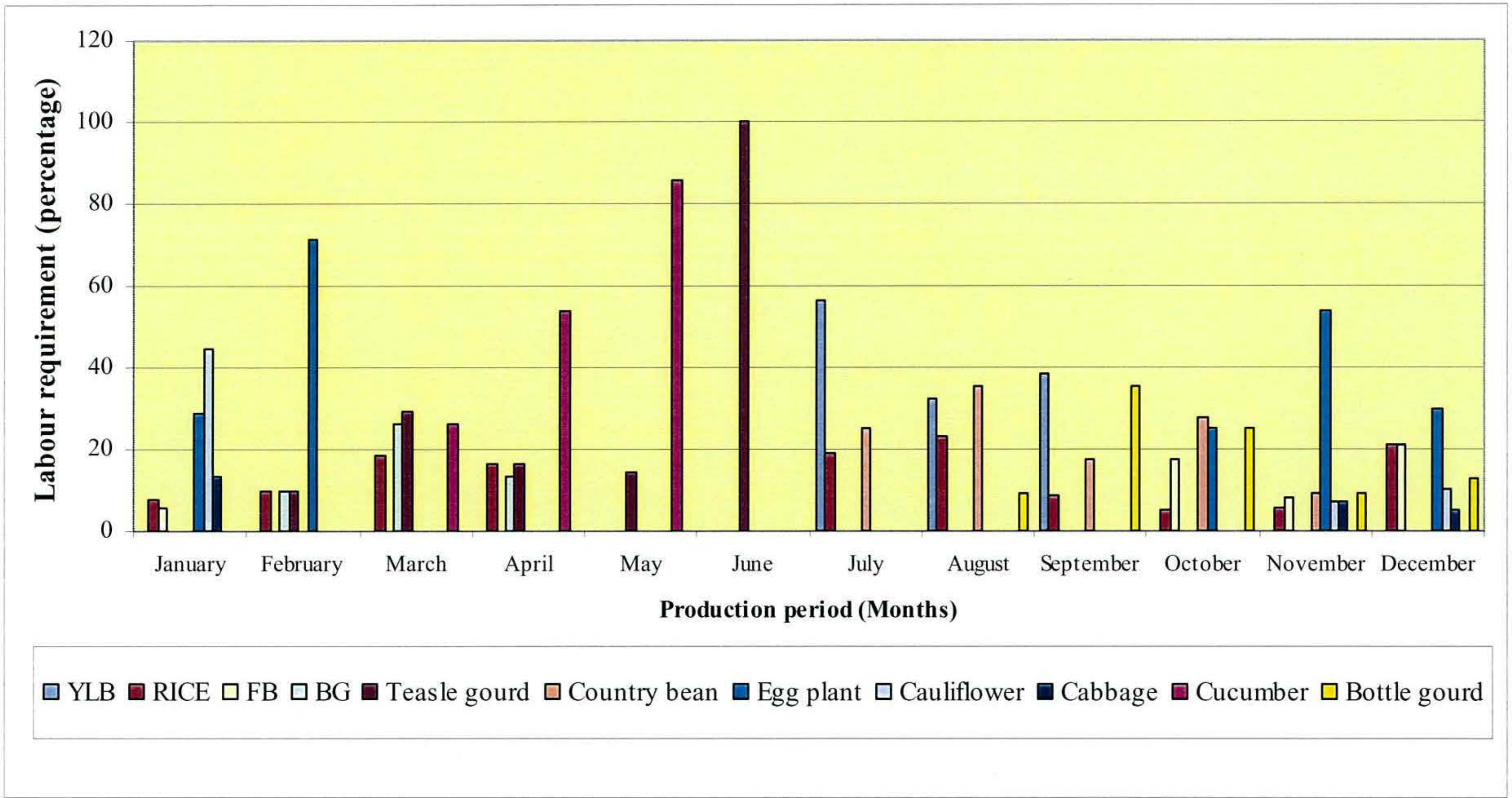


Figure 4.9 Major crop wise labour requirements in Shibpur (Narshingdi)
Note: Labour requirement figure based on farmers' group survey

4.5 Distribution of agricultural inputs and credits

Under the changed scenario of a more free market economy, procurement and distribution of agricultural inputs as well as distribution of agricultural credits became a concern not only to the government, but also to the private sector and non-government organizations in Bangladesh. Distribution of agricultural inputs has now shifted largely to the private sector, leaving the regulatory functions with government institutions. The Ministry of Agriculture (1999) noted in its National Agriculture Policy that agricultural credit is provided mainly by the banks but not fulfilling the total requirement, and is not easily available to the farmers. The Ministry of Agriculture (2002) reported that it is constantly monitoring and evaluating the status of production, import, distribution, stock levels, and retail price of various fertilizers and supervising private fertilizer distribution to make cheaper fertilizer available to the farmers on time.

4.5.1 Procurement and distribution of agricultural inputs

The Department of Agricultural Extension (DAE), previously the Directorate of Agriculture, the Bangladesh Agricultural Development Corporation (BADC) and the then East Pakistan Development Corporation (EPDAC) as government organisations all played a dominant role in the scientific development of agriculture, particularly in the procurement and distribution of agricultural inputs amongst farmers. BADC, being a public organisation, is now running agricultural inputs trading on a small scale while the private sector, along with NGO's, is running a vast portion of this business.

4.5.1.1 Public sector procurement and distribution of agricultural inputs

The Directorate of Agriculture (presently the Department of Agricultural Extension) was responsible for procurement and distribution of chemical fertilizer throughout the country, in 1962 this responsibility was shifted to the East Pakistan Agricultural Development Corporation (EPADC) (BADC, 1990-91). The Directorate of Agriculture was then only responsible for motivation of the farmers and extension services covering, *inter alia*, the application of fertilizer and irrigation, and crop cultivation practices. Furthermore, the Bangladesh Agricultural Development Corporation (BADC) (then EPDAC) was responsible for procurement and distribution of agricultural inputs, but from the sixties it also provided irrigation facilities to farmers to make the " Green Revolution" a success and to feed the people of Bangladesh (BADC, 1972-73).

BADC reported that application of chemical fertilizer was first introduced in Bangladesh in early 1951 to increase crop production (BADC, 1984-85). The consumption of fertilizer in its introductory stage in 1952-53 was only 8,571 MT this rose to 719,053 MT in 1978 (BADC, 1991-92). It procured fertilizer from local fertilizer plants and abroad whilst pesticide, sprayer machines, low lift pumps, and well equipment were brought from abroad. Fertilizers were distributed to the farmers through licensed private retailers at the village level on a commission basis and later through the Thana/Union Krishi Unnayan Committee. The sale price of fertilizer was subsidized by the government in order to encourage better crop yields and to improve profitability. Since privatisation of agricultural inputs distribution in the late eighties, the Department of Agricultural Extension (DAE) estimates the annual demand for different fertilizers and the Ministry of Agriculture (MOA) reviews and evaluates domestic production and requirement for import. Based on this evaluation, the Bangladesh Chemical Industries Corporation (BCIC), in charge of domestic fertilizer production, also imports fertilizer. The private sector now also imports various fertilizers (Ministry of Agriculture, 2002).

With the power and functions vested by the Seed Ordinance, 1977, the National Seed Board (NSB), under the Ministry of Agriculture, serves for the seed industry from variety release to seed marketing to the farmers. Provision for inspection, analysis and legal action is envisaged in the Ordinance for any agency involved in importation, production and marketing of seed in order to ensure its quality (The Seeds Ordinance, 1977). Breeder seed is developed by the National Agricultural Research Institutes (NARI) while foundation and certified seed is developed by BADC, the private sector and the NGO's. Varieties are released by the technical committee of NSB and notified by the NSB. Importation, multiplication, production and marketing of all kinds of seeds by the private sector are also governed by the NSB (Ministry of Agriculture, 1993). Within the stipulated framework in the Seed Ordinance and the National Seed Policy, NSB, NARI, DAE, the Seed Certification Agency, BADC, the private sector and

NGO's are all involved in the coordinated procurement, development and distribution of quality seeds to the farmers.

Quality seed, as a vital input for increased and profitable production of any crop, is addressed in the National Seed Policy. Being a pioneer public organization, BADC has a key role in the production and distribution of foundation and certified seed. This corporation is responsible for production, and processing of quality seeds and making them available to the farmers as well (BADC, 1997-98). Its role in the field of production, processing, and preservation of seed of different crops like paddy, vegetables, wheat, and maize, is delineated in the Seed Policy and also its annual report of 1999-2000. Breeders' seeds released by agricultural research institutes are handed over to BADC for the production of foundation and certified seeds. It produces foundation seed in its seed multiplication farm and distributes among the contract farmers for production of certified seeds (BADC, 1999-2000). However, only a small portion of quality seed is supplied by BADC while the rest is managed by the private sector according to the guidelines of the National Seed Policy (Ministry of Agriculture, 1999).

The Pesticides Ordinance, 1971, addresses the issues of price, registration and quality of pesticides whether manufactured locally or imported, and provides guidance on trading of this input. The government has the responsibility of appointing inspectors and analysts to test the quality of pesticides (The Pesticides Ordinance, 1971). The Ministry of Agriculture, being the lead ministry, applies the laws, regulations and policies in connection with crop production (including vegetables), while the Ministry of Commerce applies the regulatory instruments related to domestic or export marketing of locally produced crops like vegetables.

The respondents reported some problems regarding price and distribution of inputs which will be discussed later.

4.5.1.2 Procurement and distribution of agricultural inputs by private sector

Due to a change in the policies of the government regarding procurement and distribution of fertilizer and other inputs, the private sector started to import fertilizers from 1991.The government continued to fix the sale price of fertilizers at different distribution points for the private sector. According to the privatisation policy of the government, BADC was no more linked with the procurement, and distribution of fertilizer, and the private sector started procurement of most of the fertilizers from the local factories and from abroad and carried out distribution among the farmers through their own networks from the early nineties (BADC, 1991-92).

Within the National Seed Policy, non-government organizations (NGO) and the private sector are heavily involved in the importation, production and distribution of seed amongst the farmers. BADC also provides technical assistance to the private seed companies to produce, preserve and store quality seed. It also procures certified seeds from the contract growers and maintains buffer stocks to meet any emergencies. It is also implementing a vegetable seeds production programme, assisting private entrepreneurs to produce quality vegetable seed and distributing these among the farmers (BADC, 1999-2000).

The NGO's, such as BRAC, in collaboration with NARI, are involved in the production of foundation and certified seed of different crops (including vegetables) and marketing among farmers (BRAC, 2000). The BADC, DAE and the private sector were meeting 36% of the total requirement of vegetable seed in the early nineties; this increased 25% and 119% over the years 1995-96 and 1996-97 respectively (Hussain *et al.,* 1995, BBS, 2000). The public, and private sectors and NGO's are involved in a collaborative manner in this sector, but Bangladesh faces a scarcity in quality seed that is influencing production.

4.5.2 Distribution of agricultural credit

Agricultural credit is another important factor affecting crop production, usually being disbursed by the banks, public sector organizations and some NGO's, including the Grameen Bank. Vegetable production cost was found to be higher than other crops, but unfortunately the producers lack institutional credit (Hussain *et al*, 1995).

4.5.2.1 Distribution of agricultural credit by the public sector

The National Agriculture Policy emphasized the agricultural credit issue through the formation of a number of monitoring and evaluation committees for credit disbursement and recovery at national, district, sub-district and union level. The commercial banks, the Grameen Bank, and some NGOs are providing credit to some farmers, but this is not enough to meet their requirements. The 'Agricultural Credit Foundation' is another approach proposed to make credit available to farmers, particularly the landless, marginal and small farmers (Ministry of Agriculture, 1999).

The Bangladesh Krishi Bank (BKB) is the leading bank disbursing agricultural credit followed by Rajshahi Krishi Unnayan Bank (RAKUB). Total disbursement of agricultural credit in 2003 was 32.78 billion TK by the nationalised commercial banks (NCBs), BKB and RAKUB, the Bangladesh Rural Development Board (BRDB) and the Bangladesh Samabay Bank Ltd (BSBL). The NCBs, BKB, RAKUB, disbursed 6.80, 16.69, 5.75 billions TK respectively in 2003 as agricultural credit. But the figures do not stipulate which crop. According to the Bangladesh Bank, the commercial banks (Sonali, Janata, and Agrani Bank), mainly deal with industry assets. There are four nationalized (government), thirty private and ten foreign commercial banks now operating in Bangladesh (Bangladesh Bank, 2003).

Agricultural credit disbursement by BKB to the traders for agribusiness changed at the rates of -15%, 18% and 40% for the years 1991-92, 1992-93 and 1993-94 respectively and the size of loan ranged from 0.83 to 1.180 million TK per year. This credit was mostly disbursed to the traders who were not linked with vegetable marketing. The Bangladesh Bank disbursed from TK 6833 to 13207 per acre for various vegetable production activities and TK 9412 and TK 9436 per acre for country bean (smaller sized bean) and bitter gourd respectively in the early nineties through different banks although this did not cover the cash cost of production. Disbursement by BKB for vegetable crop activities was minimal, ranging from 0.01 to 0.14% of total crop loans. They also recommended the establishment of a corporation to address the issues of vegetable production and marketing (Hussain *et al*, 1995).

4.5.2.2 Distribution of agricultural credit by private sector

Micro-credit operations run by the Grameen Bank and some NGOs in Bangladesh have been successful in the context of poverty alleviation, particularly in the rural areas. The Grameen Bank and micro-credit NGOs conduct micro-credit programmes to provide small sized loans to the poorest in the rural areas for income generating, self employment initiatives. The total disbursement by Grameen Bank and three large NGOs was TK 62.16 billion which was about double that of the public sector, yet their recovery rate was much higher than that of the public sector. Although this micro-credit is only partially agricultural credit, it does encourage crop production in Bangladesh. Shifting of subsistence farming to commercial farming, including horticultural production for exports, has become an interest area for financing by the commercial banks. The Bangladesh Bank recommended that micro-credit NGOs need to be allowed to accept deposits from individuals or institutions other than their own member borrowers, although this would require an appropriate regulatory structure (Bangladesh Bank, 2003).

Although, the public and private banks, and other financial institutions are providing agricultural credit, in practice little is available to farmers. About 46% of the respondents borrowed agricultural credit from different banks and financial institutions, NGO's and 34% among them borrowed from national banks. But 75% of the borrowing respondents obtained credit from the nationalised bank (See Appendix I. Table 14). This further indicates that the majority of vegetable producers face problems obtaining loans for cultivation. They identified financial insolvency as one of their major problems (see Table 4.33, p-176).

4.6 Economics of production of the sample vegetables

Economic analysis is performed through financial as well as statistical and production function analysis in this study.

4.6.1 Financial analysis of the production of the sample vegetables

Financial analysis is carried out to determine the profitability of the sample vegetables, French bean, yard long bean and bitter gourd. Local units are used in most of the reports in Bangladesh, so the present study also used them. Costs and returns are expressed in TK whilst the area is in acre and output in metric tonnes and kilogrammes. The financial analysis is conducted on a full cost and cash cost basis. The cost items incurred by the farmers in cash are termed as cash costs while the cost incorporating the cash costs, the opportunity costs of family labour, rental value of own land and other fixed costs, is termed full cost. The terms purchased seed and free seed are used in the table, where purchased seed means that the respondents bought seeds for cultivation but free seed implies that the Hortex Foundation provided French bean seeds to the respondents through DAE or NGO free of charge.

The financial analysis is carried out for each vegetable in total as well as by farm size, at an aggregate and also at survey district level. The term aggregate means the average figure for four survey districts in this study. The Benefit Cost Ratio (BCR) is one economic indicator by which the efficiency of investment is determined in production. The economic performance of exportable vegetables is determined through measuring the net return and BCR on a cash and full cost basis. Costs are divided into two groups namely, fixed costs and variable costs. Fixed costs do not vary with the small changes in output, and include taxes, rent and interest on capital for resources which are fixed over the specified time period. Variable costs are dependent upon output in the production period. Taxes should be included if they are paid. Total costs thus include fixed costs and variable costs (Heady, 1952). Although the discounted BCR for a project may includes economic, social, financial costs and benefits accruing to project over time (Bannock *et al*, 2003), the BCR in this study is computed simply based on financial costs and return over one time period.

4.6.2 Economic performance of French bean cultivation

Both traditional and non-traditional vegetables are being produced commercially and increasing day by day, But homestead gardening is also run under the supervision of a number of government and non-government organizations. It stated the organisation wise activities for homestead gardening throughout the country. Such gardening meets the home consumption and also provides extra income by selling surplus vegetables (Talukder *et al*, 1997). This study focuses on traditional and non-traditional vegetables with French bean being the latter. The profitability of each of the three vegetables is considered in turn.

4.6.2.1 Revenue from French bean at aggregate level

The following table shows cost and return figures on a farm size basis for French bean production at the aggregate level.

Table 4.3 Aggregate cost - return analysis for French bean (TK per acre)

Description of Items	Marginal	Small	Medium	Large	All
Yield (MT per acre)	4.49	4.53	3.61	3	4.27
Price (TK per MT)	10575	10308	11500	10000	10677
Gross Income	47482	46695	41515	30000	45591
Full Cost	32535	39067	34456	19976	37484
Full Cost (per MT)	7243	8626	9554	6659	8780
Cash Cost	22940	22132	20137	7747	21790
Cash Cost (per MT)	5107	4887	5584	2582	5104
Net income (Full cost)	14947	7628	7059	10024	8107
	(31.48)	(16.34)	(17.00)	(33.41)	(17.78)
Net income (Cash cost)	24542	24563	21378	22253	23801
	(51.69)	(52.60)	(51.49)	(74.18)	(52.21)
Benefit Cost Ratio (BCR) (Full cost)	1.46	1.20	1.20	1.50	1.22
Benefit Cost Ratio (BCR) (Cash cost)	2.07	2.11	2.06	3.87	2.09

Figures in parentheses indicate the percentage of net income against gross income

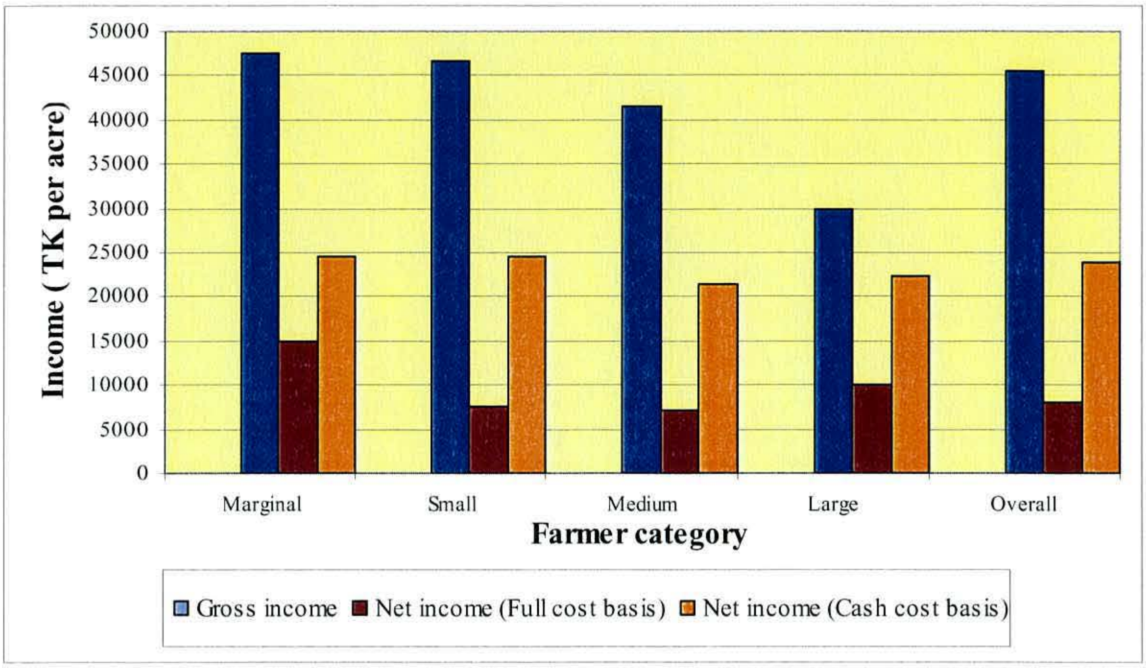


Figure 4.10 Income of French bean producers by farm size (TK per acre)

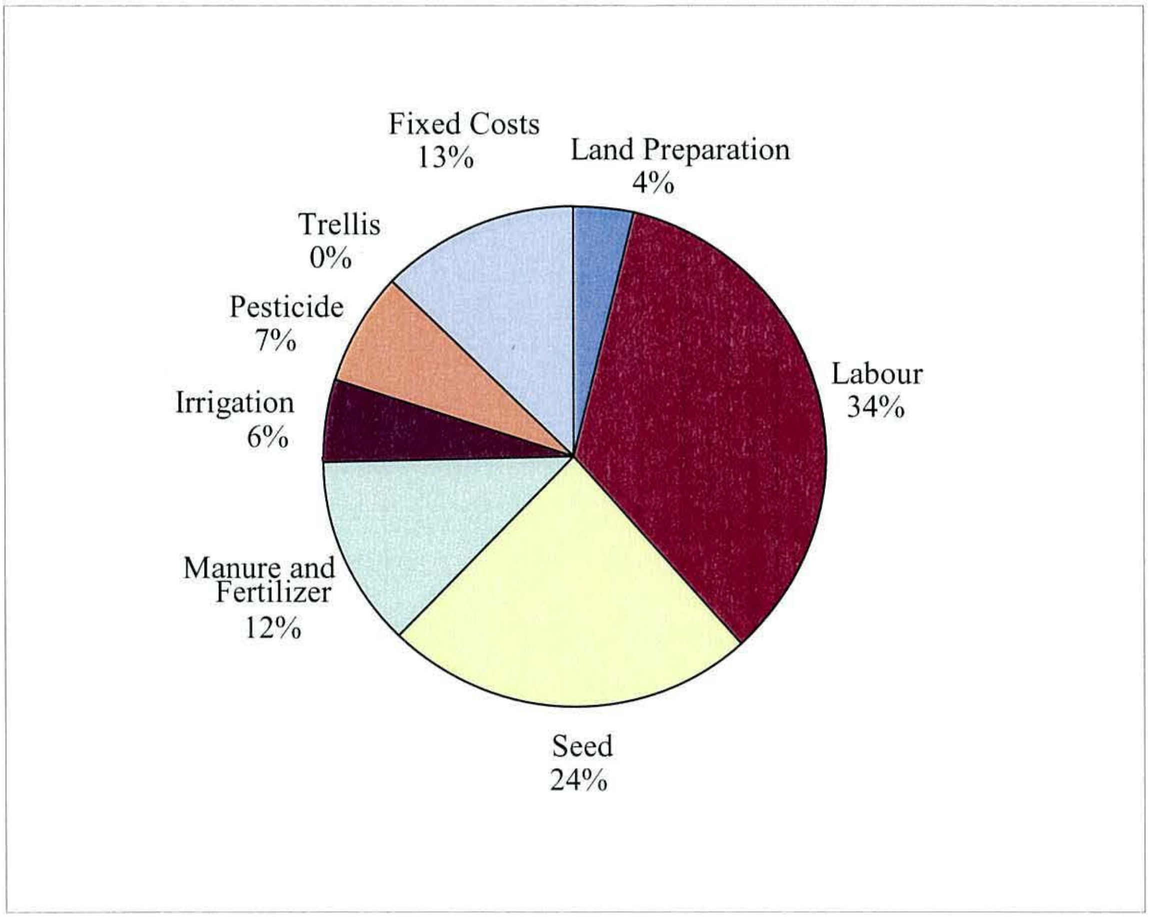


Figure 4 .11 Cost shares of French bean production

Table 4.3 shows the detailed picture of cost and income in French bean cultivation at an aggregate level, where the large farmers have the highest benefit-cost ratio on a full cost basis followed by the marginal farmers, with the other two groups well below. On a cash cost basis BCR, large farmers are again ranked first, with the other three groups well below. Alam (2002) found BCR figures of 2.41, 1.95 and 2.87 for small, medium and large farmers respectively on a full cost basis which roughly corroborates the findings of this study. He reported figures of TK 31119, 30722 and 22933 on a full cost per acre for small, medium and large farmers respectively in 2000, a similar pattern to that found in the current study. Both studies tell us that the cost of production for small farmers is the highest and for large farmers is the lowest, which might be due to higher labour costs at the small farmers level, but also appears to be due to some zero costs in the larger farmer group (Appendix I, Table 15). It is worth mentioning that large farmers did not apply pesticide for organic farming, Hortex Foundation provided them seed without costs, depreciation costs of country plough used for land preparation accounted as fixed costs, which result zero costs for such items in the case of cash cost

Although the yields of French bean in the case of large farmers and, to a lesser extent, for medium farmers are less than of other two categories of farmers, and prices are slightly lower, income is higher in the case of large farmers because of lower production costs for full costs, but not when viewed on a cash cost basis. Table 15 of Appendix 1 reveals that the large farmers did not incur charges for land preparation, seed and pesticide, and relatively low costs for hired labour as mentioned above. The appendix shows higher per acre production costs in the case of marginal and small farmers than medium and large farmers at a full and cash cost which was also found by Alam (2002). This particularly relates to land preparation, irrigation and pesticide costs. However, although marginal and small farmers employed more labour than large farmers, they used considerably less than medium farmers.

The Table 15 of Appendix 1 reveals that labour cost is the highest for all categories of farmers, followed by seed, manure and fertilizer and rental value of land. In fact, labour constitutes more than 33% of the total, full cost for all categories of respondents in this study, indicating the labour employment opportunities prevailing in vegetable production.

4.6.2.2 Revenue from French bean at district level

The cost-return status at the survey district levels has also been computed.

Table 4.4 Financial analysis for French bean in Rangpur (TK per acre)

Description of Items	Farmers Category				
	Marginal	Small	Medium	Large	All
Yield (MT)	-	2.83	4.82	-	4.16
Price (per MT)	-	4500	4750	-	4667
Gross Income	-	12750	22868	-	19495
Full Cost	-	23676	23329	-	23445
Full Cost(per MT)	-	8356	4837	-	5636
Cash Cost	-	12696	12171	-	12346
Cash Cost (per MT)	-	4481	2523	-	2968
Net Income (Full Cost)	-	-10926 (-85.69)	-461 (-2.02)	-	-3949 (-20.26)
Net Income (Cash Cost)	-	54 (0.42)	10697 (46.78)	-	7149 (36.67)
BCR (Full Cost)	-	0.54	0.98	-	0.83
BCR (Cash Cost)	-	1.00	1.88	-	1.58

Figures in parentheses indicate the percentage of net income against gross income

Table 4.4 shows the cost-return position in Rangpur survey area where there were no marginal or large respondents. The net income for both small and medium farmers is negative on a full cost basis but positive on cash cost basis, but barely so for the former. The BCR for the medium category is 1.88 at little higher than the aggregate figure and only 1.00 for small farmers on a cash cost basis. This is partly due to yield variation, but the price is less than half the average, although the costs are much lower too. The price at the aggregate level being more than double that of Rangpur indicates a marketing problem in this district due to its long distance from capital city in comparision to the other survey areas. The lacking of direct linkage between producer and exporter might be another reason for such reduced farmgate price.

The labour cost constitutes the highest cost item for both categories where a figure of 72% of the full cost occurs for small farmers (see Appendix I, Table 16).

Table 4.5 Financial analysis for French bean in Comilla (TK per acre)

Description of Items	Farmers	Category			
	Marginal	Small	Medium	Large	All
Yield (MT per acre)	4.81	5.58	3.76	-	4.97
Price (per MT)	9781	9893	10400	-	9914
Gross Income	46154	55842	39562	-	49088
Full Cost	32171	34861	29760	-	32903
Full Cost(per MT)	6688	6247	7916	-	6622
Cash Cost	23492	25540	23084	-	24253
Cash Cost (per MT)	4883	4576	6140	-	4881
Net Income (Full Cost)	13983 (30.30)	20981 (37.57)	9802 (24.78)	-	16185 (32.97)
Net Income (Cash Cost)	22663 (49.10)	30303 (54.26)	16478 (41.65)	-	24835 (50.59)
BCR (Full Cost)	1.43	1.60	1.33	-	1.49
BCR (Cash Cost)	1.96	2.19	1.71	-	2.02

Figures in parentheses indicate the percentage of net income over gross income

Table 4.5 shows that there were no large farmers among the respondents in Comilla district, where net incomes for all categories of farmers are positive on both a full cost and cash cost basis, indicating the profitability for this vegetable. Labour costs are the highest cost item, as for example, 39.6% of the full cost was incurred for labour, identified as highest cost items for medium farmers, despite family labour being very small (Appendix I, Table 17).

The yields and prices for this vegetable in Comilla are similar to the overall average with prices again being highest for medium sized farms but yields being greatest for small and marginal farmers. Price of FB depends upon mainly its quality. It also indicates that the medium farmers were relatively more quality concerned. Munshi (2002) found a lower BCR figure of 1.11 in Comilla district while Alam (2002) found a higher 1.95 on a full cost basis for medium farmers due to higher yield.

It should be noted that the BRAC, a local NGO, bought most of the French bean from the producers, offering a reasonable price along with market support.

Table 4. 6 Cost- return analysis for French bean in Tangail (TK per acre)

Description of the items	Farmers Category				
	Marginal	Small	Medium	Large	All
Yield (MT per acre)	-	3.27	2.75	3.00	3.19
Price (per MT)	-	10375	10000	10000	10300
Gross Income	-	33994	27500	30000	32945
Full Cost	-	29542	16250	19976	27257
Full Cost(per MT)	-	9045	5909	6659	8550
Cash Cost	-	9548	3917	7747	8804
Cash Cost (per MT)	-	2923	1424	2582	2762
Net Income (Full Cost)	-	4452 (13.10)	11250 (40.91)	10024 (33.41)	5689 (17.27)
Net Income (Cash Cost)	-	24447 (71.91)	23583 (85.76)	22253 (74.18)	24141 (73.28)
BCR (Full Cost)	-	1.15	1.69	1.50	1.21
BCR (Cash Cost)	-	3.56	7.02	3.87	3.74

Figures in the parentheses indicate the percentage of net income over gross income

Table 4.6 reveals that the BCR for French bean production in the case of small, medium and large farmers on both a cash cost and full cost basis is more than one which indicates its profitability in Tangail district. The BCRs on a cash cost basis are very high, especially for medium farmers (7.02) which is higher than any other category because these farmers did not incur any costs for manure and fertilizer and all had comparatively low labour costs and zero irrigation and pesticide costs (see Appendix I, Table 18), despite generally lower yields than aggregate level. Such farmers in this district did not apply fertilizer and pesticide for organic farming, Hortex Foundation provided them seed without costs, depreciation costs of country plough used for land preparation accounted as fixed costs, which result zero costs for such items in the case of cash cost. Note that Proshika, a local NGO, bought French bean from the producers at a similar price to BRAC.

Table 4.7 illustrates the financial status in respect of cost and return in Narshingdi, showing that the BCRs for marginal, small and medium farmers, based on both cash cost and full cost, are again more than one. The prices and net incomes on both a cash and full cost basis are generally higher than those of the aggregate level which reflects the price support provided by the BRAC to the producers.

Again, BRAC bought French bean from the producers with pre-fixed prices which were 20 TK, 15 K and 2 TK per KG for extra fine, fine and local quality FB. In general, there is no special pricing system for FB prevailing in the country but BRAC fixes its price in consultation with their contract producers before going to production (see section 5.7). Therefore, the contract farmers of BRAC in different areas produce the FB with pre-determined price which seems to be some sort of price support to the producers. Moreover, the difference between the average price provided by BRAC in Comilla and Narshingdi indicates that the FB producers in Narshingdi supplied comparatively better quality FB than those in Comilla.

Table 4.7 Cost - return analysis for French bean in Narshingdi (TK per acre)

Description of Items	Farmers Category				
	Marginal	Small	Medium	Large	All
Yield (MT per acre)	3.22	3.56	3.27	-	3.32
Price (per MT)	13750	14000	14429	-	14143
Gross Income	44088	48889	46329	-	46237
Full Cost	33143	29896	30552	-	31152
Full Cost(per MT)	10301	8408	9338	-	9391
Cash Cost	20009	18960	18889	-	19224
Cash Cost (per MT)	6218	5333	5773	-	5795
Net Income (Full Cost)	10945 (24.83)	18992 (38.85)	15776 (34.05)	-	15085 (32.63)
Net Income (Cash Cost)	24079 (54.62)	29929 (61.22)	27440 (59.23)	-	27013 (58.42)
BCR (Full Cost)	1.33	1.64	1.52	-	1.48
BCR (Cash Cost)	2.20	2.58	2.45	-	2.41

Figures in parentheses indicate the percentage of net income over gross income

4.6.3 Financial performance of yard long bean cultivation

The profitability of yard long bean, a traditional vegetable, is computed based on both a full cost and cash cost basis at an aggregate and a district level. The following table illustrates the costs and returns of this vegetable at the aggregate level.

4.6.3.1 Revenue from yard long bean at aggregate level

Table 4. 8 Cost- return analysis for yard long bean in Bangladesh (TK per Acre)

Description of items	Marginal	Small	Medium	Large	Over all
Yield (MT per acre)	5.39	6.73	6.22	5.58	6.10
Price (per MT)	8800	8217	8167	7750	8083
Gross Income	47450	55320	50760	43212	49323
Full Cost (per acre)	37313	36312	36282	30200	36206
Full Cost (per MT)	6920	5394	5837	5416	5934
Cash Cost (per acre)	22248	22670	22819	20655	22462
Cash Cost (per MT)	4126	3367	3671	3704	3681
Net Income (Full Cost)	10136 (21)	19008 (34)	14478 (29)	13011 (30)	13117 (27)
Net Income (Cash Cost)	25202 (53)	32650 (59)	27941 (55)	22556 (52)	26861 (54)
BCR (Full Cost)	1.27	1.52	1.40	1.43	1.36
BCR (Cash Cost)	2.13	2.44	2.22	2.09	2.20

Figures in parentheses indicate the percentage of net income against gross income

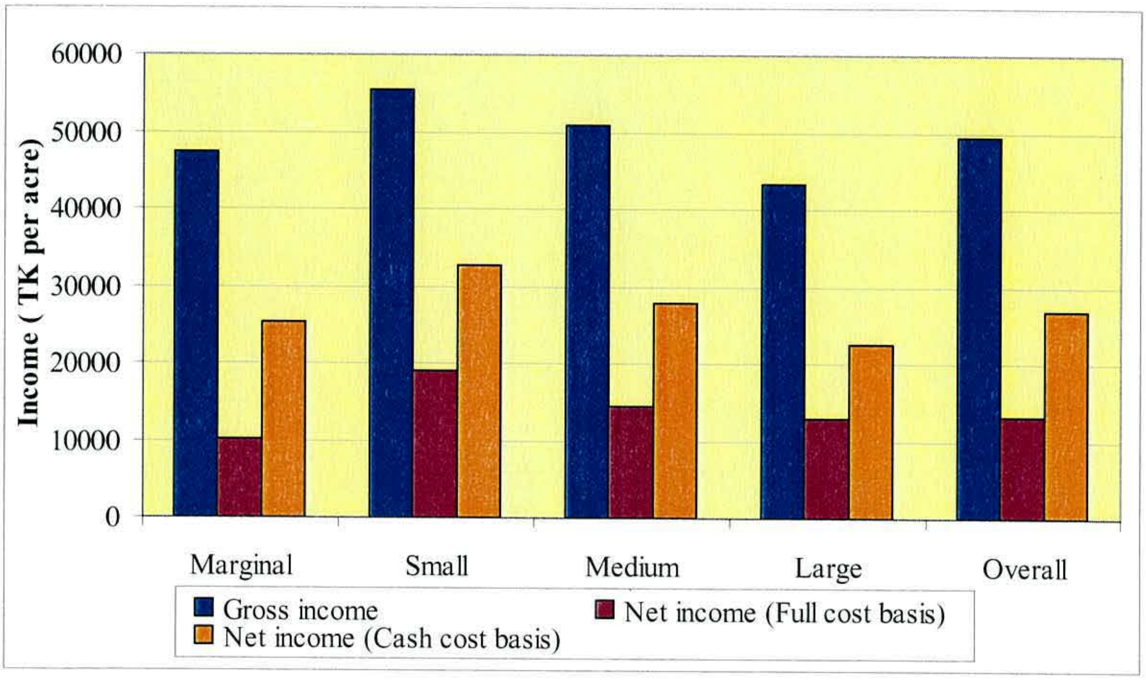


Figure 4.12 Income of yard long bean producers by farm size (TK per acre)

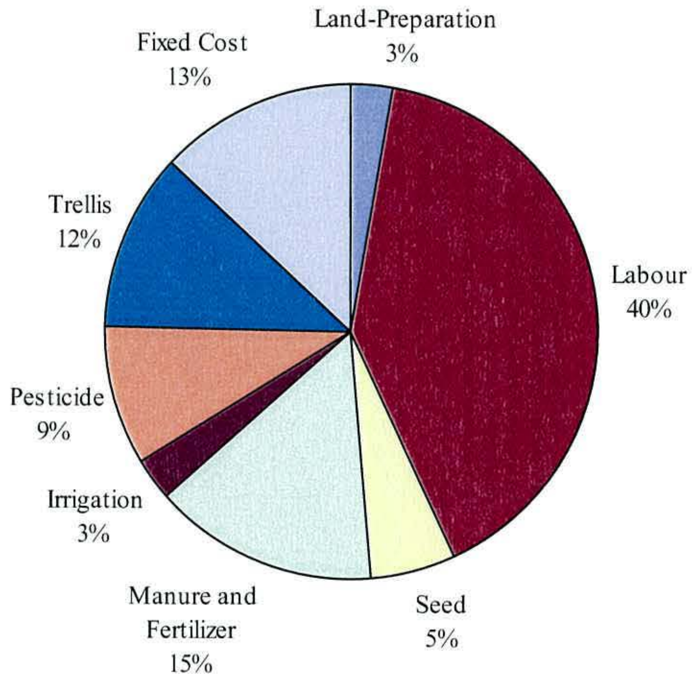


Figure 4.13 Cost shares of yard long bean production

Table 4.8 illustrates that small and medium category farmers obtained the higher yields while marginal farmers had the highest price. However, the full and cash cost is higher for the two middle groups. Marginal, small and medium farmers spent TK 36000-37000 in terms of full costs in the present study, while Alam (2002) found a figure of TK 18029 for small farmers and Munshi (2002) found TK 23126 per acre in 2000. Note, however, that Alam and Munshi did not include costs for depreciation, own land rent and interest on working capital in the case of full cost. They only included costs for family labour and the inputs supplied from home in the full cost. The marginal farmers obtained relatively low yields and incurred much higher costs for pesticide and average family labour which results in the lowest full costs BCR.

Production cost per acre in cash terms cost is TK 22462 (including trellis cost) (Appendix I, Table 20) while Alam (2002) found costs of TK 9629 in 2000 which resulted in a much higher BCR of more than four. Alam did not include the trellis cost to cash costs which made a sizable difference with the present study.

The BCRs for all categories of farmers are more than one on a full and more than two on a cash cost basis, indicating the profitability of this vegetable. On the other hand, Alam (2002) calculated a figure of 2.34 as the BCR for large farmers while Munshi (2002) reported 1.53, Biswas (1994) 2.24 and Barman and Shiblee (2003) 1.23 as the BCR on a full cost basis which are not widely different from the present study.

Figure 4.13 shows the average cost shares of yard long bean production in Bangladesh and again indicates labour as the highest cost item followed by manure and fertilizer and trellis costs.

4.6.3.2 Revenue from yard long bean at a district level

In order to allow comparison of costs, returns and profit in the four survey districts with the aggregate level for this vegetable, the following tables indicate the cost-return position of yard long bean in the four survey districts.

Table 4.9 Cost -return analysis for yard long bean in Rangpur (TK per acre)

Description of Items	Marginal	Small	Medium	Large	Overall
Yield (MTper acre)	-	5.43	6.58	5.87	6.18
Price (per MT)	-	5333	7875	8000	7357
Gross Income	-	28939	51822	46933	45469
Full Cost	-	28000	34285	31884	32424
Full Cost(per MT)	-	5160	5210	5435	5246
Cash Cost	-	17193	21735	23581	21157
Cash Cost (per MT)	-	3169	3303	4019	3423
Net Income (Full Cost)	-	940	17537	15050	13045
	-	(3.25)	(33.84)	(32.07)	(28.69)
Net Income (Cash Cost)	-	11746	30087	23353	24311
	-	(40.59)	(58.06)	(49.76)	(53.47)
BCR (Full Cost)	-	1.03	1.51	1.47	1.40
BCR (Cash Cost)	-	1.68	2.38	1.99	2.15

Figures in parentheses indicate the percentage of net income against gross income

Table 4.9 shows that production of yard long bean is profitable on a cash cost and full cost basis, although barely so for small farmers when full costs are applied. The gross income and full cost for the medium farmers are the highest but lowest for the small farmers. The medium and large farmers spent more money on manure and fertilizer, one of the influencing factors for better yield, than the small farmers (Appendix I, Table 21), yet the former obtained the highest yields. The BCR for medium farmers is the highest of the three groups. Alam (2002) found a figure of 2.34 for large farmers on a full cost basis. The prices for medium and large farmers are similar to the overall average, but small farmers appear to receive a relatively low price in Rangpur.

Table 4.10 reveals a positive net return position for this vegetable in Comilla on a full cost basis, except for small farmers, due to moderate yield and price, and higher production costs particularly for labour and pesticide (Appendix I, Table 22). However, all categories of farmers made a profit on a cash cost basis which indicates short term viability in vegetable farming as they do not pay rent for their own land rent or for family labour. The medium farmers are getting more financial benefit than other categories, as in Rangpur district. Biswas (1994) found a BCR figure of 2.24 and Munshi (2002) reported 1.53 in terms of full cost in this district.

Table 4.10 Cost-return analysis for yard long bean in Comilla (TK per acre)

Description of the Items	Farmers Category				
	Marginal	Small	Medium	Large	All
Yield (MT per acre)	6.46	5.47	6.14	-	6.04
Price (per MT)	7615	7900	9667	-	7962
Gross Income	49193	43213	59355	-	48090
Full Cost	36938	43524	42850	-	40153
Full Cost (per MT)	5721	7959	6980	-	6648
Cash Cost	22095	27754	24986	-	24605
Cash Cost (per MT)	3422	5075	4070	-	4074
Net income (Full cost)	12255	-311	16505	-	7937
	(24.91)	(-0.72)	(27.81)	-	(16.51)
Net income (Cash cost)	27098	15459	34369	-	23485
	(55.08)	(35.77)	(57.90)	-	(48.84)
BCR (Full Cost)	1.33	0.99	1.39	-	1.20
BCR (Cash Cost)	2.23	1.56	2.38	-	1.95

Figures in parentheses indicate percentage of net income against gross income

Table 4.11 Cost-return analysis for yard long bean in Tangail (TK per acre)

Description of the Items	Marginal	Small	Medium	Large	Overall
Yield (MTper acre)	6.71	5.51	6.31	4.68	5.84
Price (per MT)	8750	8562.5	9000	10000	8852.941
Gross Income	58727	47201	56805	46800	51681
Full Cost	32809	31194	28261	27675	30643
Full Cost(per MT)	4888	5659	4478	5914	5249
Cash Cost	18984	18826	20127	16267	18791
Cash Cost (per MT)	2829	3415	3189	3476	3219
Net Income (Full Cost)	25918	16007	28544	19125	21039
	(44.13)	(33.91)	(50.25)	(40.86)	(40.71)
Net Income (Cash Cost)	39743	28375	36678	30533	32890
	(67.67)	(60.12)	(64.57)	(65.24)	(63.64)
BCR (Full Cost)	1.79	1.51	2.01	1.69	1.69
BCR (Cash Cost)	3.09	2.51	2.82	2.88	2.75

Figure in parentheses indicates percentage of the net income over gross income

Table 4.11 shows the position in Tangail district. The overall net income in terms of full and cash cost is higher in this district than the aggregate average while net income for the marginal farmer is the highest (cash cost basis) and the large category the lowest, due mainly to yield variation. (Appendix- I, Table 23)

Table 4.12 Cost-return analysis for yard long bean in Narshingdi (TK per acre)

Description of the Items	Marginal	Small	Medium	Large	Grand Total
Yield (MT per acre)	7.34	5.98	5.92	-	6.34
Price (per MT)	9167	7600	7700	-	8095
Gross Income	67304	45450	45565	-	51320
Full Cost	41128	35063	38315	-	38344
Full Cost(per MT)	5602	5863	6475	-	6048
Cash Cost	24754	21938	23843	-	23650
Cash Cost (per MT)	3372	3668	4029	-	3730
Net Income (Full Cost)	26175	10387	7251	-	12976
	38.89	22.85	15.91	-	25.28
Net Income (Cash Cost)	42549	23512	21723	-	27671
	(63.22)	(51.73)	(47.67)	-	(53.92)
BCR (Full Cost)	1.64	1.30	1.19	-	1.34
BCR Cash Cost)	2.72	2.07	1.91	-	2.17

Figure in parentheses indicates percentage of the net income over gross income

Table 4.12 indicates the profitability level of yard long bean in Narshingdi district where the net income for the marginal farmer group is the highest followed by the small farmers in terms of full and cash cost. Although the production costs of pesticide, trellis and family labour cost are higher for marginal farmers, the BCR is the highest due to higher yield and price (Appendix I, Table 24). Labour costs are higher compared to other districts irrespective of farm size.

4.6.4 Economic performance of bitter gourd cultivation

Bitter gourd is another traditional exportable vegetable in Bangladesh, and its costs, returns and profitability are considered below at aggregate and district level

4.6.4.1 Revenue from bitter gourd at aggregate level

Table 4.13 Cost- return analysis for bitter gourd in Bangladesh (TK per acre)

Description of items	Marginal	Small	Medium	Large	Overall
Yield (MT)	5.70	5.73	6.34	5.56	5.89
Price per MT	9885	10107	9460	10000	9839
Gross Income	56315	57933	59939	55598	57961
Full Cost	42332	36401	28590	31438	35617
Full Cost (per MT)	7430	6351	4512	5655	6046
Cash cost	28624	23769	19709	21804	23946
Cash Cost (per MT)	5024	4147	3111	3922	4065
Net return-Full Cost basis	13983	21531	31348	24159	22344
	(24.83)	(37.17)	(52.30)	(43.45)	(38.55)
Net return-Cash cost basis	27692	34164	40230	33793	34014
	(49.17)	(58.97)	(67.12)	(60.78)	(58.69)
Benefit-Cost Ratio (BCR)-Full cost	1.33	1.59	2.10	1.77	1.63
Benefit-Cost Ratio (BCR)-Cash cost	1.97	2.44	3.04	2.55	2.42

Figures in parentheses indicate the percentage of net income against gross income

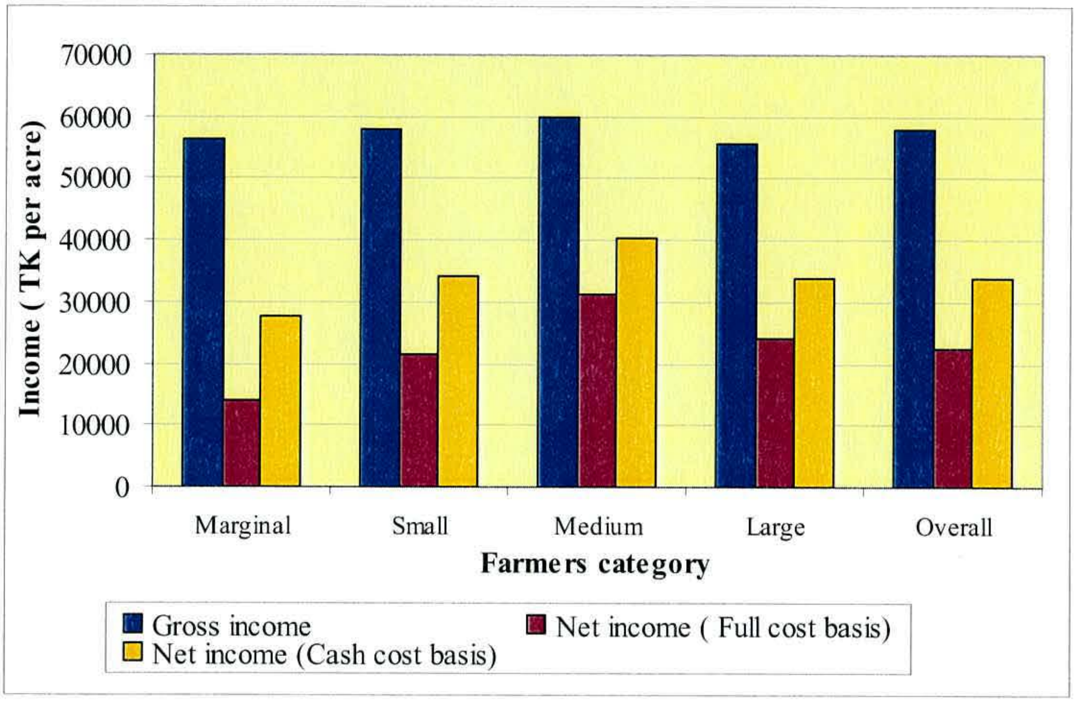


Figure 4.14 Income from bitter gourd by farm size (TK per acre)

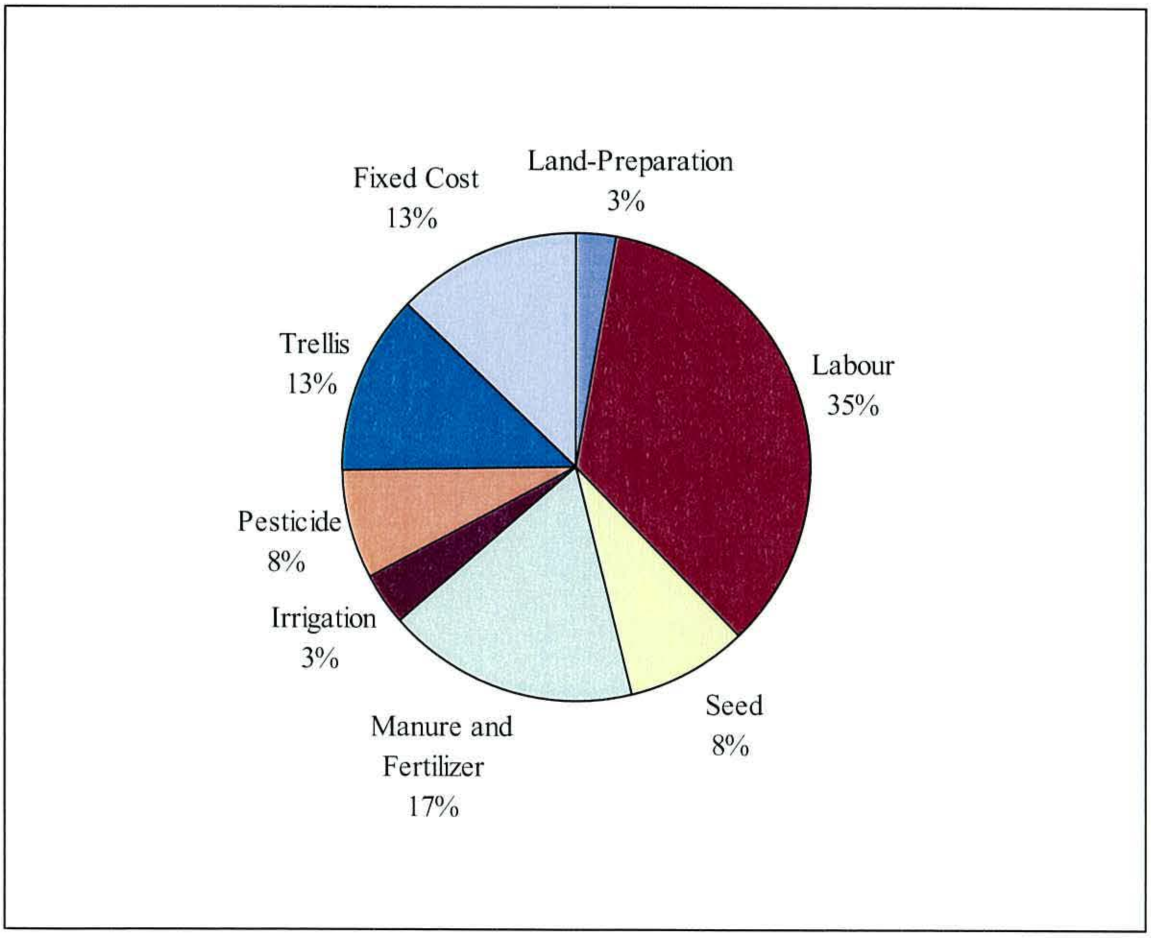


Figure 4.15 Cost shares of bitter gourd production

Table 4.13 reveals that average respondents in all categories enjoyed a positive net return on both a full and cash cost basis. The figures of BCR and net income indicate that some medium and large farmers got about the same the return whilst marginal farms some received what low returns due to higher production costs, particularly labour, manure and fertilizer and irrigation. Alam (2002) found BCRs of 2.60, 1.92 and 2.26 in 2000 for small, medium and large farmers respectively which are not too dissimilar to this study. Barman and Shiblee (2001), however, reported the BCR for this vegetable as 1.41 rather lower than the average for this study due to lower yield which was only 4.93 MT. Munshi (2000) found BCR a figure of 1.97 on cash cost basis which is also lower than this study because of lower sale price.

The highest cash cost is for manure and fertilizer which varies from about 15 to 19%, but for full costs labour is the highest, varying from about 29% to 37% with heavy involvement of family labour. Other major element of the full cost include manure and fertilizer (17%), trellis (13%) and rental value (11%) (Appendix-I, Table 25, Figure 4.15).

When the three vegetables are compared, although total costs are similar, return per acre from bitter gourd is higher than that of French bean and yard long bean on both a cash and full cost basis at aggregate level (Table 3, Table 8, and Table 13).

4.6.4.2 Revenue from bitter gourd at district level

Table 4.14 Cost-return analysis for bitter gourd in Rangpur (TK per acre)

Description of Items	Marginal	Small	Medium	Large	Overall
Yield (MT per acre)	4.00	6.22	6.69	5.93	6.36
Price (per MT)	15000	6667	8909	11000	9118
Gross Income	60000	41454	59599	65281	57983
Full Cost	36814	25396	26816	22791	26680
Full Cost (per MT)	9204	4084	4009	3840	4195
Cash Cost	19450	17549	19524	17169	18894
Cash Cost (per MT)	4863	2822	2919	2893	2971
Net Income (Full Cost)	23186	16058	32783	42490	31303
	(38.64)	(38.74)	(55.01)	(65.09)	(53.99)
Net Income (Cash Cost)	40550	23905	40075	48112	39089
	(67.58)	(57.67)	(67.24)	(73.70)	(67.41)
BCR (Full Cost)	1.63	1.63	2.22	2.86	2.17
BCR (Cash Cost)	3.08	2.36	3.05	3.80	3.07

Figures in parentheses indicate percentage of net income against gross income

Table 4.14 shows the BCRs on a cash and full cost basis, with all figures indicating profitability for all categories of respondents. The net income based on full costs is the highest for large farmers due to a relatively high price, reasonable yields and low costs while it is lowest for the small farmers due to a low sale price. The same scenario is observed on a cash cost basis. The average net income based on full and cash costs is somewhat higher than the aggregate figure due to a slightly higher price but lower yield and lower production costs (Table 4.13 and Table 4.14).

The average net income on both a full and cash cost basis in this district is the highest among the four survey districts due to lower production costs, although the average price in Rangpur is much lower than that of Comilla (Table 4.15). It is observed that more than 36% of the full cost was incurred for labour (and it rose to 55% for marginal farmers) with about 17% for family labour, similar in total to the aggregate average figure (Appendix-I, Table 25, Table 26). Manure and fertilizer was the second highest cost item at 14% of the total cost followed by seed at 12%, trellis 11% and rental value 10%.

Table 4.15 Cost - return analysis for bitter gourd in Comilla (TK per acre)

Description of the Items	Marginal	Small	Medium	Large	Overall
Yield (MTper acre)	5.02	5.97	5.19	4.92	5.27
Price (per MT)	10235	14143	13000	10000	11444
Gross Income	51380	84434	67470	49200	60310
Full Cost	44620	47222	31230	52412	44591
Full Cost(per MT)	8896	7913	6012	10660	8458
Cash Cost	29803	32333	19747	35417	29922
Cash Cost (per MT)	5942	5418	3802	7203	5675
Net income (Full cost)	6760	37212	36240	-3212	15719
	(13.16)	(44.07)	(53.71)	(-6.53)	(26.06)
Net income (Cash cost)	21577	52101	47723	13783	30388
	(41.99)	(61.71)	(70.73)	(28.01)	(50.39)
BCR (Full Cost)	1.15	1.79	2.16	0.94	1.35
BCR (Cash Cost)	1.72	2.61	3.42	1.39	2.02

Figures in parentheses indicate percentage of net income against gross income

Table 4.15 states the profitability level of BG for four categories of farmers in Comilla district, where net incomes for all categories of farmers are positive except large farmers on a full cost basis. The negative return for large farmers appears to be due to lower yield and higher production costs for seed, manure and fertilizer, pesticides and family labour.

The net income and BCR for medium farmers are the highest due to a relatively high price and lower production costs, particularly for labour and manure and fertilizer. The average labour cost in this district is more than TK 14000 per acre which with Narshinhgdi is the highest among the four survey districts because of a higher labour cost (Appendix-I, Table 27).

Munshi (2002) found a figure of TK 26036 as net income per acre in 2000 and the BCR for this vegetable as 1.97 in Comilla on a full cost basis. Biswas (1994) reported the BCR for this vegetable in Comilla as 1.35 and 2.60 on full and cash cost basis respectively which is similar to this study.

Table 4.16 Cost-return analysis for bitter gourd in Tangail (TK per acre)

Description of the Items	Marginal	Small	Medium	Large	Overall
Yield (MT per acre)	3.80	5.26	6.51	5.51	5.41
Price (Per MT)	9000	9111	8625	9000	8971
Gross Income	34200	47931	56116	49557	48538
Full Cost	32746	31696	27918	29598	30684
Full Cost (per MT)	8617	6025	4291	5375	5671
Cash Cost	20506	19938	16610	19633	19186
Cash Cost (per MT)	5396	3790	2553	3566	3546
Net Income (Full Cost)	1454	16235	28198	19959	17854
	(4.25)	(33.87)	(50.25)	(40.27)	(36.78)
Net Income (Cash Cost)	13694	27993	39506	29924	29353
	(40.04)	(58.40)	(70.40)	(60.38)	(60.47)
BCR (Full Cost)	1.04	1.51	2.01	1.67	1.58
BCR (Cash Cost)	1.67	2.40	3.38	2.52	2.53

Figures in parentheses indicate percentage of net income against gross income

The net income from BG in Tangail district is positive throughout as showing in Table 4.16, irrespective of farm size. The values of net income and BCR are the highest in the case of medium farmers and lowest for the marginal farmers due to variations in yield and production costs.

The item-wise cost details show that farmers in Tangail spent most on manure and fertilizer, followed by trellis and then hired labour. Family labour involvement is still highest in full cost items as with other districts. The average labour cost constitutes 33% of the full cost (Appendix-I, Table 28). The average yields for Rangpur, Comilla Tangail and Narshingdi are similar, although extreme low values occur for marginal farmers in Rangpur and Comilla and very high values for the same group in Narshingdi. The price in Comilla is comparatively high, possibly due to good connections with the exporters such as BRAC.

Table 4.17 Cost-return analysis for bitter gourd in Narshingdi (TK per acre)

Description of Items	Marginal	Small	Medium	Large	Overall
Yield (MTper acre)	8.54	5.86	6.05	-	6.63
Price (per MT)	8333	9111	9750	-	9130
Gross Income	71193	53371	58989	-	60491
Full Cost	39964	36359	30706	-	35333
Full Cost (per MT)	4678	6207	5075	-	5333
Cash Cost	29518	23012	21503	-	24185
Cash Cost (per MT)	3455	3929	3554	-	3650
Net Income (Full Cost)	31230	17012	28282	-	25158
	43.87	31.87	47.94	-	41.59
Net Income (Cash Cost)	41675	30358	37486	-	36307
	58.54	56.88	63.55	-	60.02
BCR (Full Cost)	1.78	1.47	1.92	-	1.71
BCR (Cash Cost)	2.41	2.32	2.74	-	2.50

Figures in parentheses indicate the percentage of the net income over gross income

Table 4.17 shows the net revenue from bitter gourd in Narshingdi by farm size based on full cost and cash costs along with BCR. Large farmers for BG were not available in this district. The average net income and BCR in this survey district are similar to the aggregate data. The net income and BCR for marginal farmers are the highest due to higher yields. The average yield in this area is higher than the aggregate but this is largely due to extremely high yields for marginal farmers.

4.6.5 Contribution of vegetable production to the livelihoods of the respondents

Farmers in Bangladesh are producing crops especially for their own consumption, but a shift towards diversified crop production, particularly high value-added vegetable crops, has been recognized. An attempt has been made here to measure the contribution of vegetable production by the respondents, nearly of 79% whom had agriculture as their only occupation. Income shares from all vegetables and sample vegetable production was calculated so as to determine the contribution of vegetable production to the livelihoods of the people in each area.

Table 4.18 Annual income from agriculture by survey district (TK/US$)

Items	Rangpur	Comilla	Tangail	Narshingdi	Overall
Annual income all crops (TK)	44720	35443	70158	43910	45935
Annual income all vegetables (TK)	19798 (44)	30255 (85)	37073 (53)	32990 (75)	30463 (66)
Annual income sample vegetables (TK)	6468 (14)	11541 (33)	7150 (10)	10605 (24)	9584 (21)
Annual income per household from crops (US$)	765	606	1201	751	786
Annual Per capita income from crops (US$)	137	104	224	117	137

Figures in parentheses indicate percentage in respect of income from all crops
1 US$=58.44 (TK), 2003, Bangladesh Bank

Table 4.18 reveals that average annual income from all crops for the four districts is TK 45935 with Tangail ranked the highest and Comilla the lowest. Income share from all vegetables general and sample vegetables in particular in Comilla is 85% and 33% respectively, the highest proportions, while Rangpur has the lowest proportions and actual values, indicating more involvement of the farmers in Comilla district in commercial farming of vegetables rather than other crops.

The overall income from vegetable production in the survey areas is 66% of primary income which shows the overall importance of vegetable production. The sample vegetables constitute 21% on average; this rises to 33% and 24% in Comilla and

Narshingdi respectively, which also have the highest actual income from these vegetables. The average income per household is US$ 786 but per capita income is US$ 137 from all crops where the aggregate per capita income in Bangladesh is US$ 400 (World Bank, 2005). The average household size in these districts is 5.99 which are also more than the aggregate average of 5.6 (BBS, 2000). It is evident that the rural people in the survey areas are chronically poor as their annual income from crops is less than US$365, although there may be unreported income from outside agriculture (Chronic Poverty Research Centre, 2004).

Table 4.19 Annual income from agriculture by farm size (TK/US$)

Items	Marginal	Small	Medium	Large	Over all
Annual income all crops (TK)	24755	31060	66127	252770	45935
Annual income all vegetables (TK)	20585 (83)	24635 (79)	36394 (55)	142595 (56)	30463 (66)
Annual income sample vegetables (TK)	8473 (34)	9399 (30)	9109 (14)	26146 (10)	9584 (21)
Annual income per house hold from crops (US$)	424	531	1132	4325	786
Annual per capita income from crops (US$)	77	106	185	681	137

Figures in parentheses indicate percentage in respect of income from all crops
1 US$=58.44 (TK), 2003, Bangladesh Bank

Table 4.19 shows the annual income of the respondents based on farm size, where large farmers had the highest income and marginal farmers had the lowest from all crops in the survey areas. However, the income share from vegetables in general and sample vegetables in particular for the marginal producer is the highest, closely followed by the small category. These two groups obtain about four fifths of their incomes from vegetables, and about one third from the sample vegetables. It indicates that the marginal and small farmers mainly produce vegetables among the crops in the survey districts. The average per capita income for all categories of producers is US$ 137, less than the chronical poverty line, but for the large farmers it is US$ 681.00 followed by medium farmers and marginal had the lowest. It is to be noted that the large farmers' incomes exceed US$ 365.00, the chronically poverty line, and US$ 400.00 the national per capita income (World Bank, 2005), It is also notable that three categories of farmers in the survey areas (95% of the sample) are chronically poor (Table 3.3).

The World Bank (2005) stated that 36% of the people in Bangladesh were chronically poor in 2000 while the Chronic Poverty Report (2004) mentioned 31.4% of the rural people were chronically poor. This contrasts with this study, conducted in 2003, in which 95% of the respondents' households are identified as chronically poor in the context of their income from crops. Nevertheless, they might have had some income from non-crop agriculture, agricultural and non-agricultural wages, businesses, services and remittances which would increase their total income and so reduce the percentage of chronically poor people in these areas.

Although, the table reveals that 95% of the respondents, irrespective of farm size and district, are chronically poor, they are earning a good deal from vegetable cultivation which also suggests that if production of vegetables was to become more profitable through market, price and production support, the number of chronically poor people might be reduced.

4.6.6 Descriptive statistics of yield of the sample vegetable

The mean yield and respective standard deviation for French bean, yard long bean and biter gourd were computed by farm size as well as by district. One-way analysis of variance was performed to compare the variation in yield of the three vegetables.

4.6.6.1 Yield statistics for the sample vegetables by farm size

Table 4.20 shows the mean yields and respective standard deviations for French bean, yard long bean and bitter gourd by farm size; this is also presented in graphical form in Figures 4.16, 4.17 and 4.18 respectively. The mean yield is the highest for small and marginal then medium farmers but lowest for large farmers in the case of French bean. The mean yield is the highest for marginal and medium farmers and lowest again for large farmers in the case of yard long bean, while the mean yield for medium is the highest and lowest again for large farmers in the case of bitter gourd, indicating the intensity of production of the marginal, small and medium farmers relative to large farmers.

Table 4.20 Comparison of yields and standard deviation of sample vegetables by farm size (Metric tonne per acre)

Name of the crop	Statistics	Farm size				
		Marginal	Small	Medium	Large	Overall
French bean	Mean	4.49	4.53	3.61	3.00	4.27
	Standard deviation	*2.17*	*2.19*	*1.46*	*0.00*	*2.01*
Yard long bean	Mean	6.66	5.62	6.27	5.39	6.10
	Standard deviation	*3.43*	*1.43*	*1.01*	*0.99*	*2.13*
Bitter gourd	Mean	5.70	5.73	6.34	5.56	5.89
	Standard deviation	*2.63*	*1.91*	*3.16*	*1.55*	*2.53*

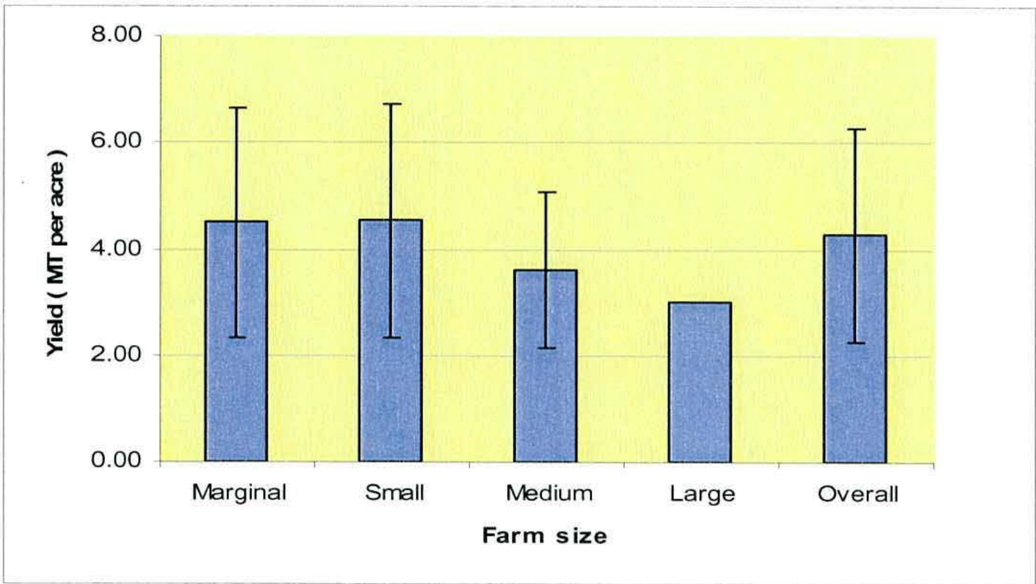


Figure 4.16 Mean yields of French bean in Bangladesh by farm size
Note: Lines indicate respective standard deviations

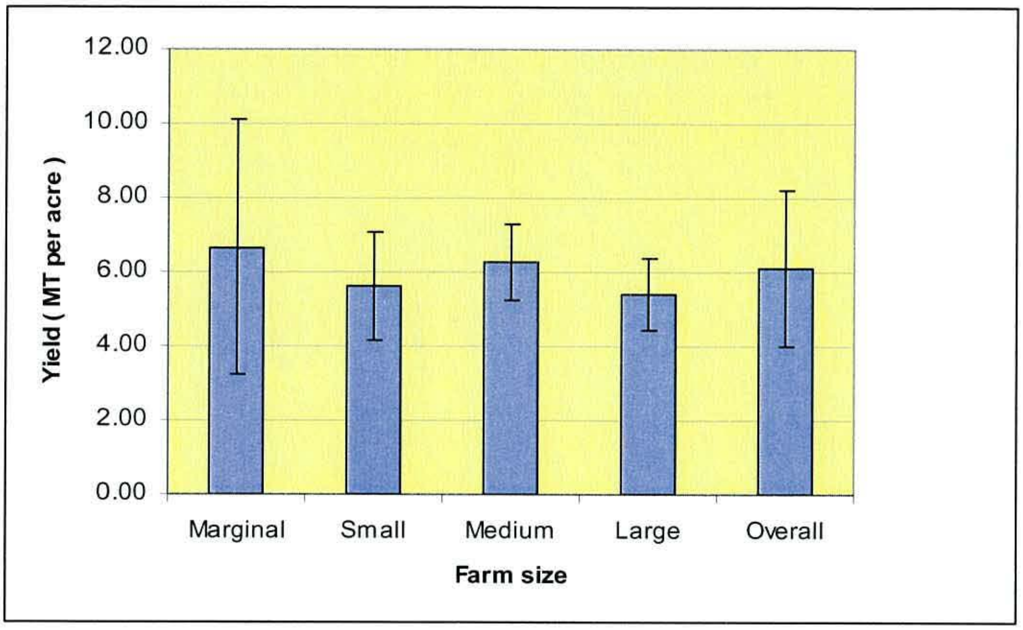


Figure 4.17 Mean yields of yard long bean in Bangladesh by farm size
Note: Lines indicate respective standard deviation

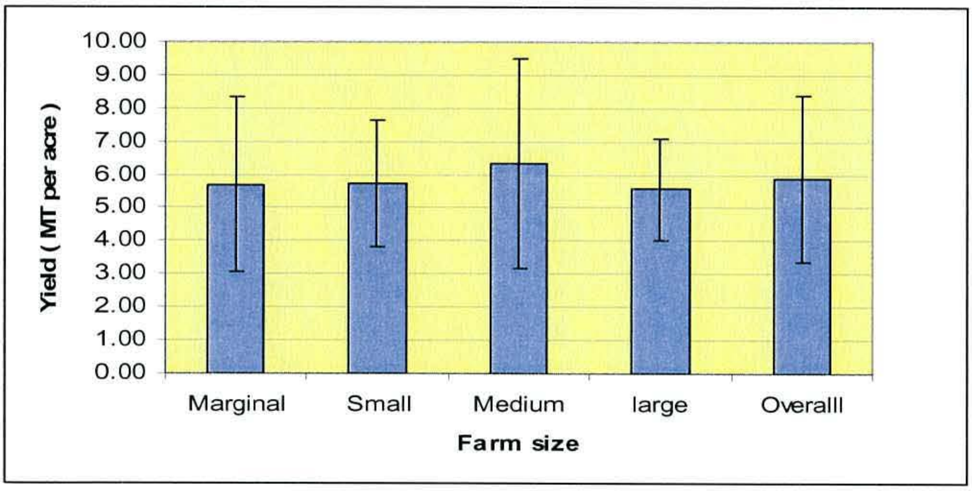


Figure 4.18 Comparison of mean yield of bitter gourd in Bangladesh by farm size
Note: Lines indicate respective standard deviation

4.6.6.2 Yield statistics for the sample vegetables by district

The mean yields of the three sample vegetables were compared by survey districts as well. Table 4.21 shows the mean yield and respective standard deviation for French bean, yard long bean and bitter gourd by survey district, information which is also presented in graphical form in Figures 4.19, 4.20 and 4.21 respectively. The mean yield is the highest in Comilla and lowest in Tangail in the case of French bean. The mean yield is the highest in Narshingdi and lowest again in Tangail in the case of yard long bean while the mean yield for Narshingdi is the highest and lower again for Tangail in the case of bitter gourd, although, Comilla has a lower yield. Thus the farmers in

Narshingdi obtained the highest yield from the non-traditional vegetables in the sample, but performed less well in the case of FB.

Table 4.21 Comparison of yield of three sample vegetable by district (MT per acre)

Name of the vegetable	Statistics	Rangpur	Comilla	Tangail	Narshingdi	Overall
French bean	Mean	4.16	4.97	3.19	3.32	4.27
	Standard deviation	*1.16*	*2.36*	*0.67*	*0.97*	*2.03*
yard long bean	Mean	6.18	6.04	5.84	6.34	6.10
	Standard deviation	*1.22*	*2.80*	*2.08*	*1.76*	*2.13*
bitter gourd	Mean	6.36	5.27	5.41	6.63	5.89
	Standard deviation	*3.57*	*2.07*	*1.72*	*2.49*	*2.53*

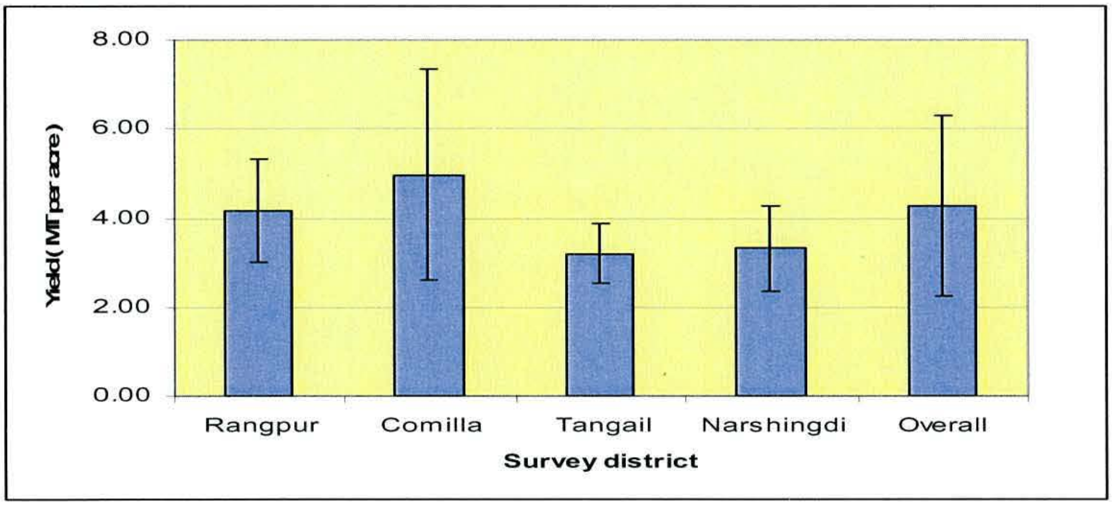


Figure 4.19 Mean yield of French bean by survey district
Note: Lines indicate respective standard deviation

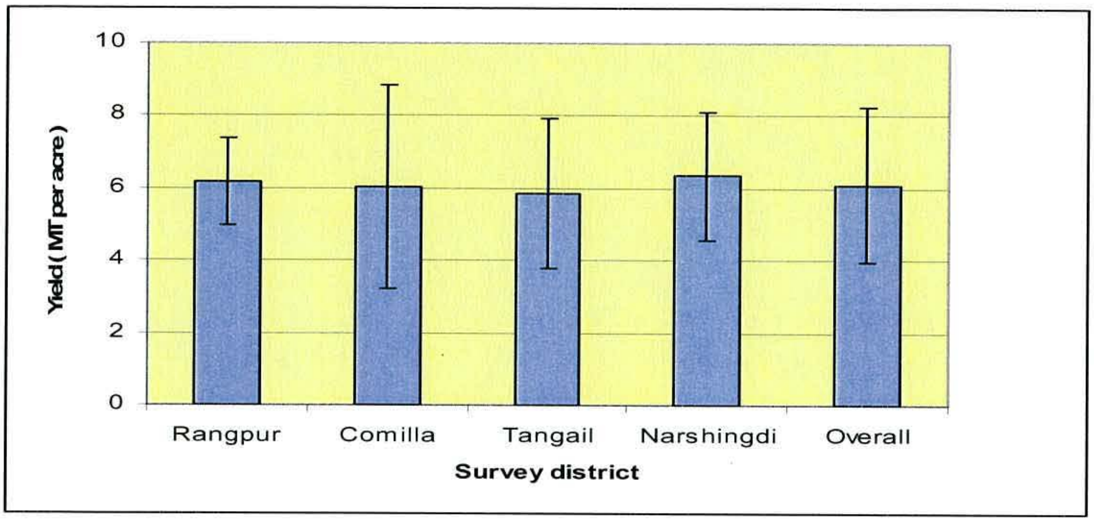


Figure 4.20 Mean yield of yard long bean by survey district
Note: Lines indicate respective standard deviation

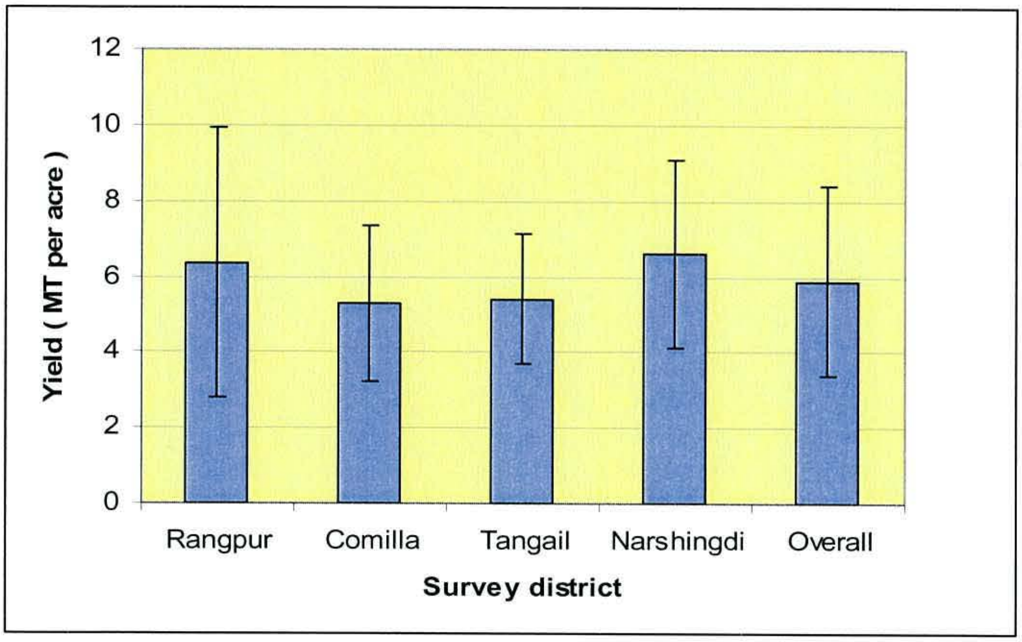


Figure 4.21 Mean yield of bitter gourd in Bangladesh by survey district
Note: Lines indicate respective standard deviation

4.6.6.3 Yield variation of the sample vegetables by farm size

One-way ANOVA was carried out to determine the significance of variation of the mean yields of the sample vegetables by farmer category. The Table 4.22 shows no significant variation of yield French bean, yard long bean and bitter gourd when considering farm size groups.

Table 4.22 Yield variation of French bean, yard long bean and bitter gourd by farm size group

Name of the vegetable	Source of variation between groups	Mean square between groups	F-value	P-value
French bean	Four farm sizes	2.74	0.67	0.61 ns
yard long bean	Four farm sizes	3.94	0.87	0.48 ns
bitter gourd	Four farm sizes	1.80	0.28	0.89 ns

4.6.6.4 Yield variation of the sample vegetables by district

Table 4.23 Yield variation of French bean, yard long bean and bitter gourd by district

Name of the vegetable	Source of variation between groups	Mean square between groups	F-value	P-value
French bean	Four districts	10.38	2.69	0.03 **
yard long bean	Four districts	0.64	0.14	0.97 ns
bitter gourd	Four districts	7.60	1.20	0.31 ns

** indicates the significance level at 95% ($p = .05$)

One-way ANOVA was performed to determine the significance of yield variation by district. The table shows that yield variation is significant at the 95% level in the case of French bean among the districts while no significant yield variation among the districts was evident in the case of two other vegetables yard long bean and bitter gourd. Table 4.21 would suggest that the high mean for Comilla would be significantly different from the low yields in Tangail and Narshingdi. This significant difference for French bean and insignificance for the other two vegetables is not surprising, since the former is novel and expertise may not have spread widely, yet it may have done so for the traditional vegetables. Furthermore, the yield variation occurred due to the differences in ecology and soil properties among the survey districts.

4.7 Economic analysis of exportable vegetable production

4. 7. 1 Factors affecting sample vegetable production

Cobb-Douglas production function analysis was performed to estimate the contribution of the various factors in the production process, the existence of economies of scale and the degree of technical efficiency amongst producers of the sample vegetables.

4.6.2 Production function analysis for sample vegetable production

Production function estimation using multiple regression was performed both on an actual land and per acre basis for each of the sample vegetables. Actual land is the total amount of land for each of the sample vegetables which the respondents cultivated and provided the information regarding production and sale of that vegetable. Alam (2002) included land preparation, seed, fertilizer, irrigation, and labour cost for harvesting as independent variables and yield as the dependent variable in his regression analysis. In the analysis here, output was considered as the dependent variable while farm size, land preparation, land rent, labour, seed, manure and fertilizer, irrigation, pesticide, as well as district dummy variables, are considered as independent variables.

Field (2003) described the stepwise methods of regression that help to identify the variables which are statistically redundant, and helps the inclusion of the important variables in the model. However, he warned that inclusion of large numbers of variables in the model can render it meaningless. Both stepwise and normal regression is performed to identify and estimate effects of the independent variables influencing the output.

Correlation among inputs is tested and may indicate a multicollinearity relationship among the independent variables. Field (2003) reported that multicollinearity exists where there is strong correlation among the predictors in the multiple regression model. He further commented that multicollinearity between the predictors makes it difficult to assess the contribution of individual predictors included in the model. The effects of each of the independent variables are not possible to quantify exactly due to this multicollinearity problem, so a number of production function models were adopted to try to overcome these effects.

Model 1 utilized eight variables, namely farm size, land preparation, land rent, labour, seed, manure and fertilizer, irrigation and pesticide costs. The influence of the four districts (Rangpur, Comilla, Tangail and Narshingdi) was tested using dummy variables in Model 2 along with the other eight variables. In Model 3, four contributing factors, namely land preparation, seed, manure and fertilizer and pesticide, were combined into one variable, in an attempt to avoid the problem of multicollinearity, while farm size, land rent, labour and irrigation were included separately. Additionally, three steps were performed using stepwise regression to see which were the most significant variables. The natural logarithms of each variable were used and the resulting equations were then transformed into Cobb-Douglas form.

Model 1

The multiple linear regression effectively produces a log-linear model of the form:

$$LogY = \beta_1 + \beta_2 \log X_2 + \beta_3 \log X_3 + \beta_4 \log X_4 + \beta_5 \log X_5 + \beta_6 \log X_6 + ... + \beta_9 \log X_9 + u$$

This can then be transformed into Cobb-Douglas equation, thus:

$$Y = \alpha X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} X_8^{\beta_8} X_9^{\beta_9} e^u$$

Where Y= output per actual land area

$\alpha = \exp(\beta_1)$

X_2 = farm size, X_3 = land preparation cost, X_4 = land rent cost

X_5 = labour cost, X_6 = seed cost, X_7 = manure and fertilizer cost,

X_8 = irrigation cost, X_9 = pesticide cost, u = disturbance term

e = base of natural logarithm

β_1 = constant, and $\beta_2, \beta_3, \ldots, \beta_9$ are the coefficients or elasticities of output Y with respect to the independent variables of $X_2, X_3, \ldots, X_9$ respectively

Model 2

In model 1, the effects of the eight independent variables are estimated but the effects of the districts are not considered. Therefore, in order to assess the district effect on production, Model 2 is designed to estimate the elasticities of output incorporating district dummy variables along with the other eight variables of the model 1. The four survey districts namely Rangpur, Comilla, Tangail and Narshingdi are included (using only 3 dummy variables) with the other eight independent variables mentioned above. The following production function equation can then be derived:

$$Y = \beta_1 X_2^{\beta_2} X_3^{\beta_3} X_4^{\beta_4} X_5^{\beta_5} X_6^{\beta_6} X_7^{\beta_7} X_8^{\beta_8} X_9^{\beta_9} X_{10}^{\beta_{10}} X_{11}^{\beta_{11}} X_{12}^{\beta_{12}} e^u$$

Where X_{10} = Rangpur, X_{11} = Comilla,

X_{12} = Tangail, u = disturbance term

e = base of natural logarithm

Note that the effect of the dummy variables will be to tilt the production function up or down from its fulcrum at the origin.

Model 3

Although, in models 1 and 2, the effects of the individual independent variables are estimated, model 3 is also designed to see the combined and individual effect of the variables influencing production. In this model, the four variables - land preparation, seed, manure and fertilizer and pesticide are combined together.

An equation can then be derived:

$$Y = \alpha X_2^{\beta_2} X_4^{\beta_3} X_5^{\beta_4} X_8^{\beta_5} X_{13}^{\beta_{13}} e^u$$

Where Y= output per actual land

X_2 = farm size, X_4 = land rent, X_5 = labour, X_8 = irrigation

X_{13} = land preparation, seed, manure and fertilizer, pesticide

4.7.2.1 Production function analysis for French bean per actual land basis

The following table shows the results of both normal and stepwise regression for French bean on an actual land basis.

Table 4.24 Logarithmic regression analysis for French bean -actual land basis

Dependent var.	Output					
Types of regression	Enter			Stepwise		
	Coefficients					
Independent var.	Model 1	Model 2	Model 3	Step 1	Step 2	Step 3
Constant	-3.18 (-0.97)	-3.46 (-0.99)	3.37** (1.96)	-1.02* (-1.92)	-0.93* (-1.95)	-1.17** (-2.58)
Farm size	-0.25 (-0.56)	-0.24 (-0.51)	0.62** (2.75)			
Land preparation	0.35** (2.12)	0.36** (2.24)				0.31** (2.62)
Land rent	0.13 (0.91)	0.11 (0.74)	0.06 (0.6)			
Labour	0.08 (0.48)	0.08 (0.53)	0.19 (1.5)			
Seed	0.63** (2.61)	0.72** (2.72)		1.18** (15.20)	0.89** (7.69)	0.70** (5.55)
Manure and fertilizer	0.20** (2.06)	0.18* (1.91)			0.27** (3.17)	0.22** (2.72)
Irrigation	0.01 (0.23)	0.04 (0.61)	0.07 (1.24)			
Pesticide	0.11 (1.18)	0.06 (0.55)				
Land preparation, seed, manure-fertilizer and pesticide			0.32** (2.47)			
Rangpur		0.55** (2.05)				
Comilla		0.03 (0.13)				
Tangail		0.47 (1.32)				
$\sum \beta$ coefficients	1.26	1.31	1.26			
F	41.56**	34.43**	100.37**	230.99**	148.86**	117.67**
n	38	38	59	38	38	38
R	0.96	0.97	0.95	0.93	0.94	0.95
R^2	0.92	0.93	0.90	0.86	0.89	0.91

* = 90 % (p=.10) level of significance, * * = 95 % (p=.05) level of significance

Figures in parentheses indicate the t- value

Model 1

From Table 4.24, we obtain the following equation using the eight farm input variables

$$LogY = -3.18 - 0.25\log X_2 + 0.35\log X_3 + 0.13\log X_4 + 0.08\log X_5 + ... + 0.11\log X_9 + u \qquad (4.1)$$

which then converts to the Cobb-Douglas form, thus;

$$Y = 0.041 X_2^{-0.25} X_3^{0.35} X_4^{0.13} X_5^{0.08} X_6^{0.63} X_7^{0.20} X_8^{0.011} X_9^{0.11} e^u \qquad (4.2)$$

From a statistical point of view, the estimated regression results fit the data quite well. The coefficient of multiple determination (R^2) is 0.92 which means that 92% of the variation of the output is explained by the influence of the eight independent variables included in the model. The F-value of the log linear regression equation is 41.56 and is significant at the 95% (p=.05) level, which indicates that at least one of the independent variables is a significant determinant of variation in output.

The output elasticity of land preparation (elasticity of response) is 0.35 which is positive and significant at the 95% (p=.05) level and indicates that, holding the other seven variables constant, a one percent increase in the land preparation cost, will lead to a 0.35% increase in the output of French bean. The output elasticity of seed is 0.63 and significant at the 95% (p=.05) level, while that for manure and fertilizer is 0.20 and again significant at the 95% (p=.05) level. It also denotes the positive impact of fertilizer on French bean production. The output coefficients for urea and TSP were also found to be significant in a Cobb-Douglas production function analysis for country bean in 2001-2002 in Bangladesh with coefficients of 0.19 for urea and 0.13 for TSP at the 99% level of significance (Haque *et al*, 2002).

The coefficients for farm size, land rent, labour, irrigation and pesticide were not significant at the 95% level. Surprisingly, the coefficient for farm size is negative but insignificant. This may have been due to multicollinearity since correlation between farm size and some of the other variables is high (See Appendix I, Table 30).

As Jhingan (1999) noted, one property of the Cobb-Douglas production function is that the sum of the elasticities of output gives information about the returns to scale. If the sum of the elasticities is 1 then the returns to scale are constant: doubling the inputs will double the output. If the sum is less than 1, there are decreasing returns to scale, and if the sum is greater than 1, there are increasing returns to scale. Adding the eight elasticities of output, we obtain a figure of 1.26 which indicates economies of scale since it is greater than 1. This implies that bigger farms are likely to be more profitable than smaller farms, other things being equal.

It is evident that manure and fertilizer together constitute one of the important factors for vegetable production, significant in most cases of the sample vegetables in this study. Consequently, the curve showing the production function is plotted, illustrating the relationship between manure and fertilizer and output from equation 4.2, while all other variables are held constant at their mean values. Figure 4.22 illustrates the relationship.

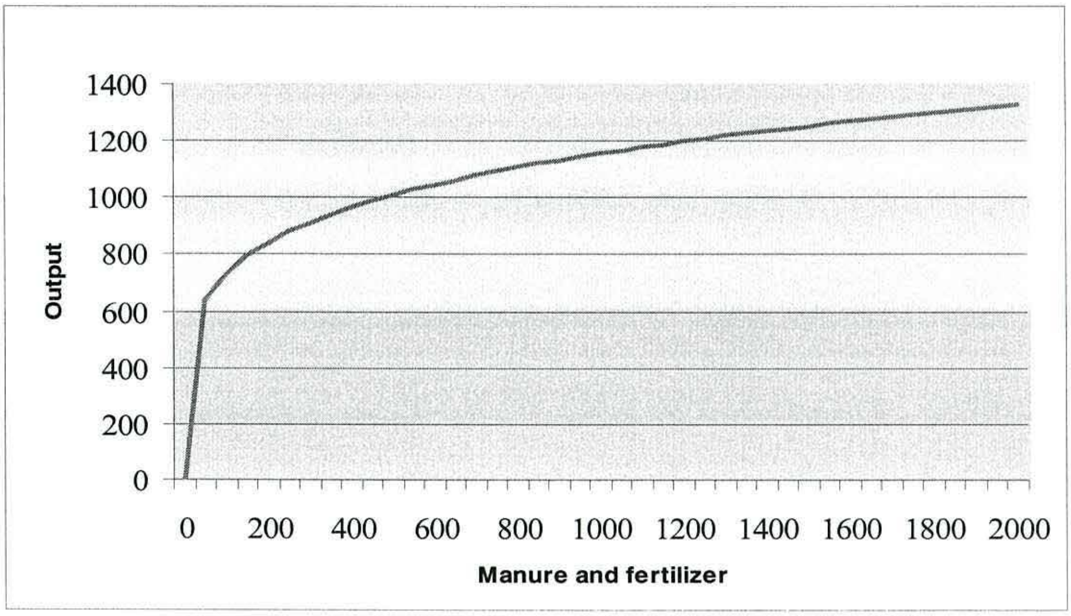


Figure 4.22 Estimation of French bean production for manure and fertilizer

The declining slope of the curve as manure and fertilizer are increased illustrates the short run phenomenon of diminishing returns. However, although output is responsive to manure and fertilizer, the proportionate response is stronger for the significant factors such as seed and land preparation.

Model 2

In this model, four district dummy variables, along with the other eight variables of model 1 are included to ascertain their district effects on output. Taking the values of the output elasticities, we get the following equation of the logarithmic regression;

$$LogY = -3.46 - 0.24\log X_2 + 0.36\log X_3 + 0.11\log X_4 + 0.08\log X_5 + \ldots + 0.47X_{12} + u \qquad (4.3)$$

which then converts to the Cobb-Douglas form, thus:

$$Y = 0.031\, X_2^{-0.24}\, X_3^{0.36}\, X_4^{0.11}\, X_5^{0.08} X_6^{0.72} X_7^{0.18}\, X_8^{0.04}\, X_9^{0.06} \,.\, e^{(0.55\, X_{10})} .e^{(0.03\, X_{11})} .e^{(0.47 X_{12})}\, e^{u} \quad (4.4)$$

The R^2 means that 93% variation of the output is explained by the contribution of the thirteen independent variables included in the model. The F-value of the log linear regression equation is 34.43 which indicates significance at the 95% (p=.05) level.

The output elasticity of land preparation is 0.36 which is significant at the 95% (p=.05) level. Also significant is seed, with a coefficient of 0.72 and that of manure and fertilizer is 0.18 and is significant at the 90% (p=.10) level. The elasticity of output in respect of the district dummy variable for Rangpur is 0.55 which is significant at the 95% (p= .05) level. Thus Rangpur outputs are significantly different from those of the base district, Narshingdi, whereas those of the other two districts are not.

Adding the eight elasticities of output, we obtain 1.31 which shows the value of the returns to scale, which is greater than 1 and so economies of scale exist here. The coefficients for farm size, land rent, labour, irrigation and pesticide were not significant at the 95% level. Surprisingly, the coefficient for farm size is negative but insignificant. This may again have been due to multicollinearity since correlation between farm size and some of other variables is high (see Appendix I, Table 30).

Similarly to Model 1, manure and fertilizer together constitute an important factor for French bean production, and dummy variables can be considered by holding other variables constant to plot the production function against these four dummy variables. Thus, a curve has been drawn showing the production function, illustrating the effect of districts by manipulating the quantity of manure and fertilizer from Equation 4.4, where all other variables are held constant at their mean values. The curves for Rangpur and

Tangail show much higher output compared to Comilla and Narshingdi are shown in figure 4.23.

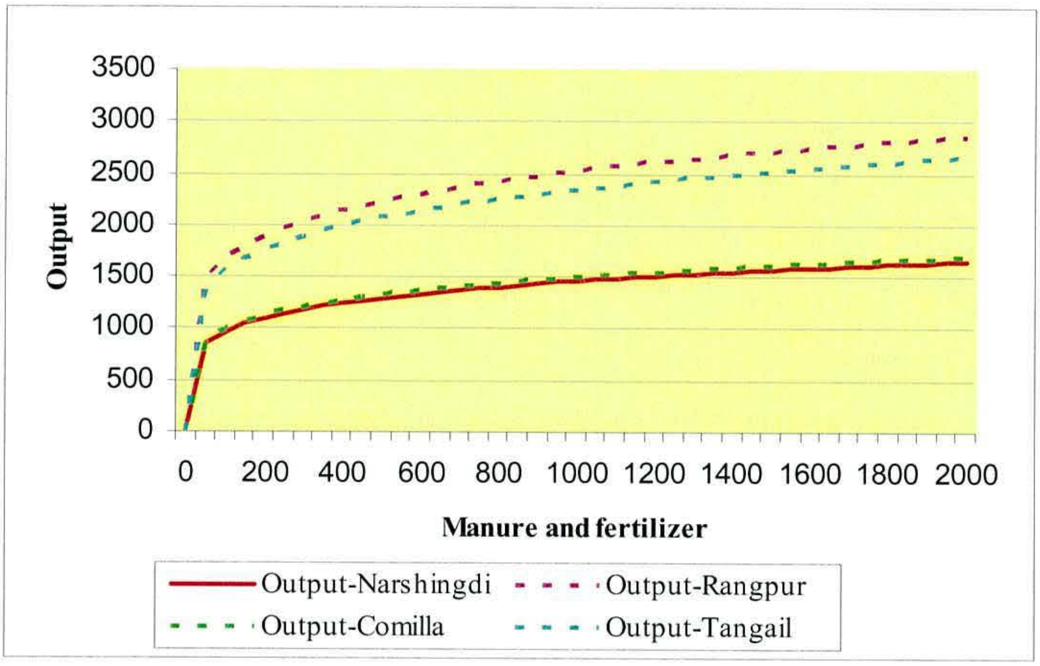


Figure 4. 23 Estimation of French bean production from manure and fertilizer in four districts

Model 3

In this model, the four variables: land preparation, seed, manure and fertilizer, and pesticide are combined together as one variable due to multicollinearity, while farm size, land rent, labour and irrigation are included individually. We get the following equation of the logarithmic regression through putting the output coefficients of the variables in this model

$$Log Y = 3.37 + .62 \log X_2 + .06 \log X_4 + .19 \log X_5 + .07 \log X_8 + ..32 \log X_{13} + u \qquad (4.5)$$

which then converts to the Cobb-Douglas form, thus;

$$Y = 29.079 X_2^{0.62} X_4^{0.06} X_5^{0.19} X_8^{0.07} X_{13}^{0.32} e^u \qquad (4.6)$$

The R^2 of 0.90 means that 90% of the variation in output could be explained by the effects of the five independent variables included in the model and the F-value of the log linear regression equation is 100.37 which is significant at the 95% (p=.05) level.

The output elasticity of farm size (elasticity of response) is 0.62 which is now significant at the 95% (p=.05) level and indicates that farm size has a sizeable, positive effect on production. The returns of scale figure is 1.26 which is similar to those figures already obtained. The output elasticity of the combined variable for land preparation, seed, manure and fertilizer and pesticide is 0.32 and is significant at the 95% (p=.05) level. Other variables are again insignificant.

Stepwise regression gives only three variables: land preparation, manure and fertilizer and seed as significant, but still exhibits a high in R^2 value as in the other Models.

4.7.2.2 Production function analysis for French bean per acre basis

The following table shows the results of both normal and stepwise regression for French bean on a per acre basis.

Table 4.25 Logarithmic regression analysis for French bean (per acre basis)

Dependent var.	Output					
Regression type	Enter			Stepwise		
	Coefficients					
Independent var.	Model 1	Model 2	Model 3	Step 1	Step 2	Step 3
Constant	-3.18 (-0.96)	-3.46 (-0.99)	3.41** (1.97)	8.87** (63.38)	6.57** (8.08)	2.12 (1.08)
Farm size	0.26** (2.68)	0.31** (3.23)	0.25** (3.44)	0.37** (4.02)	0.3** (3.39)	0.24** (2.8)
Land preparation	0.35** (2.11)	0.36* (2.24)				
Land rent	0.13 (0.91)	0.11 (0.74)	0.06 (0.58)			
Labour	0.08 (0.48)	0.08 (0.53)	0.18 (1.47)			
Seed	0.63** (2.61)	0.72** (2.72)				0.56** (2.46)
Manure and fertilizer	0.20** (2.06)	0.18* (1.91)			0.26** (2.87)	0.23** (2.69)
Irrigation	0.01 (0.23)	0.04 (0.61)	0.07 (1.2)			
Pesticide	0.11 (1.18)	0.06 (0.55)				
Land preparation, Seed, manure - fertilizer and pesticide			0.32** (2.46)			
Rangpur		0.55** (2.05)				
Comilla		0.03 (0.13)				
Tangail		0.47 (1.32)				
F-value	5.69**	5.23**	7.12**	16.20**	13.81**	12.52**
n	38	38	59	38	38	38
R-value	0.78	0.83	0.63	0.55	0.66	0.72
R^2-value	0.60	0.68	0.40	0.30	0.43	0.52

* = 90 % (p=.10) level of significance, * * = 95 % (p=.05) level of significance
Figures in parentheses indicate the t- value

All equations are effectively giving the same results as those in Table 4.24, since here all values are divided by the actual land of the crop on each farm. The only differences are in terms of a) the farm size variable and b) the R^2 values. These can be further explained, thus: a) the models in Table 4.25 have, as dependent variable the log of yield per acre, so the farm size variable shows its influence, not on total output, but on output per acre. Unlike in Table 4.24, all of these farm size coefficients are positive and significant with per acre output rising by some 25-30% of any change in farm size. This positive effect of farm size ties in with economies of scale indicated in the previous figure. So it further indicates that output per acre tends to be higher for larger farms; b) The R^2 values are much lower than in the previous figure, perhaps because of the almost automatic high level of correlation between farm size and output, along with most of the other variables.

4.7.2.3 Production function analysis for yard long bean per actual land basis

The regression results for YLB are given in Table 4.26 below.

Table 4.26 Logarithmic regression analysis for yard long bean per actual land basis

Dependent var.	Output					
Types of regression	Enter			Stepwise		
	Coefficients					
Independent variable	Model 1	Model 2	Model 3	Step 1	Step 2	Step 3
Constant	8.88** (3.18)	10.36** (2.84)	7.26** (4.75)	8.74** (48.46)	7.11** (12.47)	8.59** (7.99)
Farm size	0.99** (3.35)	1.15** (2.88)	0.85** (4.71)	1.05** (11.32)	0.78** (6.29)	0.95** (5.96)
Land prep	-0.14 (-1.39)	-0.16 (-1.45)				
Land rent	-0.23 (-1.53)	-0.38 (-0.95)	-0.07 (-0.80)			- 0.19 (- 1.61)
Labour	0.02 (0.08)	0.04 (0.18)	0.04 (0.30)			
Seed	0.03 (0.25)	0.01 (0.09)				
Manure and fertilizer	0.08 (1.02)	0.10 (1.22)				
Irrigation	0.21** (2.59)	0.19** (2.10)	0.18** (3.09)		0.23** (2.99)	0.25** (3.19)
Pesticide	0.02 (0.27)	-0.01 (-0.08)				
Land preparation, seed, manure-fertilizer and pesticide			0.06 (0.66)			
Rangpur		-0.07 (-0.30)				
Comilla		0.09 (0.27)				
Tangail		-0.14 (-0.48)				
$\sum \beta$ coefficients	0.99	0..94	1.06			
F	20.47**	14.13**	63.02**	128.23**	80.94**	56.99**
n	42.00	42.00	71.00	42.00	42.00	42.00
R	0.91	0.91	0.91	0.87	0.90	0.90
R^2	0.83	0.83	0.83	0.76	0.80	0.81

* = 90 % (p=.10) level of significance, * * = 95 % (p=.05) level of significance
Figures in parentheses indicate the t- value

Model 1

The major contributing factors farm size, land preparation, land rent, labour, seed, manure and fertilizer, irrigation and pesticide are included in this model, where the following equation of this production function model expresses the results of the logarithmic regression undertaken for YLB ;
Taking the values of the output elasticities, we get the following equation of the logarithmic regression;

$$Log Y = 8.88 + .99 \log X_2 - .14 \log X_3 - .23 \log X_4 + .02 \log X_5 + .03 \log X_6 + ... + .02 \log X_9 + u \quad (4.7)$$

Which then converts to Cobb-Douglas form,

$$Y = 7{,}186.791\, X_2^{.99}\, X_3^{-.14}\, X_4^{-.23}\, X_5^{.02}\, X_6^{.03}\, X_7^{.08}\, X_8^{.21}\, X_9^{.02}\, e^{u} \quad (4.8)$$

The R^2 is 0.83 which is lower than in the FB equations, but still shows that a high degree of variation in output is explained by the equation. The F-value of the log linear regression equation is 20.47 which indicates significance at the 95% (p=.05) level.

The output elasticity of farm size (elasticity of response) is 0.99 which is significant at the 95% (p=.05) level, and reveals that farm size has an almost unitary effect on production of yard long bean. The output elasticity of irrigation is 0.21, significant at the 95% (p=.05) level, while all other variables coefficients are insignificant.

Adding the eight elasticities of output, we obtain a figure of 0.99 which is almost 1, indicating economies of scale. A curve showing the production function, illustrating the relationship between output and manure and fertilizer from equation 4.8, when all other variables are held constant at their mean values, is shown in figure 4.24.

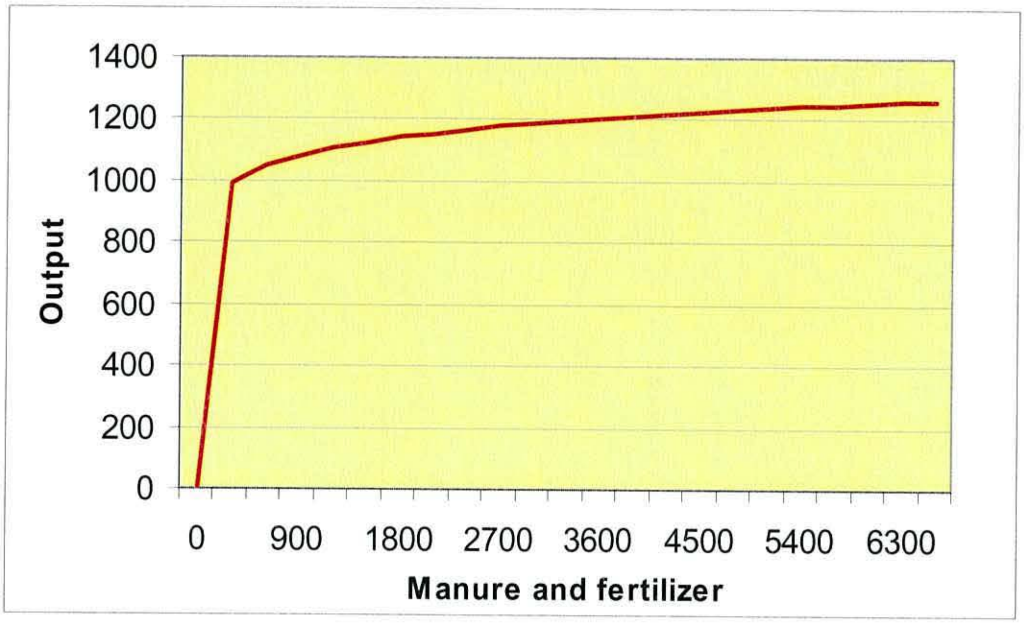


Figure 4.24 Manure and fertilizer response function for YLB

Model 2

In this model, four survey districts via three district dummy variables, along with the other eight variables of model 1, are included to ascertain the district effects on output.

Taking the values of the output elasticities, we get the following equation of the logarithmic regression;

$$LogY = 10.36 + 1.15\log X_2 - .16\log X_3 - .38\log X_4 + .04\log X_5 + ... - .14X_{12} + u \qquad (4.9)$$

We then get the following Cobb-Douglas equation;

$$Y = 31{,}640.087 X_2^{1.15} X_3^{-.16} X_4^{-38} X_5^{.04} X_6^{.01} X_7^{.10} X_8^{.19} X_9^{-.01} .e^{(-0.07X_{10})} .e^{(0.09X_{11})} .e^{(-0.14X_{12})} e^{u} \quad (4.10)$$

The R^2 is again 0.83 and the F-value is significant at the 95% (p=.05) level. The output elasticity of farm size (elasticity of response) is 1.15 which is significant at the 95% (p=.05) level. The output elasticity of irrigation is 0.19 which is also significant at the 95% (p=.05) level. The output coefficient for land preparation, land rent, seed, labour, manure and fertilizer, pesticide, dummy districts are not significant. Adding the eight elasticities of output, we obtain a figure of 0.94 that gives decreasing returns to scale.

Neverthless, an attempt has been made to draw the output curves showing the production function and illustrating the relationship between the output of the four survey districts and manure and fertilizer from equation 4.10, where all other variables are held constant at their mean values.

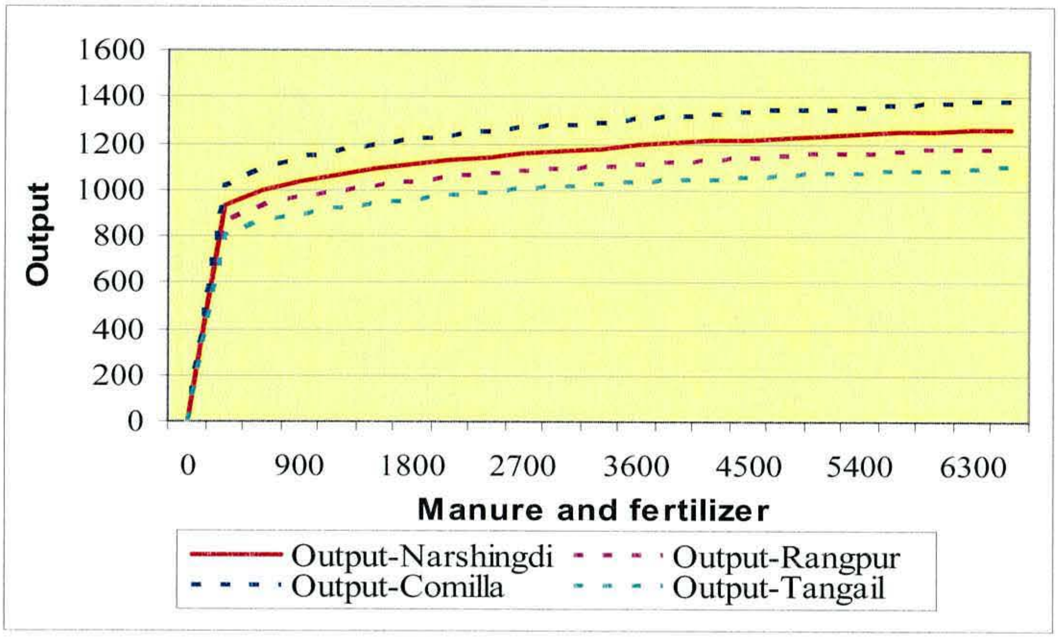


Figure 4.25 Estimation of yard long bean production from manure and fertilizer in four districts

The production curves for Comilla and Narshingdi show higher outputs compared to Rangpur and Tangail, although the gap is much smaller than the example of French bean in Figure 4.23.

Model 3

In this model, the four variables land preparation, seed, manure and fertilizer, pesticide are combined together as one variable to avoid multicollinearity while farm size, land rent, labour and irrigation are included individually (Appendix I, Table 31).

Using the values of the output elasticities of the variables included in this model, we get the following equation:

$$LogY = 7.26 + .85\log X_2 - .07\log X_4 + .04\log X_5 + 18\log X_8 + .06\log X_{13} + u \qquad (4.11)$$

$$Y = 1422.257\, X_2^{0.85}\, X_4^{-0.07}\, X_5^{0.04}\, X_8^{0.18}\, X_{13}^{0.06}\, e \qquad (4.12)$$

The R^2 is again 0.83 and the F-value of the log linear regression equation is 63.02 and is significant at the 95% (p=.05) level. The output elasticity of farm size is 0.85 which is significant at the 95% (p=.05) level, and shows that farm size has a major, positive effect on production. The output elasticity of the combined variable for land preparation, seed, manure and fertilizer and pesticide is 0.06 that is positive but not significant and the output coefficient for irrigation is 0.18 which is significant at the 95% (p=.05) level again. The returns to scale figure is 1.06 which shows slight economies of scale.

Stepwise regression only yields farm size and irrigation as significant variables, and the R^2 value is similar.

4.7.2.4 Production function analysis for yard long bean per acre basis

Table 4.27 Logarithmic regression analysis for yard long bean on a per acre basis

Dependent var.	Output					
Regression type	Enter			Stepwise		
	Coefficients					
Independent var.	Model 1	Model 2	Model 3	Step 1	Step 2	Step 3
Constant	8.88** (3.18)	10.36** (2.84)	7.26** (4.75)	7.07** (13.77)	8.59** (8.15)	
Farm size	-0.01 (-0.06)	-0.05 (-0.29)	0.06** (4.75)			
Land preparation	-0.14 (-1.39)	-0.16 (-1.45)				
Land rent	-0.23 (-1.53)	-0.38 (-0.95)	-0.07 (-0.80)		-0.19	
Labour	0.02 (0.08)	0.04 (0.18)	0.04 (0.30)			
Seed	0.03 (0.25)	0.01 (0.01)				
Manure and fertilizer	0.08 (1.02)	0.10 (1.22)				
Irrigation	0.21** (2.59)	0.19** (2.10)	0.18** (3.09)	0.24** (3.08)	0.25** (3.27)	
Pesticide	0.02 (0.27)	-0.01 (-0.08)				
Land preparation, seed, manure-fertilizer and pesticide			0.06 (0.66)			
Rangpur		-0.07 (-0.30)				
Comilla		0.09 (0.27)				
Tangail		-0.14 (-0.48)				
F	1.78	0.32	3.08**	9.48**	6.29**	
n	42.00	42.00	71.00	42.00	42.00	
R	0.54	0.56	0.44	0.43	0.49	
R^2	0.30	0.32	0.19	0.19	0.24	

* = 90 % (p=.10) level of significance, * * = 95 % (p=.05) level of significance
Figures in parentheses indicate the t- value

Table 4.27 shows the regression results of the three models and also of the three steps of the stepwise regression.

Again, the equations in Table 4.27 largely mirror those in Table 4.26. The farm size coefficients are either close to or are not significantly different from zero, which matches the almost constant returns to scale shown in Table 4.26. Only irrigation is significantly different from zero at around 0.2. Finally, the R^2 values are much lower, reaching only 0.32, which suggests that there are other factors, not presented here, which influence per acre yield of yard long bean.

4.7.2.5 Production function analysis for bitter gourd per actual land basis

Table 4.28 below shows the logarithmic regression results of the three models and three steps of the stepwise regression for BG.

Table 4.28 Logarithmic regression analysis for bitter gourd per actual land basis

Dependent var.	Output					
Regression type	Enter			Stepwise		
	Coefficients					
Independent var.	Model 1	Model 2	Model 3	Step 1	Step 2	Step 3
Constant	10.38** (3.40)	4.69 (1.16)	9.14** (5.14)	8.95** (54.08)	9.92** (17.25)	8.55** (9.23)
Farm size	1.29** (3.61)	0.59 (1.21)	1.23** (6.09)	1.24** (11.68)	1.31** (11.74)	1.14** (7.82)
Land preparation	0.02 (0.11)	0.12 (0.59)				
Land rent	-0.17 (-0.72)	0.40 (1.08)	-0.21 (-1.50)			
Labour	-0.24 (-1.15)	-0.26 (-1.21)	-0.09 (-0.50)			
Seed	0.08 (1.06)	0.08 (1.13)				
Manure and fertilizer	0.33** (2.74)	0.40** (3.23)				0.20* (1.85)
Irrigation	-0.14 (-1.44)	-0.17* (-1.74)	-0.08 (-0.99)			
Pesticide	-0.16* (-1.71)	-0.13 (-1.36)			-0.13* (-1.75)	-0.18** (-2.30)
Land preparation, seed, manure-fertilizer & pesticide			0.27* (1.95)			
Rangpur		0.23 (1.15)				
Comilla		-0.33 (-1.24)				
Tangail		-0.53 (-1.47)				
$\Sigma\beta$ coefficients	1.01	1.03	1.12			
F-value	20.79**	16.12**	53.36**	136.49**	72.71**	52.10**
n	49.00	49.00	75.00	49.00	49.00	49.00
R-value	0.90	0.91	0.89	0.86	0.87	0.88
R^2-value	0.80	0.82	0.79	0.74	0.76	0.77

* = 90 % (p=.10) level of significance, * * = 95 % (p=.05) level of significance
Figures in the parentheses indicate the t- value

Model 1

The contributing factors farm size, land preparation, land rent, labour, seed, manure and fertilizer, irrigation and pesticide are included in this model, where the following equation of this production function model expresses the results of the logarithmic regression undertaken for bitter gourd:

$$LogY = 10.38 + 1.29\log X_2 + 0.02\log X_3 - 0.17\log X_4 - 0.24\log X_5 + \ldots + 0.16\log X_9 + u \qquad (4.13)$$

Which then converts to the Cobb-Douglas form, thus;

$$Y = 32073.24\, X_2^{1.29}\, X_3^{.02}\, X_4^{-.17}\, X_5^{-.24}\, X_6^{.08}\, X^{.33}\, X_8^{-.14}\, X_9^{.16}\, e^{u} \qquad (4.14)$$

The R^2 indicates that this model is able to explain 80% of the variation in output of bitter gourd and the F-value is 20.79 indicating significance at the 95% (p=.05) level.

The output elasticity of farm size (elasticity of response) is 1.29 which is significant at the 95% (p=.05) level, and indicates that farm size has a greater than proportionate effect on production of bitter gourd. The output elasticity for manure and fertilizer is 0.33 which is significant at the 95% (p=.05) level, and reveals that if the cost for manure and fertilizer is increased by one percent, holding the other seven independent variables constant, then output of BG will be increased by 0.33. This input has a major impact on production of this vegetable. The estimated coefficients for fertilisers triple super phosphate and muriate of potash were found to be significant at the 1% and 5% level respectively in the case of cucumber production in Rangpur district in Bangladesh which concuss with these findings (Rahman *et al*, 2003). A production function analysis for bitter gourd also found that the coefficient for fertilizer was significant in the survey area of Faisalabad and Rahim Yar Khan in Pakistan (Ahmad and Baksh, 2005)

The coefficient for pesticide is -0.14, negative but significant at the 90% (p=.10) level, which suggests that pesticide has a negative effect on production. The coefficient of insecticide for country bean was also found to be negative and significant at the 1% level in Jessore district in Bangladesh (Haque *et el*, 2002). However, this apparent negative effect may be spurious: high correlation with farm size may result in multicollinearity or high pesticide usage might merely reflect high pest incidence which might lead to yield reductions.

The coefficients of the other variables are not significant at the 95% or 90% level, although, again, multicollinearity might be clouding the results (Appendix I, Table 32).

Adding the eight elasticities of output, we obtain a figure of 1.01that gives almost constant returns to scale. This is similar to the situation for YLB, but unlike FB, where increasing returns to scale appear to exist.

Figure 4.26 shows the production function curve, illustrating the relationship between output and manure and fertilizer from equation 4.14, where other variables are held constant at their mean values.

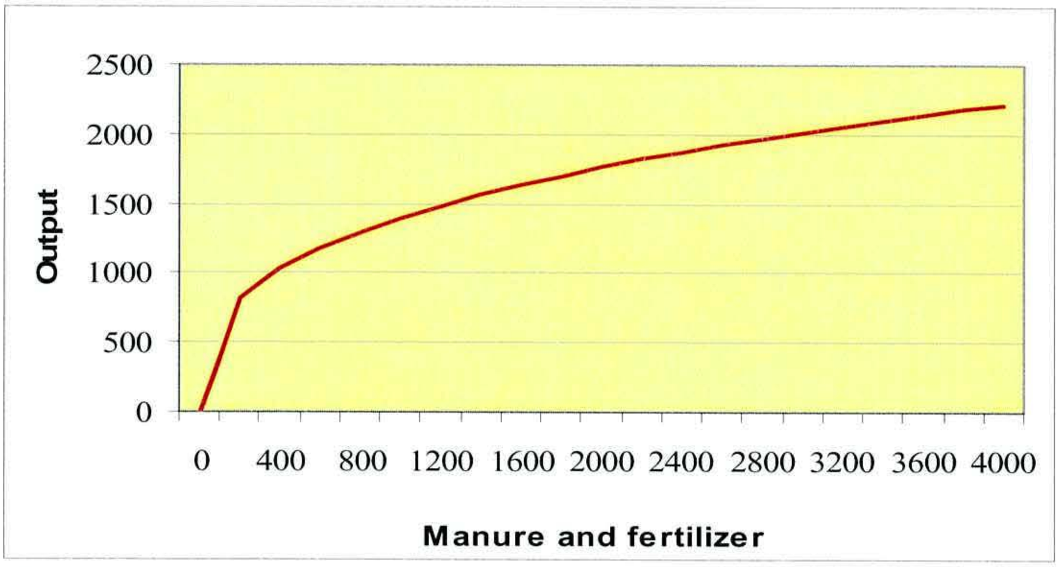


Figure 4.26 Bitter gourd production: manure and fertilizer relationship

Model 2

In this model, four survey districts were introduced using 3 dummy variables along with the other variables of model 1.

We get the following logarithmic regression equation;

$$LogY = 4.69 + .59\log X_2 + .12\log X_3 + .40\log X_4 - .26\log X_5 + .08\log X_6 + ... - .53X_{12} + u \quad (4.15)$$

which can then be shown in Cobb-Douglas form, thus:

$$Y = 109.23\, X_2^{.59}\, X_3^{.12}\, X_4^{.40} X_5^{-26}\, X_6^{.08} X_7^{.40}\, X_8^{-.17}\, X_9^{-.13}\,.\, e^{(0.23X_{10})}.e^{(-.33X_{11})}.e^{(-.53X_{12})}\, e^{u} \quad (4.16)$$

The R^2 is 0.82, slightly higher than for Model 1. The F-value of the regression equation is 16.12 and is significant at the 95% (p=.05) level.

The farm size coefficient is not significant, the output elasticity of manure and fertilizer (elasticity of response) is 0.40 which is significant at the 95% (p=.05) level. The elasticity of output in respect of irrigation is -0.17 that is now significant at the 90% (p=.10) level but negative, which may again reflect multicollinearity, unless there is an over watering problem. The coefficients of other variables are not significant at the 95% level for this vegetable; this includes pesticides which was previously significant.

Adding the elasticities of output, we obtain a figure of 1.03 which again gives constant returns to scale.

Similarly to Model 2 for French bean and yard long bean production, district dummy variables are considered for this vegetable, but having no significant effect on production. Curves were drawn illustrating the relationship between the output of the four survey districts and manure and fertilizer from the equation 4.16, with all other variables held constant at their mean values.

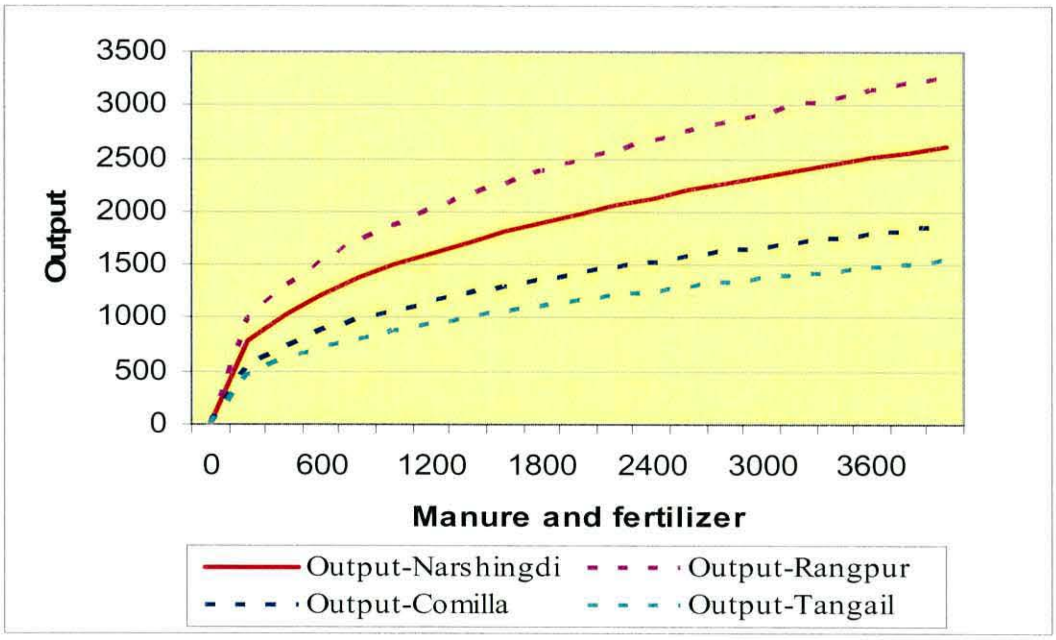


Figure 4.27 Bitter gourd production from Manure and fertilizer in four districts

The output curves for Rangpur and Narshingdi are a good deal higher than Comilla and Tangail, although the differences are not statistically significant.

Model 3

In this model, the four variables land preparation, seed, manure and fertilizer, and pesticide are combined together as one variable due to multicollinearity while farm size, land rent, labour and irrigation are included individually. The following equation is obtained from Table 4.28.

$$LogY = 9.14 + 1.23\log X_2 - .21\log X_4 - .09\log X_5 - .08\log X_8 + .27\log X_{13} + u \qquad (4.17)$$

$$Y = 9320.765 X_2^{1.13}\, X_4^{-0.217}\, X_5^{-0.09}\, X_8^{-.08}\, X_{13}^{0.27}\, e^u \qquad (4.18)$$

The R^2 is reasonably high at 0.79 and the F-value is significant at the 95% (p=.05) level. The output elasticity of farm size (elasticity of response) is 1.23 which is significant at the 95% (p=.05) level and similar to that in Model 1. The output elasticity of the combined variable for land preparation, seed, manure and fertilizer and pesticide is 0.27 and is significant at the 90% (p=.10) level.

The returns to scale measure is 1.12, slightly above that in model 1 and 2 and suggests some degree of economies of scale.

Stepwise regression gives only three variables farm size, manure and fertilizer and pesticide significant, but still gives nearly as high an R^2 value as in the other models. The pesticide coefficient is again negative.

4.7.2.6 Production function analysis for bitter gourd per acre basis

The Table 4.29 shows the logarithmic regression results of the three models undertaken and also of the three steps of the stepwise regression with all variables on a per acre basis.

The equation in Table 4.29 again reflects the results in Table 4.28. The low and insignificant farm size coefficient suggests almost constant returns to scale and, as with YLB, the R^2 values are only moderate, leaving a good deal of variation in yield per acre unexplained.

Table 4.29 Logarithmic regression analysis for bitter gourd per acre basis

Dependent var.	Output					
Regression type	Enter			Stepwise		
	Coefficient					
Independent var.	Model 1	Model 2	Model 3	Step 1	Step 2	Step 3
Constant	10.38** (3.06)	4.69 (1.16)	9.14** (5.14)	9.98** (17.09)	8.45** (9.06)	8.74** (9.46)
Farm size	0.02 (0.12)	0.03 (0.18)	0.12 (1.32)			
Land preparation	0.02 (0.11)	0.12 (0.59)				
Land rent	-0.17 (-0.72)	0.40 (1.08)	-0.21 (-1.50)			
Labour	-0.24 (-1.15)	-0.26 (-1.21)	-0.09 (-0.50)			
Seed	0.08 (1.06)	0.08 (1.13)				
Manure and fertilizer	0.33** (2.74)	0.40** (3.23)			0.22** (2.05)	0.30** (2.67)
Irrigation	-0.14 (-1.44)	-0.17 (-1.74)	-0.08 (-0.99)			-0.17* (-1.84)
Pesticide	-0.16* (-1.71)	-0.13 (-1.36)		-0.17 (-2.37)	-0.22** (-2.94)	-0.20** (-2.65)
Land preparation, seed, manure-fertilizer and pesticide			0.27* (1.95)			
Rangpur		0.23 (1.15)				
Comilla		-0.33 (-1.24)				
Tangail		-0.53 (-1.47)				
F	2.35**	2.19**	2.02*	5.60**	5.09**	4.69**
n	49.00	49.00	75.00	49.00	49.00	49.00
R	0.56	0.62	0.35	0.32	0.42	0.48
R^2	0.31	0.39	0.13	0.10	0.18	0.23

* = 90 % (p=.10) level of significance, * * = 95 % (p=.05) level of significance
Figures in parentheses indicate the t- value

4.7.2.7 Conclusion on production function analysis

Production function analysis is carried out for FB, YLB and BG adopting three models per actual land and acre basis. Correlation matrix shows the multicollinearity problem which temped to adopt several models to find out the contribution of individual independent variables included in these models. Attempt has been made to include dummy district variables in model 2 and combined variable in model 3 rather than excluding less important variables from the model 1 to overcome the multicollinearity problem.

However, acre basis regression gives almost the same significant variables like actual land basis regression. Farm size is found significant in most cases per acre basis analysis but not in the case of actual land basis. On the other hand, actual land basis regression analysis gives better result with higher R^2 value than the acre basis regression for the three sample vegetables. Additionally, the model 2 gives higher R^2 than that of other two models and dummy Rangpur is found significant in model 2 for FB. The model 3 does not give better result than model 1 and model 2 except the combined variable. Even though, the three models are found useful to find out the significant variables through alternative way for FB, YLB and BG production function analysis.

This production function analysis tells us that actual land basis regression gives better result than acre basis analysis. Adopting different models in such analysis for various factors is useful to find out the significant contribution of the different factors and also to overcome the multicollinearity problem as well.

4.8 Estimation of technical efficiency of the sample producers

4.8.1 Introduction

Added to the cost-benefit analysis and the production function estimation already carried out, a further attempt has been made to estimate the performance of the producers in the production of these three vegetables through measuring their technical efficiency. Such technical efficiency measurement of these three vegetables does not previously appear to have been examined in Bangladesh.

Technical efficiency is one of the components of overall economic efficiency of any firm. An economically efficient firm must be technically efficient because profit maximisation depends on producing the maximum output with the same levels of inputs (Kumbhaker and Lovell, 2000). Formulation of agricultural policy is aided by quantitative analysis of agricultural production systems where technical efficiency is one measure of a producer's performance. They mentioned that the theoretical concept covering measurement of productive efficiency was first developed by Farrell (1957). The stochastic frontier production functions could be estimated either by the maximum likelihood method or the ordinary least squares (OLS) method as suggested by Richmond (1974). A frontier production function was used to estimate technical efficiency for farms in North-West England (Russell and Young, 1983).

The estimation of technical efficiency is performed here using by stochastic frontier production function derived by the ordinary least squares method considering actual production and estimated production for each of the vegetables on an actual land basis. Before measuring the technical efficiency, estimated production or output is computed using the Cobb-Douglas production function model, with the actual values of the independent variables included in model 1 for French bean, yard long bean and bitter gourd (Equations 4. 2, 4.8, and 4. 14). The actual output levels are then compared to the predicted output levels and converted to an index taking the most efficient producer as 100.

4.8.2 Estimation of technical efficiency of French bean producer

Output was predicted using Equation 4.2 and the actual level of inputs for each farm. The estimated production to actual production of French bean is plotted in the following scatter diagram. Points above a 45^0 line would be farms with expected production greater than actual and those below it, with actual greater than expected.

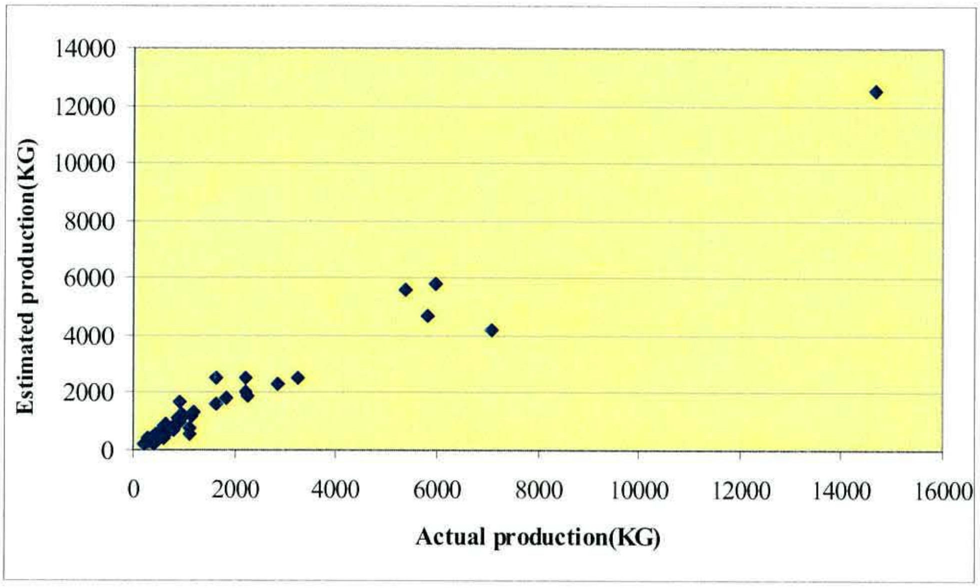


Figure 4.28 Distribution of estimated production of French bean to actual production

The stochastic frontier technique is applied to measure the technical efficiency of French bean producers as follows: The ratio of actual production to estimated production is computed. To obtain the frontier, the farm showing maximum possible output with the same inputs utilized in the production process is that with the highest ratio. All farm ratios are then divided by this 'frontier' ratio.

Ratio = actual production/ estimated production

Technical efficiency = Ratio obtained / Frontier value

The 'frontier' is obtained as a figure of 2.093. The mean estimated technical efficiency is a figure of 0.50 which indicates 50% technical efficiency for the French bean producer on average for this Bangladesh. This suggests that the output of French bean could be increased substantially if the producers achieved the highest possible technical efficiency. It should also be noted that the range of technical efficiency is from 26 to 100 indicating a vast difference between the efficiency levels of the producers.

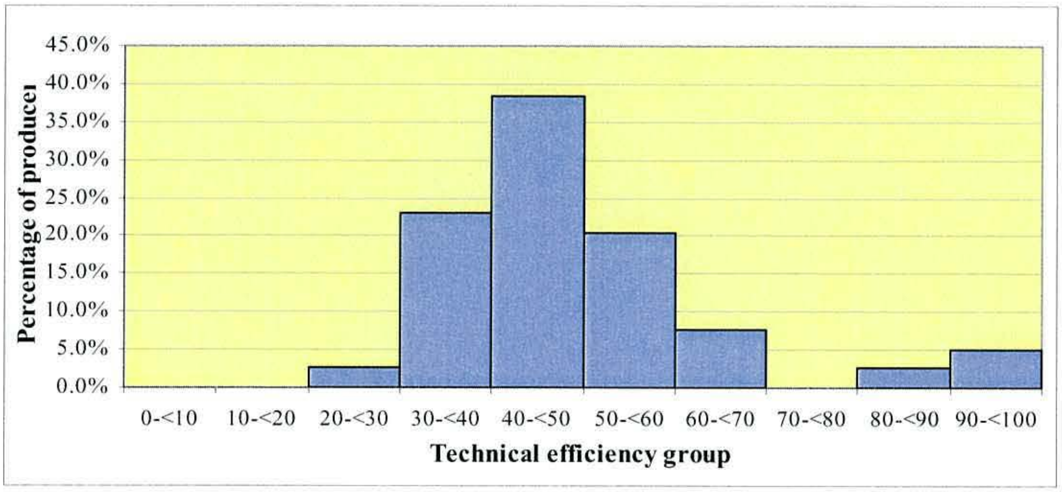


Figure 4.29 Distribution of technical efficiency of different producers of French bean

Figure 4.29 shows the distribution of technical efficiency of the farmers. The highest number of farmers (38.5%) are in the 40-<50 range. Again, 20.5% of the farmers are in the range of 50<60 and 23% are in the 30-<40 group giving about 92% of the farmers between 30-<70 with only 8% reaching 80% efficiency.

4.8.3 Estimation of technical efficiency of yard long bean producers

The Cobb-Douglas production function model in equation 4.8 was used to estimate output for yard long bean. The estimated production to actual production of yard long bean is plotted in the following scatter diagram shown in figure 4.30.

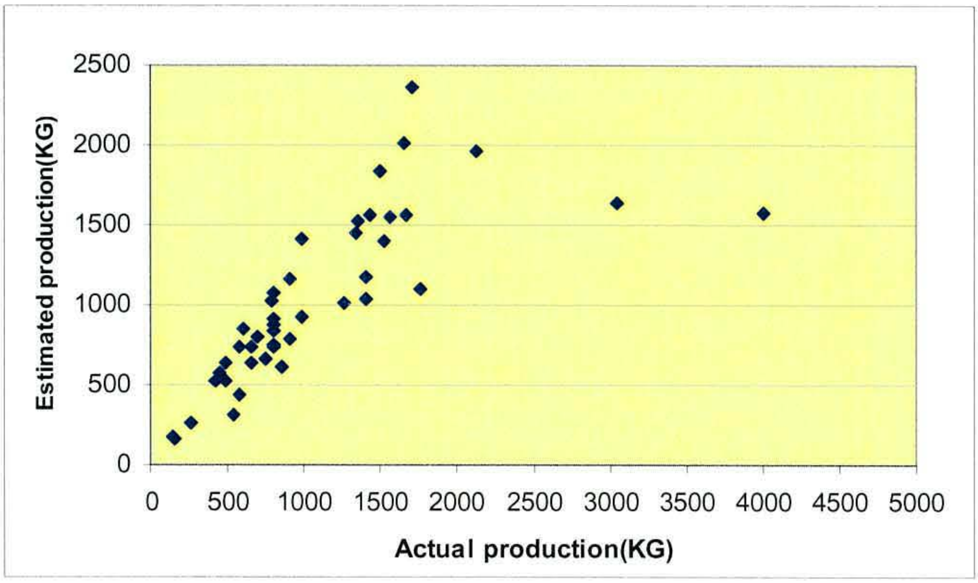


Figure 4.30 Distribution of Estimated production to actual production of yard long bean

The same procedure to estimate technical efficiency was adopted. The 'frontier' is obtained as a figure of 2.55 while estimated mean technical efficiency 41%. This again suggests that output of yard long bean can be increased substantially with the same inputs if the producers increase technical efficiency. The technical efficiency ranges from 27 to 100 except the frontier indicating a vast difference between the technical efficiency levels of the producers.

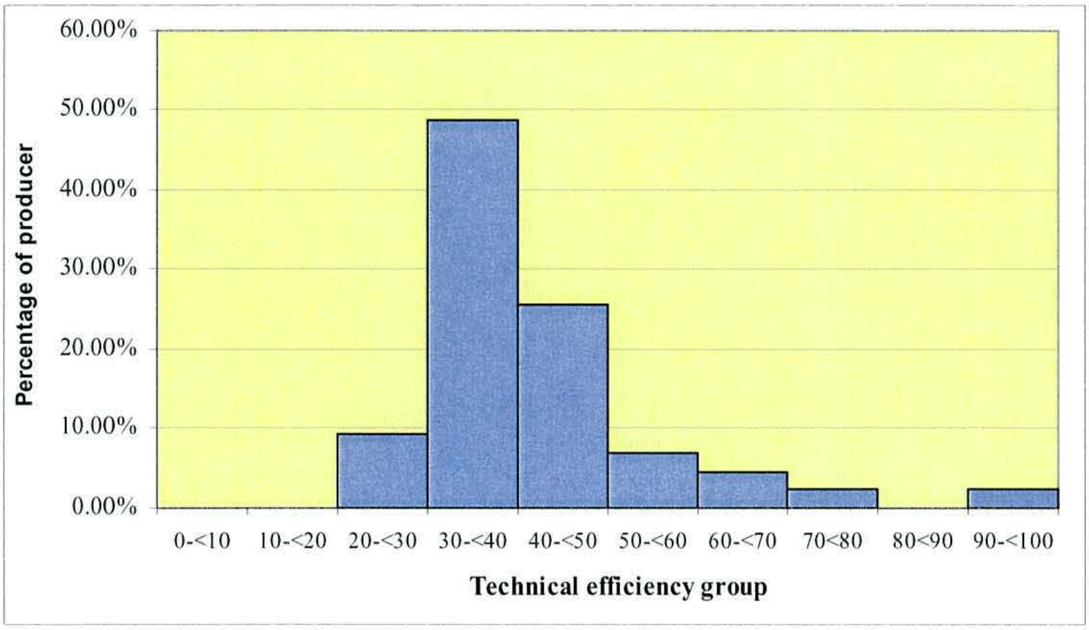


Figure 4.31 Distribution of technical efficiency of different producers of yard long bean

Figure 4.31 shows the distribution of technical efficiency of the farmers. The highest number of farmers (48.8%) are in the 30-<40 group. The second category of technical efficiency is the 40-<50 group with 25.6% whilst only 2.3% are in the 90-100 technical efficiency group for YLB. Thus, nearly ¾ of producers have technical efficiency ranging between 30-50%, with very few above 50%.

4.8.4 Estimation of technical efficiency of bitter gourd producer

The Cobb-Douglas production function model in equation 4.14 was used to estimate output for bitter gourd. The estimated production to actual production of bitter gourd is plotted in the following scatter diagram (Figure 4.32).

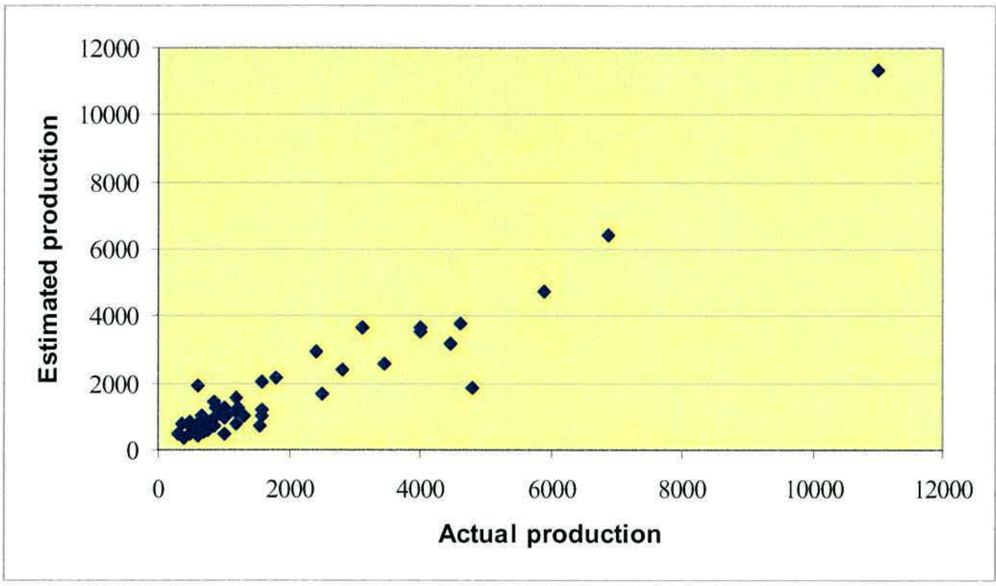


Figure 4.32 Distribution of Estimated against actual production of bitter gourd

Using the same method as before, the technical efficiency of each producer is computed by dividing the individual's ratio by the frontier value. The 'frontier' producer has a figure of 2.58 while estimated mean technical efficiency is 41%. It again suggests that output of BG could be increased substantially if the producers achieved high technical efficiency. Technical efficiency ranges from 12 to 100% indicating a vast difference between the efficiency levels of the producers.

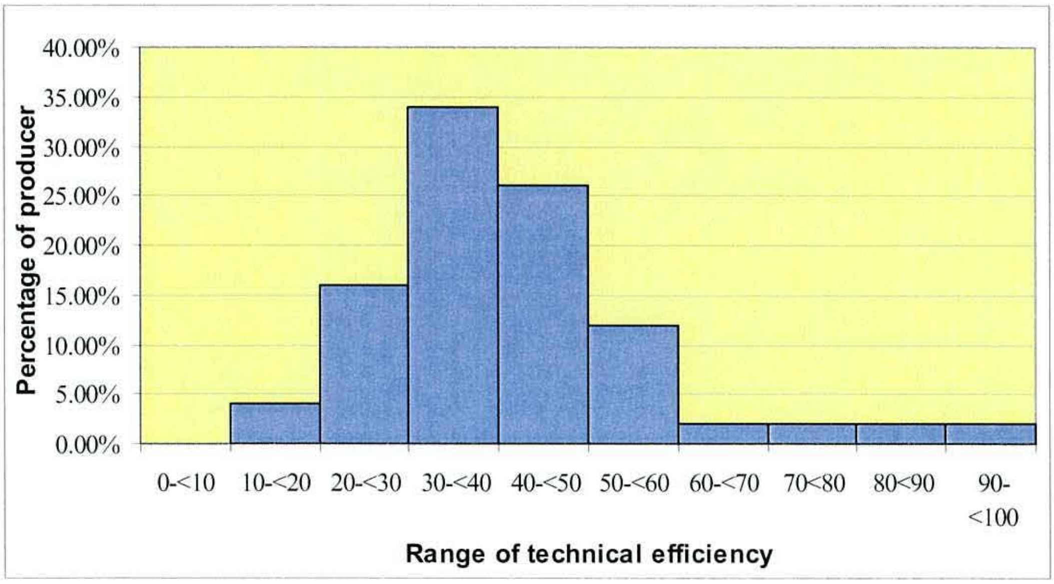


Figure 4.33 Distribution of technical efficiency of bitter gourd producers

Figure 4.33 shows the distribution of technical efficiency of the farmers. The highest number of farmers (34%) is in the 30-<40% group. The technical efficiency group of

40-<50 comprised of 26% of the farmers, but the 90-100% group contained only 2 % for this vegetable. Thus, 60% of the farmers exhibit technical efficiency in the range of 30-50% while only 8% reach the 60% level.

4.9 Factors affecting technical efficiency of vegetable producers

Further statistical analysis was carried out to estimate the factors responsible for the technical efficiency of the vegetable producers measured earlier. Two models, Model 1, including the district dummies along with other independent variables and model 2, incorporating the same variables excluding the district dummies were analysed to test the determinants of efficiency. Timmer (1971) and Kalirajan and Shand (1989) had suggested that the technical efficiency of farmers is influenced by the socio-economic and demographic characteristics of the farmers. According to their suggestions, the independent variables included in the model 1 and model 2 relate to these characteristics.

Model A

Farm size, age, household size, contract farming, education of the respondents, and district are incorporated in this model. Contract farming, education and districts are included in dummy form in the equation.

The multiple regression equation in this model is as follows:

$$Y = a + b_1 x_1 + b_2 x_2 + b_3 x_3 + b_4 x_4 + b_5 x_5 + b_6 x_6 + b_7 x_7 + b_8 x_8 + b_9 x_9 + b_{10} x_{10} + b_{11} x_{11} + U$$

Where, Y = technical efficiency ratios;
X1 = Farm size; x_2 = Age; x3 = House hold size; x4 = Experience;
X5 = Dummy contract farming; x6 = Dummy primary; x_7 = Dummy secondary;
X8 = Dummy graduate; x_9 = Dummy Rangpur; x_{10} = Dummy Camilla;
x_{11} = Dummy Tangail; $b_1, b_2, \ldots, b_{11}$ are the coefficients of Y in respect of the independent variables $x_1, x_2, \ldots, x_{11}$; and u = disturbance term.

Model B

A second model was tested with district dummies excluded. Table 4.30 shows the regression results for models 1 and 2 for FB, YLB and BG.

Table 4.30 Factor analysis for technical efficiency of vegetable producer by normal regression

Dependent variable	Frontier Ratio					
	Model 1 (including districts)			Model 2 (excluding districts)		
Independent variable	FB	YLB	BG	FB	YLB	BG
Constant	0.716*** (3.624)	0.116 (0.447)	0.592 *** (3.241)	0.647*** (5.150)	0.294 * (1.861)	0.484 *** (3.872)
Farm size	0.169 (1.655)	0.087 (0.260)	-0.023 (-0.172)	0.158 (1.639)	0.087 (0.264)	0.025 (0.205)
Age	-0.002 (-0.976)	0.003 (1.121)	0.001 (0.208)	-0.003 (-1.480)	0.001 (0.410)	0.001 (0.207)
Household size	-0.002 (-0.130)	0.016 (0.928)	-0.007 (-0.498)	0.001 (0.108)	0.011 (0.676)	-0.008 (-0.568)
Experience	-0.005 (-0.798)	-0.001 (0.778)	-0.007 (-1.695)	-0.002 (-0.859)	-0.001 (-0.156)	-0.006 (-1.648)
Dummy contract farming	0.195 (1.192)	0.070 (1.004)	-0.037 (-0.495)	0.274*** (3.624)	0.014 (0.281)	0.012 (0.214)
Dummy primary	-0.166** (-2.697)	0.002 (0.029)	0.067 (1.209)	-0.161*** (-2.810)	0.025 (0.431)	0.073 (1.322)
Dummy secondary	-0.142 * (-2.024)	-0.007 (-0.091)	0.020 (0.254)	-0.143** (-2.266)	-0.043 (-0.739)	0.029 (0.410)
Dummy graduate	-0.140 (-1.224)	-0.060 (-0.360)	-	-0.151 (-1.382)	-0.077 (-0.474)	-
Dummy Rangpur	0.019 (0.077)	-0.026 (-0.238)	-0.005 (-0.065)	-	-	-
Dummy Comilla	-0.078 (-0.564)	0.063 (0.491)	-0.090 (-1.003)	-	-	-
Dummy Tangail	0.078 (0.341)	-0.094 (-0.764)	-0.121 (-1.033)	-	-	-
F-value	1.767	0.426	0.756	2.535 **	0.346	0.774
n	38	42	49	38	42	49
R-value	0.647	0.362	0.403	0.635	0.274	0.338
R^2-value	0.419	0.131	0.162	0.403	0.075	0.114

Figure in the parentheses indicates the t-value. *** indicates 1% (p=.01), ** indicates 5% (p=.05) And * indicates 10% (p=.10) level of significance respectively.

4.9.1 Factors affecting technical efficiency of French bean producer

Model A

The dummy for higher secondary education was not included in this model due to non-availability of respondents at this level of education. This is the case for all 3 vegetables.

In model 1 for FB, the value of the multiple coefficient of determination ($R^{2)}$ is 0.42 but the F- value of 1.767 is not significant. However, the coefficient of the primary level of education dummy is -.166 and is significant at the 5% level. The negative sign indicates that primary education has a negative impact on technical efficiency. Similarly, the coefficient of the dummy for secondary education is -0.142 and is significant at the 10% level. This suggests that illiterate producers are technically more efficient than the primary and secondary educated people, perhaps because illiterate producers (having no formal education) gave their full attention to cultivation instead of off farm activities. Other factors are either positive or negative, but not significant. The coefficient of contract farming is positive, but not significant. The dummies for districts have no significant effect on technical efficiency in this model, so technical efficiency cannot be said to be influenced by district.

Model B

Again the dummy for higher secondary education is not put in this equation due to non availability of respondents at this level of education. Table 4.30 above shows the regression results for model 2 for FB with an R^2 of 0.40, similar to model 1.The F-value is 2.535 and is significant at the 95% (p=.05) level. The coefficient for contract farming is 0.274 which is highly significant at the 99% (p = .01) level, indicating its positive effect on the technical efficiency of French bean producer. It appears that dropping the district dummies leads to the significance of contract farming, which may indicate the concentration of contract farming in one or more districts. The coefficient of primary education is -.161, also significant at the 99% (p=.01) level and in model 1, it is negative while the coefficient for secondary education is -0.143 which is significant at the 95% (p =.05) level and also negative, indicating that both primary and secondary education have a negative effect on technical efficiency. Note also that the coefficients for primary, secondary and graduate levels are of similar values and all negative. The coefficients of other factors are either positive or negative but these are not significant at all.

4.9.2 Factors affecting technical efficiency of yard long bean producers

Model A

The R^2 of this equation is 0.13, extremely low and much lower than that for FB. The F-value is 0.426 which is not significant. The coefficients of the factors included in the equation are either positive or negative but none are significant; this includes district variables. Parikh and Shah (1994) concluded that credit improves farmers' liquidity, facilitates the purchase of inputs and also encourages the farmers to purchase the high yielding varieties of seed that improve yield per acre. In this study, other factors such as credit usage and extension services rendered to the farmers by the Department of Agricultural Extension might be affecting the technical efficiency of yard long bean producers.

Model B

The R^2 of this model is again extremely low at 0.08 and the F-value is 0.346 and not significant. The coefficients of the variables are either positive or negative but not significant.

4.9.3 Factors affecting technical efficiency of bitter gourd producer

Model A

The R^2 of the equation for model 1 is 0.16 and the F-value is 0.756 which is not significant. The coefficients of the variables (age, primary level, and secondary level) are either positive or negative but none are significantly contributing to technical efficiency. Again other factors such as farmers' financial ability and extension services (Lindara *et al* , 2004), might be some important variables missing from the analysis, but

site factors (slope, elevation, soil quality, etc) might also be important influences on the level of the effective production function and thence apparent technical efficiency.
It is worth mentioning here that the most of the BG producers in the survey areas are not contract farmers of the exporters, unlike with FB.

Model B

The R^2 of the equation for BG is 0.11and the F-value is 0.774 but not significant.
The coefficients of the variables show that none are significantly influencing to the technical efficiency.

4.9.4 Technical efficiency and policy implications

Quantitative analysis of agricultural production systems has become an important step to formulate agricultural policy. Measurement of producers' performance in terms of technical efficiency is often useful for policy formulation (Russell and Young, 1983). In this study, technical efficiency of the producers of French bean, yard long bean and bitter gourd and the factors responsible for such measured efficiency have been estimated. The technical efficiency of the producers of French bean, yard long bean and bitter gourd averages 50%, 41% and 41% respectively. The socio-economic factors farm size, age, household size, contract farming, experience, education and district effect were considered as determinant of the technical efficiency.

Contract farming was found to be highly significant in the case of French bean cultivation in model 2 while education at the level of primary and secondary was found to be negatively significant. Yet no factors were found to be significant in the case of YLB and BG. Usually YLB and BG producers are not directly contract farmers. Aspects of producers' ability, not measured by education, age, and experience, as well as credit or own capital and extension services were not included due to lack of data, but those could have significant effects, as could site specific factors. Nevertheless, technical efficiency is, on average, low and further research on its determinants could yield major gains in productivity.

Increased output of these vegetables will depend, to some extent upon improvements in technical efficiency of the farmers and this could be a major policy issue in the most densely populated country of the world.

4.10 Experience of the producers in vegetable cultivation

The level of experience of the producers was examined during the field survey. The length of experience in vegetable cultivation and technology adoption status of the producer were also analysed to ascertain the intensity of vegetable cultivation among the farmers.

4.10.1 Experience of the producers in vegetable cultivation by year

Table 4.31 Experience of the sample farmer in vegetable cultivation

	Experience group				
Farmers Category	0 – 5 years	6 - 15 years	16 - above years	Overall	Mean
Marginal	17 (24.64)	38 (55.07)	14 (20.29)	69 (100)	11.7
Small	26 (32.50)	35 (43.75)	19 (23.75)	80 (100)	11.4
Medium	15 (23.44)	26 (40.63)	23 (35.94)	64 (100)	13.7
Large	2 (18.18)	7 (63.64)	2 (18.18)	11 (100)	13.5
Overall	60 (26.79)	106 (47.32)	58 (25.89)	224 (100)	-
Mean	3.3	11	23.7	-	12.2

Figures in parentheses indicate percentages
Chi-Square value = 7. 71 df = 6. p = 0.26,
2 cells (16.7%) have expected count less than 5 and the minimum expected count is 2.85.

Table 4.31 explains that about 73% of the respondents, irrespective of farm size, are relatively experienced having had involvement in vegetable cultivation for 6 years or more, indicating their familiarity with these crops. On average, small farmers to have least experience and medium farmers the most. Furthermore, the results show the mean experience of the producers by farmer category which indicates that the marginal and small farmers had comparatively lower experience (about 12 years) but the medium and large farmers had higher experience (about 14 years). However, the Chi-square test reveals that there is no significant relationship between farm size and experience of vegetable cultivation.

4.10.2 Adoption status of modern technology by the sample producers

Table 4.32 Adoption status of modern technology in vegetable cultivation by the producers

Farmers category	Improved seed	Irrigation	Organic fertilizer	IPM technology	All
Marginal	41 (59.42)	68 (98.55)	4 (5.97)	4 (5.97)	69 (100)
Small	43 (53.75)	78 (97.5)	21 (26.25)	18 (22.5)	80 (100)
Medium	29.00 (45.31)	64 (100.00)	7 (10.94)	7 (10.94)	64 (100)
Large	2.00 (18.18)	11 (100.00)	1 (9.09)	1 (9.09)	11 (100)
All	115 (51.34)	221 (98.66)	33 (14.86)	30 (13.51)	(224) 100

Figures in parentheses indicate the percentage

An attempt was made to find out the adoption situation of modern technology as well as organic farming among the farmers in the survey areas. Table 4.32 shows that almost 100% of the respondents applied irrigation in commercial vegetable production in 2002-03; only a few of marginal and small farmers did not. On the other hand, total area under vegetable cultivation, including potato in 2001-02 was 1.2 million acres in Bangladesh whereas 676,000 acres were irrigated which is only 57% (BBS, 2003).

About 15% of the respondents applied organic fertilizer instead of chemical fertilizer and 14% adopted IPM technology instead of pesticides which indicates the tendency towards organic farming, although, the producers are not yet recognized as carrying out full organic farming of vegetables. Both practices are more common amongst small farmers, but even then only a quarter are involved. The table also shows that the vegetable producers are active in using the improved seed, including hybrid seed; more than 50% use improved seed, but this increases with decreasing farm size.

4.10.3 Major problems faced by the vegetable producers during production and marketing

The questionnaire designed for the producer includes open ended questions regarding various problems faced by them. The respondents raised the following issues on inputs, marketing, liquidity and other important problems.

Table 4.33 Major problems faced by the producers during production and marketing

Problems	Name of the survey districts				
	Rangpur	Comilla	Tangail	Narsingdi	All
Low price of vegetable in peak season	22 (64.7)	46 (52.3)	33 (75.0)	43 (74.1)	144 (64.3)
No linkage between producer, middlemen and exporter	28 (82.4)	4 (4.5)	36 (81.8)	34 (58.6)	102 (45.5)
Unavailability of quality seed	8 (23.5)	48 (54.5)	11 (25.0)	23 (39.7)	90 (40.2)
Financial insolvency	5 (14.7)	32 (36.4)	11 (25.0)	5 (8.6)	53 (23.7)
High fertilizer/pesticide cost	4 (11.8)	37 (42.0)	6 (13.6)	5 (8.6)	52 (23.2)
Weak marketing channel	11 (32.4)	4 (4.5)	6 (13.6)	16 (27.6)	37 (16.5)
No multipurpose cold storage for fresh vegetable	3 (8.8)	8 (9.1)	9 (20.5)	13 (22.4)	33 (14.7)
Lack of Government price support for vegetables	5 (14.7)	23 (26.1)	0 (0.0)	5 (8.6)	33 (14.7)
Low price of vegetable	9 (26.5)	16 (18.2)	0 (0.0)	5 (8.6)	30 (13.4)
No cooperative society among farmers as bargaining agent	4 (11.8)	8 (9.1)	15 (34.1)	3 (5.2)	30 (13.4)

Figures in the parentheses indicates the percentage

Table 4.33 shows the major problems prevailing in connection with the various activities of vegetable cultivation and provides a baseline constraint frame for policy formulation. The main issues arising are related to product price (particularly at the peak), storage, marketing of inputs and outputs.

4.11 Conclusion

In this chapter the socio-economic characteristics of the respondents, and the financial and economic potential of production of the three sample vegetables in this study was analysed. The education, occupation, household size, and respondents' categorisation according to land holding and tenure pattern were presented. The distribution of agricultural inputs and credit by the public as well as the private sector was briefly reviewed. The Ministry of Agriculture is monitoring the procurement and distribution, stock level, and retail price of fertilizer. It is also regulating the import of fertilizer, and quality of pesticides and seeds, particularly vegetable seed, handled by the private sector. Both public and the private organisations need to produce increased vegetable seed to meet the shortages and this needs an appropriate policy. The production cost of vegetable is relatively high, so to combat financial insolvency of the producers, state owned banks, private banks and NGOs need to disburse increased amounts of credit covering the production costs.

The economics of the sample vegetable was determined through detailed financial analysis followed by statistical and economic analysis. The financial analysis was carried out for each of French bean, yard long bean and bitter gourd vegetable by farmer category and survey district, and showed that the production of the three sample vegetables is profitable, using net income and the benefit- cost ratio based on a full cost and cash cost basis.

Descriptive analysis for the sample vegetable was undertaken by farmer category and survey district to determine their yield variation. Cobb-Douglas production function analysis for each of the vegetables was also carried out to determine the factors affecting production. Three models were designed and, seed, land preparation, manure and fertilizer, and district for FB, farm size and irrigation for YLB, and farm size, manure and fertilizer and pesticide (negatively) for BG were identified as significant factors in models for the different vegetables, findings supported by some other researchers in Bangladesh. Economies of scale were found in the case of FB and BG, but constant returns to scale for YLB.

After conducting the production function analysis, technical efficiency and factors affecting the efficiency of the respondents were measured. The mean technical efficiency indices of French bean, yard long bean and bitter gourd were about 50%, 41% and 41% respectively. Contract farming was found to be a significant determinant of technical efficiency for French bean production as were some educational variables, although the latter were not of the expected sign. No variables were significant in the case of YLB and BG.

4.12 Linkage between vegetable production and export marketing

This chapter has presented results concerning the profitability and technical efficiency of FB, YLB and BG as well as the factors affecting these. These vegetables have the potential for commercial farming and the expansion of output but this would also necessitate the development of an efficient marketing system.

Vegetables are highly perishable but no facilities have yet been developed to store such perishables so that marketing becomes a prime concern for Bangladeshi vegetables. Vegetables are being traded in the local as well as export market and, demand in both markets, the farmgate price, and input costs heavily influence the profitability of vegetable production. Against this backdrop, this study also involved research on the export marketing of vegetables. Thus, a production to market approach is emphasized instead of a market to market approach. An efficient and well-structured marketing system could enhance vegetable production profitability. Therefore, this study addresses both the production and export marketing of vegetables so that the linkage between producers and traders could be strengthened and effective. In view of this, the next chapter is organized to cover the various dimensions of domestic and export marketing so that a complete picture of the whole production-marketing chain could be drawn, based on these two chapters. Following this, it will be possible to make recommendations for the improvement of production as well as export marketing in the vegetable sector.

Chapter V

Export Marketing of Vegetables in Bangladesh

5.1 Introduction

Marketing includes all the activities involved in the flow of goods from the production point to the consumer level (Kohls and Uhl, 1980). Food marketing is defined as the performance of all business activities involved in the flow of food products and services from the point of initial agricultural production until they are in the hands of the consumers (Kohls and Uhl, 1990). This consists of both the domestic and the international marketing system in respect of any product.

Abbott (1986) suggested improving the marketing of vegetables in the developing countries for the following reasons: (1) rapid increases in demand from a faster growing urban population; (2) opportunities to earn foreign currency by exporting high value produce; (3) income raising opportunities for small farmers; and (5) the creation of employment opportunities due to labour-intensive production, handling and sales requirements.

This study focuses on the export marketing rather than the domestic marketing of vegetables in Bangladesh. Export marketing of vegetables involves a chain of domestic and international marketing with buying and selling along the chain. Therefore, this study addresses the market players: producers and intermediaries in the domestic markets in Bangladesh and exporters and importers in the export market to the United Kingdom from Bangladesh. Penson *et al.* (1996) defined value added exports as the products that have been processed to some extent or unprocessed goods that have high transport and storage costs and relatively high value per unit. The value added products include consumer-ready products like dried, frozen, canned or fresh vegetables, fruits, meat, poultry, dairy products and intermediate products like vegetable oils and flour that have been partially processed, but are not ready for consumption. They further mentioned that farm exports generate additional economic output in the supporting services required to produce them.

Export marketing stimulates economic activity in manufacturing, wholesale, retail trade, transportation and other services involved in handling export products. For example, USDA economists estimated a minimum of $1.38 in additional business generated for every dollar of agricultural exports, while value added exports generated an additional £1.61 per dollar of exports in 1993 in USA (Penson *et al.*, 1996).

Efforts have been made to determine the profitability of vegetables for the producers (see chapter IV), intermediaries (middlemen) and exporters in Bangladesh and importers in the UK. Bangladesh is mostly exporting its fresh vegetables to the European and Middle Eastern countries.

Based on country and year wise export volumes of vegetables (EPB, 2001, 2002, 2003, 2004), the net return for the exporters in respect of exports to two European countries (the United Kingdom and Italy) and two Middle Eastern countries (the Kingdom of Saudi Arabia and United Arab Emirates) are compared to appraise the export performance.

5.2 Vegetable production and consumption status in Bangladesh

5.2.1 Status of vegetable production in government policy

Emphasis has been put on making the nation self-sufficient in food through increasing cereal crops in the National Agriculture Policy, and steps were taken to provide Government support to the farmers through reducing the prices of agricultural inputs and ensuring fair prices of all agricultural products, as well as lowering the interest rates on agricultural credit which particularly favour vegetable production. The five year plan of Bangladesh encompasses all the development activities and identifies the priority areas, but unfortunately vegetable production was not incorporated in the first five year plan of 1973-78 (Ministry of Planning, 1973) and the two year plan of 1978-80 (Ministry of Planning, 1978). However, the second five year plan of 1980-85 addressed the importance of vegetable production due to its nutritional values as well as financial benefits to marginal and small farmers (Ministry of Planning, 1980).

The third five year plan of 1985-90 recognized vegetables as minor crops for the first time and emphasized a special programme that would be undertaken to intensify the vegetable production, not only for domestic demand but also for the export market (Ministry of Planning, 1985).

In the fourth five year plan of 1990-95, attention was given by the policy makers to non-cereal food items like vegetables in respect of nutritional requirements of the people. It was mentioned that the situation regarding key nutritional foods had been disappointing. The per capita availability of vegetables has dropped from about 58 gms in 1969 to 36 gms in 1983. It was envisaged in this plan that, although the minor crops like vegetables were less significant in terms of contribution to GDP, they were important to provide a balanced, nutritious diet to the people. This plan emphasized the promotion a nutrition-based agriculture in the country (Ministry of Planning, 1990).

The fifth five year plan of 1997-2002 took account of the issue of production and export of vegetables in terms of quantity and value. It revealed that vegetables (including potato) covered about 2.5% of total cultivated land (Ministry of Planning, 1997). The further five year plan is not yet approved; rather three year rolling plan is under process. But emphasis has been given to agro-processing and agri-business development to increase the growth of agriculture and promote high technology-oriented agro-industries (horticulture and floriculture) in the export processing zones in the Poverty Reduction Strategy Paper (PRSP) (ERD, 2005).

5.2.2 Consumption status of vegetables in Bangladesh

Vegetables are a relatively cheap source of vitamins and minerals for a nutritionally balanced diet in Bangladesh, but people are deficient in vegetable consumption due to its seasonal variation of production and overall shortage of annual production. The World Health Organization (WHO) and the Food and Agriculture Organization (FAO) developed formulae to calculate the daily requirement of nutrients for individuals, varying according to body weight, profession, sex and climate. The National Nutrition Council (NNC) in Bangladesh has recommended a dietary requirement of 235 gms of vegetables per capita per day with 944 gms (2280 calories) as the daily food requirement for the individual (Rashid, 1998). According to this recommendation, vegetables should include 125gms of non-tuber vegetables, 100 gms of tuber vegetables and 10 gms of spices, where intake of potato as a tuber vegetable occurs thoughout the year. Rashid (1998) estimated the average intake of vegetables at 67.78 gms in 1997 which is only 28.85% of the 235 gms of the NNC recommendation. Note that the quantity of vegetable intake in the rural areas is comparatively higher than in the urban areas.

5.2.3 Future trends of area, production and demand for vegetables in Bangladesh

Although the population in Bangladesh is increasing but with a decreasing growth rate, more vegetable production is needed to meet nutritional requirements as well as improving financial solvency of rural households. Presently, a trend has developed to produce both traditional and non-traditional vegetables for local consumption and also for export markets under the changed scenario of globalization. Against this backdrop, demand for vegetable is increasing with the increased rate of requirement in the local as well as overseas markets. The following table shows the projected annual growth of area under vegetable cultivation, using a growth rate of 1.69 percent and for production, 3.32 percent, and annual demand up to 2020, estimated by the researcher (Table 5.4). To estimate the future demand for vegetables, the year 2001 is taken as the base year for this projection using 262 gm/head/day and 200 gm/head/day as daily requirements according to the Bangladesh National Nutrition Council (1995) and Rampal and Gill (1990) recommendation respectively.

Since Bangladesh is not self-sufficient in vegetable production, then a question may arise regarding its scope for exporting vegetables, when deficient in meeting the minimum requirements of the people. Fresh vegetables are highly perishable, it is not being possible to store them in chilled conditions for a long time, and no structural arrangement currently exists for chilling the excess vegetables in the peak season in Bangladesh. Even then vegetables are not being processed to any great extent for export, even when not consumed by the local people. From another point of view, consumption of vegetables depends upon food habits and prices as well, which is important, particularly in both peak and lean periods. People in rural areas eat comparatively more vegetables than urban people but even then the people are not used to eating vegetables in the recommended quantities to meet their nutritional requirements even though some of them are well able to buy vegetables for their own consumption. Moreover, the people consume fewer vegetables when prices increase. Irrespective of income, people are concerned to consume the required quantity of rice as their main staple food rather than vegetables.

Nevertheless, the share of annual exports to total vegetable production is very small: on average a figure of 0.49 percent, which does not adversely affect the local supplies. Increased exports in the peak period could be much more remunerative to the producer as well as exporters.

Table 5.4 shows the projection of population, and area, production, requirement, deficit, and availability of vegetables calculated based on two recommendations of minimum requirements of vegetables, one by the Bangladesh National Nutritional Council (BNCC), (1995), of Bangladesh and another by Rampal and Gill (1990), and population projection by Mabud (2004). The former suggested 262 gm per head per day and the latter 200 gm.

The population and future demand for vegetables is projected in Table 5.4 up to 2020. The adjusted population in 2001 is 130.00 million which is projected to rise up to 173.10 million in 2020 while vegetable production in 2001 was 4.83 million MT, which covers about 45% of local requirements according to BNNC. This would rise to 9 million MT in 2020 if the annual growth rate of 3.32% continues, and this would meet about 54% of the total requirement of 16.55 million MT or 71 percent of 12.64 MT under the Rampal and Gill suggestion. The area under vegetable cultivation was 1.25 million acres in 2001 which will increase to 1.72 million acres in 2020 if the growth rate of 1.69% continues.

Table 5.1 Projection in population and area, production, requirement of vegetable in Bangladesh up to 2020

Year	Projected populations (million)	Projected areas ('000' acres)	Projected production ('000' MT)	Requirement as per NNC ('000' MT)	Deficit as per NNC ('000' MT)	Deficit in Percentage as per NNC	Requirement as per Rampal and Gill ('000' MT)	Deficit as per Rampal and Gill ('000' MT)	Deficit in percentage as per Rampal and Gill	Availability (gm/head/day) as per Rampal and Gill
2001	130	1247	4834	12432	7598	61.11	9490	4656	49.06	102
2002	132.39	1268	4994	12660	7666	60.55	9664	4670	48.32	103
2003	134.77	1289	5160	12888	7728	59.96	9838	4678	47.55	105
2004	137.1	1311	5331	13111	7780	59.34	10008	4677	46.73	107
2005	139.45	1333	5508	13336	7828	58.70	10180	4672	45.89	108
2006	141.78	1356	5691	13558	7868	58.03	10350	4659	45.02	110
2007	144.1	1379	5880	13780	7900	57.33	10519	4639	44.10	112
2008	146.42	1402	6075	14002	7927	56.61	10689	4613	43.16	114
2009	148.69	1426	6277	14219	7943	55.86	10854	4578	42.17	116
2010	150.95	1450	6485	14435	7950	55.07	11019	4534	41.15	118
2011	153.16	1475	6700	14647	7946	54.25	11181	4480	40.07	120
2012	155.35	1500	6922	14856	7934	53.40	11341	4418	38.96	122
2013	157.51	1525	7152	15063	7911	52.52	11498	4346	37.80	124
2014	159.67	1551	7389	15269	7880	51.61	11656	4266	36.60	127
2015	161.79	1577	7634	15472	7838	50.66	11811	4176	35.36	129
2016	163.96	1604	7887	15679	7792	49.70	11969	4082	34.10	132
2017	166.18	1631	8149	15892	7743	48.72	12131	3982	32.83	134
2018	168.44	1659	8420	16108	7688	47.73	12296	3877	31.53	137
2019	170.72	1687	8700	16326	7626	46.71	12463	3763	30.19	140
2020	173.1	1716	8989	16554	7565	45.70	12636	3647	28.86	142

Source: Different issues of BBS, Dr Mabud .M.A, Centre for Health, population and development (CHPD), Independent University, Bangladesh

Note:

1. The vegetable requirement is calculated based on the minimum requirement of 262 gm/head/ day (excluding spices)as recommended by Bangladesh National Nutritional Council (BNNC, 1995), Bangladesh and 200 gm /head/day as recommended by Rampal and Gill (1990).
2. The annual growth rate for area (X) and production of vegetable (Y) was computed using the following formula;

$$X = ((\mathit{New\,year\ area} \,/\, \mathit{Old\ year\,area})\ \hat{}\ (1/(\mathit{No.\ of\ years})) - 1) * 100$$

$$Y = ((\mathit{New\,year\ production} \,/\, \mathit{Old\ year\ production})\ \hat{}\ (1/(\mathit{No.\ of\ years})) - 1) * 100$$

Estimated annual growth rate for vegetable area is 1.69% based on the average growth rate for ten years from 1992 to 2001.
4. Estimated annual growth rate for vegetable production is 3.32% based on the average growth rate for ten years from 1992-2001.
5. The area and production in 1999 increased dramatically by 44% and 50% respectively which is unusual. So the growth rate for area and production for this year was computed using average growth rate of the four years 19997, 1998, 2000 and 2001 straddling 1999.

Rashid (1998) proposed a requirement of 300gm/person/day including non-tubers, tuber and spices and projected a requirement of 16.22 million MT in 2010 and 17.16 million MT in 2015, while Hussain and Elias (1994) projected 1.94 million of production and 10.65 million MT as the requirement in 2010 considering the 200 gm /person /day according to the recommendations of Rampal and Gill, with a deficit of 8.71 million MT or 449%. However, projected vegetable production in this study will be 6.49 million MT in 2010 with a deficit of 41% as if Rampal and Gill's recommendations are used.

The table shows that the available vegetables, based on the projected population and production, amount to 102 gm per head per day in 2001, 118gm in 2010 and 142gm in 2020 while Hussain and Elias (1994) projected 31gm and 36gm in 2001 and 2010 respectively. The vast divergence in estimates might be partly because Hussain and Elias excluded tuber vegetable production in the projection, although the main cause seems to have been that their initial production figures. On the other hand, The BNNC reported that actual daily vegetable intake during 1995-96 was 184 gm per day per head (BNCC, 1998)

The deficient status of vegetable production mentioned above needs to be boosted, which deserves policy interventions to meet minimum nutritional requirements as well as to increase exports of fresh and processed vegetables.

5.3 Status of vegetable exports in the government policy of Bangladesh

The issue of vegetable exports was addressed in the third, fourth and fifth five year plans. Vegetables as horticultural crop have also been emphasized in the PRSP (see section 5.2.1). In 2003, the Ministry of Commerce published its export policy incorporating export of agro-products as one of the top most priority sector. The following special arrangement has been included in this policy:

- Financial support, including cash incentives would be provided for such a priority area.
- Bangladesh Biman, the national airline, should consider reduced rate air fares for export of fresh fruit and vegetables. The royalty payable by cargo services of foreign air lines will be withdrawn to allow increased air cargo space and reasonable air fares for the export of fresh fruit and vegetables. Direct air booking of fresh vegetables and other perishable items from Rajshahi and Syadpur airports, will continue, in order to enable them to reach the destination of export in good condition.
- Additionally, contract farming of exportable vegetable will be encouraged and Government khas land will be allocated in favour of the exporters of fresh vegetables and fruit, and subsequently "Export villages" will be established in this regard.
- Modern and scientific packaging industries will be extended for the export of fresh vegetables.
- A training programme will be organized for the producers and exporters involved in production and export of vegetables. Efforts will be made to encourage private sector entrepreneurs to be involved in commercialization of production, processing and marketing of exportable agro-products. The producers cultivating a minimum five acres of land for vegetables, fruit and flowers will be provided with venture capital with a reduced interest rate from the Export Promotion Bureau. Cool chain management will also be encouraged for perishables.

5.3.1 Year wise production, export and import status of Bangladesh and leading exporting countries

There follows a brief picture of leading countries in the field of vegetable production, export and import along with that of Bangladesh. Country-wise statistics for the last five years are presented in Appendix III and presented in pie charts below to compare their position from a world perspective. It is notable that although France and Japan are among the top ten producing countries but they are also among top ten importing countries (Appendix IV, Table1). Surprisingly, Japan, Vietnam, Nigeria and Myanmar are among the top ten producing countries, not even among the top 24 exporting countries, which might be due to local demand and policy regarding export marketing in these countries (Appendix III, Table 3 and 4).

5.3.1.1 Vegetable production status of Bangladesh and leading exporting countries

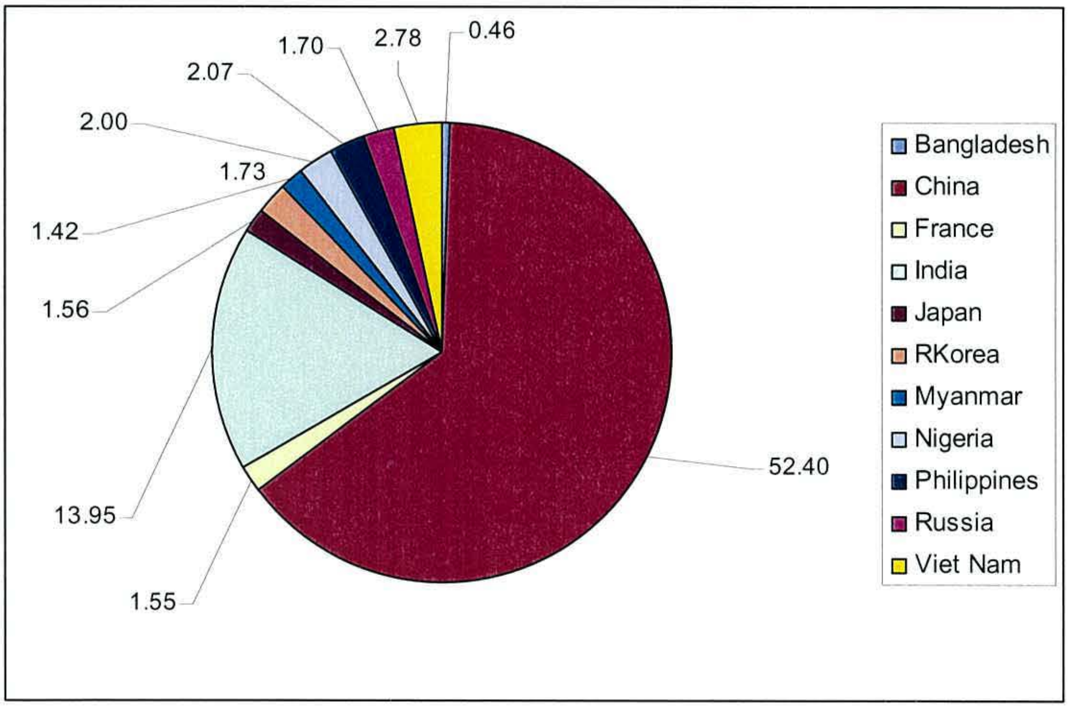


Figure 5.1 Production share of top ten producing country and Bangladesh in 1999
Source: FAO database, internet version 2005.

The 5.1 shows the production shares of the top ten producing countries along with Bangladesh for the year of 1999 where China topped the list, followed by India with shares of world production of 52% and 14% respectively. Bangladesh had 22nd position with a share of 0.46%.

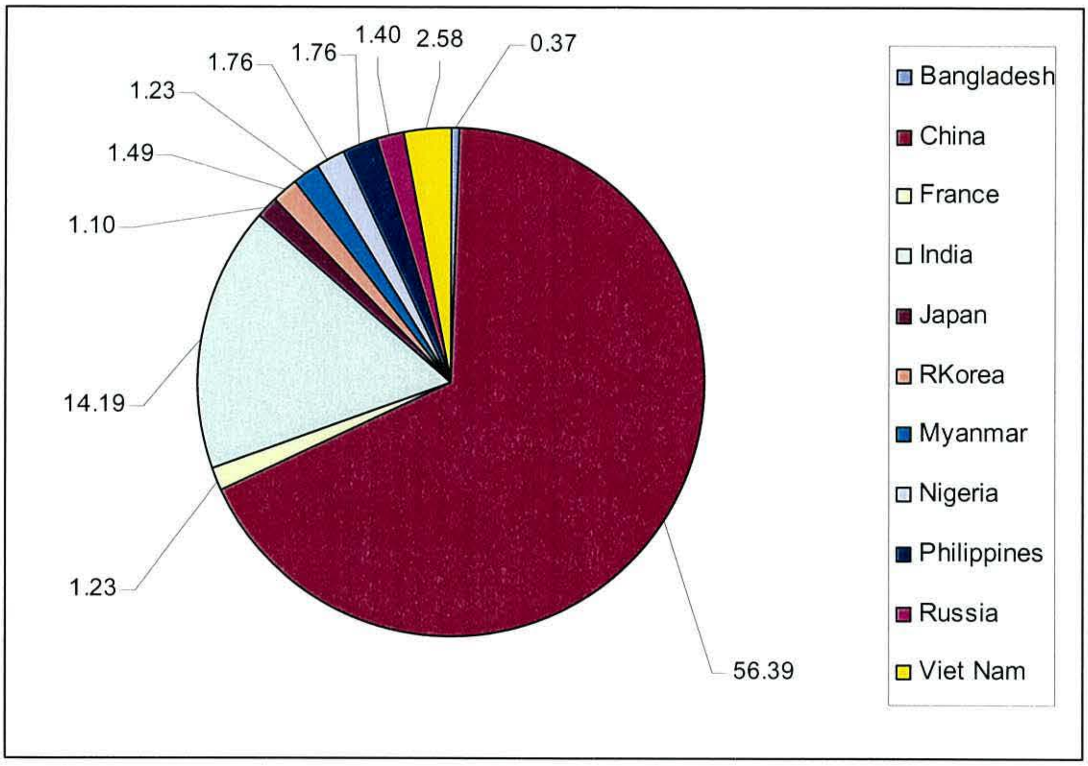


Figure 5.2 Production share of top ten producing country and Bangladesh in 2003
Source: FAO database, internet version 2005

Figure 5.2 shows the production share of the top ten producing countries along with Bangladesh for the year 2003 with China again ranked first, followed by India with shares of world production of 56% and 14% respectively. Bangladesh achieved 21st position but with a reduced share of 0.37%.

It is surprising that France is the only country which is among the top ten producing, exporting and importing countries of the world. It should be noted that the share of the top ten countries and Bangladesh in each year stays much the same. Moreover, these top ten countries' production share ranges from 81.16% to 83.12% of world production between 1999 and 2003 (Appendix III, Table 1 and 2).

5.3.1.2 Export status of Bangladesh and leading fresh vegetables exporting countries

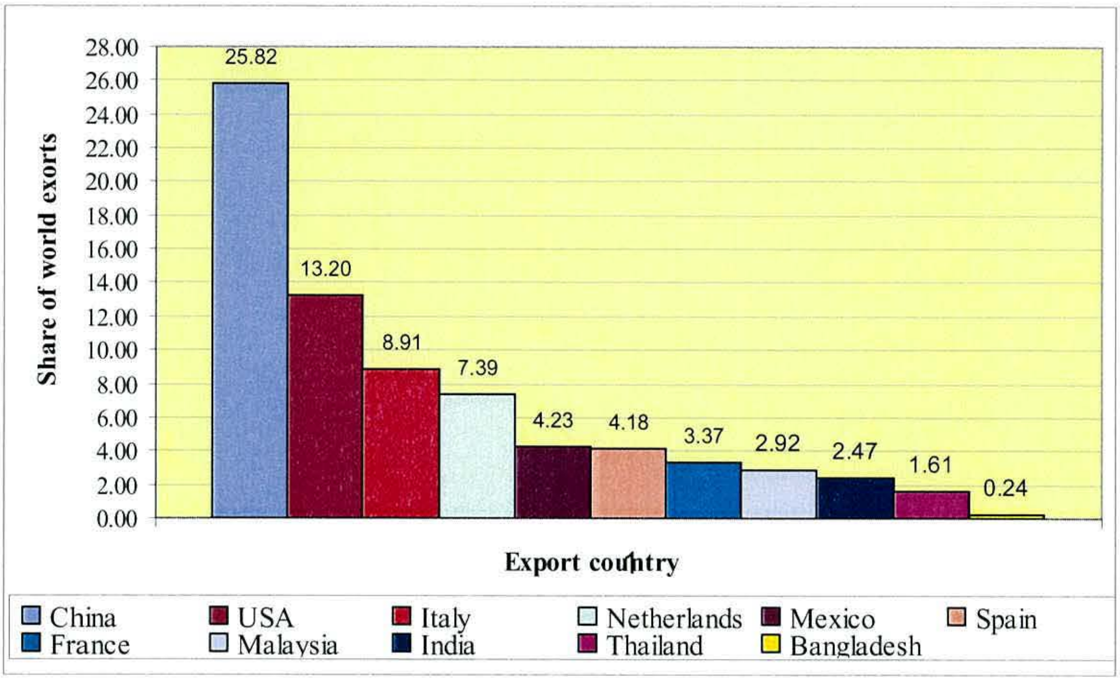


Figure 5.3 Export status of top ten exporting countries and Bangladesh in 1999
Source: FAO database, internet version 2005

Figure 5.3 shows the export share of the top ten exporting countries of the world in 1999 where China ranked first, followed by USA, and Bangladesh achieved 30[th] position with an export share of 0.24%. The top ten countries cover 74% of the total exports of the world (Appendix III, Table 3 and 4).

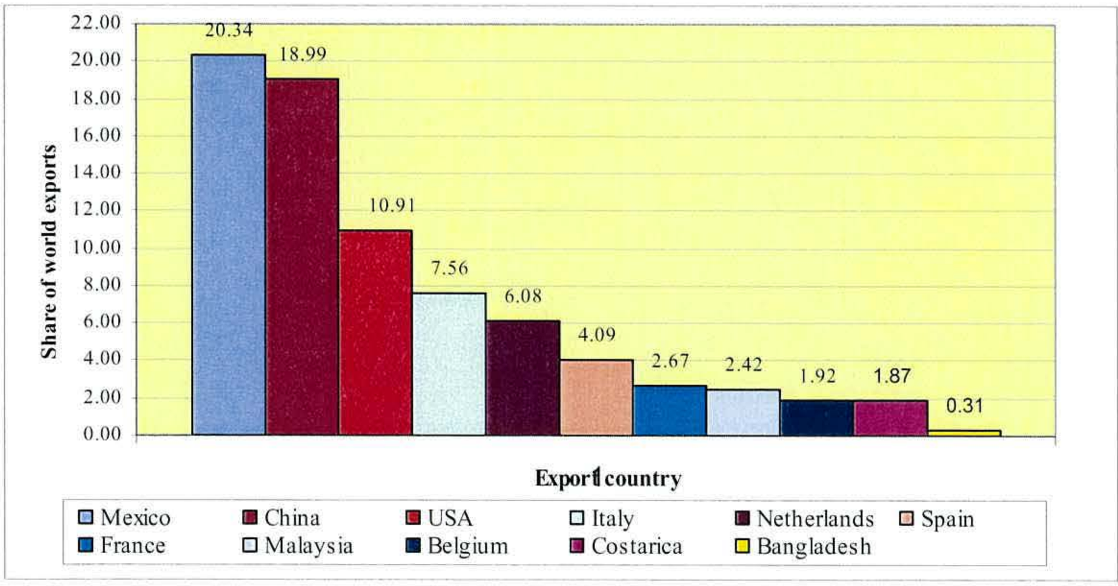


Figure 5.4 Export status of top ten exporting countries and Bangladesh in 2003
Source: FAO database, internet version 2005

Figure 5.4 shows the export shares of the top ten exporting countries of the world in 2003 where Mexico was ranked first, followed by China and Bangladesh achieved 29^{th} with an export share of 0.31%. The top ten countries cover 77% of the total export of the world in 2003 (Appendix III, Table 3 and 4). It is notable that USA, Italy and France, being exporting countries are also leading importing countries, as well. Over the period 1999-2003, these top ten exporting countries' export share range from 72% to nearly 77% of world exports.

5.3.2 Import status of leading importing countries

Appendix IV Table 1 shows the year-wise import shares of 24 leading importing countries of fresh vegetables for the years 1999 to 2003. It reveals that Hong Kong was ranked first, followed by France in 2003 and 2001 whilst Canada ranked second in 2002, 2000 and 1999. The other leading importing countries among the top ten in different years were Germany, USA, UK, Japan, Netherlands, Russia, Argentina, Malaysia and UAE. It is notable that Malaysia was both a leading exporting and importing country for fresh vegetables. The top 24 leading importer countries constituted a total import share of 77-78%, throughout the period.

5.4 Domestic and export market structure of vegetables in Bangladesh

There are number. of categories of agro-product markets existing at local, regional and city level which are defined as primary, secondary and terminal markets. Primary markets are those markets which sit once or twice a week in rural areas where the producers sell their produce either to the consumers or to the middlemen, while the secondary markets are situated at nodal points where the middlemen have permanent sites for marketing. Terminal markets are the central markets where wholesale markets are situated; middlemen in the domestic and export marketing channel and also the exporters are the participants here (Alam, 2002). However, agricultural markets include not only primary, secondary and terminal markets, but also supermarkets and traditional retail markets for vegetables.

5.4.1 Market participants in the domestic vegetable market in Bangladesh

Domestic consumers tend to eat fresh rather than processed vegetables, and vegetables are exported mostly in fresh form. Market players (see chapter II) are involved mostly in the fresh vegetable-based agribusiness, both in the traditional and the supermarket sectors.

5.4.1.1 Traditional domestic market participants in Bangladesh

Even though the traditional retail outlets are the key elements of the domestic fresh produce market, bapari, wholesalers, and aratdar as intermediaries, play a dominant role in the domestic market chain. Government parastatals, such as BADC, are also running retail outlets for fresh produce and compete with the traditional retailers in the cities and towns, through their own outlets. Some NGOs, like Proshika are supporting the farmers through providing training and micro-credit to enable them to produce exportable vegetables. Proshika is also conducting a programme for producing organic vegetables. It encouraged production of 3,131 MT of organic vegetables during 2001-2002 through a farmers' group involved in an ecological agriculture programme. It purchases vegetables directly from its own contract farmers and sells to the supermarkets within Bangladesh (Proshika, 2002).

5.4.1.2 Emergence of the supermarket in Bangladesh

Abbott (1986) defined the supermarket as a self service retail outlet, offering a full range of food products and possibly other convenience goods with at least $1000m^2$ floor space. Supermarkets like those in developed countries emerged in the late nineties in the capital city and also Chittagong and Khulna. The eminent supermarkets, namely Agora, Best Buy, Family World, Minabazar, Nandan Megashop, Price and Quality Service, and Shop and Sale became familiar to city people, particularly in terms of business environment and service as well as competitive prices of food especially fresh vegetables.

About 64 superstore retail outlets are running across the country in the cities. However, some problems, like the expiry period of fresh and processed food, have arisen, but they still offer far better service to the consumers, particularly in the urban areas (The Daily Star, 2005). Although the market share of the supermarkets in respect of fresh produce is yet to reach anything like the UK, it is still growing very fast in the city areas. Some of the supermarkets buy vegetables directly from the farmers and some from the middlemen and wholesalers. The Agro-based Industries and Technology Development Project in the phase-11 (ATDP, 2002) is promoting privately owned agribusiness such as horticulture and other sectors so that they might succeed in an open and competitive market. As part of promotional work, it conducted a survey on the food chain and market research for seasonal fruits and vegetables in Bangladesh

5.4.2 Market participants and promoter in vegetable export markets

There are two distinct marketing chains existing in vegetable marketing. One is domestic marketing for local consumption and another is the export marketing chain for the export market. The middlemen, exporters and some NGOs and private organizations are mainly involved in this marketing chain. Most of the exporters are running their business through middlemen without linkages with contract farmers, with substandard packaging, transport and storage facilities.

5.4.2.1 The Bangladesh Rural Advancement Committee (BRAC) involvement in export of vegetables from Bangladesh

BRAC, a leading NGO, has made progress but is, however, facing some international marketing difficulties. It purchases exportable vegetables from its own contract farmers through a joint programme for production and marketing of vegetables, and exports to markets in Europe and Asia (Plate 5.1). BRAC (2000) reported that it started the production and export of some traditional and non-traditional vegetables in 1997-98 via farmers without the involvement of middlemen.

It fixes the price of the fresh vegetables in consultation with contract farmers before going to production which gives price certainty to the producers. BRAC has adopted international standard packaging and maintains a cool chain right from the purchase centre to the airport for shipment (Plate 5.2 and Plate 5.3). It is notable that BRAC's quality packaging was recognized by a few importers in the New Spitalfield wholesale market in London during the field survey of the researcher.

5.4.2.2 Development of private organizations in export promotion of vegetables

ATDP promotes the growth of privately-owned agribusinesses so that they might succeed in open and competitive markets, and signed an agreement with British American Tobacco, Bangladesh (BATB), a multinational company, with the aim of promoting the production and export of vegetables. It is also working to provide technical assistance to entrepreneurs regarding processing of fruits and vegetables and also post-harvest handling of vegetables for commercial farmers. This project is continuing efforts to improve the quality of vegetables to be supplied in the local supermarkets like Agora, and Nondan (ATDP, 2003). BATB, an export-oriented, agro-based company stated that they started the production of exportable vegetables by their tobacco contract farmers from 2002. They are exporting vegetables indirectly by Eurasia, a third party, which processes the vegetables that come from the BATB and exports them in frozen form.

Plate 5.1 BRAC supplied baskets to the contract farmers for FB at Chandina, Camilla.

Plate 5.2 Female workers are packing YLB at the BRAC purchase centre at Chandina, Camilla.

Plate 5.3 Vegetable cartons being loaded into a refrigerated van at the BRAC centre at Chandina, Comilla

5.4.2.3 The Hortex Foundation

The Hortex Foundation, a company governed by both public and private sector representatives, has the responsibility of promotion of production, processing and export of horticultural crops, particularly vegetables, and is pioneering the export marketing chain. It introduced some modern pre- and post-harvest techniques such as contract farming and quality packaging through some NGOs and business organizations, to ensure the export quality of the traditional and non-traditional exportable vegetables as demanded by the upstream export market. Hortex also performs some market promotion and intelligence work for the exporters through arranging visits to some export fairs and markets by experts and exporters as well.

It is worth further mention that Bangladesh Frozen Fish and Frog Legs Ltd started export of processed traditional vegetables to the ethnic market of USA from 2ooo-o1, supported by Hortex.

As requested by the Planning Commission, Hortex made the following recommendations in the field of production and export of horticultural products when the horticulture sub–sector was identified as the 10th largest export sector of Bangladesh: a production to market approach instead of a market to market approach should be adopted; a contract farming system, with cool chain management and packaging improvements, should be introduced and institutionalized to meet the export market needs;. The Export Village concept was proposed to be implemented by the government of Bangladesh where horticulture potential areas should be declared as export villages, with some investment in infrastructure such as good communication networks, a cold storage facility, a packing house and regular market information.

The recommendation also addressed some issues like an open sky policy, and total quality management (TQM). Within the former royalty and handling charges payable by the foreign airlines to Biman Bangladesh airlines need to be withdrawn fully or partly. Rationalization of the price of aviation fuel should be made in comparison with competing countries. Bangladesh Biman as the sole handling agent should be reviewed as other airlines could have their own handling agents. It emphasized total quality management (TQM) that needs to be followed at every stage of production and marketing of vegetables (Hortex Foundation, 2000).

Hortex sent a delegation to Kenya, a leading exporting country of the developing world, and reported about the production and export status of horticultural crops there. It mentioned that favourable climatic conditions in Kenya allows the country to produce vegetables and export for the international markets throughout the year. Fifty percent of its total exports of horticultural produce are being exported to supermarket of the EU with the UK as the leading importing country. To make their vegetables more competitive in the export market, Kenya developed policies to promote the development of an efficient marketing system, a contractual production system and marketing arrangements, the financial institutions to provide credit to the producers, exemption of import duties for equipment for cold storage and greenhouse shade netting, training farmers in respect of modern technology and quality control measurement. It also reported that the export of French bean in 1999 made up 50.5% of total vegetable exports while bitter gourd was 3.8% from Kenya (Hortex Foundation, 2001).

A three member delegation sponsored by Hortex, participated in the Bangladesh Trade Fair in London in 2002. The fair was organized by the Ethnic Minority Enterprise Project and a stall for vegetables and fruits was set up. The delegation recommended that intensified and strengthened promotional work is an utmost necessity for the UK market for fresh produce (Hortex Foundation, 2002).

Hortex studied air freight, aviation fuel and handling costs in Bangladesh and some competing countries, and reported that air freight of Bangladesh Biman and also the cost payable by the other foreign air lines at Dhaka international airport is comparatively expensive. It is envisaged in the study report that the total airport cost (landing, parking, navigation, and handling) for a weight of 150 tonnes for Delhi, airport was US$5,000 while that for Dhaka, airport was US$6,780 for Boeing 707. The report also revealed that Bangladesh Biman provides air space for about 67-75% of total exports of perishable items such as vegetables, at a reduced airfreight rate. An acute air space problem exists because the foreign passenger carriers and cargo planes are not interested in carrying the perishables for a lower income in comparison with dry cargo such as garments. Therefore, it recommended that the Bangladesh government should offer some monetary incentives and operational freedom to the foreign passenger carriers and the cargo planes to encourage them to increase air space proportionately for the perishables. For example, the foreign airlines could be exempted fully or partly from paying royalty, be offered reduced rates for landing, aviation fuel could be offered, or they could be allowed to carry out self-handling instead of Bangladesh Biman having a handling monopoly. The report also envisaged that Bangladesh Biman might lose some income from this sector, although the air space problem could be resolved, facilitating an increase in the export volume of perishables (Hortex Foundation, 2002).

As part of the export market development of high value non-traditional horticultural crops, Hortex succeeded in developing upstream markets in Germany, French, Singapore, Dubai, Bahrain, Hongkong for French bean, broccoli and other Asian vegetables, including bitter gourd, yard long bean, green chilli (Hortex Foundation, 2003).

The activities mentioned above reveal that the Hortex Foundation is pioneering the upstream export market promotion programme for horticultural products including vegetables.

5.4.2.4 Domestic support by the government in export of vegetable

Bangladesh Bank (2002) reported that cash incentives were to be provided to the exporters of fresh vegetables and processed agro-products for 20% of the net FOB (Free on Board) value of such items. These cash incentives for the fresh vegetable exporters which was later enhanced to 30% by the government. A Letter of Credit would be needed for such cash incentives but this is not possible yet because this business is run through a consignment sale basis. Nevertheless, the Hortex Foundation (2002) commented that this cash incentive programme would encourage exporters to use quality packaging materials, and also be helpful to increase the competitiveness of Bangladeshi products in the export market.

5.4.3 Marketing channels of vegetables in Bangladesh

The two main marketing channels are the domestic and export marketing channel. More participants are involved in the domestic market channel.

5.4.3.1 The Domestic marketing channel of vegetable

Commercial farming of this perishable item needs an efficient marketing system with minimization of market intermediaries in the supply chain in order to gain a suitable share of the final price. And an efficient marketing sector guides the farmers towards newer production opportunities and encourages improvement in response to demand and prices (Abbott, 1987).

The intermediaries middlemen, aratdars, wholesalers and retailers in the domestic marketing channel perform movement of vegetables from the producer to the consumer (see section 2.3.2.2). Another domestic marketing channel has recently developed whereby the NGO's BRAC and Proshika Manobik Unnoyan Kendro and few supermarkets such as Mina Bazar buy the perishable produce directly from their contract producers with a prefixed price. The supermarkets sometimes buy vegetables from the middlemen (bapari) in the primary markets and from wholesalers from the terminal market. Proshika sells at their own retail outlet or to supermarkets.

The domestic and export marketing diagram (Figure 5.5) shows the market participants from the producer to the consumer.

5.4.3.2 The Export marketing channel of vegetables

Vegetable producers previously sold only to local traders, but recently the scenario has changed to some extent, the producers sell their vegetables directly to the exporter namely BRAC, at its buying centre. BRAC and a few exporters organize contract farmers and buy vegetables directly from their farmers. But the producer also sells to a number of middlemen who are appointed as agents by the exporters. NGO's are organizing contract farmers to ensure constant and quality supply of agro-food products such as vegetables.

Some of the intermediaries between producers and consumers, who play a key role in domestic marketing, are also linked with export marketing. The middlemen (bapari) perform the transportation of vegetables from the producer to the exporters (see section 2.3.2.2 and 3.3.2). The exporters are the main players in this channel, sometimes buying vegetables directly from their contract producers.

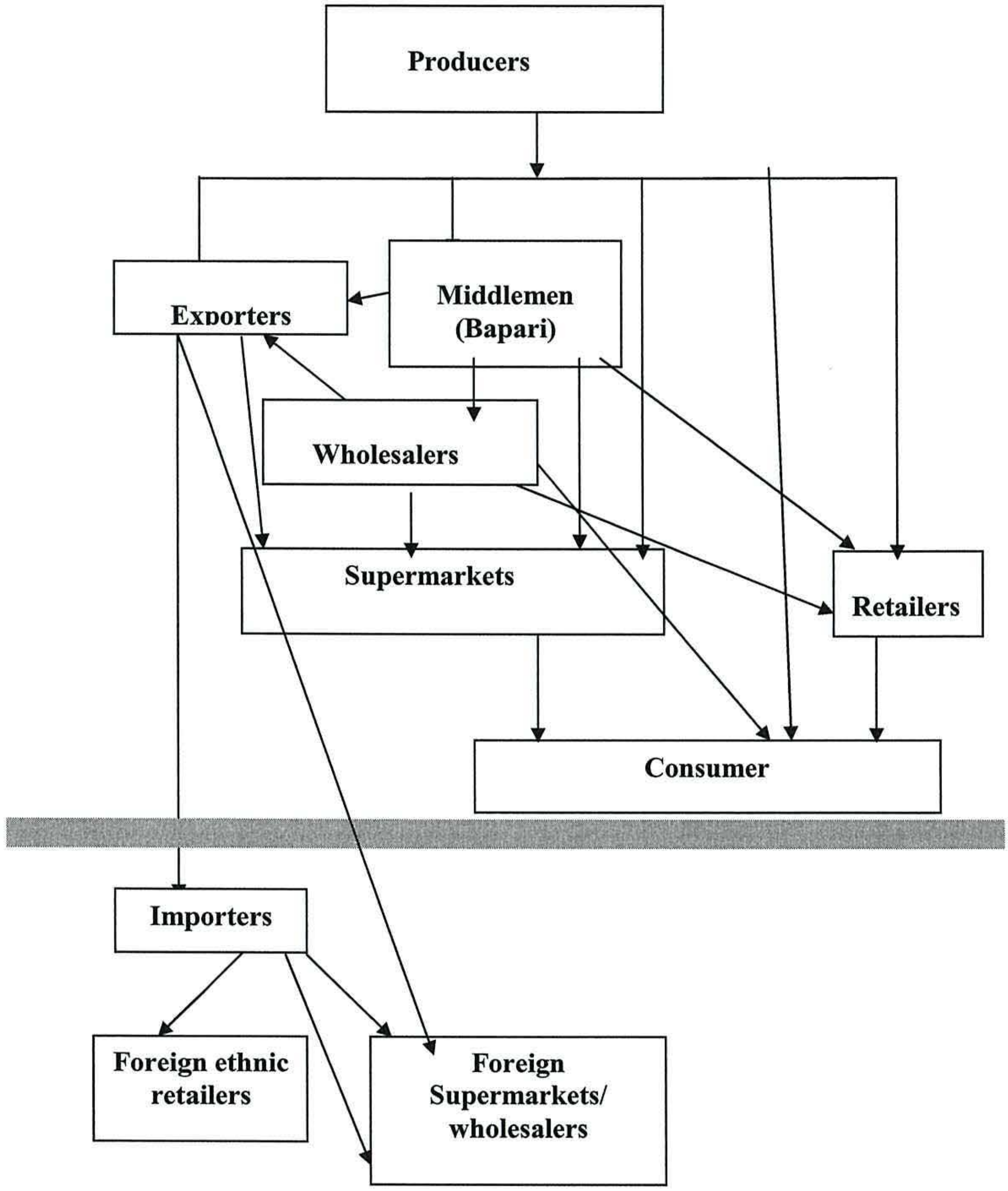


Figure 5.5 Diagram showing the domestic and export marketing channel of vegetable in Bangladesh

5.5 Packaging, transportation, and storage of vegetables in Bangladesh

The producers transport vegetables by local vehicle (Ricksha) in locally made baskets and sometimes in containers supplied by the NGO's. The middlemen in the domestic channel use bamboo baskets and transport to the secondary and terminal markets by trucks, but in the export channel utilise used cartons supplied by the exporters and usually transport directly to the airport by mini truck.

The NGO's use their own vehicle, BRAC use a refrigerated van. Amongst the exporters, BRAC supplies containers to the contract farmers and temporarily stores the purchased vegetables in their refrigerator to maintain freshness. It packages the fresh vegetables using a special type of carton, labeled with its own logo, thus attempting to signal the quality standards demanded by the export markets. BRAC shifts vegetables in a relatively short period from the farm gate level to the airport in an organized framework.

5.5.1 Cold chain management

Abbott (1986) pointed out that the integrated production and marketing of exportable vegetables is incomplete if it does not include refrigerated measures to maintain the freshness of perishable vegetables for a lengthy period. Pre-cooling equipment at the assembly and packaging point, and a refrigerated ship/plane and refrigerated transport to the terminal market are often necessary. He made some recommendations regarding ideal storage temperatures and approximate periods for keeping vegetables in refrigerated stores.

Name of the vegetables	Approximate storage period in refrigerated stores	Temperature recommended (°C)
Cabbages	3-4 months	0
Carrots	4-5 "	0
Potatoes	6-8 "	4.5-10
Beans	2-4 weeks	0-6
Cauliflowers	2-3 "	0
Cucumbers	1-2 "	11.5
Lettuce	1-3 "	0
Egg plants	10 days	7-10
Spinach	10-14 "	0
Tomatoes	8-12 "	10

Source: Abbott, (1986)

Figure 5 .6 Vegetable wise shelf life requirement

Although vegetables are highly perishable, in Bangladesh, they are not generally being stored in chilled conditions to maintain freshness, despite the warm climate. However, the supermarkets have some arrangements to keep fresh vegetables in chilled conditions.

5.6 Disposal pattern of vegetables at the producer level in Bangladesh

The producers usually dispose of their vegetables in line with their socio-economic condition. They tend to consume a portion of their produce within the household, give within some to relatives and neighbours and sell the rest to the middlemen, retailers in the primary markets or the buying centre of exporters in the rural areas.

The disposal pattern of the respondents varies by farm size as well as region. Efforts have been made to analyze the disposal pattern and actual share of marketed vegetables that contributes to their cash income. Table 5.2 shows the details of the disposal patterns of the respondents for FB, YLB and BG by farm size in the four survey districts.

Table 5.2 Average production, consumption, wastage, gift, and marketable surplus of sample vegetable by farm size (kg per acre)

		Marginal	Small	Medium	Large
FB	Production	4492	4529	3606	3000
	consumption	69 (1.53)	82 (1.81)	77 (2.13)	80 (2.67)
	Wastage	99 (2.20)	120 (2.65)	108 (2.99)	100 (3.33)
	Gifts	30 (0.67)	40 (0.88)	36 (0.99)	40 (1.33)
	Marketable surplus	4294 (95.60)	4287 (94.66)	3386 (93.89)	2780 (92.67)
YLB	Production	6732	5576	6216	5392
	Consumption	212 (3.15)	169 (3.03)	157 (2.53)	128 (2.37)
	Wastage	150 (2.22)	118 (2.12)	126 (2.02)	106 (1.96)
	Gifts	65 (0.96)	52 (0.92)	47 (0.76)	55 (1.02)
	Marketable surplus	6306 (93.67)	5237 (93.92)	5885 (94.68)	5103 (94.65)
BG	Production	5697	5732	6336	5560
	Consumption	107 (1.87)	103 (1.79)	122 (1.92)	71 (1.27)
	Wastage	155 (2.72)	148 (2.59)	175 (2.76)	102 (1.83)
	Gifts	54 (0.95)	52 (0.90)	60 (0.95)	36 (0.64)
	Marketable surplus	5382 (94.46)	5429 (94.72)	5979 (94.37)	5351 (96.25)

Figures in parentheses indicate the percentage of respective items to production

The mean yields and yield variations of the sample vegetables FB, YLB and BG by farm size and survey districts were already discussed in Section 4.5.6. All categories of farmers consume more yard long bean than any of the other two vegetables and this is more than three percent of production for marginal and small farmers. For the average family size only about 13, 29 and 18 KG of FB, YLB and BG respectively are consumed within the household. Note that there is not much difference between the different farm sizes. Wastage of vegetables occurs as a loss of vegetables during post harvest handling. The highest percentage of wastage happened in the case of French bean: perhaps this item is being produced and sorted mainly for export, and high quality is demanded by the BRAC. Nevertheless, there is not a substantial difference between the three vegetables as regards wastage.

The respondents gave about one percent of their vegetables to their neighbours, relatives and friends which is, all farm sizes gave about the same amount. The average marketable surplus is about 93%-94% for all categories of farmers for all three vegetables, but highest in the case of French bean for marginal farmers and bitter gourd for large farmers. Irrespective of farm size, farmers sell around 93% on an average of their total production, with relatively little retained or wasted at village level.

The disposal pattern of the vegetables in the four survey districts irrespective of farm size was also analysed in order to compare the regional differences. Table 5.3 shows that the marketable surplus lies between 92-94% in the four survey districts with 2-3% wastage which suggests that the farmers in the survey districts are careful about post harvest handling. Moreover, it could be concluded that the disposal pattern of vegetables by the respondents in the survey areas are similar by farm size and district.

Table 5.3 Average production, consumption, wastage, gift and marketable surplus of sample vegetables by survey district (kg per acre)

District		FB	YLB	BG
Rangpur	Production	4160	6180	6359
	Consumption	112 (2.68)	161 (2.61)	111 (1.75)
	Wastage	156 (3.75)	117 (1.90)	165 (2.60)
	Gift	48 (1.15)	41 (0.66)	56 (0.88)
	Marketable surplus	3844 (92.41)	5861 (94.83)	6027 (94.77)
Comilla	Production	4968	6040	5259
	Consumption	75 (1.50)	212 (3.52)	103 (1.97)
	Wastage	110 (2.20)	124 (2.06)	148 (2.82)
	Gift	37 (0.74)	62 (1.03)	54 (1.02)
	Marketable surplus	4748 (95.56)	5641 (93.39)	4970 (94.50)
Tangail	Production	3188	5838	5411
	Consumption	72 (2.26)	99 (1.69)	104 (1.91)
	Wastage	101 (3.16)	118 (2.02)	135 (2.50)
	Gift	43 (1.33)	44 (0.76)	51 (0.94)
	Marketable surplus	2973 (93.25)	5577 (95.54)	5122 (94.65)
Narshingdi	Production	3317	6340	6625
	Consumption	76 (2.30)	202 (3.18)	115 (1.73)
	Wastage	20 (0.59)	26 (0.41)	62 (0.93)
	Gift	26 (0.79)	61 (0.96)	57 (0.86)
	Marketable surplus	3107 (93.67)	5925 (93.46)	6282 (94.81)

Figures in parentheses indicate the percentage of respective items to production

5.7 Pricing in vegetable marketing in Bangladesh

Theoretically, agriculture in general faces a particular set of price problems which include annual price fluctuations, price cycles and the long term price decline in farm product prices relative to the prices of inputs. The prices of farm products are subject to year to year fluctuations influenced by weather. A year of good output results *ceteris paribus* in a drop in of prices and vice versa. If the demand is inelastic, the farmers' income will be less in year of good output than in a poor year (Hill and Ray, 1987). These authors, however, also mention the effects of government intervention in manipulating the farm product prices through buffer stocks, support buying, restricting supply from abroad, imposing physical restrictions on foreign supply, like health and hygiene regulations, domestic quotas for the producers, deficiency payments to the farmers, and other production subsidies and taxes on farmers.

In the case of vegetables as a perishable product, the price depends upon many factors including season, production cost, volume of production, demand from the consumer in domestic markets, storage facilities, and export opportunities. In a Bangladeshi context, the prices of vegetables usually fluctuate due to peak and off-season, depending on the demand and supply of vegetables in the market. The producers get a lower price for perishable vegetables in the peak or normal season due to plentiful supply, lack of chilled storage, and limited export opportunities and processing industries (Ahmad *et al*, 1995). The prices of vegetables in Bangladesh also vary according to location, transportation costs in the domestic market and transportation costs in the export market. The exporters determine their offer price for vegetables considering the price in the wholesale and central markets within the country and also the price prevailing in the export market as well (Alam, 2002). Rashid (1998) concluded that the price of vegetables in Bangladesh varies from region to region and season to season, and that both producers and consumers are losers in the existing marketing chain. In this situation, the producers receive less than in a more efficient and competitive market whilst the consumers pay a higher price. He also suggested that transportation costs are too high and influence the price strongly.

Using the prices along the chain, a financial analysis of exportable vegetables was computed at aggregate level as well as district level in Bangladesh and at the importer level in London to determine the margins at production and intermediary level in the domestic and export market chain.

5.8 Financial analysis of export marketing aspects of vegetable

The financial analysis is carried out to measure the marketing performance at each level of marketing.

5.8.1 Marketing cost

According to Kohls and Uhl (1990), marketing firms incur a number of costs when performing marketing functions and these are referred to as marketing costs. Excessive profits, inefficiency, unnecessary services and high marketing costs are often considered as responsible for high retail prices and low farm prices.

5.8.2 Marketing margin

The marketing margin may be defined as the difference between the price at which some quantity of product would sell at the farm level and the price at which that same quantity of product would sell at different levels (Goodwin, 1997). It may also be defined as the price difference between two marketing stages (either producer, wholesale, processor or consumer). The absolute marketing margin, relative marketing margin and net marketing margins are computed according to the formulae below as described by Briz and de Felipe (2002).

5.8.3 Absolute marketing margin (AMM)

The absolute or gross marketing margin is the gap between prices at different marketing levels (farmers, middlemen, wholesalers, exporters, retailers). Thus,

$M_1 = Pm\text{-}Pp$, $M_2 = P_w\text{-}P_m$, $M_3 = P_e\text{-}P_w$,

where M_1, M_2, M_3 are the absolute marketing margins (AMM) at different levels, and P_p, P_m, P_w and P_e are the prices at producer, middlemen, wholesale and exporter levels.

5.8.4 Relative marketing margin (RMM)

The relative marketing margin is the ratio of absolute marketing margin and the price at which it is bought or sold and expressed in percentage terms. The relative marketing margin in relation to selling price is defined as the ratio of absolute marketing margin in respect of the sale price and is expressed in percentage terms:

Thus, $RMM_{pm} = M_{1/} P_m *100\%$,

where, RMM_{pm} is the relative marketing margin from the producer to middlemen.

The relative marketing margin in relation to buying price is defined as the ratio of absolute marketing margin in respect of the buying price at which it is bought and expressed in percentage terms:

Thus, $RMM_{pm} = M_{1/} P_p *100\%$.

Therefore, RMM_{pm}: P_m is in relation to selling price and RMM_{pm}: P_p in relation to buying price.

5.8.5 Net marketing margin (NMM)

The net marketing margin is the difference between the absolute marketing margin or gross marketing margin and the marketing costs involved in the marketing functions. It indicates the marketing efficiency at different levels of marketing participants involved throughout the chain.

5.8.6 Marketing efficiency at different levels

Marketing efficiency is computed using certain indicators, but it should be related to marketing cost, margin, producer's share, consumer's satisfaction and technical efficiency as well. A market is said to be more efficient where marketing costs are lowered, margins of different intermediaries involved in the marketing chain are reduced and higher consumer's satisfaction ensues (Alam, 2002). It also provides a higher producer's share. The technical efficiency of the market could be improved through reducing wastage of perishable commodities like vegetables.

Efficiency in the marketing of vegetables in the food chain can be analyzed using the indicators: gross marketing ratio, net marketing ratio, return on investment, and producer's share at different levels of marketing.

5.8.6.1 Gross marketing ratio

The gross marketing ratio is the ratio of gross marketing margin or absolute marketing margin to the sale price of any commodity, thus:

$GMR = GMM/p_s$

Where, GMR and GMM are the gross marketing ratio and gross marketing margin and p_s is the sale price.

5.8.6.2 Net marketing ratio

The net marketing ratio is the ratio of net marketing margin to the sale price of any commodity, thus:

$NMR = NMM/p_s$

Where, NMR and NMM are the net marketing ratio and net marketing margin.

5.8.6.3 Return on investment

Return on investment is the net profit against capital, expressed as a percentage.

5.8.6.4 Producer's share

The producer's share could be computed at different levels of intermediaries. It is usually computed using the consumer's price in percentage terms as follows:

Producer's share of consumer's price = producer price/ consumer price * 100.

5.9 Financial analysis of marketing aspects at middleman level

Marketing performance at the middlemen level was measured through computation of marketing cost, marketing margins and marketing efficiency, as follows.

5.9.1 Marketing cost

The marketing cost incurred by the middlemen was computed where the average marketing cost per metric tonne of vegetable was:

AMC = TC / Total no. in sample

Where, AMC = average marketing cost per MT, TC = total costs incurred for all cost items per MT.

The table reveals the cost per MT for the middlemen in five survey markets, namely; Dhaka, Rangpur, Comilla, Tangail and Narshingdi (Appendix II, Table 1). It shows that the middlemen, irrespective of district, incurred the highest cost for transportation followed by wastage or weight loss of the vegetables. The middlemen in Chandina, Comilla incurred TK 3500 per MT as the highest cost followed by the middlemen in Narshingdi district with TK 3348 per MT. The lowest figure of TK 2150 was spent by the middlemen in Rangpur. A total marketing cost figure of TK 1320 per MT was reported for middleman (bapari) based on January, 1995 (Hossain *et al.*,1996) while Shaha (2000) obtained a figure of TK 2135.65 per MT at Chandina in Comilla in 1999.

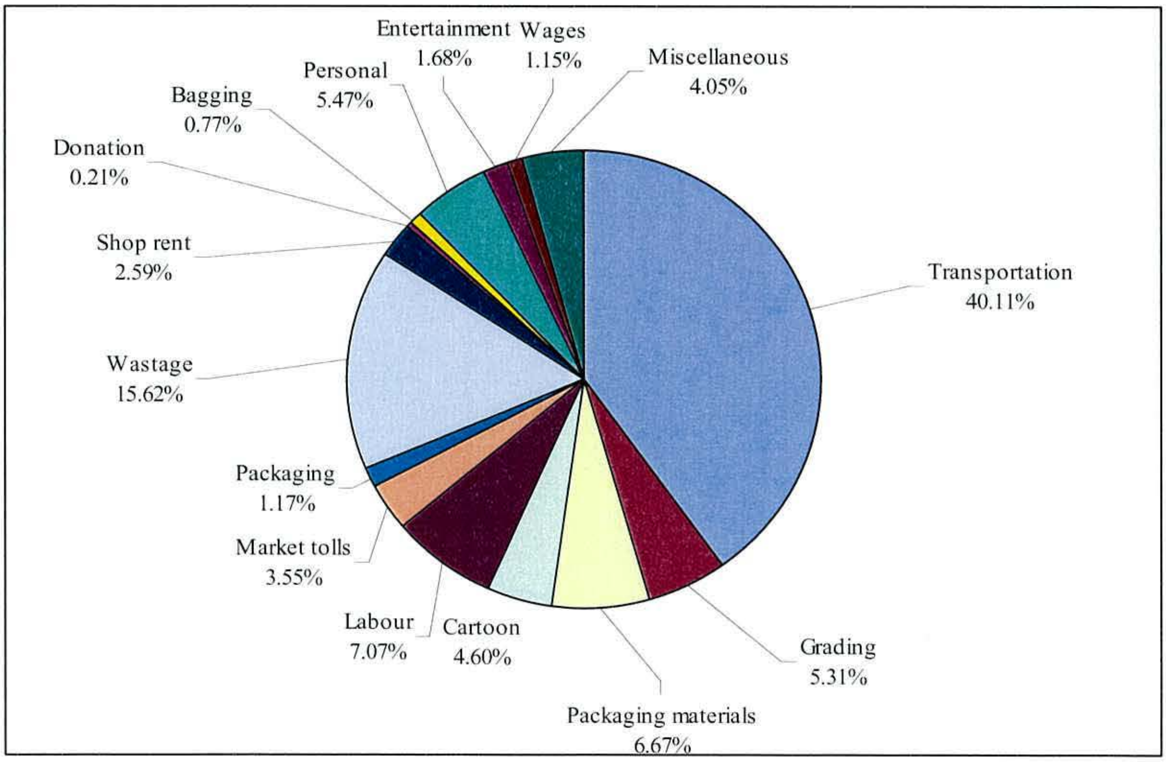


Figure 5.7 Average marketing cost for middlemen in Bangladesh (per MT)

Figure 5.7 shows the breakdown of the costs incurred for different categories for middlemen in the survey markets. It shows that transportation constitutes 40.11% followed by wastage of vegetable with a figure of 15.62%. These two major cost items (transportation and wastage) constituted 34% and 19% of the total marketing costs in the case of BG, in two areas in Rangpur (Hossain *et al,1996*).

5.9.2 Estimation of net profitability

The gross marketing margin was computed as the difference between sale price of the farmer and sale price of the middlemen to the exporter or wholesaler. The Net marketing margin or net profit made by the middlemen was calculated by the following equation:

NMM = GMM – AMC where,

NMM = net marketing margin or net profit, GMM = gross marketing margin, and AMC = average marketing cost.

Return on investment, profit as a percentage of total investment, was also calculated.

Return on investment =Profit / total capital investment*100.

Total capital investment = Purchase price + marketing cost

The profit made by the middlemen selling to exporters and wholesalers was calculated for different markets and vegetables.

Table 5.4 Profitability of vegetables for middlemen at different markets (export channel) Tk per MT

Particulars	Dhaka	Rangpur	Comilla	Tangail	Narshingdi
A. Weighted sale price of the exportable vegetables to the Exporters	15281	9366	20257	10616	18502
B. Weighted purchase price of the exportable vegetables	10647	5194	13473	6243	11924
C. Absolute marketing margin (A-B)	4633	4171	6784	4373	6578
D. Marketing cost	2638	2150	3500	2854	3348
E. Net marketing margin or profit (C-D)	1995	2021	3284	1518	3230
F. Gross marketing ratio (C/A)	0.30	0.45	0.33	0.41	0.36
G. Net marketing ratio (E/A)	0.13	0.22	0.16	0.14	0.17
H. Total capital invested (B+D)	13285	7344	16973	9098	15272
I. Return on investment (%)	15.02	27.52	19.35	16.69	21.15

Table 5.4 illustrates the economic performance of vegetable businesses by region at the middleman level where purchase and sale prices of vegetable are highest in the local markets of Comilla and Narshingdi and lowest in Rangpur. Table 2 and Table 3 of Appendix II show the purchase and sale prices in the export channel respectively. They also reveal that the highest net income per MT was earned by the middlemen in Comilla while lowest by the middlemen in Dhaka market where the middlemen sold vegetables to the exporters.

The indicators of marketing efficiency, gross marketing ratio and net marketing ratio, indicate lower marketing efficiency in Dhaka, Camilla, Tangail and Narshingdi but Rangpur showed comparatively better efficiency. The return on investment is 27.52%

in Rangpur followed by Narshingdi with a figure of 21.15%. The return on investment in Chandina, Comilla was 19.35% in the export channel where as Shaha (2000) estimated the return on investment in Chandina, Comilla to be 12.93%.

Table 5.5 Profitability of middlemen at different markets (domestic channel) TK per MT

Particulars	Dhaka	Rangpur	Comilla	Tangail	Narshingdi
A. Weighted sale price of the exportable vegetables to the Whole sellers	14009	8366	17740	10959	16177
B. Weighted purchase price of the exportable vegetables	10647	5194	13473	6243	11924
C. Absolute marketing margin (A-B)	3361	3171	4267	4716	4253
D. Marketing cost	2638	2150	3500	2854	3348
E. Net marketing margin or profit (C-D)	723	1021	767	1861	905
F. Gross marketing ratio (C/A)	0.24	0.38	0.24	0.43	0.26
G. Net marketing ratio (E/A)	0.05	0.12	0.04	0.17	0.06
H. Total capital invested (B+D)	13285	7344	16973	9098	15272
I. Return on investment (%)	5.44	13.91	4.52	20.46	5.92

Table 5.5 shows the economic performance of the vegetable business of middlemen in five survey markets in the domestic channel, where the middlemen sold vegetables to the wholesalers within Bangladesh. It reveals that the weighted average sale price was the highest for the middlemen in the local market of Comilla followed by those of Narshingdi, Dhaka and Tangail markets. Tables 2 and 4 of Appendix II show the weighted purchase and sale prices in the domestic channel respectively.

The absolute marketing margin was highest for the middlemen in Tangail followed, some way behind by the middlemen in Comilla while the net margin was also highest in Tangail but lowest in Dhaka district market. The indicators gross and net marketing ratio reveal that the middlemen in Tangail and Rangpur earned most in terms of gross marketing ratio, while Tangail was far ahead of the other markets in terms of net marketing ratio. Hossain *et al.* (1996) reported that the net marketing margin was TK 600 at the level of middlemen for BG in some selected areas of Bangladesh including Rangpur, although this figure is not directly comparable with the present study due to the time difference.

It is notable that the return in the export channel is comparatively higher than that in the domestic channel for the middlemen in all markets except Tangail. The return on investment in Tangail is 20.46% which is so high due to the effect of Proshika, a leading NGO, which sells vegetables either at their own sale centres or to the supermarkets. Nevertheless, the overall figure shows that the export marketing channel is comparatively more profitable than the domestic channel for the middlemen.

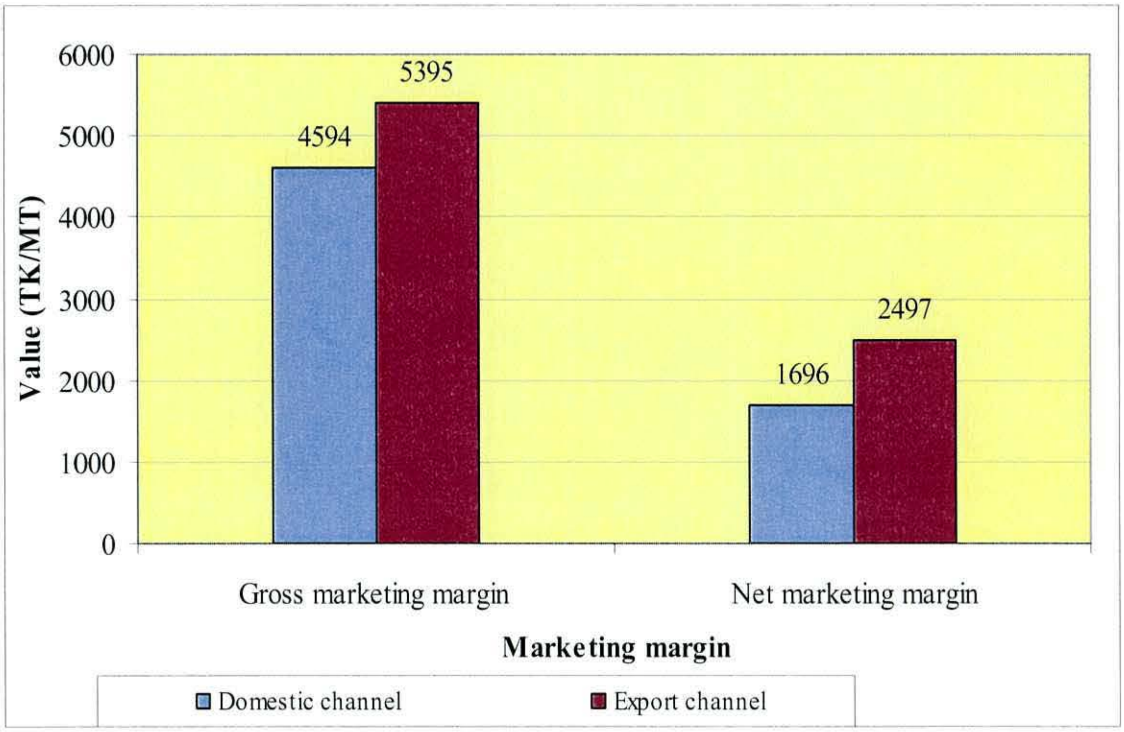


Figure 5.8 Marketing margin in domestic and export channel for the middlemen in Bangladesh (TK per MT)

Figure 5.8 shows the gross marketing and net marketing margins in both the export and the domestic channel at middlemen level. It indicates that the average gross and net marketing margins in the export channel are higher than those of the domestic channel. In fact, the net marketing margin is almost 40% higher in the export channel.

5.10 Export potential of exportable vegetables in Bangladesh

5.10.1 Status of export marketing of vegetables of Bangladesh

Financial analysis at the exporter level is carried out to compute the profitability of the exportable vegetable business in the export marketing chain. The marketing cost, marketing margins and marketing efficiency have been calculated. Before proceeding to measure the economic performance of the export trade at the exporter level, the present status of exports of vegetables in Bangladesh in the international market is discussed.

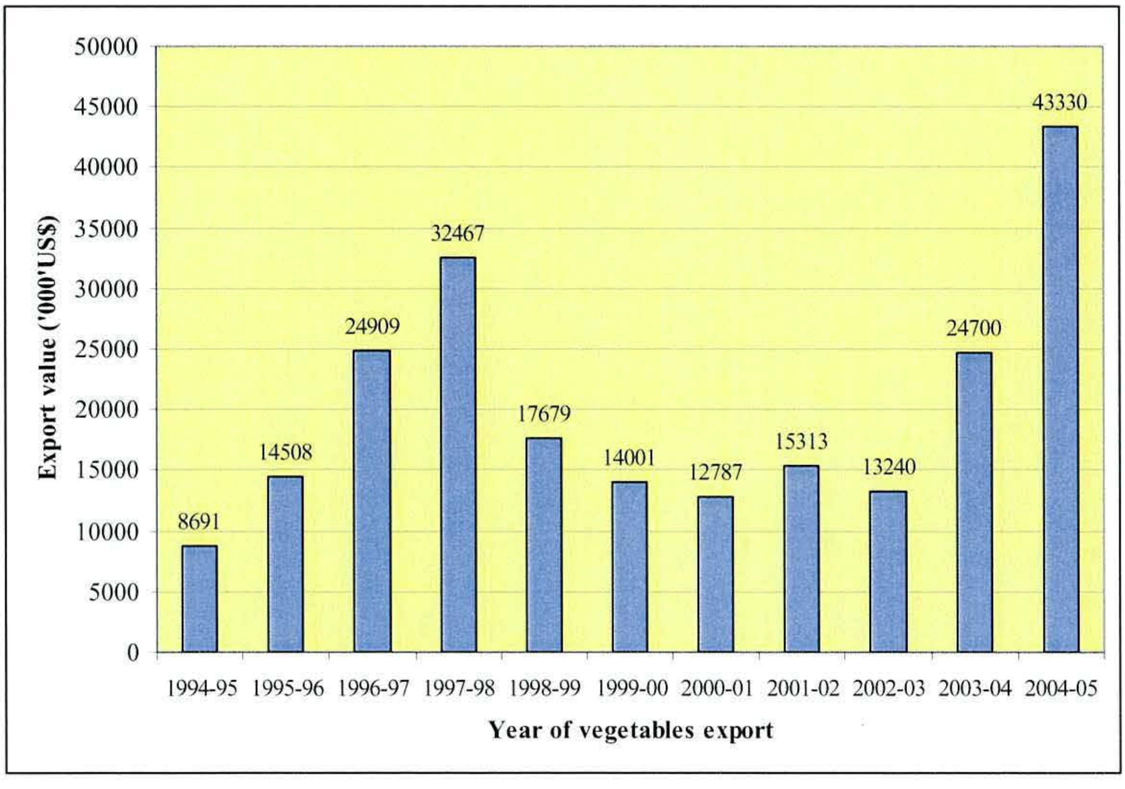


Figure 5.9 Year wise export value of vegetables in Bangladesh ('000'US$)
Source: EPB (1995, 1996, 1998, 1999, 2001, 2003, 2005)

Figure 5.9 shows the year-wise export value for vegetables in Bangladesh. The increasing value of export value for the last two years is encouraging, but the previous variability suggests this rise may not be a longer term trend. Bangladesh exported 6779 MT in 2003 (FAO, 2005) and was placed 29th among the leading exporting countries of the world (Appendix-III, Table 3). However, Bangladesh exported a volume of 29100 MT in 2004-05 (EPB, 2005) which represents a dramatic increase (see Figure 1.2).

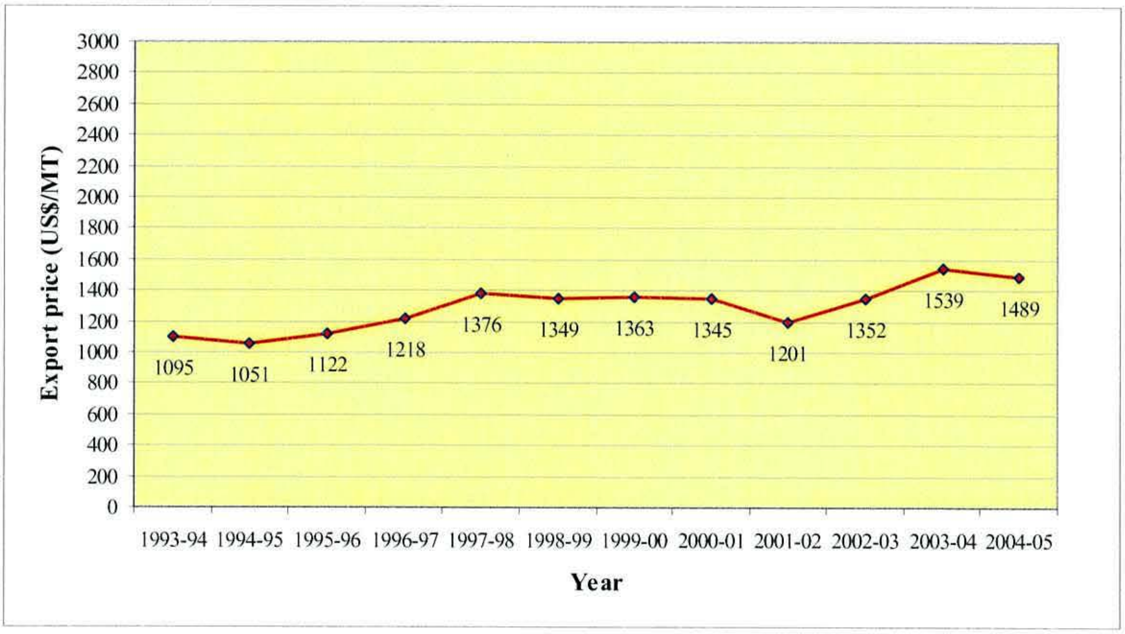


Figure 5.10 Year wise average export price of vegetables in Bangladesh (US$/MT)
Source: EPB (1995, 1996, 1998, 1999, 2001, 2003, 2005)

Figure 5.10 expresses the year wise export price per MT of the vegetable of Bangladesh for the last twelve years, indicating a gently rising trend.

5.10.2 Financial analysis of marketing aspects at the exporter level

5.10.2.1 Estimation of marketing cost

The marketing cost involved for different cost items was computed for four major export marketing channels. Based on the data collected from the exporters, the major export markets, namely London and Rome in Europe; and Jeddah and Dubai in the Middle East, were identified for estimation of the export potential of Bangladeshi vegetables. Vegetables were exported by different passenger aircraft, but, Bangladesh Biman was the main carrier of fresh vegetables from Bangladesh to the above destinations. Therefore, the air freight rates for Bangladesh Biman, applicable for these destinations, was used. The average marketing costs per metric tonne of exported vegetables incurred in each of the four export marketing channels were calculated and compared. The following equation was followed to estimate the average marketing cost:

AMC = TC / Total sample size

Where, AMC = average marketing cost per MT, TC = total costs incurred for all cost items per MT.

5.10.2.2 Estimation of marketing margin and profitability at exporter level

The marketing margin here is the difference between the price paid to the middlemen and the sale price of the exporter. The gross marketing margin was computed as the difference between the sale price of the middlemen and sale price of the exporter to the importer. The net marketing margin or net profit made by the exporter and profit as a percentage of total costs were calculated as earlier for middlemen. The profitability of the exportable vegetables, particularly the three sample vegetables, at the exporter level in the four major export markets was calculated, and compared.

5.10.2.3 Marketing efficiency at the exporter level

Table 5.6 Profitability of vegetable trade at the exporter level in four major export markets (TK per MT)

Particulars	Name of export market UK	Italy	KSA	UAE
A. Weighted average sale price of vegetables in the major export market	141717	143610	98053	78664
B. Weighted average purchase price of selected vegetables in the domestic market	18416	18416	18416	18416
C. Absolute marketing margin (A-B)	123300	125194	79636	60248
D. Marketing cost	104828	101494	74328	57993
E. Net marketing margin or Profit (C-D)	18472	23699	5309	2255
F. Gross marketing ratio(C/A)	0.87	0.87	0.81	0.77
G. Net marketing ratio(E/A)	0.13	0.17	0.05	0.03
H. Total capital invested (B+D)	123244	119911	92744	76410
I. Return on investment (%)	14.99	19.76	5.72	2.95

Source: Bangladesh Bank (2003), Biman (2003)

Table 5.6 illustrates the measures of economic performance for the exportable vegetables. The sale prices obtained by the exporters were the highest in Italy market and the lowest in the UAE market (see Appendix III Table 13 and 14).

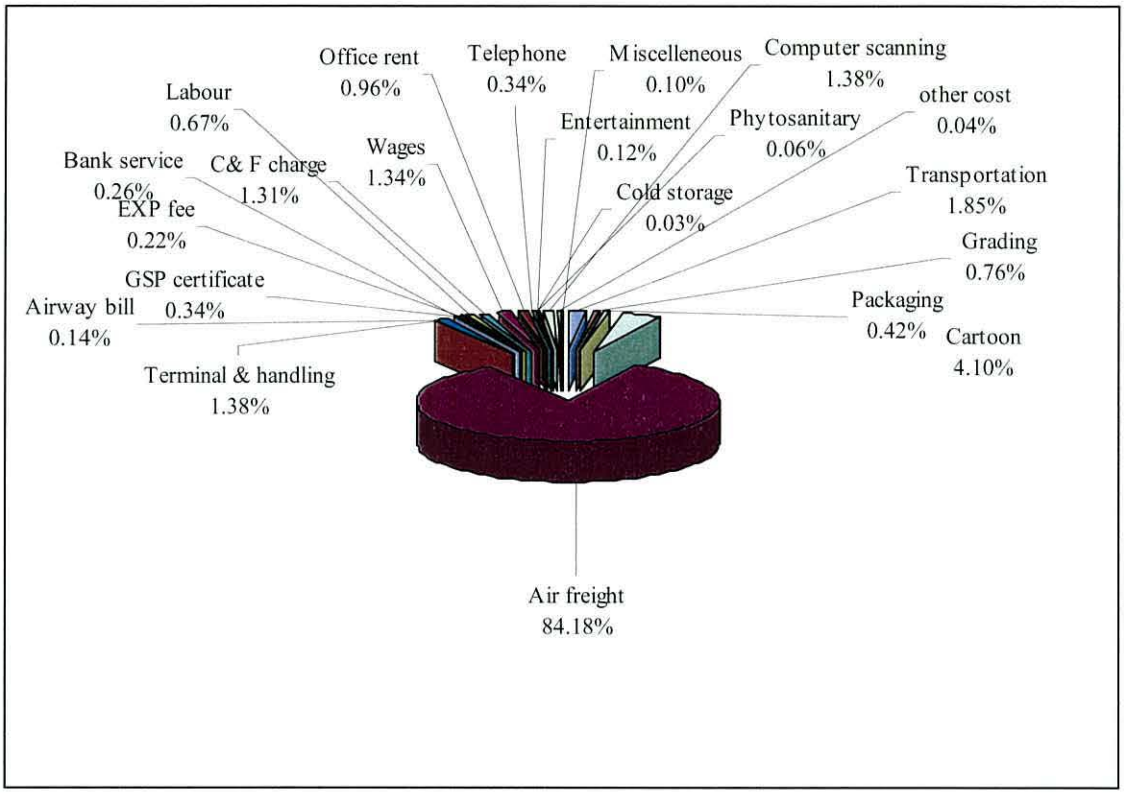


Figure 5.11 Average marketing cost for exporters for all export markets (Per MT)

Figure 5.11 shows the average marketing costs for exporters. Air freight constitutes the lion's share of the marketing cost; 84.18% irrespective of export markets. Table 5.10 of Appendix III expresses costs for the exporters for the different markets where the highest marketing cost was TK 104828 for the UK followed by Italy, while the lowest was the UAE in 2003. The air fare constituted 86.55% of the total cost in the case of London market. Shaha (2000) found the highest marketing cost for leading exporters to the London market to be TK 87677 in 1999. He also found the air freight cost to be 92.37% and 88.54% of the total cost in the case of small and leading exporters respectively for the London market. Both studies identified the air fare as the highest cost item involved in the fresh vegetable export.

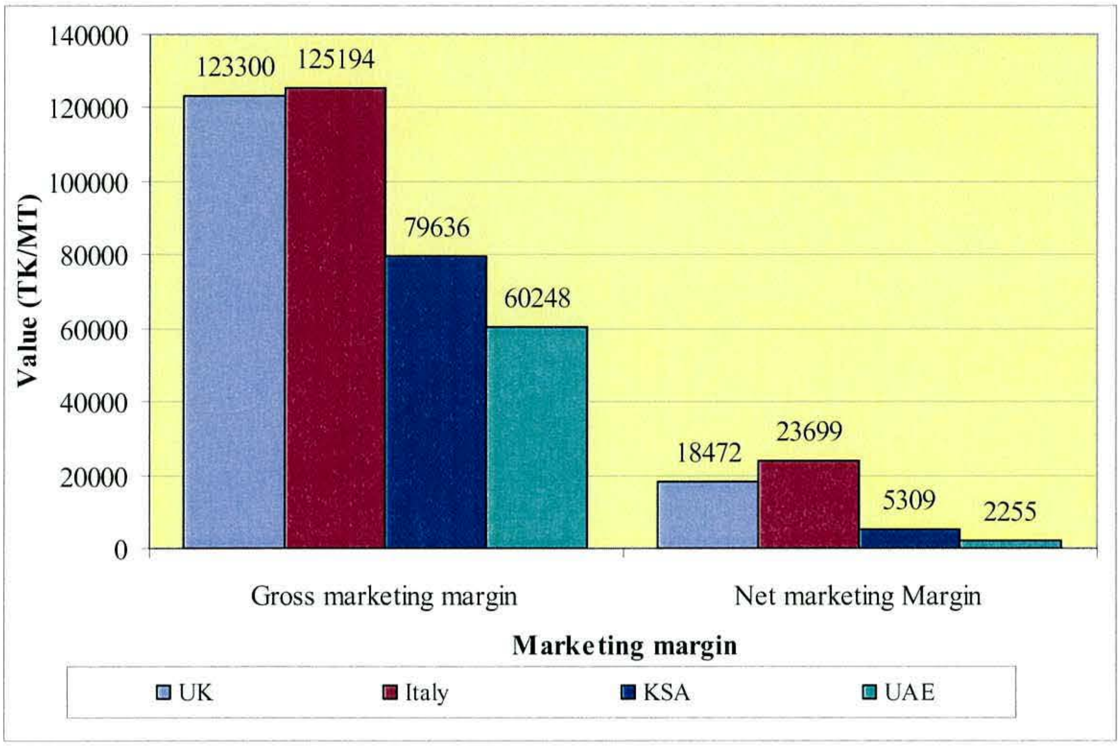


Figure 5.12 Marketing margins at exporter level in four major export markets

Figure 5.12 shows the gross and net marketing margins for the exporters in the four export markets. The highest gross margin was obtained for UK and the lowest for UAE. Thus, the European market appears to be more profitable than that of the Middle East.

Table 5.6 shows that the gross marketing ratio ranges from 0.77 to 0.87 and the net marketing ratio ranges from 0.03 to 0.17 which indicates the profitability of this export business. The return on investment ranges from 2.95 to 19.76% which further confirms that a reasonable profit appears to be possible, particularly in the European markets. Shaha (2000) found the return on investment was 19.2, 20.7 and 22.9 % for small, medium and large exporters respectively for the London market. Both studies found similar returns and market potential for exportable vegetables in Europe markets but surprisingly quite different returns in Middle East markets. The returns in this study were 3% and 5.7% for the UAE and KSA markets respectively while Shaha (2000) found returns of 27%, 28.1 and 30.4% for small, medium and large exporters for Middle East markets. The Hortex Foundation (2002) reported that the exporter's profit margins for French bean, green chilli, bitter gourd and yard long bean were TK 26.32, 22.2, 26 and 26 per kg respectively to the UK exotic farm produce market while that to the UK ethnic market was TK 12.25 only, indicating higher profits for supermarkets suppliers in the international market.

Table 5.7 Profitability of FB exporters in four major export markets (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
A. Sale price of French bean in the major export market	140120	-	78894	81816
B. Purchase price of French bean in the domestic market	16500	-	16500	16500
C. Absolute marketing margin (A-B)	123620	-	62394	65316
D. Marketing cost	104828	-	74328	57993
E.Net marketing margin or Profit (C-D)	18792	-	-11934	7323
F. Gross marketing ratio (C/A)	0.88	-	0.79	0.80
G. Net marketing ratio (E/A)	0.13	-	-0.15	0.09
H. Total capital invested (B+D)	121328	-	90828	74493
I. Return on investment (%)	15.49	-	-13.14	9.83

Apart from the profitability of exporters for vegetables in general, the profitability of the three sample vegetables for these markets was also computed. Table 5.7 shows the export performance of FB. The exporters obtained the highest sale price in the London market with the UAE and KSA prices well below. The profit or net marketing margin was highest in the UK, with the UAE market much lower and negative in the case of KSA due to a lower sale price and higher marketing costs in comparison with UAE. The return on investment for the UK market was 15.5% and 9.8% for the UAE, but for the KSA market the return was negative in 2003.

Table 5.8 Profitability of YLB exporters in four major export markets (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
A. Sale price of yard long bean in the major export market	142600	143136	103940	82442
B. Purchase price of yard long bean in the domestic market	21086	21086	21086	21086
C. Absolute marketing margin (A-B)	121514	122050	82854	61356
D. Marketing cost	104828	101494	74328	57993
E.Net marketing margin or Profit (C-D)	16686	20556	8526	3363
F. Gross marketing ratio (C/A)	0.85	0.85	0.80	0.74
G. Net marketing ratio (E/A)	0.12	0.14	0.08	0.04
H. Total capital invested (B+D)	125914	122580	95413	79079
I. Return on investment (%)	13.25	16.77	8.94	4.25

Table 5.8 illustrates the export market performance for the exporters of YLB. Again, the highest sale prices were in Italy and the UK and the lowest price in the UAE market. The gross and net marketing ratios and return on investment figures indicate that the Italy and UK markets provided better returns than the Middle East markets.

Table 5.9 Profitability of BG exporters in four major export markets (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
A. Sale price of Bitter gourd in the major export market	143409	143136	95330	81139
B. Purchase price of Bitter gourd in the domestic market	20194	20194	20194	20194
C. Absolute Marketing margin (A-B)	123214	122942	75136	60945
D. Marketing cost	104828	101494	74328	57993
E.Net Marketing Margin or Profit (C-D)	18386	21447	808	2952
F. Gross marketing ratio (C/A)	0.86	0.86	0.79	0.75
G. Net marketing ratio (E/A)	0.13	0.15	0.01	0.04
H. Total capital invested (B+D)	125022	121689	94522	78188
I. return on investment (%)	14.71	17.62	0.85	3.78

The profitability analysis in Table 5.9 indicates that the profit margin was the highest in the Italian market while KSA provided the lowest profit in the case of BG. It also shows that the exporters obtained more profit from the UAE market with a lower sale price because of a higher marketing cost incurred for the KSA market even though it provided a comparatively higher price.

Across the three vegetables, the return on investment for the European market ranges from 13.3% to 17.6% while that of the Middle East market ranges from -13.14% to 9.83%, indicating a superior economic performance for the European markets. Italy tends to provide higher rates than the UK due to a slightly higher sale price and slightly lower marketing costs, while in the Middle East, the KSA has higher marketing costs and higher prices in the case of two traditional vegetables, but a lower price for FB.

It is to be noted that the prices in the KSA and UAE are much lower than Europe, perhaps, because of exchange rates, less demand with a smaller ethnic population, more supplies going into these markets, lower transport costs resulting in lower supply prices and a lower quality product. Costs are also lower, but not so low in the KSA while might be due to less quality control needed for packaging and grading, although KSA may have more rules and bureaucracy and other physical barriers.

5.10.3 Sensitivity test for air freight rate changes

The overall air freight cost for all export markets constitutes 84.18% of the total marketing cost which led the researcher to perform a sensitivity test using the air freight cost of Bangladesh Biman, the national carrier, which deals with the major portion of vegetable transport. Considering a 10% increase and decrease of the air freight rate, the profitability level for the four markets in respect of exportable vegetables and also FB, YLB and BG was computed and compared.

Table 5.10 Profitability for vegetables at exporter level in four major export markets with a 10% increase in airfreight rates (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	113901	110503	80184	62562
E.Net Marketing Margin or Profit (C-D)	9399	14690	-547	-2314
G. Net marketing ratio(E/A)	0.07	0.10	-0.01	-0.03
I. Return on investment (%)	7.10	11.39	-0.56	-2.86

Despite a general drop in profitability the European markets exporters obtained higher profits, while a negative return ensues in the KSA and UAE market which is much lower than that profit margin obtained at the current air freight rate (Table 5.6 and Table 5.10). The lower return on investment in all markets reveals that an increase in air freight charges would have a considerable effect on the export market potential of vegetables from Bangladesh.

Table 5.11 Profitability for vegetables at the exporter level in four major export markets with a 10% reduction in airfreight rates of (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	95755	92485	68472	53424
E.Net Marketing Margin or Profit (C-D)	27545	32708	13637	6824
G. Net marketing ratio(E/A)	0.19	0.23	0.14	0.09
I. Return on investment (%)	24.13	29.49	12.85	9.50

Similarly, when air freight rate rise by 10%, profitability in all markets rises substantially so that even in the UAE market a reasonable return is generated.

Table 5.12 Profitability for FB exporters with a 10% increase in airfreight rates (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	113901	-	80184	62562
E.Net Marketing Margin or Profit (C-D)	9719	-	-17790	2754
G. Net marketing ratio (E/A)	0.07	-	-0.23	0.03
I. Return on investment (%)	7.45	-	-18.40	3.48

Table 5.12 shows that the return for exporters considerably worsened in all three cases, while Table 5.13 shows a substantial improvement, although this is not enough to lead to a positive return in the KSA.

Table 5.13 Profitability for FB exporters with a 10% reduction in airfreight rates of (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	95755	-	68472	53424
E.Net Marketing Margin or Profit (C-D)	27865	-	-6078	11892
G. Net marketing ratio (E/A)	0.20	-	-0.08	0.15
I. Return on investment (%)	24.82	-	-7.15	17.01

Table 5.14 Profitability for YLB exporter with a 10% increase in the airfreight rate (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	113901	110503	80184	62562
E.Net Marketing Margin or Profit (C-D)	7613	11547	2670	-1205
G. Net marketing ratio (E/A)	0.05	0.08	0.03	-0.01
I. Return on investment (%)	5.64	8.77	2.64	-1.44

Table 5.14 shows that the return on investment for the exporter was reduced to relatively poor levels in the case of YLB when an increase in 10% is occurs. For the UAE market the return became negative.

Table 5.15 Profitability of YLB exporter at four major export markets considering 10% reduced airfreight rate (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	95755	92485	68472	53424
E.Net Marketing Margin or Profit (C-D)	25759	29565	14382	7932
G. Net marketing ratio (E/A)	0.18	0.21	0.14	0.10
I. Return on investment (%)	22.05	26.03	16.06	10.65

Table 5.15 shows when the freight rates are reduced, for YLB exporters obtain reasonable profit margins even in the lower price markets.

Table 5.16 Profitability of BG exporter considering 10% enhanced airfreight rate (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	113901	110503	80184	62562
E.Net Marketing Margin or Profit (C-D)	9313	12438	-5048	-1617
G. Net marketing ratio (E/A)	0.06	0.09	-0.05	-0.02
I. Return on investment (%)	6.95	9.52	-5.03	-1.95

In the case of BG with a 10% increase in the air fare, profits are halved in the European market but for the KSA and UAE markets returns become negative (Table 5.16).

Table 5.17 Profitability of BG exporter with a 10% reduction in airfreight rate (TK per MT)

Particulars	Name of export market			
	UK	Italy	KSA	UAE
D. Marketing cost	95755	92485	68472	53424
E.Net Marketing Margin or Profit (C-D)	27459	30456	6664	7521
G. Net marketing ratio (E/A)	0.19	0.21	0.07	0.09
I. Return on investment (%)	23.68	27.03	7.52	10.22

Table 5.17 shows that the exporters' profits are boosted a good deal when air freight faces a 10% reduction in rate.

The profit margin for vegetables in general and the three sample vegetables in particular with the air freight at current, 10% increased and reduced rate shows clearly its influence over export market profitability. These findings suggest that a policy instrument could be considered to encourage an air freight rate for Bangladesh Biman more in line with competitive countries to make perishable items, like vegetables, more competitive in the export market.

5.11 Vegetable marketing channel in the United Kingdom

5.11.1 Supermarket in UK

The supermarkets have emerged as in the UK giant market players in the retail market, covering about 60% of the market share in 1997 and still holding that level. The nine leading supermarkets had a combined share of 59.8% of the total British grocery market in 2001 (Saphir, 2002). The supermarkets have achieved large economies of scale through bulk purchasing, centralized distribution departments with regional distribution centres to ensure organized and constant supply of branded products as well as one-stop shopping facilities. Some large superstores sell TV's, clothing, petrol and even insurance, making them more attractive to consumers and caterers. The supermarkets' supply chain structure has mainly four supply chains, where first tier suppliers processors, pre-packers, and marketing organizations, collect the fresh produce from the primary producer in or outside the UK, and supply to the supermarkets through their marketing and procurement division (Duffy and Fearne, 2004, See section 2.3.2.1)

The Office of Fair Trading (OFT) attached to the Department of Trade and Industry in the UK supervises of the Code of Practice made for supermarkets who buy groceries from suppliers and have, at least, an eight percent market share from the purchase of groceries for resale. Such supermarkets should be required to give undertakings to comply with this code. The code encompasses the major dealings namely written standard terms of business, prices and payments, promotions, compensation, consumer complaints, third party dealings, staff training, and other aspects (Office of Fair Trading, 2005).

5.11.2 Wholesale market in London

Wholesalers with warehouses, transportation and product consolidation facilities, maintain a link between primary producers and retailers, manufacturers, agents, packers, suppliers, caterers, and consumers in the UK. After the wide emergence of supermarkets, the importers, suppliers, and packers who were not able to supply fresh food to the supermarkets, supplied to the wholesale markets. The five main wholesale markets, three for fresh horticultural produce, one for fish and another for meat, are currently rendering a service in the Greater London area (Saphir, 2002). The wholesale markets supply fresh food for the traditional as well as the ethnic markets. Plate 5.4 shows the quality packaging of fresh horticultural produce in cartons and containers in the New Spitalfield wholesale market in London. Such packaged vegetables are being exported by European countries (e.g Turkey, the Netherlands, Cyprus), African (Kenya), South and North America (Brazil), and Asian countries (China, India, Jordan). However, few exporters were offering BRAC's quality packaging of vegetables from Bangladesh during a field visit to this market by the researcher. The wholesalers sell fruit, vegetables, and flowers to retailers of the various ethnic markets, greengrocers in London and semi-urban areas, consumers, and catering customers (Plate 5.4).

5.11.3 Ethnic market in London in the UK

Apart from traditional greengrocery, another category of retail outlet (usually called cash and carry) is especially organized for the Asian and African origin ethnic group, this type of retailer collects ethnic fresh produce from both wholesale markets and through import from the respective countries. Plate 5.5 and 5.6 show the fresh produce in bamboo baskets and used, tied up cartons from Bangladesh, indicating its low quality of packaging which damages the vegetable. Some ethnic importers reported that they bought Indian vegetables at a higher price than Bangladeshi vegetables due to quality packaging that better maintains the freshness of the vegetable. Bangladeshi vegetables are mostly being exported to ethnic markets in the UK with sub-standard packaging since preference for Bangladeshi vegetables prevails in such markets. Plate 5.7 shows an ethnic market retail outlet where Bangladeshi vegetables are being sold, particularly to ethnic consumers.

Plate 5.8 shows some dry fish marked as a product of Bangladesh, which came in cartons of vegetables from Bangladesh, and was reported as a banned item by the retailers. This reflects certain unethical business practices being carried out by some exporters from Bangladesh. These banned items came in these cartons through Dhaka and Heathrow airports, and such practices were reported by a few importers during the field survey. It is presumed that this type of illegal practice might happen due to oral agreements between importers in London and exporters in Bangladesh. Such unethical business would be likely to be detrimental to the overall export of vegetables from Bangladesh.

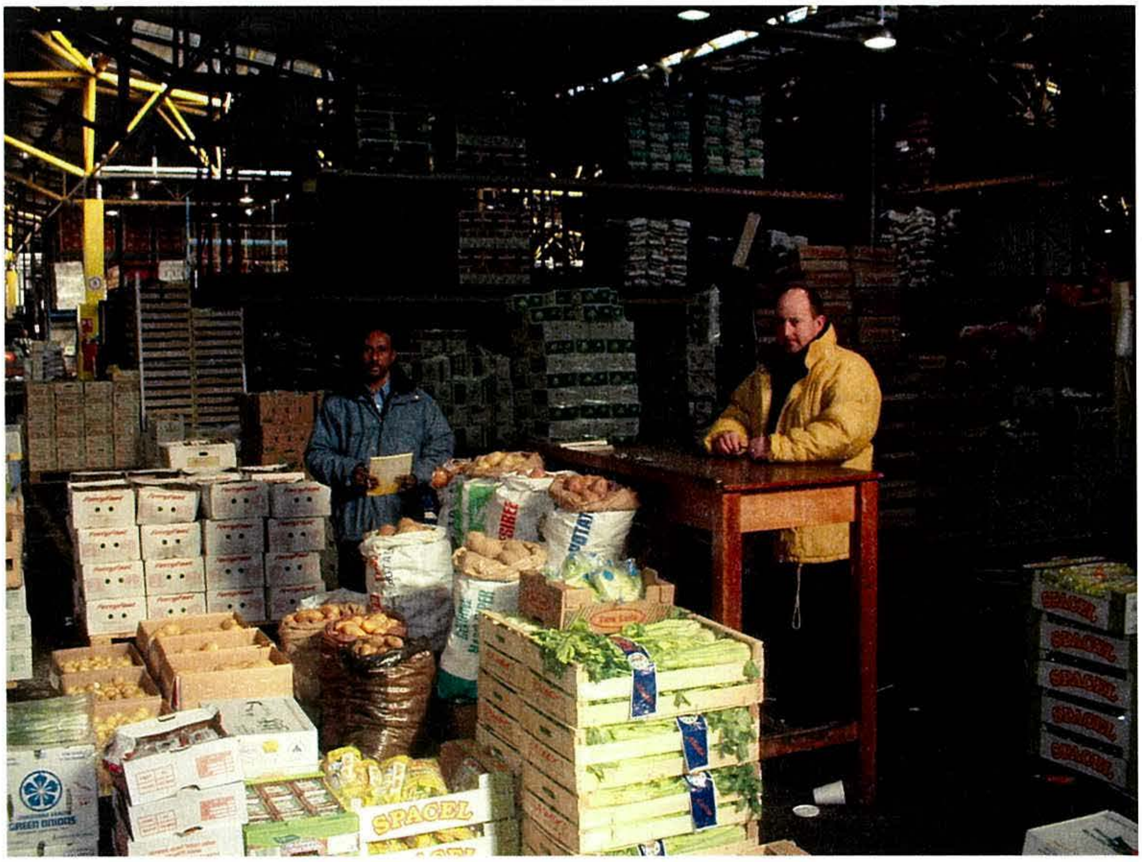


Plate 5.4 Showing cartons of horticultural products of different countries at New SpitalField Wholesale market in London, UK (2004)

Plate 5.5 Showing the cartons of Bangladeshi vegetable in ware house in ethnic market in London, UK (2004)

Plate 5.6 Showing bamboo basket and used cartons for Bangladeshi vegetable in London ethnic market (2005)

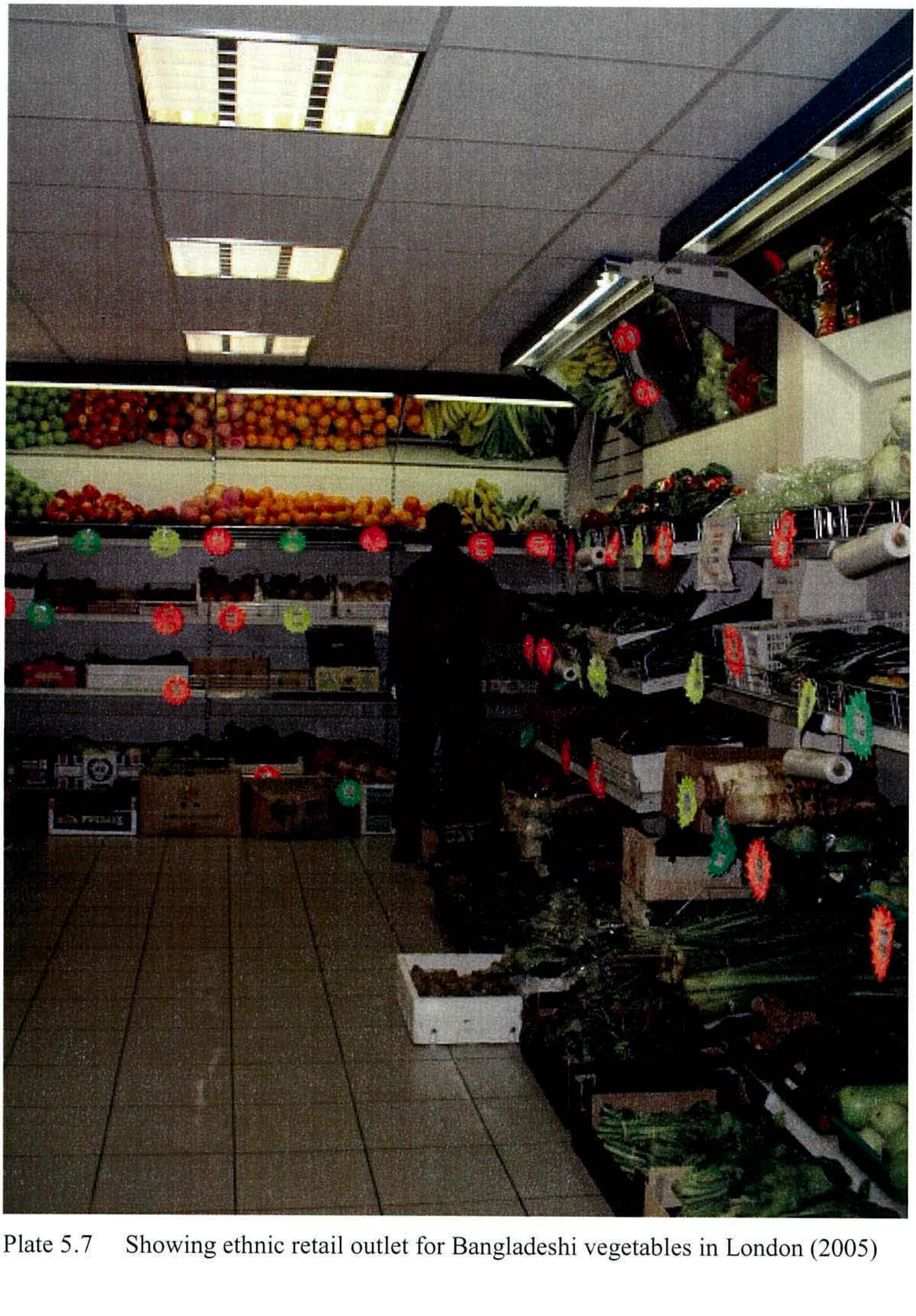


Plate 5.7 Showing ethnic retail outlet for Bangladeshi vegetables in London (2005)

Plate 5.8 Dry fish was found within the carton of Bangladeshi vegetable for London Ethnic retail outlet (2005)

5.11.4 Market structure for vegetables in the UK

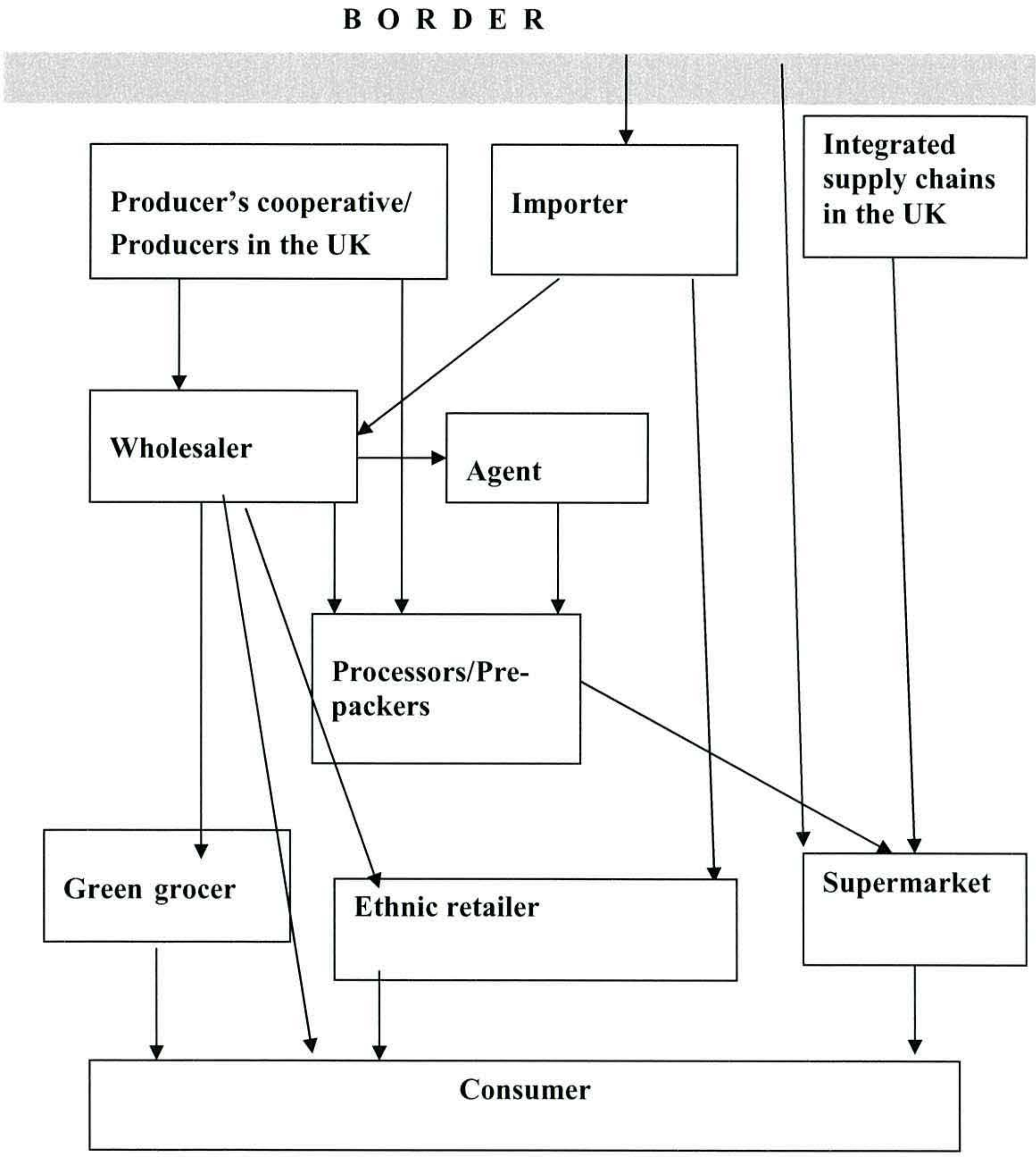


Figure 5.13 Diagram showing domestic and import marketing channel of vegetables in the United Kingdom
Source: Duffy and Fearne (2004), Field survey 2004 in the UK

5.12 Financial analysis of marketing aspects of Bangladeshi vegetables in the United Kingdom

Financial analysis at the importer level was carried out to compute the profitability of the exportable vegetable business in London

5.12.1 Estimation of marketing costs at the importer level

The marketing cost involved for different items was computed for the London market. Data was collected on the costs of transport, salaries and wages, and airport entry and handling, and average marketing cost was computed.

5.12.2 Estimation of profitability at the importer level

The marketing margin is the difference between price paid to the exporter and the sale price of the importer. The gross marketing margin was computed as the difference between the purchase price of the importer and sale price of the importer to the retailer or wholesaler. The net marketing margin or net profit made by the importer was also calculated.

The profitability of the exportable vegetables, particularly of the two sample vegetables at the importer level in London market was calculated, and compared. FB was not traded by the importers at the ethnic market in the data collection year.

5.12.3 Vegetable marketing at importer level in the market of London, UK

Table 5.18 and Figures 5.14 and 5.15 show the economic performance for the importers in London where the net margin is higher at the consumer than the retailer level in the ethnic market.

Table 5.18 Profitability for vegetable importers in London in the UK (£ per MT)

Particulars	Ethnic retailer level	Consumer level
A. Weighted sale price of vegetable by the importer	1799	2054
B. Weighted purchase price of selected vegetable by the importer	1467	1467
C. Absolute marketing margin (A-B)	333	587
D. Marketing cost	310	310
E. Net Marketing Margin or Profit (C-D)	22	277
F. Gross marketing ratio (C/A)	0.18	0.29
G. Net marketing ratio (E/A)	0.01	0.13
H. Total capital invested (B+D)	1777	1777
I. Return on investment (%)	1.26	15.58

Sale prices were high at the consumer level, and with common marketing costs, the return was higher.

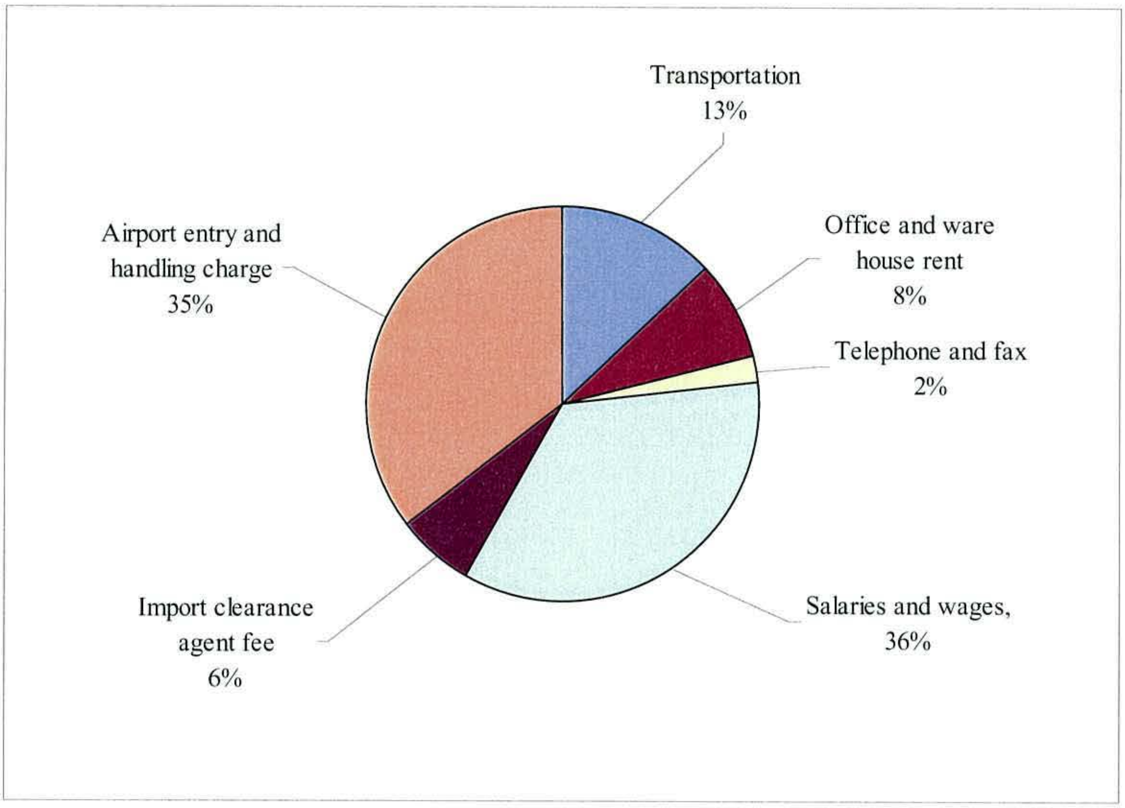


Figure 5.14 Share of the marketing cost incurred by the importers in London

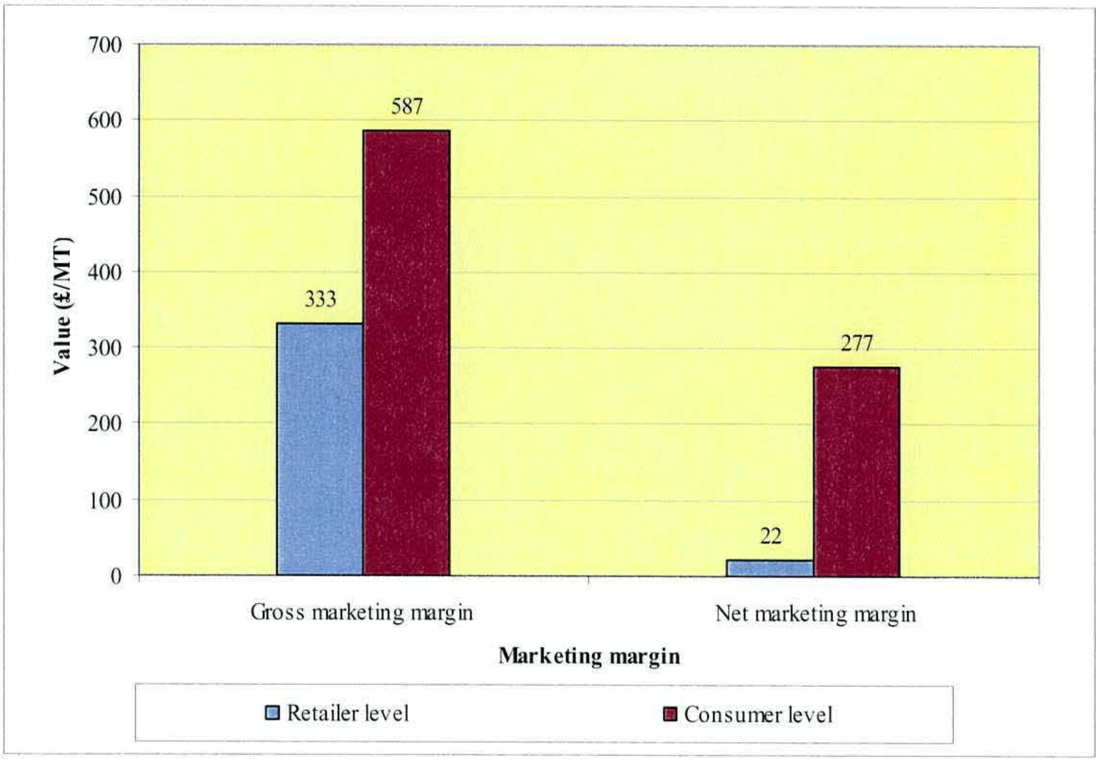


Figure 5.15 Distribution of marketing margin of importers in the London market

Figure 5.14 shows the cost details for the importers in London. Cost for salaries and wages, and airport entry and handling charges constitute the major portion, over 70% of total marketing costs (Appendix IV, Table 3).

Table 5.19 Profitability for YLB importers in the UK (£ per MT)

Particulars	Ethnic retailer level	Consumer level
A. Sale price of vegetable by the importer	1775	2088
B. Purchase price of selected vegetable by the importer	1467	1467
C. Absolute marketing margin (A-B)	308	621
D. Marketing cost	310	310
E. Net Marketing Margin or Profit (C-D)	-2	311
F. Gross marketing ratio (C/A)	0.17	0.30
G. Net marketing ratio (E/A)	0.00	0.15
H. Total capital invested (B+D)	1777	1777
I. Return on investment (%)	-0.11	17.48

Table 5.19 shows the economic performance of YLB trading at importer level in the London ethnic market. The net marketing margin or net profit is higher at the consumer but negative at the retailer level due to sale price differences with common marketing costs.

Table 5.20 Profitability for BG importers in the UK (£ per MT)

Particulars	Ethnic retailer level	Consumer level
A. Sale price of vegetable by the importer	1803	2088
B. Purchase price of selected vegetable by the importer	1492	1492
C. Absolute marketing margin (A-B)	311	596
D. Marketing cost	310	310
E. Net Marketing Margin or Profit (C-D)	1	286
F. Gross marketing ratio (C/A)	0.17	0.29
G. Net marketing ratio (E/A)	0.00	0.14
H. Total capital invested (B+D)	1802	1802
I. Return on investment (%)	0.06	15.84

Table 5.20 shows the marketing margin of BG trading at importer level in the London market. The net marketing margin is again much higher at the consumer

level but almost at the break even point at the retailer level. It indicates that the importers who sold YLB and BG at consumer level, made a net profit due to a higher sale price.

5.13 Producer's share in vegetable marketing

The Producer's share could be computed at different levels of intermediaries. It is usually computed in terms of consumer's price in the following way:
Producer's share in consumer's price = producer's price/ consumer's price *100.

The consumer's price was not possible to collect from the four export markets so the producer's price was computed in terms of the exporter's sale price, as the exporters are the last seller of the country.

Table 5.21 Producer's share in terms of exporters' price by export market

Particulars	UK	Italy	KSA	UAE
Exporters' weighted sale price	141717	143610	98053	78664
Producer's weighted sale price	9154	9154	9154	9154
Producer's share in exporters' price	6.8	6.8	9.9	12.3

Table 5.21 shows the producer's share at the exporter level by export market. The shares in export markets in Europe are lower than the Middle East due to a higher sale price in the former. The exporters do not pay producer according to the export market price. Table 5.6 shows that the exporters obtained a higher profit in the European than the Middle Eastern markets.

5.14 Estimation of export market potential of vegetables

The market potential may be defined as the total level of sales possible in a target market by all participating firms. An attempt has been made to estimate vegetable market potential of the exporting firms of Bangladesh in the export markets and also that of the ethnic importers in London in the year of 2003-04. The estimated export market potential and actual export of vegetables are compared in the tables below.

5.14.1 Estimation of export market potential of vegetables in Bangladesh

The total vegetable sales of the exporters of Bangladesh and the importers in the ethnic market in London was computed, based on the equation 3.20 (see section 3.10.5, p-86). Total sales by the exporters and importers are considered for estimating the market potential for vegetables in the export market. Moreover, this approach assumed that the exporters and importers would sell vegetables at a constant rate and the tastes and preferences of the consumers would be the same throughout the year.

Table 5.22 Estimation of export market potential of vegetables at exporter level in Bangladesh in 2003-04

Description	Export by the respondents/all exporters in 2003-04	Actual annual export in 2003-04 (tonnes)	Actual annual export in 2004-05 (tonnes)
Weekly export by 40 exporters (Kg)	200,318	-	-
Annual export by 40 exporters (tonnes)	10,417 (33)	-	-
Annual estimated export by all participating exporters (tonnes)	31,250	16,144	29,100

Source: Field survey 2003, Export Promotion Bureau (2003, 2005).
Figure in parentheses indicates the percentage of respondents' export to all exporters' sales

Table 5.22 shows the estimated yearly export market potential in 2003-04 and actual export of vegetables in Bangladesh over a two year period. The estimated annual export market potential of vegetables by the respondents (40) in 2003-04 was 10417 MT and by all exporters was 31250 MT. The total number of exporters in Bangladesh was estimated to be three times more than the number of the respondents based on which the market potential was predicted. This estimation method assumes that all the farms will produce and sell at the same rate throughout the year. The estimated market potential is compared with the actual export volume in the same year and the following year as reported by EPB. The actual export volume in 2003-04 is about half of the estimated market potential which indicates that the exporters did not maintain their rate of export throughout the year, perhaps due to the acute air cargo space problem, as reported during the field survey or it may be that the period taken for this survey was not representative of the whole year, particularly because of seasonality. They did, however, export vegetables almost equal to the estimated market potential in the following year, which may support the actual market potential in the export market as projected in this study.

5.14.2 Estimation of export market potential of Bangladeshi vegetables in London (MT)

Table 5.24 Estimation of market potential of importers in the ethnic market in London

Description	Total vegetable sale in London ethnic market (MT)	Actual annual export of vegetables to the UK in 2003-04 (MT)
Monthly vegetable sales by the respondents	168	-
Annual vegetables sale (respondents) in London (MT)	2016 (50)	-
Annual estimated vegetable sales by the assumed importers	4032	3818

Source: Field survey in 2004 in London, Annual report of 2003-04, Export Promotion Bureau .
Figure in parentheses indicates the percentage of sale of respondents of the total

Table 5.24 expresses the estimated market potential of vegetables for the six respondent importers, assumed number of importers in the London ethnic market and also actual export volume to the UK market in 2003-04 as reported by EPB. The total number of importers in the UK was assumed to be double the number of the respondents based on which the market potential was estimated. The annual estimated market potential of vegetables in the London ethnic market was 3,919 MT in 2003-04. The EPB reported that the actual export volume of vegetable in the whole UK market in 2003-04 was 3,864 MT. This method assumes that the consumers' choice and preferences and rate of consumption will be the same throughout the year in the ethnic market in London. The estimated market potential in the London ethnic market in 2003-04 is almost equal to the actual export volume in the whole UK market in the same year which indicates the likely huge market potential prevailing in the ethnic, and possibly mainstream markets, not only in London, but across the UK.

5.15 Economic analysis of market power of participants in vegetable export marketing chain

Market competition is defined as a process of competitive rivalry which is maximized in an oligopoly market structure (Whitely, 2003). Market power may be defined as the degree to which a firm exercises influence on price and output in a particular market. Under perfect competition, all participating firms are assumed to have zero market power (Bannock *et al.*, 2003). In a competitive market, a single firm has no power to influence the market prices, although it may attempt to raise prices by supplying fewer commodities but that would result in increased supply by other firms (Ohno and Paul, 1992). If market power exists then both perceived marginal revenue and marginal cost are less than price.

Market concentration or market power of sellers or buyers is commonly determined by two measures namely the four firm concentration ratio (CR_4) and the Herfindahl-Hirschman Index (HHI) (Oligopoly Watch, 2003). Market concentration is a function of the number of the firms in a market and their market shares. The HHI is generally considered a superior economic measure of market concentration and is the sum of squares of the market shares of all firms participating in the market, and also implies the degree of market power (Compecon, 2002).

Reportedly, CR_4 is the most typical concentration ratio for judging an oligopolistic situation prevailing in the market. The four firm concentration ratio is the sum of the four largest farms' market share.

If CR_4 is over 50%, this indicates a tight oligopoly, between 25 and 50% indicates a loose oligopoly and under 25% indicates no oligopoly. A CR_4 of four equal sized farms of 80% indicates a 'super tight' oligopoly (Oligopoly, 2003)

5.15.1 Market power of Producer considering sample vegetable and survey districts

A number of assumptions were made in order to compute the market powers of the market participants comprising the respondents in this study, which were described earlier (see section 3.10.6). Although, there might be some shortcomings in these assumptions, it was a reasonable means of giving some indication of the relative degree of market power of the market participants. The market power for the producer as seller, and middlemen and exporters as buyer and seller, and for importer as buyer, was computed. The market power or market concentration (HHI) for the market participants in this study were computed and take a value between 0 and 1.

Table 5.24 shows the estimated market power of respondents and the total numbers of sellers of the three sample vegetables in the local markets of the four survey districts. The market power of the respondents of FB, considering only participants in the local market in Rangpur district is 0.335 which indicates a weak oligopolistic market for this vegetable in this market while of a greater degree of competition exists in the case of the other three survey areas. The market power or HHI of FB sellers in the four villages of each district ranges from 0.01 to 0.07 that indicates a high degree of competition exists in the local markets of all four districts.

The market power of the respondents for YLB considering only participants in the local markets of the four survey districts ranges from 0.05 to 0.11 which suggests some degree of oligopoly in the market. The market power of the all sellers of YLB in all local markets of the survey districts ranges from 0.01 to 0.003, indicating a high degree of competition among the sellers in all the survey areas in the case of this vegetable.

Table 5. 24 Estimation of market power of producer of FB, YLB and BG in local markets of four survey districts

Vegetables	Description of items	Rangpur	Comilla	Tangail	Narshingdi
FB	Total sale of by the respondents (kg)	1051	73824	2547	8193
	Market power of respondents of in local market	0.335	0.076	0.117	0.120
	Market power of producer in two survey villages in local market	0.144	0.019	0.070	0.056
	Market power of producer in four villages in local market	0.072	0.010	0.035	0.028
YLB	Total sale of by the respondents (kg)	15637	26130	18322	22540
	Market power of respondents of in local market	0.101	0.058	0.109	0.079
	Market power of producer in two survey villages	0.043	0.015	0.065	0.037
	Market power of producer in ten survey villages in local market	0.009	0.003	0.013	0.007
BG	Total sale of by the respondents (kg)	30162	33309	25729	54971
	Market power of respondents of in local market	0.101	0.066	0.138	0.086
	Market power of producer in two survey villages	0.044	0.017	0.082	0.040
	Market power of producer in ten survey villages in local market	0.009	0.003	0.016	0.008

The market power of the respondents for BG considering only participants in the markets of the survey areas ranges from 0.07 to 0.14, indicating similar degree of competition to YLB but less than for FB. The market power of all sellers of this vegetable in the markets ranges from 0.02 to 0.003 which again implies that near perfect competition exists in the markets of the four survey areas in the case of BG sellers (Appendix I Table 35, 36, 37, 38, 39, 40, 41and 42) .

It can be concluded that a small degree of oligopoly power exists in the localized market in the case of all three sample vegetables in all the survey areas. However, when the number of markets in the district involved in sales of these vegetables is brought together, any oligopolistic power diminishes a great deal. Therefore, the vegetable producers have very little market power to influence the price of their produce.

5.15.2 Market power of buyer middlemen in local markets in the survey areas

Table 5.25 expresses the HHI or market power of the respondents and all middlemen participating in the local markets of the four survey districts for the three vegetables.The market powers of the respondent middlemen buying FB in the local markets of Dhaka, Comilla and Narshingdi district is one which implies a monopsony market. The market power of all middlemen in the same markets of the above districts is 0.333, indicating an oligopsony market, while for Tangail district the figure is 0.133, indicating rather more competition in this district in the case of FB. Respondents in Rangpur did not buy FB.

Table 5.25 Local market estimation of market power of buyer middlemen including BRAC

	Description of the items	Dhaka	Comilla	Rangpur	Tangail	Narshingdi
FB	Purchase of by the respondents (kg per week)	600	6200	-	4100	1550
	Market power of respondents in the local market	1	1	-	0.400	1
	Market power of all middlemen in the local market	0.333	0.333	-	0.133	0.333
YLB	Purchase of by the respondents (kg per week)	8160	14290	14700	3650	9520
	Market power of the respondent in the local market	0.756	0.217	0.252	0.149	0.279
	Market power of all middlemen in the local market	0.252	0.072	0.084	0.050	0.093
BG	Purchase of by the respondents (kg per week)	26165	14640	16800	5990	9520
	Market power of the respondent in the local market	0.240	0.178	0.212	0.223	0.279
	Market power of all middlemen in the local market	0.080	0.059	0.071	0.074	0.093

BRAC in the Chandina market in Comilla and in Narshingdi and one middleman in Dhaka buy FB from producers, and are influencing the FB price with their monopsonistic market power, especially since these producers are producing FB as contract farmers for BRAC. It was observed during the field survey in 2003 that the local people do not tend to consume such non-traditional vegetables as FB, so BRAC is virtually the only user of FB in this market, but they do provide an agreed fixed price to their producers.

The market concentration of the respondents for YLB, considering them as the only participants in the local market in Dhaka is 0.756 and for all middlemen there, 0.252 which implies that a high degree of oligopsony exists in this market. The market power for all middlemen participating in the other markets of three districts ranges from .05 to .09, indicating a relatively competitive market exists in these markets for YLB. The market power of the respondent buyers of BG, in the local markets of five regions ranges from 0.178 to 0.279, and for all middlemen in the five regions it ranges from 0.059 to 0.093, indicating more market competition for BG.

This study concludes that the middlemen in all the survey districts face a reasonably competitive market situation in the case of YLB and BG while a more oligopsonistic market situation exists in the case of FB and the Dhaka market for YLB. When these figures are compared to those of the producers (Table 5.27) in all cases middlemen appear to have a good deal more market power than producers.

Table 5.26 Estimation of market power of seller middlemen in the terminal market

Description	FB	YLB	BG
Weekly sale by the middlemen (Kg)	10900	50320	80535
Market power of the respondents	0.403	0.07	0.045
Market power of the assumed number of middlemen in the terminal market	0.134	0.014	0.009

The estimated number of middlemen is three times the number of respondent. Table 5.26 reveals the lower degree of market competition for the respondents while an oligopolistic market exists for all middlemen for FB while competitive market exists for all seller middlemen for YLB and BG in the terminal market. It can be concluded that that the market power for buyer middlemen is higher than that of the seller middlemen for FB while similar market power exists for both buyer and seller middlemen for YLB and BG (Table 5.25).

5.15.3 Market power of exporters sample vegetables

Table 5.27 Estimation of market power of buyer exporters of vegetables

Description	FB	YLB	BG
Weekly purchase by the respondents (Kg)	14963	13900	13920
Market power of the respondents	0.412	0.262	0.209
Market power of the assumed exporters	0.206	0.087	0.070

Table 5.27 shows the market power of the exporters for each of the sample vegetables considering the respondents as the only participants and then for all exporters in the export market. The HHI or market power for exporters in the FB market is 0.206 which indicates their oligopsony power in the market. The HHI for the respondents shows a much lower degree of market power in the case of YLB and BG. The market power measures for seller middlemen and buyer exporters for FB are similar while the buyer exporters have a good deal more market power than they do as sellers of YLB and BG (Table 5.26).

Table 5.28 Estimation of market power of exporter selling to London ethnic market

Monthly export of all vegetables to the UK market by respondents (MT)	530
Market power of the respondents exporting to the UK	0.089
Monthly export of all vegetables to the UK market by assumed number of exporters (MT)	1060
Market power of assumed exporters to the UK	0.045

Table 5.28 reveals the estimated market power of the respondent exporters and all exporters as sellers which indicates a competitive market. It can be compared with the market power of buyer exporters who have a higher degree of market power than when they sell (Table 5.27)..

5.15.4 Market power of importers in the London ethnic market

Table 5.29 Estimation of market power of the vegetable importer in London

Monthly vegetables purchase by the respondent importers (MT)	168
Market power of importers in London	0.171
Market power of assumed number of importers of Bangladesh origin in the UK ethnic market	0.085

An attempt was made to measure the market power for the importers in the London ethnic market. Table 5.29 shows the market power of the respondents as well as all importers in the aforesaid market. The market power for the respondents is 0.171, considering them as the only participants in the market, and for all importers the figure is 0.085, which indicates a fairly low degree of market power. It also reveals that the market power of the importers is a little greater than the seller exporters (Table 5.28), although both indices are low.

Finally, it can be concluded that the buyers have more market power than the sellers right from the producers to the importers in the export marketing chain.

5.16 Factors affecting price transmission of vegetables and policy implications

5.16.1 Factors affecting price transmission

The price of any commodity transmits from the producer to the consumer level through intermediaries, and is influenced by certain economic aspects including market power, returns to scale, marketing costs, and government intervention. A competitive market provides a fair price to the market participants, and an efficient market structure involves lower marketing costs and margins but higher producer's share and consumer satisfaction.

McCorriston *et al.*, (2001) studied the role of market structure in determining the degree of price transmission in the food marketing chain. They found that market power is not the only major factor influencing price transmission; returns to scale is also a key determinant of price transmission. They concluded that price transmission may be greater in a market with increasing returns to scale than in markets characterized by perfect competition with constant returns to scale, which indicates that returns to scale might sometimes be a more influential measure than market power. They further reported that the degree of price transmission will also depend on the functional form of the demand curve. They found that the price of any commodity can be greater or less than the competitive case due to interaction of market power and returns to scale. Thus, the market structure, encompassing both market power and the nature of the industry cost function will have an important influence on price transmission. Consequently, market structure considerations should not be confined to identifying only market power.

5.16.2 Price transmission and policy implications

Price transmission or price spread is a key indicator of economic performance of any agricultural produce. It is determined by market power and returns to scale of different intermediaries involved in the marketing chain. In the present study, market power and returns to scale have been computed through the marketing chain right from the producer in Bangladesh to the importer in the UK. Market power analysis indicates that a reasonably competitive market structure seems to exist in the case of YLB and BG, particularly at the early stage of the marketing chain, while competition is more imperfect in the case of FB due to powerful buyers. Neverthless, as one might expect, more power appears to reside with the buyer at each stage of the chain, with least power for the producers. Producer's share as another indicator of market efficiency is particularly low in the export market due to higher marketing costs, air freight costs in particular.

From the policy perspective, a more competitive or balanced structure market needs to be ensured both in Bangladesh and the UK market. The air fare constitutes the major portion of the marketing cost of vegetable exports which demands an immediate solution. This might be through introducing subsidized public and private air cargo services, if this could be economically justified, leading to a higher producer's share, and making Bangladeshi vegetables more competitive in the export market.

Additionally, efficiency along the marketing chains needs to be studied more closely. The market participants, especially the producers, might be assisted via the provision of market information and advice along with the encouragement of greater cooperation. Organisations like BRAC and Proshika can be very helpful if moving in the producers' interests.

5.17 Vegetable production and export and WTO Agreement implications

The World Trade Agreement on Agriculture (WTAA) 1994, which is presently presumed to be implemented by all member countries, is pertinent to the issue of the production of exportable vegetables and their export. The developing countries are exempted from domestic support reduction commitments to encourage agricultural and rural development as an integral part of the development programmes of these countries within the auspices of Article 6 of the agreement. Furthermore, export subsidies in terms of direct subsidies including payments in kind, are allowed in developing countries, subject to the provision of Article 9 of this agreement (WTAA, 1994). The developed countries have agreed to replace quantitative restrictions and non-tariff measures on agricultural products with tariffs which will be reduced by 30%. The developing countries have also agreed to cut tariffs by nearly two thirds of the average. It is also stated that countries using subsidies, particularly the developed countries, have agreed to reduce both production and export subsidies for agricultural produce (Ministry of Commerce, 1998).

Vegetable production is comparatively expensive relative to other crops while prices fluctuate, and few storage facilities prevail in Bangladesh which makes products vulnerable due to perishability. This situation may warrant domestic support in terms of direct payment or input support to the producers to develop this sector, particularly to ensure food security as well. Further, Bangladesh is trying to increase export of vegetables, and may need export subsidies to develop this value added sub-sector facing the international market. Current exports of Bangladesh are concentrated heavily on ready-made garments and thus low diversification of exports may detract from reforms such as giving greater flexibility within its exchange rate system (International Monetary Fund, 2002). It is suggested that the export subsidy should be product-specific and domestic support in respect of production could be provided at permitted levels in Bangladesh agriculture (Centre for Policy Dialogue, 2002). The WTAA is favourable towards the promotion of the production and export of vegetables from Bangladesh which requires proper policy intervention by the government as part of diversification of export commodities of this country.

5.18 Problems encountered by the market participants in vegetable marketing in Bangladesh

5.18.1 Problems encountered by middlemen in vegetable marketing

Table 5.30 Problems encountered by middleman in vegetable marketing in Bangladesh

Major heads	Major problems	Frequency
Finance	Finance to run the business	31 (67.4)
	Exporter does not pay money regularly	12 (26.1)
	Payment from the exporter is always uncertain, sometimes exporters stops business without paying previous payment	4 (8.7)
	No trade license so cannot enjoy bank credit	16 (34.8)
	Sometimes exporter receives delay payment from the importers, so they get payment in delayed that makes the farmer disinterested to supply vegetable	3 (6.5)
Links with buyers and sellers	Exporter has no linkage with the middleman at the field level	11 (23.9)
	Fluctuation of vegetable price makes uncertainty in business	4 (8.7)
	No contact farmer links with the middlemen	2 (4.3)
	No choice about buyer such as exporter or wholesaler	1 (2.2)
Transport and storage	No multipurpose cold storage in the production and market area	29 (63.0)
	Transportation problem	17 (37.0)
	Storage problem in the production area	6 (13.0)
	No refrigerator van to carry the vegetable from the field to the capital city	5 (10.9)
Unavailability of vegetable	Scarcity of vegetable in the lean period	1 (2.2)
	Unavailable of different vegetable items at the farmers level as per demand of the buyer	1 (2.2)

Figures in parentheses indicate percentage to total

Table 5.30 reveals the major problems encountered by the middlemen both in the domestic and export market chain. The middlemen are main the link between producers and retailers in the domestic market and producers and exporters in the export market chain, but are not linked with contract farmers. The table shows that financial problems constitute the most important category of problems. The highest number of middlemen identified financial difficulties to run their businesses while 35% said they could not get credit from the bank without trade license. They reported irregular payment by the exporters as their major problems. They also reported a lack of linkages with the exporters at the field level. Storage problems in the production and marketing areas were identified by about 63% of middlemen.

5.18.2 Problems encountered by the exporter in vegetable marketing in Bangladesh

Table 5.31 reveals the major problems encountered by the exporters in Bangladesh. The major problems are categorized into five. About 5% of the exporters identified unavailability of appropriate varieties of vegetables demanded by the importers as major problems. About 95% of the exporters reported air cargo space problems which is affecting the supply of the required quantity of vegetables. One fifth identified packaging as major problems, while 45% reported storage problems. Cool chain management was also identified, which is a constituent for total quality management for such perishables. About 23% identified price fluctuation of vegetables in the local market.

Table 5.31 Problems encountered by the exporters in vegetable export in Bangladesh

Major heads	Major problems	Frequency
Vegetable supplies	Lack of appropriate varieties of vegetables as per demand of the importer	2 (5.0)
transport/ storage/ packaging	Acute air cargo space problem in Bangladesh Biman and lack of air cargo flights	38 (95.0)
	Increased rate of airfreight	1 (2.5)
	Lack of quality cartons for packaging	8 (20.0)
	No multipurpose cold storage for fresh vegetables within the airport	18 (45.0)
	Cool chain management	5 (12.5)
	Loading/unloading/ offloading system at the airport	1 (2.5)
	Increased number. of exporters create air space and some other problems	1 (2.5)
Costs/price/ Payment	Price fluctuation of vegetables in the local market	9 (22.5)
	Importers do not pay when aircraft is delayed and vegetables become damaged	3 (7.5)
	No L/C system of payment by the importer in the case of fresh vegetable	6 (15.0)
	No guarantee of payment through consignment sale	3 (7.5)
Government initiatives	No incentive is being provided by the government	18 (45.0)
	Short shipment problem is being created by the customs department	2 (5.0)
	Lack of proper initiative by the government	2 (5.0)
	For some countries, government to government arrangement is necessary for import of vegetables	1 (2.5)
	Export Promotion Bureau (EPB) takes a long time to issue GSP certificate which delays export	1 (2.5)
Market intelligence	Not able to reach the supermarket due to lack of market information	13 (32.5)

Figures in parentheses indicate percentage to total

Although, the government is committed to provide cash incentives to the exporters they are not getting such incentives. A few exporters reported that they were facing a lack of initiatives from the government side for this sector. About 33% of them reported that they could not have access to the upstream market due to the lack of market information. These results indicate that the vegetable export sector is facing major constraints in terms of quality, supply, market intelligence and government initiatives which need to be addressed to promote this rising sector.

5.18.3 Problems encountered by importers in vegetable marketing in the UK

Table 5.32 Problems encountered by importers in London

Major heads	Major problems
Quality and packaging problems	Substandard grading, labeling and packaging of the fresh vegetables of Bangladesh
	Sometimes fewer cartons of vegetable are received at London airport than the export invoice states
	Low quality vegetables are being exported
	Some dishonest exporters send some banned items like cigarettes, potato, dried fish, beef and mutton in the cartons
	No cold storage facilities at the Dhaka airport to maintain freshness of vegetables
Air craft inefficiency	Irregular shipment due to acute air cargo space problems
	Quality vegetables are not being exported as per export market demand due to air cargo space problem
	Delayed arrival of Bangladesh Biman in London airport results delayed release of vegetables which increases the overhead costs of the importers
	Failure of Bangladesh Biman to maintain flight schedule, results in cancellation of space for Biman in London airport which causes delayed release of vegetables
	Irregular supply of vegetables due to delayed arrival of Bangladesh Biman in London airport
	Delayed release of imported vegetables from London airport due to negligence of the officials of Bangladesh Biman
	No regular shipment due to delayed flight of Bangladesh Biman
Supply irregularities	Irregular and delayed supply of fresh vegetables which hampers the whole marketing chain of the importer
	Due to irregular shipment and below standard vegetables along with the cartons, the Bangladeshi importers and retailers buy the vegetables from the wholesale market of other countries' produce.

Table 5.32 shows the major problems encountered by importers in the ethnic market in London. Some of those could be resolved in Bangladesh, particularly

quality packaging and air transportation. It is possible that if the problems are not addressed by the Bangladesh side, the export market will shift to other exporting countries before long. The importers reported almost the same problems mainly regarding quality and packaging problems, aircraft inefficiency and supply irregularities. They reported that quality grading, labeling and packaging are not being maintained so a low quality of vegetables faces the Bangladeshi origin importers. They complained about receipt of lower volumes than according to the export invoice. Banned items are being sent in the cartons of vegetables possibly due to oral agreements between importers and exporters.

Irregular shipment of vegetables due to the air cargo space problem and irregular supplies due to delayed arrival of Bangladesh Biman in London causes increasing overhead costs of the importers. The importers in London pointed out a new problem which is the failure of Bangladesh Biman in maintaining flight schedule which results in cancellation of its earmarked space and delayed release of the perishables. This suggests that shortage of air cargo space is not only the problem with Bangladesh Biman but also its service is not up to a satisfactory level. The importers also reported that irregular and delayed supply of vegetables creates marketing problems, and commented that they would be inclined to buy these perishables from other countries

5.19 Expert opinion in export oriented vegetable sector development

The opinion of nine experts in vegetable production and export sector in Bangladesh is briefly presented in the following table (see section 3.7, p- 71).

Table 5.33 Experts' major opinion regarding vegetable production and export

Major heads	Key issues	Possible options to developing the sector
Vegetable production	Export market demand led production, pre and post harvest handling, cool chain, packaging up to air shipment	Supervised contract farming system, harvesting, post-harvest handling, packaging, cool chain management of vegetables is needed to ensure good agricultural practice (GAP) and total quality management (TQM)
	Contract between farmers and exporters for export quality vegetable	Government may develop a code of conduct for sponsors and contract farmers in respect of vegetable production and marketing
Air transportation	Acute air cargo space problem	Bangladesh Biman may operate regular cargo flights at a reduced freight rate, and, private sector and foreign airlines may be encouraged to operate cargo flights at reasonable freight rates without paying royalty to the government and at competitive airport cost
Market promotion	No government market intelligence organisation for vegetables	Ministry of Commerce can open a market intelligence cell, and export promotion could be explored through commercial wing of Bangladesh missions
Storage	Absence of cool chain management	Multipurpose cold storage and transportation with different temperatures needs to be maintained in producing zones and at international airports
Research	Export market demand oriented research using modern technology	Export market demand-led research on variety, shelf life, size, colour, shape needs to be conducted which demands training and logistic support to the researchers
Joint venture	Joint venture between exporter and importer	The joint venture is one of the best alternative ways to promote the horticultural sector. Foreign investors may be provided extra privileges for such a venture
Formation of Institution	Standards and accreditation body for meeting importers demand	Government should develop standards and an accreditation system through regulatory measures as per HACCP and ISO regulations of the importing countries

Some similarity between the suggestions of the respondents of this study and the experts' opinion is found in respect of air cargo space, contract farming, improved packaging, institutional approach, cool chain management, multipurpose cold storage, export market demand-led research, and agreement between sponsor and producer (Appendix I Table 42, Appendix II Table 2, Appendix III Table 9, Appendix IV Table 2).

However, presently, there is no institutional framework to implement the export policy, and to develop the production and export of vegetables and agro-products through integrated activities. Despite some existing policies, further policy formulation is needed to implement those policies already adopted and to address the issues in this study. An organisation to resolve the issues raised by the respondents and the experts could be established for not only the vegetable industry but also for agro-products with a holistic view.

5.20 Conclusion

Export marketing of vegetables is directly linked with the domestic as well as the export market situation. Although Bangladesh lacks vegetable supplies to meet requirements according to nutritional recommendations, it is still in a position to export certain quantities in the peak period when vegetable production seems to be in surplus which may also provide a good price to the producer in their peak season. However, to meet export requirements a greater continuity of supply would be needed.

The export market potential of Bangladeshi vegetables was measured through financial analysis of vegetable marketing at the market participant level right from the producer in the domestic market to the importer in the UK export market. Vegetable marketing at the traders' level was found to be profitable. The middlemen in the export channel made more profit than those in the domestic channel in the survey districts excepting Tangail where domestic channel was more profitable due to Proshika. Moreover, the returns on investment at the export level, range from 14.99% to 19.76% for the European market and 2.95% to 5.72% for the Middle East markets for all vegetables. On the other hand, the returns on investment range from 13.25% to 17.62% for the European markets while those for the Middle Eastern markets range from -13.14% to 9.83% for the sample vegetables. The return for FB was only negative for the KSA market. This suggests that the Europe markets are more profitable than the Middle-Eastern markets in the case of sample vegetables, be due to higher sale price.

The producer's share was also computed based on the sale price of the exporters for four export markets (UK, Italy, KSA and UAE). The share is 6.8% for European markets and 9.8% to 12.2% for Middle East markets. Although, export of vegetables in the European markets is more profitable rather than Middle East, the producer's share is lower. The exporters spent more for marketing and made more profit margins from European markets.

Market power analysis also reveals that markets are less competitive further along the chain, particularly from the buyers' side.

Chapter VI

Discussion of findings, conclusions and policy recommendations

The study hypothesised that the production and export of selected exportable vegetables in Bangladesh are profitable and that the key factors affecting the profitability can be determined. It is also hypothesised that appropriate policies are needed for expanding of the vegetable sector. The discussion of the findings of this research are aimed at addressing these hypotheses and will form a basis for the formulation of appropriate polices regarding further improvement of vegetable production and export of vegetables. This chapter consists of four sections concerning a discussion of the findings of the present research, conclusion, recommendations and suggestions for future research.

Section one comprises twelve sub-sections discussing the findings concerning the different issues in respect of vegetable production and export marketing.

Section two concludes the discussion on exportable vegetable production, and export marketing, institutional role and regulatory measures in the vegetable sector in particular and for agro-products in general. Section three includes the major recommendations of this study on vegetable production, export marketing and institutional reform and regulatory measures. Suggestions for future research are outlined in section four.

6.1 Discussion of the findings

6.1.1 Socio-economic characteristics and land holdings of the respondents

The educational and occupational status, household size and farm size of the respondents in the survey districts assist in understanding the background against which production and marketing of the vegetables take place. The respondents who were illiterate and limited to primary level education accounted for about 61% in

Rangpur, Comilla, Tangail and Narshingdi districts in 2003, which is similar to the findings of Alam (2002) whose respondents numbered about 68% at the same level in Rangpur and Comilla in 2000. This implies that, although vegetable production is not limited to the well-educated, there might be benefits if they could be given further training by DAE, NGOs and private sectors.

According to the survey, marginal and small farmers constitute more than 66% of the total number of respondents followed by 29% medium and 5% large farmers. Marginal farmers are proportionately the highest in Comilla and the lowest in Rangpur whilst large farmers are the highest in Rangpur and lowest in Comilla and Narshingdi district.

6.1.2 Requirements for labour and distribution of inputs and credits

The sample vegetables were competing with other major crops in Comilla, Tangail and Narshingdi, but not Rangpur, in respect of agricultural labour. The sample vegetables needed a great deal of labour in all the survey areas, reflecting the labour intensity of vegetable production (see sections 4.4.1, 4.4.2, 4.4.3, 4.4.4 and Appendix I, Table 26, 26, 28, 29). Moreover, the aggregate production costs for the three vegetables reveal that labour constituted 34%, 40% and 35% of production costs for French bean, yard long bean and bitter gourd production respectively which further illustrates the labour intensiveness of vegetable production (see chapter IV, Figure 4.6, 4.8, and 4.10).

Within the purview of legal and government privatisation policy, agricultural inputs are mostly procured and distributed through private channels. MOA is constantly monitoring the procurement and distribution, stock levels, and retail price of fertilizer, and also regulating the import of fertilizer, pesticides and seeds, particularly vegetable seed, by the private sector.

Nevertheless, the vegetable producers assert that they are encountering high fertilizer and pesticide costs and financial difficulties with the need for agricultural credit (see section 4.10.3). Farmers buy fertilizers at a subsidized rate and should be applied at the right dose, possibly after soil testing. The price of pesticides is determined by the private sector so increased pesticide cost might be due to low quality of pesticide which needs more application or overuse than the recommended dose by the respective government agency. Munshi (2002) suggested that methods of application of good quality fertilizer and pesticides should be followed by the farmers according to recommendations (see section 2.3.1.2). In this context, this study suggests that government agency needs to regulate the quality of pesticide and the mode of application of it might also need to be supervised by the DAE and the sponsors of contract farmers or at least more training be given.

Unavailability of quality vegetable seed has become a big problem for the producers. Supply of breeder seed is a fundamental component for developing a vegetable seed industry, which implies that the National Agricultural Research Institutes (NARIs) need to be supported for the development of the vegetable sector to take place. BADC and NARIs, being public organizations, need appropriate government support to increase foundation and certified seed production. On the other hand, registered or contract vegetable growers of BRAC and private seed companies might be given remunerative prices and production support to encourage them to produce quality seed.

Access to agricultural credit is another important concern, particularly for the marginal and small farmers for vegetable production. Agricultural credit provided by the state owned banks, namely BKB and RAKUB, has not tended to meet the cash costs of vegetable production in the past. Other researchers have recommended that the amount of credit should cover the cash costs (see sections 4.5.2.1 and 4.5.2.2). In this study, only 46% of the respondents were able to borrow credit from banks and NGOs (Appendix I, Table 14). Marginal, small and medium farmers had least access to credit which could be made easier and more available. Bangladesh Bank (2003) stated that micro-credit operations run by the Grameen Bank and some NGO's in Bangladesh have been successful in the rural areas but this credit is only partially agricultural credit, it does encourage crop production particularly vegetable in Bangladesh (see section 4.5.2.2). Additionally, appropriate action might be taken to set up a government 'Agricultural Credit Foundation' for the marginal and small farmers as suggested in the plan of action on National Agriculture Policy (Ministry of Agriculture, 2004).

6.1.3 Economic performance of sample vegetable production

6.1.3.1 Profitability of French bean production

The financial analysis of French bean production reveals the profitability of this vegetable by survey district and farmer category. The average net incomes were 16% and 51% of gross income on a full cost and cash cost basis respectively at the aggregate level which indicates greater profit on a cash cost basis because family labour constitutes about 15% of total costs (see section 4.6.2.1).

The average net incomes on a full cost basis were negative in Rangpur, the lower price and relatively high family labour costs resulted in losses in Rangpur. However, this vegetable production was profitable on a cash cost basis in all the districts. FB was also found profitable on a full cost basis in Comilla district by Alam (2002) and Munshi (2002) in separate studies. Hortex Foundation (2003) also found production of FB to be profitable on a cash cost basis, supporting the findings of this study.

The respondents referred to lack of local consumption which indicates that the local people are not used to eating non-traditional vegetables. BRAC fixes the purchase price of FB prior to cultivation to encourage the producers to cultivate such a non-traditional vegetable.

Note that the farmers who participated in non-traditional vegetable production found it more profitable than traditional vegetables in Guatemala (see section 2.3.1.1). However, in Bangladesh, FB was not more profitable than other traditional vegetables for a number of reasons: farmers are not familiar with the production of such new vegetables, the exporters could not develop the export marketing chain with the international supermarkets properly and local consumption was very low. Increasing the interest of local people in the consumption of non-traditional vegetables could also be helpful.

These findings support the hypotheses of the present study

6.1.3.2 Profitability of yard long bean production

The financial analysis of yard long bean production further indicates the level of profitability of this vegetable by survey district and farmer category. The average net income on a full and cash cost basis to total gross income was 26 and 54% respectively at the aggregate level with family labour about 25% to the total costs. Vegetable producers are obtaining a higher return on a cash cost basis than a full cost basis due to the effect of family labour on the latter. The BCRs for this vegetable are slightly higher than those of FB. These results reveal that yard long bean production is profitable and is a high value crop, which again supports the hypotheses of this study (see sections 4.6.3.1 and 4.6.3.2). Yard long bean was also found to be profitable by Alam (2002) and Munshi (2002) on a full cost basis. The economic performance of this traditional vegetable is due in part to existence of both local and export market demand.

6.1.3.3 Profitability of bitter gourd production

The financial analysis of bitter gourd production also indicates the profitability of this vegetable by survey district and farmer category. Financial efficiency measures, net income and BCR show that bitter gourd production was highly profitable in all survey districts and farmer categories. The average net incomes on a full cost and cash cost basis at the aggregate level were 36 and 56% respectively which were higher than for FB and YLB. Bitter gourd production was found profitable by Alam (2002) and Munshi (2002). The large costs of family labour can also be seen in a positive light due to its use for harvesting and post-harvesting activities that involve a good deal of labour (see sections 4.6.4.1.and 4.6.4.2).

6.1.3.4 Determinants of sample vegetable production

The financial analyses indicated that FB, YLB and BG production were profitable, which supports the first objective and hypothesis of this study (see chapter I). It was found that the mean yields for marginal, small and medium farmers were higher than those of large farmers, although one-way ANOVA shows that there is no significant yield variation among the farmer categories for the three sample vegetables. A significant yield variation was found among districts for FB ($p=.05$) (see sections 4.6.6.1, 4.6.6.2, 4.6.6.3 and 4.6.6.4).

The effects of different inputs on profitable production of these vegetables were determined using multiple logarithmic regression followed with a Cobb-Douglas production function analysis (see section 4.7.2). Land preparation, seed, manure and fertilizer were found to be significant in model 1 for FB production while Rangpur district had significant effects in model 2 and the farm size, and the combined variable for land preparation, seed and manure and fertilizer and pesticide were also found significant in model 3 (see sections 4.7.2.1 and 4.7.2.3). Seed was found to be significant in the production of FB and YLB in another study by Alam (2002). Economies of scale were indicated by the sum of coefficients being 1.26.

Irrigation was found to be a significant factor for YLB production along with farm size. Manure and fertilizer and farm size were positively significant in the case of BG with irrigation negative and significant in model 2 and pesticide negative and significant in model 1. The combined variable of land preparation, seed, manure and fertilizer and pesticide was also found to be positively significant in the case of BG in model 3.

Fertilizer (TSP and MP) and pesticide were significant factors for cucumber production in Bangladesh according to Rahman *et al* (2003). Another study revealed the positive and significant effects of fertilizer and labour on country bean production in Bangladesh (Haque *et al*, 2002). Fertilizer was a positive and significant factor for BG production in a study conducted in Pakistan (Ahmad and Baksh, 2005). These studies' findings of fertilizer and pesticide as significant factors are in line with the present study. Although the effect of labour was not found significant here, it did have positive effects on FB and YLB production and its effect may have been masked by multicollinearity.

These findings, thus revealed the positive and significant effects of some factors, particularly manure and fertilizer, seed, irrigation, and pesticides on production of sample vegetables.

6.1.3.5 Technical efficiency of sample vegetable producers

The technical efficiency of FB, YLB and BG producers was estimated using the Cobb-Douglas production function to estimate output. The estimated mean technical efficiency for FB, YLB and BG producers was 50%, 41% and 41% respectively (see section 4.8).

A few researchers in Bangladesh and other nearby countries conducted studies to estimate farmers' technical efficiency. The average technical efficiency for cucumber producers in Rangpur and Kushtia district was estimated at 95% in 2002-03 (Rahman *et al*, 2003) while for farmers involved in the spice-based agro forestry systems in one district of Sri Lanka it was 84.3% in 2002 (Lindara *et al,* 2004). Another study was conducted in Pakistan in 1988-89 where the average technical efficiency for the farmers in certain region was found to be 96.2% (Parikh and Shah, 1994). Although the findings of the present study indicate efficiencies well below those of other studies, there appears to be considerable scope to increase technical efficiency.

The factors affecting technical efficiency were estimated using two models with socio-economic characteristics -education, household size, age, experience of the respondents, farm size, contract farming and district dummy variables. Contract farming was significant in one model while primary and secondary education levels were negatively significant in both models for FB. This implies that illiterate farmers, who made up about 36%, had positive effects on technical efficiency, perhaps because they gave their full attention to production rather than spending time on off- farm activities. Furthermore, both models explained about 40% of the variation in efficiency for FB and R^2 values for YLB and BG were much less on average at around 15%. Lindara *et al;* (2004) in Sri Lanka, found education as negatively significant while extension service assistance and farmer training were positively significant factors influencing technical efficiency.

6.1.4 Organic vegetable farming towards the export market

Production of organic products including vegetables is increasing gradually due to increased demand from the consumers towards organic products particularly in the developed countries. Western European countries have government policy to encourage farmers to convert to organic production; some have even set a target of 10% of the agricultural area under organic production by 2010 (FAO, 2001). FAO studied the world market situation for organic vegetables and highlighted the production and export opportunities, and also suggested some strategies for the developing countries (see section 2.3.1.1). The Bangladesh government's plan of action on National Agriculture Policy (NAP) suggests the establishment of an organic export village through initial public investment, aimed at meeting quality standard requirements of the export market .

The present study found that about 15% of the respondents applied organic fertilizer instead of chemical fertilizer and 14% adopted IPM technology instead of pesticides (see section 4.10.2). DAE, the government department, is implementing a project for dissemination of IPM technology and a few NGOs are trying to adopt ecological agriculture by contract farming. Proshika, a leading NGO, is conducting such agriculture programme for producing organic vegetables (5.4.1.1). However, the present National Agriculture Policy does not duly address this programme and no institutional approach has yet been commissioned for certification of organic products in Bangladesh. This study suggests the incorporation of organic farming in the government's National Agriculture Policy and the setting up of an assistance scheme for the producers. It would require a standards and accreditation body at the national level following the terms and conditions of the International Federation of Organic Agriculture Movements (IFOAM) which would help to increase export of organic vegetables into the markets of developed countries.

6.1.5 Domestic support to the vegetable producers

The issue covering the provision of domestic support in terms of direct payment or input support to producers involved in vegetable production is very prominent for the development this sector, particularly with a need to ensure food security.

According to the World Trade Agreement on Agriculture (WTAA) of 1994, the developing countries are exempted from domestic support reduction commitments so as to encourage agricultural and rural development as an integral part of the development programmes of these countries (see section 5.16).

Farmers in Bangladesh are purchasing fertilizer at a subsidized rate and applying fertilizer for vegetables. Direct cash subsidies were started to provide for agricultural activities, other than fertilizer, through the agricultural ministry in 2003. Such allocations seem to be extra allocations to some government organisations for implementing their own programmes but not to the farmers (Krishi Mantranalya, 2003).

The Arable Area Payment Scheme under the Common Agriculture Policy (CAP) of European Union provided domestic support to the producers of some selected combinable crops, eg about 371 euro/ha for cereals. Such payments were linked to area of crops grown, not yield. Furthermore, the Assured Produce Scheme covers 40 crops, including potatoes, fruit and vegetables, and is supported by the major supermarkets where retailer-driven production is carried out by the producer (see section 2.3.1.1). On the other hand, Giannakas (2003) studied enforcement costs and misrepresentation in connection with export and production subsidies provided by different governments. He pointed out that corruption and misrepresentation by the producers and exporters for subsidies, are adversely affecting the welfare policies of the governments.

The introduction of such direct domestic support to farmers needs a well designed scheme along with specific terms and conditions so that the appropriate farmers do get this support. Corruption and misrepresentation issues need to be taken into account to implement such a welfare scheme. Like CAP, domestic support payments may be made based on the area of specific crops grown, not the yield. Moreover, various grants are being provided to small and medium sized enterprises involved in production, processing and marketing for organic products in the UK (see section 2.3.1.). Against this backdrop, despite negative impact of subsidization in the macro-economy, entrepreneurs, at an initial stage, can be supported by the government on a short term basis. Therefore, a domestic support scheme may be limited to selected perishable crops like vegetables and to organic farming for actual crops grown on an area basis for the short term.

6.1.6 Contract farming in a commercial vegetable industry

The Plan of Action (Ministry of Agriculture, 2004) highlighted the promotion of agricultural exports and the reduction of seasonal price fluctuation of fresh produce out of four issues for commercial agriculture. This Plan of Action (POA) recommended contract farming as a means of production for meeting market demand. The contract farming system is carried out for different crops, particularly wheat, cotton, and tobacco in Bangladesh. Commercial farming of vegetable production is relatively new but it is increasing due to its high value. Being perishable commodities, they could benefit from technical, financial and marketing support which could be met through contract farming.

A contract farming system allows the small farmers access to production resources and to markets (Minot, 1986). It is defined as an agreement between farmers and processing or marketing firms for the production and supply of agricultural products under forward agreement with predetermined prices (FAO, 2001a, p 45). It was found that 40% of the respondents of this study were linked to the exporters /middlemen (Appendix I, Table 30). About 46% of the respondents reported that no linkage between producer and middlemen and exporter existed. Contract farming was found to be a significant factor for technical efficiency of the vegetable producers in this study. These findings suggest that the extension and improvement of contract farming could be key factor in the development of vegetable farming for the export market and also for the domestic market. But it needs a code of practice for the buying organisations and the cooperatives of contract farmers.

6.1.7 Price support and formation of a farmers' cooperative society

Government gives price support to rice, wheat, jute, cotton, sugarcane producers through fixing farmgate price but not for perishables like vegetables. Contract farming is not yet well developed so far for vegetables and this could provide price support to the farmers. Abbott (1987) suggested that governments usually intervene in the pricing of agricultural products against a backdrop of frequent fluctuations of prices that occur in a free market economy. Policy instruments can play a major role through the announcement of official prices of crops and food items to farmers as well as to the consumers. Although government is committed to forming an agriculture price commission for fair prices for the farmers, it has not come into effect so far.

The National Agriculture Policy emphasised the formation of farmers cooperatives (Ministry of Agriculture, 1999), but such organisations have not yet been developed for the farmers. Against this backdrop, vegetable producers are always encountering a marketing uncertainty situation. Cooperatives increase the marketing efficiency of a group of farmers through raising bargaining power in sales transactions (Abbott, 1987). The local and foreign companies make contract with the village committee for the farmers and pay the farmers a higher price than the market price in China (see section 2.3.1.1).

Small scale farmers in Africa and Asia usually till with little land and purchased inputs and experience developed locally, so naturally may not produce high quality crops, resulting in price differences for different farmer groups (McCalla and Josling, 1985). Moreover, agriculture in developing countries is often accounted as a source of tax revenue rather than as a sector requiring support (Brown, 1978). Therefore, announcement of minimum price by the government, formation of cooperatives and contract farming may reduce price variation and provide price support to the vegetable producers which will also encourage production of quality vegetables.

6.1.8 Constraints and suggestions provided by producers

Although the present study found the production of FB, YLB and BG to be profitable, being perishable commodities, they have some major problems over the production and marketing period.

The producers identified some major problems at the production level regarding liquidity problems, unavailability of quality seed, high cost of fertilizer and pesticide, low price of vegetables in the peak season, no fixing of a reasonable price by the government and no cooperative society among farmers as a bargaining agent, and the lack of links between producers and exporters (see section 4.10.3). They also provided some major suggestions to overcome the problems, regarding inputs, sale price, formation of a cooperative society, price support and credit (see Table 26, Appendix I Table 43). The issue of the formation of a cooperative society and price support were discussed earlier (see section 6.1.7). No storage facilities exist for perishable vegetables during peak period. So commercial vegetable farming is a risky business from a storage and marketing point of view.

6.1.9 Commercial vegetable farming as an alternate occupation for rural people

The financial, statistical and economic analyses performed in this study indicate the economic performance of the sample vegetables production. The commercial farming of traditional and non-traditional vegetables appears to be highly profitable. The POA (2004) has recommended the commercialization of agriculture to meet the domestic and export market demand which is very relevant for vegetables as high value crops. Furthermore, labour opportunities would be provided in a growing commercial vegetable farming sector.

Against this backdrop, the encouragement of more contract farming along with a code of practice between producers and sponsors might resolve major problems for production support, storage, price and marketing. Subsistence vegetable farming has largely shifted to commercial farming which might be promoted by the government, private sector and NGOs and this would open a new avenue for the rural people as a lucrative occupation, which could improve the rural economy and ultimately the national economy. But the experience from the USA, UK, China, India, Thailand, Guatemala, and Kenya suggests the need to take an initiative for institutional reform for the development of production, and internal and export marketing for vegetables in Bangladesh (see Chapter II). Therefore, commercial vegetable farming could be an engine for rural development, agro-based industrialization and employment.

6.1.10 Prospects of export marketing of vegetables in Bangladesh

6.1.10.1 Production and export status of Bangladeshi vegetables

Annual vegetable production figures show the gradual/increasing trend, but the annual export figures show fluctuation around a rising trend (see Figures 1.1 and 1.2). However, the share of fresh vegetable exports to total production is less than 1% (see Table 1.1). According to FAO (2005), Bangladeshi fresh vegetables' share of world fresh vegetable production fell from 0.48% to 0.36% from 1999 to 2003 and its position from 21st to 22nd. Its export share of world fresh vegetable exports fluctuated between 0.24% and 0.50% for the period from 1999 until 2003, and the position between 21^{st} and 30th (see section 5.3.1).

Although Bangladesh does not have a surplus of vegetables, production is increasing at over 3% per annum and there may be scope for greater fresh vegetable exports during the peak season and even throughout the year, if an integrated institutional approach is undertaken to develop this export sector (see section 5.2.3).

6.1.10.2 Market participants and structure for vegetables

The market participants in both the domestic and export channels play a key role in the marketing of this perishable commodity (see section 2.3.2.2). Aratdares in the wholesale markets are running a very old-fashioned trading system in the vegetable business between the bapari and paiker or retailer, and earning commission from both seller and buyer. A more efficient internal marketing system would probably need fewer intermediaries for the domestic and export market as well. Consequently, the commission based aratdar-system might be replaced so that the wholesaler (aratdar and paiker) should work efficiently in the wholesale market. The government can help change by providing advice and information and facilities.

On the other hand, traditional markets are increasingly being replaced by national and international supermarkets in developing countries (see section 2.3.2.1).

Supermarkets have become fast growing multiple retail outlets in Bangladesh as in other developing countries, attracting city consumers. But their supply chains with the producers or other suppliers are not yet well developed. Specific business policy similar to other supermarkets in developed countries might be helpful (see section 5.10.1). A study based on supply chain for fresh horticultural produce to supermarkets in Africa and Asian countries revealed that it has a major impact on the livelihoods of small farmers. It is suggested that significant benefits can be derived from long term partnership between sellers and buyers. It is also suggested that both public and private sectors have a role to a play in promoting the participation of small producers in the supermarket chain for a beneficial and sustainable partnership (Henson *et al.* 2003).

The Export channel, the supermarket channel and the traditional channel are functioning in Kenya. In the supermarket channel, farmers are obtaining a 40% gross profit margin which has encouraged strong growth amongst these farmers. Although the procurement systems of these supermarkets provide significant opportunities, they also present major challenges for small farmers, and have implications for the elevation from rural poverty and rural development programmes and policies as well (Neven and Reardon, 2005; Neven *et al,* 2005).

Integrated marketing companies are dominant in the supply chain to the supermarkets in the UK. They maintain direct contact with the producers, and pack, grade and label the product according to the specifications of the respective supermarkets (see section 2.3.2.1). Such marketing companies are not prominent in Bangladesh, but could be promoted for this sector.

Internal marketing in Thailand acts as a bridge between production and export marketing where the middlemen organise contract farmers and provide them with credit, while the agriculture department provides an extension service to the contract farmers. They supply fresh vegetables in well organised transport to wholesale markets for export. In Kenya, small and medium scale farmers are linked through contracts with export-oriented local, or joint ventures, or multinational companies (see section 2.3.2.1). This country has developed a horticultural export sector including fresh and processed vegetables through specialization of production and marketing systems where contractual arrangements have played a key role.

FAO (2005) studied the agricultural marketing systems prevailing in Argentina, Guatemala, Brazil, South Africa, Indonesia, Thailand, and Bangladesh and described the existing internal marketing systems. It focussed on the linkages of the farmers to intermediaries-middlemen, supermarkets, and leading farmers, cooperatives, and private companies. It obtained various information from different countries in respect of different linkages, and few examples are mentioned:

Supermarkets in Indonesia bought horticultural produce directly from farmers group. They provide seeds, pesticides and fertilizers and training to the farmers. Prices are either fixed in advance or related to returns within a floor price range. The prospects of the linkages between farmers and supermarkets were encouraging. A Swiss-funded project provided training to farmers in Bangladesh on production and marketing. The researcher found that the farmers were able to make linkages with the large traders, even wholesalers. They produce diversified products and supply according to the specification of the traders. A USAID project developed a new approach with "clusters" of farmers in the Philippines. The growers, being the members of the clusters, are trained by the project. The cluster provides an integrated approach where the leading farmer makes liaison with the input suppliers, transporters and buyers. The growers produce and sell under the guidance of the leading farmer. Such experiences could be taken into consideration while restructuring the marketing system in Bangladesh.

The vegetable export marketing channel in Bangladesh is still backward in respect of other countries' experiences. Direct market involvement by the exporters, wholesalers and the supermarkets with the producers could make a more competitive environment in the vegetable sector and may provide a fair price to the producers, and the role of intermediaries may be automatically reduced.

It is reported that the Fresh Produce Consortium, a federation of retailers (including supermarkets), wholesalers, importers, packers and associate members, is working to develop competitive performance in the fresh produce and floral industries in the

UK (FPC, 2001). Such a coordinated private organisation could play a vital role in a competitive, fresh produce sector in Bangladesh.

6.1.10.3 Export market performance of Bangladeshi vegetables

The financial performance for the market participants- middlemen, exporters and importers in vegetable trading, reveals their profitability.

The net profit in both the export and domestic channel of vegetable businesses at the middlemen level in Bangladesh reveals that the net marketing margin in export channel is higher than that of the domestic channel excepting Tangail district due to the influence of Proshika. Furthermore, the average purchase prices of the exporter BRAC to their contract farmers was higher than that of the middlemen's price to the producers (Appendix III, Table 15). Moreover, its sale price was higher than any other exporters due to their superior quality vegetables and packaging for the supermarkets. It suggests that direct marketing between producer and exporter would be worthy for the producer and also for the exporters. However, the average returns on investment for BRAC appeared to be lower than for other exporters due to higher marketing costs for improved packaging, cool chain and other establishment costs.

For the exporters, the return on investment for the European market is higher than that of the Middle Eastern market and thus superior performance for the Europe markets pertains for all three sample vegetables, possibly due to the higher sale price. In fact, Italy has been found as the most profitable country for exports (Appendix III, Table 3). The return analysis also suggests that European markets show more potential for non-traditional vegetables FB (see section 5.10).

The sale price obtained by BRAC suggests that there is large potential of export to the wholesale and supermarkets in Europe. This study suggests that an appropriate export business strategy needs to be adopted to gain access to these markets in Europe and other countries. However, one major cost constraint continues to be air freight charges. The air freight rate constitutes 84% of the total marketing costs.

6.1.10.4 Export market performance of Bangladeshi vegetable by market potential and power

Market competitiveness was estimated using market power indicators at different participant levels. It was found that a high degree of competition exists at the producer level for the three sample vegetables and so individual producers do not have any influencing power over the market. A competitive situation also exists in the case of middlemen and exporters for YLB and BG, but less so for FB as BRAC mostly purchased FB. It also appears that less competition exists for vegetables in the ethnic market in the UK. In general, the findings suggest that market power does not lie with the producers but with the buyers, particularly for the non-traditional vegetables (see section 5.15), and at each stage in the chain there seem to be more competition amongst the sellers than the buyers.

The producers' shares were 6.8% for UK and Italy while 6.7% and 12.2% for the KSA and UAE respectively in the FB, YLB and BG market chain. It reflects the degree of competition at the exporter level as well as economies of scale. It further suggests that marketing efficiency could be improved if market power of producers were enhanced.

6.1.10.5 Factors affecting vegetable export marketing

One factor affecting profitable export marketing was found to be availability of vegetables throughout the year (see section 5.15.1)). Due to favourable soil and climatic conditions, various types of non-traditional vegetables could be produced and exported for all categories of consumers in the international market. Cheaper and available labour force is another advantage for vegetable production. Lower farm gate prices of the vegetables in the peak season is also an advantage for the exporters. Although, the Bangladeshi vegetables as a whole do not have significant access to the supermarket or wholesale market sector in the international markets, they do have access to ethnic markets in Europe, the Middle-East and USA and some supermarkets. The new export policy may to be another important factor in dramatic increase in the recent vegetable exports, and favourable for competitive export marketing.

6.1.10.6 Internal marketing of non-traditional vegetables

Bangladeshi farmers are not so familiar with the production of non-traditional vegetables such as FB, broccoli, baby bean, lettuce, mushroom and capsicum. Similarly, consumers are not used to eating such vegetables. It was also found in this study that an oligopsonic market exists in the case of FB, so the producers of non-traditional vegetables have to depend upon only a few buyers which is also risky. However, these vegetables are important items in the supermarkets and wholesale markets in the developed countries.

These circumstances suggest that non-traditional vegetables are the most likely to be profitable in wider export markets. To enable excess to be sold, the local consumer, particularly in the city and urban areas, might be encouraged to eat such vegetables. Furthermore, processing of both traditional and non-traditional vegetables may also be helpful to address export problems as an alternate way of marketing. POA has emphasized the establishment of multi-product processing plants to diversify product mix from the same plants.

6.1.10.7 Development of packaging industry and cool chain management

The Hortex Foundation is developing improved cartons, but the traditional exporters are not interested in buying them and prefer to use old cartons and bamboo baskets. Government may wish to apply regulatory measures so that no exporter can export vegetables in such packaging. Traders in the private sector can be encouraged to develop packaging industry. Within the purview of the existing cash incentive policy of the government, such incentives might be provided to the exporters for using improved cartons.

Hortex also has some limited facilities for cool chain management, but the exporters are not availing themselves of these, possible due to the extra charges. However, integrated production and marketing of exportable vegetables would be incomplete if it did not include the cool chain management to maintain the freshness of perishable vegetables for longer periods (see section 5.5). But the Hortex foundation, being a project-bound organization, might not be able to run such packaging and cool chain management business and it might not be economically wise to do so. Rather its main role could be providing technical support to the traders for the packaging industry. Private traders could be encouraged to be involved in packaging and cool chain management.

6.1.10.8 Domestic support to the exporter

The government of Bangladesh is committed to providing cash incentives for vegetable export to make the vegetable sector more competitive in the international market (see section 5.3). Various types of grants are being provided to small and medium sized enterprises involved in production, processing and marketing for organic product in the UK (see section 2.3.1.). However, agricultural policy analysis in connection with the export subsidies provided by different governments has been carried out in the context of enforcement costs and misrepresentation. Giannakas (2003) pointed out that the cheating and misrepresentation by the exporters for such subsidies, ultimately misused the welfare policies of the government.

Bangladesh Bank (2002) has made it clear that cash incentives for this sector would be released based on exports with a net value of free on board (FOB). However, fresh vegetables are being exported on a consignment basis; consequently, cash incentives need to be released to the exporters against consignment sale subject to fulfilling some additional conditions related to export quality.

Most of the exporters are using used cartons, bamboo basket as packaging materials, and exporting to the ethnic markets. The importers in the London ethnic market complained about such substandard packaging and the quality of the vegetables (see section 5.18.3). It is clear from this research that the constant and timely supply of quality vegetables in improved packaging could improve the position of Bangladeshi vegetables even in the ethnic market. Export quality vegetables can only be produced through contract farmers according to the demands of the export market. On the other hand, supermarkets and wholesale markets are the main players in the export markets. The preconditions of such importers cannot be met by the exporters who do not have physical facilities such as a large number of trained contract farmers, international standard grading and packaging, cool chain management facilities, and a constant supply of bulk quantities of quality fresh vegetables according to specifications (see section 2.3.2.1).

Although, subsidization can have a negative effect on the macro-economy, sometimes it may be helpful for upgrading the entrepreneurs at an initial stage to enable them to compete in the world market. Corruption and misrepresentation issues need to be taken into account to implement such subsidization policy. The exporters, at an initial stage, can be supported by the government for the short term. Therefore such incentives to the exporters could be provided in form of direct cash payment against FOB value of the vegetables subject to fulfillment of the preconditions of the importers such as quality packaging, grading, and storage in chilled condition. Such export subsidy should be conditional and for short-term. Thereafter, Bangladeshi vegetables might be competitive in the supermarket, wholesale and ethnic markets.

6.1.10.9 Constraints and suggestions provided by export market participants

The respondents in the export marketing chain raised some major problems and provided suggestions as well (See section 5.18, Appendix II, Table 2, Appendix III, Table 9, Appendix IV, and Table 2).

The middlemen reported liquidity problems, lack of multipurpose cold storage and cool chain management, irregular payment from the exporters, and price fluctuation. They suggested trading agreements between middlemen and exporters, and regulatory measures for issuing trade licenses to the middlemen so that they could obtain bank loans. They also suggested that government encourage year round vegetable availability (see section 5.18, Appendix II, Table 5).

The exporters raised problems of air cargo space, cool chain management, multipurpose cold storage, market intelligence, and lack of government initiatives. They also suggested that government could arrange air cargo flights and charter cargo planes for perishables, could provide financial support to the exporters to maintain a cool chain, develop a packaging industry, create a market intelligence unit, conduct export market demand-led research through its research institutes (see section 5.18, Appendix III, Table 16).

The importers in the ethnic market in London reported problems of failure of flight schedules of Bangladesh Biman resulting in delayed release of vegetables from the airport, substandard quality of grading and packaging and sending banned items like cigarettes, beef, dried fish, mutton and potatoes in vegetable cartons. To improve this business, they suggested that the government should increase air cargo space through Bangladesh Biman and foreign airlines to ensure constant supply, the improvement of grading, packaging like that of other competing countries, vegetable production by the contract farmers to meet the demands of the export market, and the customs department and Bangladesh Biman should take steps so that banned items could not be exported in vegetable cartons (see section 5.18, Appendix IV, Table 4).

The researcher spoke to some departments and organisations about the existing problems in vegetable production and export marketing, and the constraints encountered by the respective organisations. The Customs Department at Dhaka airport randomly checks only 5% of the vegetable cartons due to time constraints.

6.1.11 Vegetable based agribusiness a priority area in Bangladesh

Recent government policy documents (NAP, EP, and POA on the NAP) and the last five year plan) emphasized the development of production and export of agro-products, particularly vegetables. But so far, vegetable-based agribusiness in the domestic as well as the export market has mostly been run on in a traditional way. The present export policy has adopted agro-products and agro-processing as priority areas (see section 5.3). Agro-processing and agri-business development to increase the rapid growth of agriculture is also emphasised in the Poverty Reduction Strategy Paper (PRSP) where the potential of promoting agro-industries (horticulture and floriculture) in the export processing zones is explored. It is stated that the government will make conscious efforts to develop appropriate policies and institutions (ERD, 2005). The increasing trend of production and export of vegetables and agro-products indicate the contribution of this sector to the national economy as does the increasing growth of this agribusiness sector (see Table 1.1, Appendix III, Table 15). However, if the traditional methods of production and export to the ethnic market continue then there is a possibility of losing the ethnic market to some extent, as reported by the importers in the London ethnic market. Importers of Bangladeshi origin mainly buy vegetables from the London wholesale market and some other exporting countries, namely India and Pakistan. Therefore, vegetable export business has become a challenging sector in the upstream market even the ethnic market. The Government is currently implementing a number of development projects focussing on agribusiness, namely ATDP-II, and the North West crop diversification project (NCDP).

However, government policies and the implementation of some projects are having some positive effects on the development of vegetable-based agribusiness as a priority area. Although, this sector has been recognized as priority area but no institutional approach has been taken so far.

6.1.12 Institutional reform and regulatory measures a new agenda

In accordance with the existing NAP, EP, and POA provision, and the current production and export marketing situation, along with other competing countries' experience, institutional reform and regulatory measures become a dominant issue to make the export marketing of vegetables a success.

It could be noted that the export shares of primary agro-products and vegetables are about 7% and 0.50% of total exports respectively in 2004-05, and primary and processed agro-products ranked second to ready made garments among the commodities (see Table 1.1 and Appendix III, Table 8). Export policy has focused on some major issues regarding the development and export of agro-products particularly exportable frozen fish, animal products, jute and horticultural products, but an organisation is needed to implement such policies right from the production point up to export market (see section 5.3).

The Hortex Foundation, is currently implementing certain promotional activities for horticultural products at the production and export marketing level within its limited project mandate. The Department of Agricultural Marketing within the Ministry of Agriculture is mostly involved in collecting and analysing crop prices from farmer, retail, and wholesale markets and comparing, and establishment of some small sized agricultural markets in the semi-urban areas to facilitate domestic marketing (see section 2.3.2.2). Moreover, no agricultural marketing organisation is functioning for domestic and export marketing for fish, animal products, dairy, poultry and shrimp under the Ministry of Commerce or Fisheries and Livestock.

The EPB mainly promotes the marketing of exportable commodities in general but currently has no programmes for the development of export-quality agro-products. The Bangladesh Export Processing Zones Authority (BEFZA) provides physical facilities and also regulatory functions to investors in export-oriented processing activities in the zone areas to stimulate economic growth of the country through industrialisation (BEPZA, 2005).

Experts consulted in this study suggested the formation of an organisational framework for a standards and accreditation system, and export market intelligence (see Table 5.33). Some researchers recommended the establishment of a corporation for production and marketing of vegetables rather than agro-products which does not seem to be realistic (see section 2.5.2.1). An international seminar held in 2003 in Dhaka, recommended the establishment of an organisation to promote agribusiness under the office of the prime minister. It was further recommended that the Eshurdi Export Processing Zone should be transformed into an agro-export processing zone adopting international standards and safety regulations (Razzaquee *et al.* 2003). Islam *et al.* (2003) suggested three specialized agro- export processing zones (AEZ) (see section 1.3). SEDF outlined the areas of the agribusiness sector, including vegetables, in Bangladesh and suggested some ways and means to achieve the target through an institutional approach by public and private sector (see section 1.2)

India has established APEDA, an autonomous body under the Commerce Ministry to develop quality production, packaging and processing of agro-products for export through sixty AEZs. It has commissioned various programmes for efficient export marketing right from production up to export marketing, dealing with horticultural, animal, poultry and dairy products, spices and cereals, and processed food (see section 2.3.3.1).

Unfortunately, Bangladesh has not yet established such an integrated export-oriented organisation for agro-products. Moreover, an integrated agro-products based organisation for agricultural export zones is conceptually quite different from the concept of BEPZA. On the other hand, the commercial wings of Bangladesh Missions in abroad work with the guide line of Commerce Ministry. This Ministry involves in export and import businesses and also in domestic trading. However, it is assumed that none of BEPZA, Hortex, DAM, the proposed organisation under the prime minister's office or EPB would not be in such a position to develop export quality agro-products and export markets for such products.

Given this situation, this study found out that the agribusiness sector in Bangladesh lacks of an export-oriented well designed government organization which should be responsible for the development and promotion of export quality agro-products including vegetables in fresh and processed form. Such organization needs to be considered from the holistic point of view.

This study suggests that an integrated ago-export oriented organisation dealing with all sorts of fresh and processed agro-products in the AEZs would be able to work most efficiently under the Ministry of Commerce. Such a government organisation would neither be realistic nor viable for only vegetables, but should cover all agro-products. This organization would be able to address the export market demand-led production by the investors through contract farming, assisting export market participants, cool chain management, improved packaging industry, transportation, and export market intelligence.

6.2 Conclusion

The findings of the production economics and export marketing of vegetables along with some relevant issues such as commercial vegetable production, organic farming, domestic support to producers and exporters, formation of export oriented organization for agro-products, regulatory measures were discussed in the previous section. This section will conclude the key issues on production of sample vegetables and its export marketing system in particular and agro-products in general which could be considered as the basis for recommendations for government policy formulation.

6.2.1 Production of exportable vegetables

In the field of the production of French bean, yard long bean and bitter gourd in Bangladesh a number of conclusions can be drawn from this study. Although the production of these three vegetables was found to be profitable and certain contributing factors were derived, some major problems were also identified at the production level which need to be resolved to develop the sample vegetables in particular and the vegetable sector in general. The production and export trend for the last ten years, if continued, provides an indication of positive production prospects for vegetables in Bangladesh (see Table 1.1 and section 5.3.1). The twenty year projection of vegetable production and consumption further indicates the production and export potential of Bangladesh (Table 5.1).

The production of the sample vegetables FB, YLB and BG was found to be profitable on a cash cost basis and, in most cases also on a full cost for all farmer categories and survey districts. Yield variation by farmer category and district was not significant, except for FB at the district level. This would indicate that the production potential among the districts studied is similar.

Farm size, land preparation, manure and fertilizer, seed for FB, irrigation for YLB and farm size, manure and fertilizer for BG significantly affected production. However, pesticide was found significant but negative for BG, and labour was not significant but had positive effects in some models. The estimated Cobb-Douglas production functions for the survey districts also showed regional variation in output, but only Rangpur was significantly different from the base district Narshingdi (see chapter IV). The estimated average technical efficiency for FB, YLB and BG producers was quite low which suggests that there is large scope for increasing output without a major increase in inputs if producers are trained.

Nevertheless, the vegetable producers assert that they are encountering high fertilizer and pesticide costs. Farmers buy fertilizers at a subsidized rate and should be applied at the right dose, possibly after soil testing. The increased pesticide cost might be due to low quality of pesticide which needs more application or overuse than the recommendation. In this context, government agency needs to regulate the quality and also train up the producers about pesticides application as per recommended dose.

Within the purview of seed policy, some appropriate strategies need to be taken which will specify the quantity of seed to be produced by the public, private and non-government organisation to meet up local demand. Additionally, the private seed companies and NGO's may organize contract farmers for seed production with production support and remunerative price.

Perhaps of more value would be the distribution of small loans by banks, financial institutions and NGOs, to cover the production costs of vegetables. Agriculture credit foundation might be an option to resolve liquidity problems of the marginal and small farmers as recognized by the National Agriculture Policy.

The present profitable position might be more sustainable if the farmers could be linked directly to the domestic as well as export markets through a shorter chain which will involve less intermediaries. Moreover, production-market approach could be emphasized through adopting some production and marketing processes as follows:

Given the increasing demand for organic produce in the international market, organic vegetable farming could be a priority issue. This could be incorporated in the government's National Agriculture Policy and a standards and accreditation body and an assistance scheme for producers could be addressed.

Government cannot fix a minimum price or provide a price above the market price through buying the perishable vegetables for buffer stocks like cereals, jute or cotton. Alternatively, government might help exporters to increase vegetable exports through increasing air cargo space, providing incentives for improvement of packaging during the peak period.

Contract farming is advantageous for commercial vegetable farming for the export market and also for the domestic market, but needs a code of practice for the buying organisations and the cooperatives of contract farmers.

Government agency namely DAE and BADC can advice to the producers to form and operate a cooperate body as a bargaining agent to ensure a better price, the buyers in the case of contract farmers and the DAE and BADC for non-contract farmers might be appropriate to deal with such an issue. As a result of such efforts, the entire farmers of the country would be brought under cooperarive society which may act as the combined voice for them.

Direct cash support scheme along with monitoring to the vegetable producers to cover a part of production costs would strengthen the export oriented production process where DAE may operate such scheme in selection of farmers and distribution of cash support, and payment could be made for actual crops grown (see section 2.3.1 and 6.7).

6.2.2 Export marketing of vegetables in Bangladesh

The export of the sample vegetables in particular and of vegetables in general was analysed and found to be profitable, although existing traditional exports are not fulfilling the demands of the export market. The financial analyses reveal the profitability of the exportable vegetables which supports the hypotheses.

The financial analysis indicated that direct marketing between exporter and producer is more efficient than the marketing between the exporter and producer through middlemen or wholesalers. Exporters like BRAC who are exporting to supermarkets are getting a better price and providing a better price to the producers as well. Nevertheless, vegetables are not as competitive as they might be, even in the ethnic market due to certain major problems which should be addressed in order to remove the bottlenecks. However, the following options might be considered to improve the vegetable industry for international market:

The domestic and export marketing channels need a restructuring to make the market more efficient and increase producers' share, reduce marketing costs and increase consumers' satisfaction. The commission-based aratdar trading system should be changed; instead the aratdar and paiker altogether as the wholesaler could work in the wholesale market in an organised way integrated marketing organisations directly linked with producers, may be developed as alternate and efficient suppliers for the wholesaler, supermarket and exporter, similar to the UK (see section 6.1.10.2).

The supermarket is the fastest growing retail outlet in the developed as well as developing countries has an impact on the small farmers' livelihoods. It was suggested that both public and private sectors needed to play a part in promoting the participation of small producers in the supermarket chain (see section 6.1.10.2).

A federation or consortium of retailers, including supermarkets, marketing organisations, wholesalers, exporters, importers, middlemen and farmers' cooperatives could increase the partnership between the parties, such organization would be able to provide market information to the producers as well as the consumers, and might improve the competitive performance which will lead to efficient marketing system.

The Ministry of Commerce can promote and develop the three marketing channels (traditional channel through wholesaler, export channel and supermarket channel) to improve the competitive performance of the domestic market for agro-products with a code of practice.

Failure of exports of non-traditional vegetables at any time usually results in increased sales in the local market which usually gives a lower price and is a source of risk for the producers. Motivation of local people to consume non-traditional vegetables and also processing those would be alternative ways of improving the situation.

A special assistance scheme incorporating certain terms and conditions might be commissioned for implementing an incentive policy for welfare of the exporters. Those exporters would be entitled for such cash incentives who have arrangements and physical facilities such as contract farmers, international standard grading and packaging and cool chain management, and a constant supply of bulk quantities of high quality fresh vegetables as per specifications of the importers.

Private traders, instead of the Hortex Foundation, could be encouraged to develop a packaging industry and cool chain management for the exporters. Government might arrange air cargo flights and charter cargo planes for perishables. Additionally, government could compare the airport costs for foreign airlines with other airports of competing countries, and the arrangements for perishables.

6.2.3 Establishment of an export-oriented integrated organization a new agenda

Government has adopted policies to develop the export business of agro-products, but none of the policies suggest the establishment of an export-oriented integrated organisation to implement those policies. Such an organisation should not be established for only vegetables but for agro-products in general. In Bangladesh, an export-oriented organisation under the Ministry of Commerce could be an alternative for addressing the activities for fresh and processed agro-product export development. Additionally, the Ministry of Agriculture, Fisheries and Livestock and Industry, as sourcing ministry and the DAE, Directorate of fisheries and Livestock, EPB, BEPZA as sourcing department may act for this integrated organization.

6.3 Policy recommendations

Based on the findings of this study, the following recommendations are made for policy formulations in connection with the improvement of agro-products in general and the vegetable industry in particular in Bangladesh. It is suggested that poverty reduction, creation of employment opportunities, and income generation would be achieved much more if the following policy recommendations come into effect.

6.3.1 Improvement of vegetable production

Although, the production of the sample vegetables appears to be profitable, to improve the production of exportable vegetables in general and French bean, yard long bean and bitter gourd in particular for competitive export markets, a number of policies could be of assistance.

Firstly, vegetable production costs might be reduced by applying recommended doses of fertilizer after performing soil testing. Regulatory measures need to be adopted by government agencies to test and control the quality of pesticides distributed by private traders. Export market demand-led variety could be developed by the government research institutes and thereafter, increased production of quality seed carried out on government farms. Additionally, the registered seed producers could be encouraged by the seed companies with a remunerative price.

Secondly, the state-owned and private banks, financial institutions and NGOs could provide credit to the vegetable producers in amounts which cover the production costs. An agricultural credit foundation could be established to ensure liquidity for the marginal and small farmers involved in agricultural production.

Thirdly, the technical efficiency of the vegetable producers needs to be improved to increase output and profit. To assist in this, the government extension service may be further strengthened through DAE for such farmers, with linked research to establish solutions to farmer-voiced problems. A contract farming system, through local and foreign companies and NGOs, to improve technical efficiency might also be encouraged.

Fourthly, a domestic support scheme could be established and direct supports provided to the producers based on cropped area and selected crops like vegetables and organic produce subject to fulfillment of certain terms and conditions.

Fifth, an organic farming programme, especially for traditional and non-traditional vegetables, could be institutionalized by government departments, the private sector and NGOs, for both domestic and export market. According to the International Federation of Organic Agriculture Movements (IFOAM), a standards and accreditation body needs to be set up for national certification of organic products to facilitate international trade (Lampkin *et al* (2004).

Sixth, formation of a farmers' cooperative needs to be addressed and implemented to protect and asssit farmers. The buyers for contract farmers, and DAE and BADC for non-contract farmers could help with the formation of such a cooperative society.

Seventh, regulatory measures need to be designed and implemented with an agreement system for the buyers and the farmers' cooperatives involved in contract farming to encourage the development of a more commercial vegetable sector.

Eighth, BARI, being a government research organization, needs to conduct a special research programme for vegetables in line with export market demand. Such research should be participatory and involve researchers, traders, farmers, and extentionists.

6.3.2 Development of vegetable export marketing system

The internal and export marketing channels together deal with the vegetable exports. The market participants in the export channel are making profits, but not meeting the highest demands of the export markets. Thus, the following recommendations are made with a view to gaining market access in to the more profitable export markets and to expand vegetable exports.

Firstly, the internal vegetable market structure may be restructured through the elimination of the commission-based aratdar system, licensing and promoting a limited number of middlemen (bapari), based on purchase volume, encouraging integrated marketing organisations, and the expansion of supermarket in the urban areas. Coordination among the traditional, supermarket and export market channels could be encouraged to improve competitive performance for the fresh produce sector.

Secondly, a code of practice for the market participant middlemen, integrated marketing organisations, wholesalers, supermarkets and exporters could be developed and applied. Additionally, the customs department could impose sticker checking of vegetable cartons to prevent banned items. Failure to comply with the customs rules could result in the cancellation of their trade and other licenses.

Thirdly, internal marketing of non-traditional vegetables for the local market needs to be further promoted by the public and private organization through increasing local consumption and processing.

Fourthly, private entrepreneurs could be encouraged and supported to develop a packaging industry, multipurpose cold storage and transport facilities for cool chain management in the production and marketing areas.

Fifth, within the purview of government policy, the exporters could be provided with cash incentives, subject to maintaining contract farming, quality packaging and cool chain management, against consignment sale. The establishment of multi-product processing plants for horticultural, animal, poultry and dairy products, fish and shrimps could also be promoted by government.

Sixth, the government, in collaboration with the private sector, could arrange air cargo flights and charter cargo planes for export of perishable commodities in order to resolve the acute air space problem. Additionally, government might fix the minimum airport costs for foreign airlines similar to other airports of competing countries, to encourage them to increase space for perishables.

Seventh, agricultural export zones (AEZs) could be organized and a number of export villages and organic export villages within each zone could be earmarked for export quality vegetable production.

6.3.3 Establishment of export-oriented organisation for agro-products

Institutional and regulatory measures are needed to develop the export oriented agro-products and vegetable sector to face the competitive international market,

Firstly, an organisation under the Ministry of Commerce needs to be established for developing the export of fresh and processed agro-products, namely vegetables, fruits, flowers, aromatic rice, cash crops, spices, fish, shrimp, animal, poultry and dairy products. This organisation would organise a number of AEZs and facilitate investors regarding contract farming, inputs and credit supply, agro-processing, development of a packaging industry, storage, cool chain management, market intelligence and market promotion.

Secondly, appropriate rules and regulatory measures could be introduced to establish the recommended organisation and implement other recommendations.

6.4 Suggestions for future research

The methodology adopted and the associated recommendations could be used as a guideline for further research in this field. However, due to time constraints, primary data from retailers and consumers in Bangladesh and the UK, and supermarkets in the UK could not be collected. Future research could address this level of respondents to make recommendations on the whole export marketing chain of Bangladeshi vegetables including the retailer and consumer level in Bangladesh and the ethnic retail and supermarket outlets of the importing country.

This study has addressed various issues in connection with the production and export marketing of vegetables from an export perspective. A number of analyses were carried out on the whole export chain from production to export of three major exportable vegetables. Based on the outcomes of this study, some key recommendations are made for the improvement of agro-product exports in general and the vegetables sector in particular which could contribute to rural development and the overall national economy.

This study did face limitations in terms of time, sample size, and geographical extent. Nevertheless, a great deal of information was gathered which can provide policy makers and researchers with useful baseline data and with the foundation on which to build more detailed study. Further research of a more extensive and intensive nature would provide a more complete picture, and work on the mechanics and likely effects of specific policies would build on the general policy suggestions made here.

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LIST OF APPENDICES

Appendix I

Producer level

Table 1 Distribution of sample vegetable producers according to level of education

Name of the village	Illiterate	Primary	Secondary	Higher Secondary	Graduate	All
Durgamati	3 (17.65)	3 (17.65)	7 (41.18)	4 (23.53)	-	17 (100)
Avirampur	7 (41.18)	8 (47.06)	2 (11.76)	-	-	17 (100)
Srimantapur	26 (47.27)	22 (40.00)	5 (9.09)	-	2 (3.64)	55 (100)
Tulatoli	13 (39.39)	14 (42.42)	5 (15.15)	-	1 (3.03)	33 (100)
Kuragacha	11 (39.29)	5 (17.86)	12 (42.86)	-	-	28 (100)
Lokdao	4 (25.00)	7 (43.75)	5 (31.25)	-	-	16 (100)
Khorokmora	4 (16.00)	8 (32.00)	13 (52.00)	-	-	25 (100)
Bramondi (South)	12 (36.36)	13 (39.39)	7 (21.21)	1 (3.03)	-	33 (100)
Total	80 (35.71)	80 (35.71)	56 (25.00)	5 (2.23)	3 (1.34)	224 (100)

Figures in parentheses indicate the percentage

Table 2 Educational level of respondents by survey districts

Survey district	Illiterate	Primary	Secondary and above	Total
Rangpur	10 (29.4)	11 (32.4)	13 (38.3)	34 (100)
Comilla	39 (44.3)	36 (40.9)	13 (14.8)	88 (100)
Tangail	15 (34.1)	12 (27.3)	17 (38.6)	44 (100)
Narsingdi	16 (27.6)	21 (36.2)	21 (36.2)	58 (100)
Total	80 (35.7)	80 (35.7)	64 (28.5)	224 (100)

Figures in parentheses indicate the percentage

Table 3 Relationship between education level of respondent and survey district

Survey district	Education level of the respondent				
		Illiterate	Primary	Secondary and above	Total
Rangpur	Count	10	11	13	34
	Expected Count	12.1	12.1	9.7	34.0
	% within Name of district	29.4	32.4	38.2	100.0
	% within Education level of the respondent	12.5	13.8	20.3	15.2
	% of Total	4.5	4.9	5.8	15.2
Comilla	Count	39	36	13	88
	Expected Count	31.4	31.4	25.1	88.0
	% within Name of district	44.3	40.9	14.8	100.0
	% within Education level of the respondent	48.8	45.0	20.3	39.3
	% of Total	17.4	16.1	5.8	39.3
Tangail	Count	15	12	17	44
	Expected Count	15.7	15.7	12.6	44.0
	% within Name of district	34.1	27.3	38.6	100.0
	% within Education level of the respondent	18.8	15.0	26.6	19.6
	% of Total	6.7	5.4	7.6	19.6
Narsingdi	Count	16	21	21	58
	Expected Count	20.7	20.7	16.6	58.0
	% within Name of district	27.6	36.2	36.2	100.0
	% within Education level of the respondent	20.0	26.3	32.8	25.9
	% of Total	7.1	9.4	9.4	25.9
Total	Count	80	80	64	224
	Expected Count	80.0	80.0	64.0	224.0
	% within Name of district	35.7	35.7	28.6	100.0
	% within Education level of the respondent	100.0	100.0	100.0	100.0
	% of Total	35.7	35.7	28.6	100.0

Chi-square value = 14.68, df = 6, p = 0.02 (.05% level of significance), expected count = >5

Table 4 Distribution of sample vegetable producers according to occupation

Name of the district	Name of the village	Agriculture	Agriculture and business	Business	Service	All
Rangpur	Durgamati	17 (100.0)	-	-	-	17 (100)
	Avirampur	17 (100.0)	-	-	-	17 (100)
Comilla	Srimantapur	51 (92.7)	2 (3.6)	-	2 (3.6)	55 (100)
	Tulatoli	32 (97.0)	-	1 (3.0)	-	33 (100)
Tangail	Kuragacha	28 (100.0)	-	-	-	28 (100)
	Lokdao	16 (100.0)	-	-	-	16 (100)
Narshingdi	Khorokmora	19 (76.0)	5 (20.0)	1 (4.0)	-	25 (100)
	Bramondi (S)	30 (90.9)	-	3 (9.1)	-	33 (100)
Overall	Overall	210 (93.8)	7 (3.1)	5 (2.2)	2 (0.9)	224 (100)

Figures in parentheses indicate the percentage

Table 5 Distribution of the respondents according to their household size by survey district

Household size	Name of the survey district Rangpur	Comilla	Tangail	Narsingdi	All
1- 3	-	3 (3.41)	9 (20.45)	3 (5.17)	15 (6.70)
4 - 6	25 (73.53)	54 (61.36)	29 (65.91)	27 (46.55)	135 (60.27)
7 - 9	9 (26.47)	27 (30.68)	5 (11.36)	19 (32.76)	60 (26.79)
10 - above	-	4 (4.55)	1 (2.27)	9 (15.52)	14 (6.25)
All	34 (100)	88 (100)	44 (100)	58 (100)	224 (100)
Mean	5.8	6.1	5.0	7.2	6.1
Standard deviation	*1.2*	*1.8*	*1.8*	*2.9*	*2.2*

F=10.08, df =223, P=0.01 (1% level of significance, Figures in parentheses indicate the percentage of the respective house hold size

Table 6 Distribution of the respondents according to their household size by farmer category

House hold size	Farmers category				
	Marginal	Small	Medium	Large	All
1-3	7 (10.14)	7 (8.75)	1 (1.56)	-	15 (6.70)
4 – 6	38 (55.07)	52 (65.00)	39 (60.94)	6 (54.55)	135 (60.27)
7 – 9	21 (30.43)	19 (23.75)	17 (26.56)	3 (27.27)	60 (26.79)
10 – above	3 (4.35)	2 (2.50)	7 (10.94)	2 (18.18)	14 (6.250
All	69 (100)	80 (100)	64 (100)	11 (100)	224 (100)
Mean	6.0	5.5	6.9	7.2	6.1
Standard deviation	*1.9*	*1.7*	*2.6*	*2.7*	*2.2*

F = 6.61, df = 223, , P = 0.01 (1% level of significance), Figures in parentheses indicate the percentage of the respective house hold size

Table 7 Land holding and tenure pattern of the respondents by survey districts

Items	Rangpur	Comilla	Tangail	Narshingdi	Overall
Owned land	3.91	0.97	2.19	1.87	1.89
Homestead land	0.22	0.19	0.23	0.26	0.22
Leased in land	0.20	0.43	0.19	0.66	0.40
Leased out land	0.24	0.02	0.06	0.00	0.06
Own cropped land	3.64	1.18	2.09	2.26	2.01
Own cultivable land	3.69	0.78	1.96	1.61	1.67

F = 14.40, df = 223, P = 0.01 (1% level of significance)

Table 8 Land holding and tenure pattern of the respondents by farm size

Items	Marginal	Small	Medium	Large	Overall
Owned land	0.33	1.08	3.09	10.56	1.89
Homestead land	0.13	0.18	0.32	0.55	0.22
Leased in land	0.67	0.29	0.31	0.08	0.40
Leased out land	0.00	0.02	0.03	0.86	0.06
Own cropped land	0.87	1.18	3.04	9.24	2.01
Own cultivable land	0.21	0.90	2.76	10.02	1.67

F = 374.98, df = 223, P = 0.01 (1% level of significance)

Table 9 Relationship between farmer category and cultivation of sample vegetables

Farmers category		French bean	yard long bean	bitter gourd	Total
Marginal	Count	20	23	26	69
	Expected Count	19.1	24.0	25.9	69.0
	% within Farmers category	29.0	33.3	37.7	100.0
	% within Name of vegetables	32.3	29.5	31.0	30.8
	% of Total	8.9	10.3	11.6	30.8
Small	Count	26	26	28	80
	Expected Count	22.1	27.9	30.0	80.0
	% within Farmers category	32.5	32.5	35.0	100.0
	% within Name of vegetables	41.9	33.3	33.3	35.7
	% of Total	11.6	11.6	12.5	35.7
Medium and above	Count	16	29	30	75
	Expected Count	20.8	26.1	28.1	75.0
	% within Farmers category	21.3	38.7	40.0	100.0
	% within Name of vegetables	25.8	37.2	35.7	33.5
	% of Total	7.1	12.9	13.4	33.5
Total	Count	62	78	84	224
	Expected Count	62.0	78.0	84.0	224.0
	% within Farmers category	27.7	34.8	37.5	100.0
	% within Name of vegetables	100.0	100.0	100.0	100.0
	% of Total	27.7	34.8	37.5	100.0

Chi-square value = 2.55, df = 4, p = 0.64 (ns), expected count = >5

Table 10 Month wise labour requirement per acre in Mithapukur, Rangpur in 2003 (man / day)

Name of the crop	Jan	Feb	March	April	May	June	July	August	Septem	Oct	Novem	Decem
RICE	15	11	6	18	0	4	0	11	11	6	27	0
Potato	0	0	0	0	0	0	0	0	0	30	19	22
Palwal	10	10	10	10	11	10	10	10	11	14	2	30
Brinjal	0	0	0	0	0	4	12	14	10	10	11	0
Black gram	0	0	0	0	0	0	0	4	2	31	0	0
BG	17	17	0	0	0	16	17	14	15	0	16	21
Indian Spinach	0	0	0	0	22	15	15	15	0	0	0	0
Cucumber	12	13	0	0	0	0	0	0	0	0	12	28
Sweet gourd	8	7	0	0	0	0	0	0	0	0	11	10
Banana	8	10	8	8	17	8	40	22	20	8	7	9
All	70	67	24	36	49	57	94	89	68	99	106	119

Table 11 Month wise labour requirement per acre in Chandina, Comilla in 2003 (man / day)

Name of the crops	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Novem	Decem
YLB	0	24	36	30	0	24	37	27	0	0	0	0
RICE	35	12	2	2	20	19	19	36	7	13	13	20
FB	38	0	0	0	0	0	0	0	0	18	19	38
BG	0	1	30	30	32	0	1	34	30	30	32	0
Potato	34	3	20	0	0	0	0	0	0	0	0	34
Ladys finger	18	91	0	0	0	0	0	0	0	0	0	9
Snake gourd	0	24	17	7	0	0	0	0	0	0	0	0
Cauliflower	21	10	10	0	0	0	0	0	0	0	2	21
Cabbage	21	10	10	0	0	0	0	0	0	0	1	23
Cucumber	0	0	0	0	0	0	31	36	25	0	0	0
Brinjal	0	0	0	10	20	25	13	0	0	0	0	0
Tomato	0	0	0	0	0	0	0	1	16	13	16	11
All	168	176	125	79	73	68	101	135	79	73	84	156

Table 12 Month wise labour requirement per acre in Modhupur, Tangail in 2003 (man / day)

Name of the crops	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Novem	Decem
YLB	14	4	26	10	0	0	0	0	0	0	0	0
RICE	15	5	5	15	0	20	10	8	6	15	0	0
FB	20	10	0	0	0	0	0	0	0	0	16	13
Potato	15	0	0	0	0	0	0	20	10	6	0	0
Wheat	3	20	0	0	0	0	0	0	5	2	0	0
Snake gourd	3	8	8	21	19	0	0	0	0	0	0	0
Bottle gourd	0	0	0	0	0	0	0	6	10	4	10	0
Cucumber	0	10	10	10	15	0	0	0	0	0	0	0
Banana	5	2	2	2	2	2	2	5	0	0	0	5
All	75	60	51	58	36	22	12	39	31	27	26	18

Table 13 Month wise labour requirement per acre in Shibpur, Narshingdi in 2003 (man / day)

Name of the crops	Jan	Feb	March	April	May	June	July	August	Sept	Oct	Novem	Decem
YLB	0	0	0	0	0	0	18	14	26	0	0	0
RICE	16	8	11	12	0	0	6	10	6	4	12	32
FB	12	0	0	0	0	0	0	0	0	14	18	32
BG	0	8	16	10	0	0	0	0	0	0	0	0
T.Gourd	0	8	18	12	10	10	0	0	0	0	0	0
C.Bean	0	0	0	0	0	0	8	15	12	22	20	0
Egg plant	61	61	0	0	0	0	0	0	0	20	121	46
Cauliflower	95	0	0	0	0	0	0	0	0	0	16	16
Cabbage	28	0	0	0	0	0	0	0	0	0	16	8
Cucumber	0	0	16	40	61	0	0	0	0	0	0	0
Bottle gourd	0	0	0	0	0	0	0	4	24	20	21	20
All	213	85	62	75	71	10	32	44	69	81	226	155

Table 14 Number of the respondents borrowed agriculture credit from financial agency

Name of the agency	Total No. of respondents	No. of respondents borrowed money	Percentage of the respondents who borrowed money	Percentage of the respondents to total respondents who borrowed money
Government		2	2	1
Cooperatives		6	6	3
National banks		77	75	34
Money lenders		4	4	2
Exporters (including BRAC)		4	4	2
Middlemen (Proshika)		10	10	4
All	224	103	100	46

Table 15 Cost of Production for French Bean in Bangladesh (TK per acre)

Description of Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land Preparation	1454 (4.47)	1415 (3.62)	1507 (4.37)	0.00	1448 (3.86)
Hired labour	6880 (21.15)	6997 (17.91)	8674 (25.18)	3080 (15.42)	7302 (19.48)
Purchased Seed	3564 (10.95)	3991 (10.22)	3579 (10.39)	0.00	3715 (9.91)
Manure and fertilizer	4566 (14.03)	4825 (12.35)	3845 (11.16)	4133 (20.69)	4504 (12.01)
Irrigation	3367 (10.35)	2078 (5.32)	790 (2.29)	533 (2.67)	2181 (5.82)
Pesticide	3110 (9.56)	2827 (7.24)	1741 (5.05)	0.00	2640 (7.04)
Trellis	-	-	-	-	-
Total Cash Cost	22940 (70.51)	22132 (56.65)	20137 (58.44)	7747 (38.78)	21790 (58.13)
B. Variable Cost					
Land-Preparation	1454	1415	1507	0.00	1448
Hired labour	6880	6997	8674	3080	7302
Family labour	4182 (12.85)	6189 (15.84)	6989 (20.28)	3720 (18.62)	5606 (14.96)
Purchased Seed	3564	3991	3579	0.00	3715
Free Seed		6000 (15.36)	3096 (8.99)	5333 (26.70)	5279 (14.08)
Manure and fertilizer	4566	4825	3845	4133	4504
Irrigation	3367	2078	790	533	2181
Pesticide	3110	2827	1741	0.00	2640
Trellis	-	-	-	-	-
Total Variable Cost	27123 (83.37)	34321 (87.85)	30222 (87.71)	16800 (84.10)	32675 (87.17)
Rental value of own land	4973 (15.29)	3972 (10.17)	3711 (10.77)	3000 (15.02)	4216 (11.25)
Depreciation of Equipment	59 (0.18)	451 (1.16)	216 (0.63)	47 (0.23)	259 (0.69)
Interest on Working Capital	380 (1.17)	323 (0.83)	307 (0.89)	129 (0.65)	334 (0.89)
Total Fixed Cost	5412 (16.63)	4746 (12.15)	4234 (12.29)	3176 (15.90)	4810 (12.83)
Total Full Cost	32535	39067	34456	19976	37484

Figures in parentheses indicate the percentage of the cost items against the full cost

Table 16 Cost of Production for French bean in Rangpur (TK per acre)

Description of Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	-	-	1250 (5.36)	-	833 (3.55)
Hired labour	-	10829 (45.74)	6331 (27.14)	-	7830 (33.40)
Purchased Seed	-	-	-	-	-
Manure and fertilizer	-	933 (3.94)	2010 (8.61)	-	1651 (7.04)
Irrigation	-	508 (2.15)	515 (2.21)	-	513 (2.19)
Pesticide	-	425 (1.80)	2066 (8.86)	-	1519 (6.48)
Trellis	-	-	-	-	-
Total Cash Cost	-	12696 (53.62)	12171 (52.17)	-	12346 (52.66)
B. Variable Cost					
Land-Preparation	-	-	1250	-	833
Hired labour	-	10829	6331	-	7830
Family labour	-	6256 (26.42)	4536 (19.45)	-	5110 (21.79)
Purchased Seed	-	-	-	-	
Free Seed	-	1667 (7.04)	3603 (15.44)		2958 (12.61)
Manure and fertilizer	-	933	2010	-	1651
Irrigation	-	508	515	-	513
Pesticide	-	425	2066	-	1519
Trellis	-	-	-	-	-
Total Variable Cost	-	20619 (87.09)	20310 (87.06)	-	20413 (87.07)
C. Fixed Cost					
Rental value of own land	-	2667 (11.26)	2667 (11.43)	-	2667 (11.37)
Depreciation	-	179 (0.75)	149 (0.64)	-	159 (0.68)
Interest on Working Capital	-	212 (0.89)	203 (0.87)	-	206 (0.88)
Total Fixed Cost	-	3057 (12.91)	3019 (12.94)	-	3031 (12.93)
Total Full Cost (B + C)	-	23676	23329	-	23445

Figures in parentheses indicate percentage of cost items against full cost

Table 17 Cost of production for FB in Comilla (TK per acre)

Description of Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	1066 (3.31)	1299 (3.73)	1246 (4.19)	-	1185 (3.60)
Hired labour	6900 (21.45)	9026 (25.89)	11199 (37.63)	-	8364 (25.42)
Purchased Seed	3827 (11.89)	4023 (11.54)	3653 (12.27)	-	3880 (11.79)
Manure and fertilizer	4682 (14.55)	6180 (17.73)	4320 (14.52)	-	5230 (15.89)
Irrigation	3509 (10.91)	2013 (5.77)	518 (1.74)	-	2483 (7.55)
Pesticide	3508 (10.90)	3000 (8.60)	2147 (7.22)	-	3110 (9.45)
Trellis	0	0	0	-	0
Total Cash Cost	23492 (73.02)	25540 (73.26)	23084 (77.57)	-	24253 (73.71)
B Variable Cost					
Land-Preparation	1066	1299	1246	-	1185
Hired labour	6900	9026	11199	-	8364
Family labour	2830 (8.80)	3861 (11.07)	595 (2.00)	-	2923 (8.88)
Purchased Seed	3827	4023	3653	-	3880
Free Seed	-	-	-	-	
Manure and fertilizer	4682	6180	4320	-	5230
Irrigation	3509	2013	518	-	2483
Pesticide	3508	3000	2147	-	3110
Trellis	0	0	0	-	0
Total Variable Cost	26321 (81.82)	29401 (84.34)	23679 (79.57)	-	27176 (82.59)
C. Fixed Cost					
Rental value of own land	5425 (16.86)	4614 (13.24)	5333 (17.92)	-	5088 (15.46)
Depreciation of Equipment	34 (0.10)	421 (1.21)	363 (1.22)	-	235 (0.72)
Interest on Working Capital	392 (1.22)	426 (1.22)	385 (1.29)	-	404 (1.23)
Total Fixed Cost	5850 (18.18)	5460 (15.66)	6081 (20.43)	-	5727 (17.41)
D.Total Full Cost	32171	34861	29760	-	32903

Figures in parentheses indicate percentage of cost items against full cost

Table 18 Cost of Production for French bean in Tangail (TK per acre)

	Farmers Category				
Description of the Cost Items	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	-	999 (3.38)	1667 (10.26)	0 (0.00)	966 (3.54)
Hired labour	-	3498 (11.84)	1750 (10.77)	3080 (15.42)	3281 (12.04)
Purchased Seed	-				
Manure and fertilizer	-	3258 (11.03)	0 (0.00)	4133 (20.69)	3020 (11.08)
Irrigation	-	1792 (6.07)	500 (3.08)	533 (2.67)	1537 (5.64)
Pesticide	-	0.00	0.00	0.00	0.00
Trellis	-	0.00	0.00	0.00	0.00
Total Cash Cost	-	9548 (32.32)	3917 (24.10)	7747 (38.78)	8804 (32.30)
B. Variable Cost					
Land-Preparation	-	999	1667	0	966
Hired labour	-	3498	1750	3080	3281
Family labour	-	9712 (32.88)	6781 (41.73)	3720 (18.62)	8820 (32.36)
Purchased Seed	-	-	-	-	-
Free Seed	-	6542	2083	5333	5975
Manure and fertilizer	-	3258	0	4133	3020
Irrigation	-	1792	500	533	1537
Pesticide	-	0	0	0	0
Trellis		-	-	-	-
Total Variable Cost	-	25801 (87.34)	12781 (78.65)	16800 (84.10)	23599 (86.58)
C. Fixed Cost					
Rental value of own land	-	3500 (11.85)	3000 (18.46)	3000 (15.02)	3400 (12.47)
Depreciation of Equipment	-	82 (0.28)	403 (2.48)	47 (0.24)	111 (0.41)
Interest on Working Capital	-	159 (0.54)	65 (0.40)	129 (0.65)	147 (0.54)
Total Fixed Cost	-	3742 (12.67)	3469 (21.35)	3176 (15.90)	3658 (13.42)
Total Full Cost	-	29542	16250	19976	27257

Figures in parentheses indicate the percentage of cash cost over full cost

Table 19 Cost of production for French bean in Narshingdi (TK per acre)

Description of Cost Items	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	2281 (6.88)	704 (2.35)	452 (1.48)	-	1029 (3.30)
Hired labour	6800 (20.52)	5587 (18.69)	8530 (27.92)	-	7405 (23.77)
Purchased Seed	2512 (7.58)	3843 (12.85)	3525 (11.54)	-	3304 (10.61)
Manure and fertilizer	4101 (12.37)	3972 (13.29)	4031 (13.19)	-	4038 (12.96)
Irrigation	2800 (8.45)	2972 (9.94)	992 (3.25)	-	1933 (6.20)
Pesticide	1516 (4.57)	1882 (6.30)	1358 (4.44)	-	1516 (4.86)
Trellis	-	-	-	-	-
Total Cash cost	20009 (60..37)	18960 (63.42)	18889 (61.82)	-	19224 (61.71)
B. Variable Cost					
Land-Preparation	2281	704	452	-	1029
Hired labour	6800	5587	8530	-	7405
Family labour	9592 (28.94)	7638 (25.55)	8292 (27.14)	-	8523 (27.36)
Purchased Seed	2512 (7.58)	3843 (12.85)	3525 (11.54)	-	3304 (10.61)
Free Seed	-	-	-	-	-
Manure and fertilizer	4101	3972	4031	-	4038
Irrigation	2800	2972	992	-	1933
Pesticide	1516	1882	1358	-	1516
Trellis	-	-	-	-	-
Total Variable Cost	29601 (89.31)	26598 (88.97)	27181 (88.96)	-	27747 (89.07)
C. Fixed Cost					
Rental value of own land	3167 (9.55)	2667 (8.92)	2952 (9.66)	-	2952 (9.48)
Depreciation of Equipment	42 (0.13)	316 (1.06)	104 (0.34)	-	132 (0.42)
Interest on Working Capital	333 (1.01)	316 (1.06)	315 (1.03)	-	320 (1.03)
Total Fixed Cost	3542 (10.69)	3299 (11.03)	3372 (11.04)	-	3405 (10.93)
D. Total Full Cost	33143	29896	30552	-	31152

Figures in parentheses indicate the percentage of cash cost over full cost

Table 20 Cost of Production of yard long bean in Bangladesh (TK per acre)

Description of the Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	1051 (2.82)	1154 (3.18)	794 (2.19)	887 (2.94)	996 (2.75)
Hired labour	5578 (14.95)	5432 (14.96)	5645 (15.56)	6395 (21.18)	5602 (15.47)
Purchased Seed	1387 (3.72)	2162 (5.95)	2177 (6.00)	2210 (7.32)	1941 (5.36)
Manure and fertilizer	4725 (12.66)	5432 (14.96)	6071 (16.73)	5282 (17.49)	5411 (14.94)
Irrigation	1016 (2.72)	1038 (2.86)	884 (2.44)	715 (2.37)	963 (2.66)
Pesticide	4056 (10.87)	3302 (9.09)	2979 (8.21)	2213 (7.33)	3355 (9.27)
Trellis	4435 (11.89)	4150 (11.43)	4268 (11.76)	2953 (9.78)	4194 (11.58)
Total Cash Cost	22248 (59.62)	22670 (62.43)	22819 (62.89)	20655 (68.39)	22462 (62.04)
B. Variable Cost					
Land-Preparation	1051	1154	794	887	996
Hired labour	5578	5432	5645	6395	5602
Family labour	9926 (26.60)	9033 (24.88)	8858 (24.42)	5719 (18.94)	9030 (24.94)
Purchased Seed	1387	2162	2177	2210	1941
Free Seed	-	-	-	-	-
Manure and fertilizer	4725	5432	6071	5282	5411
Irrigation	1016	1038	884	715	963
Pesticide	4056	3302	2979	2213	3355
Trellis	4435	4150	4268	2953	4194
C. Total Variable Cost	32173 (86.23)	31703 (87.31)	31677 (87.31)	26374 (87.33)	31492 (86.98)
Rental value of own land	4638 (12.43)	4128 (11.37)	4056 (11.18)	3400 (11.26)	4209 (11.63)
Depreciation of Equipment	131 (0.35)	103 (0.28)	169 (0.46)	82 (0.27)	130 (0.36)
Interest on Working Capital	371 (0.99)	378 (1.04)	380 (1.05)	344 (1.14)	374 (1.03)
D. Total Fixed Cost	5140 (13.77)	4609 (12.69)	4605 (12.69)	3826 (12.67)	4714 (13.02)
E. Total Full Cost (C+ D)	37313	36312	36282	30200	36206

Figures in parentheses indicate the percentage of the cost items against the full cost

Table 21 Cost of Production for Yard Long bean in Rangpur (TK per acre)

Description of Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	-	1647 (5.88)	1078 (3.14)	1200 (3.76)	1226 (3.78)
Hired labour	-	3788 (13.53)	3961 (11.55)	8526 (26.74)	4902 (15.12)
Purchased Seed	-	1732 (6.19)	2301 (6.71)	3083 (9.67)	2346 (7.24)
Manure and fertilizer	-	2932 (10.47)	6886 (20.09)	4092 (12.83)	5440 (16.78)
Irrigation	-	415 (1.48)	660 (1.92)	847 (2.66)	647 (2.00)
Pesticide	-	4033 (14.40)	3577 (10.43)	3133 (9.83)	3580 (11.04)
Trellis	-	2647 (9.45)	3273 (9.55)	2700 (8.47)	3016 (9.30)
Total Cash Cost	-	17193 (61.40)	21735 (63.40)	23581 (73.96)	21157 (65.25)
B. Variable Cost					
Land-Preparation	-	1647	1078	1200	1226
Hired labour	-	3788	3961	8526	4902
Family labour	-	8402 (30.01)	6348 (18.52)	5519 (17.31)	6611 (20.39)
Purchased Seed	-	1732	2301	3083	2346
Free Seed	-				
Manure and fertilizer	-	2932	6886	4092	5440
Irrigation	-	415	660	847	647
Pesticide	-	4033	3577	3133	3580
Trellis	-	2647	3273	2700	3016
Total Variable Cost	-	25595 (91.41)	28084 (81.91)	29100 (91.27)	27768 (85.64)
C. Fixed Cost					
Rental value of own land	-	2000 (7.14)	5625 (16.41)	2333 (7.32)	4143 (12.78)
Depreciation	-	119 (0.42)	214 (0.63)	57 (0.18)	160 (0.49)
Interest on Working Capital	-	287 (1.02)	362 (1.06)	393 (1.23)	353 (1.09)
Total Fixed Cost	-	2405 (8.59)	6202 (18.09)	2783 (8.73)	4656 (14.36)
D. Total Full Cost (B + C)	-	28000	34285	31884	32424

Figure in parentheses indicates the percentage of the cost items against the full cost

Table 22 Cost of Production for Yard long bean in Comilla (TK per acre)

Description of the Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	1692 (4.58)	1088 (2.50)	1444 (3.37)	-	1431 (3.56)
Hired labour	4557 (12.34)	5478 (12.59)	3689 (8.61)	-	4811 (11.98)
Purchased Seed	1625 (4.40)	1708 (3.93)	1361 (3.18)	-	1627 (4.05)
Manure and fertilizer	3848 (10.42)	6461 (14.84)	7150 (16.69)	-	5234 (13.04)
Irrigation	995 (2.69)	1226 (2.82)	1175 (2.74)	-	1105 (2.75)
Pesticide	4944 (13.39)	5800 (13.33)	3778 (8.82)	-	5139 (12.80)
Trellis	4433 (12)	5993 (14)	6389 (15)	-	5259 (13)
Total Cash Cost	22095 (59.82)	27754 (63.77)	24986 (58.31)	-	24605 (61.28)
B. Variable Cost					
Land-Preparation	1692	1088	1444	-	1431
Hired labour	4557	5478	3689		4811
Family labour	8936 (24.19)	9768 (22.44)	12095 (28.23)	-	9621 (23.96)
Purchased Seed	1625	1708	1361	-	1627
Free Seed	-	-	-	-	-
Manure and fertilizer	3848	6461	7150	-	5234
Irrigation	995	1226	1175	-	1105
Pesticide	4944	5800	3778	-	5139
Trellis	4433	5993	6389	-	5259
Total Variable Cost	31031 (84.01)	37523 (86.21)	37082 (86.54)	-	34226 (85.24)
C. Fixed Cost					
Rental value of own land	5333 (14.44)	5333 (12.25)	5333 (12.45)	-	5333 (13.28)
Depreciation of Equipment	205 (0.56)	206 (0.47)	19 (0.04)	-	184 (0.46)
Interest on Working Capital	368 (1.00)	463 (1.06)	416 (0.97)	-	410 (1.02)
Total Fixed Cost	5907 (15.99)	6002 (13.79)	5769 (13.46)	-	5927 (14.76)
Total Full Cost	36938	43524	42850	-	40153

Figures in parentheses indicate percentage of cost items against full cost

Table 23 Cost of Production for Yard long bean in Tangail (TK per acre)

Description of Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	542 (1.65)	951 (3.05)	775 (2.74)	417 (1.51)	761 (2.48)
Hired labour	4832 (14.73)	5136 (16.46)	3040 (10.76)	3200 (11.56)	4467 (14.58)
Purchased Seed	1167 (3.56)	2668 (8.55)	1367 (4.84)	900 (3.25)	1877 (6.13)
Manure and fertilizer	7583 (23.11)	5583 (17.90)	7562 (26.76)	7067 (25.53)	6577 (21.46)
Irrigation	1299 (3.96)	931 (2.98)	1050 (3.72)	517 (1.87)	990 (3.23)
Pesticide	500 91.52)	672 (2.15)	1500 (5.31)	833 (3.01)	797 (2.60)
Trellis	3063 (9.33)	2885 (9.25)	4833 (17.10)	3333 (12.04)	3323 (10.85)
Total Cash Cost	18984 (57.86)	18826 (60.35)	20127 (71.22)	16267 (58.78)	18791 (61.32)
B. Variable Cost					
Land-Preparation	542	951	775	417	761
Hired labour	4832	5136	3040	3200	4467
Family labour	8509 (25.93)	7704 (24.70)	5187 (18.36)	6019 (21.75)	7251 (23.66)
Purchased Seed	1167	2668	1367	900	1877
Free Seed					
Manure and fertilizer	7583	5583	7562	7067	6577
Irrigation	1299	931	1050	517	990
Pesticide	500	672	1500	833	797
Trellis	3063	2885	4833	3333	3323
Total Variable Cost	27493 (83.80)	26529 (85.05)	25314 (89.57)	22286 (80.53)	26042 (84.99)
C. Fixed Cost					
Rental value of own land	5000 (15.24)	4333 (13.89)	2333 (8.26)	5000 (18.07)	4216 (13.76)
Depreciation of Equipment	0 (0.00)	18 (0.06)	278 (0.98)	118 (0.43)	71 (0.23)
Interest on Working Capital	316 (0.96)	314 (1.01)	335 (1.19)	271 (0.98)	313 (1.02)
Total Fixed Cost	5316 (16.20)	4665 (14.95)	2947 (10.43)	5389 (19.47)	4600 (15.01)
Total Full Cost	32809	31194	28261	27675	30643

Figures in parentheses indicate percentage of cost items over full cost

Table 24 Cost of production for yard long bean in Narshingdi (TK per acre)

Description of Cost Items	Marginal	Small	Medium	Large	All
A. Cash cost					
Land-Preparation	0 (0)	1314 (3.75)	379 (0.99)	-	493 (1.29)
Hired labour	8290 (20.16)	6800 (19.39)	8360 (21.82)	-	7969 (20.78)
Purchased Seed	1017 (2.47)	2518 (7.18)	2565 (6.69)	-	2112 (5.51)
Manure and fertilizer	4720 (11.48)	4630 (13.21)	4649 (12.13)	-	4665 (12.17)
Irrigation	871 (2.12)	1209 (3.45)	927 (2.42)	-	978 (2.55)
Pesticide	4502 (10.95)	2076 (5.92)	2705 (7.06)	-	3069 (8.00)
Trellis	5354 (13.02)	3390 (9.67)	4258 (11.11)	-	4365 (11.38)
Total cash cost	24754 (60.19)	21938 (62.57)	23843 (62.23)	-	23650 (61.68)
B. Variable cost					
Land-Preparation	0	1314	379	-	493
Hired labour	8290	6800	8360	-	7969
Family labour	13014	10067	10996	-	11351
	(31.64)	(28.71)	(28.70)	-	(29.60)
Purchased Seed	1017	2518	2565	-	2112
Free Seed	-	-	-	-	-
Manure and fertilizer	4720	4630	4649	-	4665
Irrigation	871	1209	927	-	978
Pesticide	4502	2076	2705	-	3069
Trellis	5354	3390	4258	-	4365
Total variable cost	37768 (91.83)	32005 (91.28)	34839 (90.93)	-	35001 (91.28)
C. Fixed cost					
Rental value of own land	2889 (7.02)	2667 (7.61)	2933 (7.66)	-	2857 (7.45)
Depreciation of Equipment	59 (0.14)	26 (0.07)	145 (0.38)	-	92 (0.24)
Interest on Working Capital	413 (1.00)	366 (1.04)	397 (1.04)	-	394 (1.03)
Total fixed cost	3360 (8.17)	3058 (8.72)	3476 (9.07)	-	3343 (8.72)
D. Full cost	41128	35063	38315	-	38344

Figures in parentheses indicate percentage of cost items over full cost

Table 25 Cost of Production for Bitter Gourd in Bangladesh (TK per acre)

Description of Cost items	Farmers Category Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	1096 (2.59)	738 (2.03)	1074 (3.76)	940 (2.99)	961 (2.70)
Hired labour	5852 (13.83)	5300 (14.56)	5265 (18.42)	4030 (12.82)	5385 (15.12)
Purchased Seed	2857 (6.75)	2914 (8.01)	3108 (10.87)	3243 (10.32)	2974 (8.35)
Manure and fertilizer	8224 (19.43)	6205 (17.05)	4184 (14.63)	5919 (18.83)	6211 (17.44)
Irrigation-cost	2061 (4.87)	1063 (2.92)	698 (2.44)	639 (2.03)	1238 (3.48)
Pesticide	3652 (8.63)	2814 (7.73)	1496 (5.23)	2813 (8.95)	2681 (7.53)
Trellis	4882 (11.53)	4734 (13.00)	3883 (13.58)	4220 (13.42)	4496 (12.62)
Total cash cost	28624 (67.62)	23769 (65.30)	19709 (68.93)	21804 (69.36)	23946 (67.23)
B. Variable Cost					
Land-Preparation	1096	738	1074	940	961
Hired labour	5852	5300	5265	4030	5385
Family labour	8391 (19.82)	8115 (22.29)	5162 (18.05)	5227 (16.62)	7150 (20.07)
Purchased Seed	2857	2914	3108	3243	2974
Free Seed					
Manure and fertilizer	8224	6205	4184	5919	6211
Irrigation	2061	1063	698	639	1238
Pesticide	3652	2814	1496	2813	2681
Trellis	4882	4734	3883	4220	4496
Total Variable Cost	37015 (87.44)	31884 (87.59)	24871 (86.99)	27031 (85.98)	31096 (87.31)
C. Fixed Cost					
Rental value of own land	4744 (11.21)	3881 (10.66)	3213 (11.24)	3867 (12.30)	3948 (11.09)
Depreciation of Equipment	96 (0.23)	241 (0.66)	178 (0.62)	177 (0.56)	173 (0.49)
Interest on Working Capital	477 (1.13)	396 (1.09)	328 (1.15)	363 (1.16)	399 (1.12)
Total Fixed Cost	5317 (12.56)	4518 (12.41)	3720 (13.01)	4407 (14.02)	4521 (12.69)
Total Full Cost	42332	36401	28590	31438	35617

Figures in parentheses indicate the percentage of the cost items against full cost

Table 26 Cost of Production for Bitter gourd in Rangpur (TK per acre)

Description of Cost Items	Farmers Category				
A. Cash Cost	Marginal	Small	Medium	Large	All
Land-Preparation	1500 (4.07)	1714 (6.75)	1332 (4.97)	800 (3.51)	1346 (5.05)
Hired labour	7180 19.50	4129 16.26	5484 20.45	3616 15.87	5125 19.21
Purchasde Seed	1500 (4.07)	2717 (10.70)	3361 (12.53)	3400 (14.92)	3142 (11.78)
Manure and fertilizer	4500 (12.22)	3029 (11.93)	4162 (15.52)	3173 (13.92)	3866 (14.49)
Irrigation	1770 (4.81)	321 (1.27)	685 (2.56)	680 (2.98)	684 (2.57)
Pesticide	3000 (8.15)	2019 (7.95)	1546 (5.77)	2867 (12.58)	1870 (7.01)
Trellis	0 (0.00)	3619 (14.25)	2955 (11.02)	2633 (11.55)	2860 (10.72)
Total Cash Cost	19450 (52.83)	17549 (69.10)	19524 (72.81)	17169 (75.33)	18894 (70.82)
B. Variable Cost					
Land-Preparation	1500	1714	1332	800	1346
Hired labour	7180	4129	5484	3616	5125
Family labour	13000 (35.31)	3889 (15.31)	4255 (15.87)	3268 (14.34)	4588 (17.20)
Purchased Seed	1500	2717	3361	3400	3142
Free Seed	-	-	-	-	-
Manure and fertilizer	4500	3029	4162	3173	3866
Irrigation	1770	321	685	680	684
Pesticide	3000	2019	1546	2867	1870
Trellis	0	3619	2955	2633	2860
Total Variable Cost	32450 (88.15)	21438 (84.41)	23779 (88.67)	20437 (89.67)	23483 (88.02)
C. Fixed Cost					
Rental value of own land	4000 (10.87)	3444 (13.56)	2515 (9.38)	2000 (8.78)	2706 (10.14)
Depreciation of Equipment	40 (0.11)	222 (0.87)	197 (0.73)	68 (0.30)	177 (0.66)
Interest on Working Capital	324 (0.88)	292 (1.15)	325 (1.21)	286 (1.26)	315 (1.18)
Total Fixed Cost	4364 (11.85)	3959 (15.59)	3037 (11.33)	2354 (10.33)	3198 (11.98)
Total Full Cost	36814	25396	26816	22791	26680

Figures in parentheses indicate percentage of cost items against full cost

Table 27 Cost of Production for Bitter Gourd in Comilla (TK per acre)

Description of the Cost Items	Farmers Category Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	1044 (2.34)	918 (1.94)	917 (2.94)	1167 (2.23)	1006 (2.26)
Hired labour	5279 (11.83)	7265 (15.38)	3556 (11.39)	5667 (10.81)	5681 (12.74)
Purchased Seed	3182 (7.13)	2380 (5.04)	2361 (7.56)	5417 (10.33)	2996 (6.72)
Manure and fertilizer	8361 (18.74)	9082 (19.23)	3511 (11.24)	12500 (23.85)	8342 (18.71)
Irrigation	2041 (4.57)	1491 (3.16)	1172 (3.75)	833 (1.59)	1789 (4.01)
Pesticide	4702 (10.54)	4964 (10.51)	3439 (11.01)	5667 (10.81)	4712 (10.57)
Trellis	5194 (11.64)	6233 (13.20)	4792 (15.34)	4167 (7.95)	5396 (12.10)
Total Cash Cost	29858 (66.92)	32388 (68.59)	19795 (63.39)	35476 (67.69)	29977 (67.23)
B. Variable Cost					
Land-Preparation	1044	918	917	1167	1006
Hired labour	5279	7265	3556	5667	5681
Family labour	8871 (19.88)	8758 (18.55)	5803 (18.58)	10969 (20.93)	8692 (19.49)
Purchased Seed	3182	2380	2361	5417	2996
Free Seed	-	-	-	-	-
Manure and fertilizer	8361	9082	3511	12500	8342
Irrigation	2041	1491	1172	833	1789
Pesticide	4702	4964	3439	5667	4712
Trellis	5194	6233	4792	4167	5396
Total Variable Cost	38674 (86.67)	41091 (87.02)	25550 (81.81)	46385 (88.50)	38614 (86.59)
C. Fixed Cost					
Rental value of own land	5333 (11.95)	5333 (11.29)	5333 (17.08)	5333 (10.18)	5333 (11.96)
Depreciation of Equipment	116 (0.26)	259 (0.55)	18 (0.06)	103 (0.20)	146 (0.33)
Interest on Working Capital	497 (1.11)	539 (1.14)	329 (1.05)	590 (1.13)	499 (1.12)
Total Fixed Cost	5946 (13.33)	6131 (12.98)	5680 (18.19)	6026 (11.50)	5978 (13.41)
Total Full Cost	44620	47222	31230	52412	44591

Figures in parentheses indicate percentage of the cost items against full cost

Table 28 Cost of Production for Bitter gourd in Tangail (TK per acre)

Description of the Cost Items	Farmers Category				
	Marginal	Small	Medium	Large	All
A. Cash Cost					
Land-Preparation	1000 (3.05)	656 (2.07)	698 (2.50)	967 (3.27)	743 (2.42)
Hired labour	4181 (12.77)	3452 (10.89)	3213 (11.51)	3627 (12.25)	3502 (11.41)
Purchased Seed	2300 (7.02)	2556 (8.06)	2375 (8.51)	2000 (6.76)	2418 (7.88)
Manure and fertilizer	5190 (15.85)	6627 (20.91)	4399 (15.76)	5373 (18.15)	5786 (18.86)
Irrigation	2000 (6.11)	1120 (3.53)	474 (1.70)	500 (1.69)	999 (3.25)
Pesticide	2085 (6.37)	1500 (4.73)	973 (3.48)	1333 (4.50)	1425 (4.64)
Trellis	3750 (11.45)	4028 (12.71)	4479 (16.04)	5833 (19.71)	4314 (14.06)
Total Cash Cost	20506 (62.62)	19938 (62.90)	16610 (59.50)	19633 (66.33)	19186 (62.53)
B. Variable Cost					
Land-Preparation	1000	656	698	967	743
Hired labour	4181	3452	3213	3627	3502
Family labour	6898 (21.06)	7050 (22.24)	6213 (22.25)	4314 (14.58)	6513 (21.23)
Purchased Seed	2300 (7.02)	2556 (8.06)	2375 (8.51)	2000 (6.76)	2418 (7.88)
Free Seed	-	-	-	-	-
Manure and fertilizer	5190	6627	4399	5373	5786
Irrigation	2000	1120	474	500	999
Pesticide	2085	1500	973	1333	1425
Trellis	3750	4028	4479	5833	4314
Total Variable Cost	27404 (83.69)	26987 (85.14)	22823 (81.75)	23948 (80.91)	25699 (83.75)
C. Fixed Cost					
Rental value of own land	5000 (15.27)	4111 (12.97)	4500 (16.12)	5000 (16.89)	4412 (14.38)
Depreciation of Equipment	0 (0.00)	266 (0.84)	318 (1.14)	324 (1.09)	254 (0.83)
Interest on Working Capital	342 (1.04)	332 (1.05)	277 (0.99)	327 (1.11)	320 (1.04)
Total Fixed Cost	5342 (16.31)	4709 (14.86)	5095 (18.25)	5651 (19.09)	4985 (16.25)
D. Full Cost	32746	31696	27918	29598	30684

Figures in parentheses indicate percentage of the cost items against full cost

Table 29 Cost of production for Bitter gourd in Narshingdi (TK per acre)

Description of Cost Items	Marginal	Small	Medium	Large	All
A. Cash cost					
Land-Preparation	1208 (3.02)	356 (0.98)	949 (3.09)	-	785 (2.22)
Hired labour	7812 (19.55)	6010 (16.53)	6419 (20.91)	-	6622 (18.74)
Purchased Seed	2347 (5.87)	3755 (10.33)	3315 (10.80)	-	3235 (9.15)
Manure and fertilizer	9467 (23.69)	4604 (12.66)	4274 (13.92)	-	5758 (16.30)
Irrigation	2188 (5.47)	920 (2.53)	709 (2.31)	-	1177 (3.33)
Pesticide	1306 (3.27)	2722 (7.49)	1203 (3.92)	-	1824 (5.16)
Trellis	5191 (12.99)	4645 (12.78)	4633 (15.09)	-	4783 (13.54)
Total cash cost	29518 (73.86)	23012 (63.29)	21503 (70.03)	-	24185 (68.45)
B. Variable cost					
Land-Preparation	1208	356	949	-	785
Hired labour	7812	6010	6419	-	6622
Family labour	6762 (16.92)	10089 (27.75)	5724 (18.64)	-	7703 (21.80)
Purchased Seed	2347 (5.87)	3755 (10.33)	3315 (10.80)	-	3235 (9.15)
Free Seed				-	
Manure and Fertilizer	9467	4604	4274	-	5758
Irrigation	2188	920	709	-	1177
Pesticide	1306	2722	1203	-	1824
Trellis	5191	4645	4633	-	4783
Total variable cost	36280 (90.78)	33101 (91.04)	27226 (88.67)	-	31887 (90.25)
C. Fixed cost					
Rental value of own land	3111 (7.78)	2667 (7.33)	3000 (9.77)	-	2899 (8.20)
Depreciation of Equipment	81 (0.20)	207 (0.57)	122 (0.40)	-	145 (0.41)
Interest on Working Capital	492 (1.23)	384 (1.05)	358 (1.17)	-	403 (1.14)
Total fixed cost	3684 (9.22)	3258 (8.96)	3480 (11.33)	-	3446 (9.75)
Total full cost	39964	36359	30706	-	35333

Figures in then parentheses indicate the percentage of the cost items against full cost

Table 30 Correlation between the independent variables included in regression analysis for French bean

	log of output (kg)	log of farm size (acre)	Log of land preparation (TK)	log of land rent (TK)	log of labour (Hours)	log of manure and fertilizer (TK)	log of seed (TK)	log of irrigation (TK)	log of pesticide (TK)
log of output (kg)	1.00	.925	.847	.807	.738	.845	.928	.642	.727
log of farm size (acre)	.925	1.00	.869	.874	.741	.810	.954	.666	.730
Log of land preparation (TK)	.847	.869	1.000	.663	.739	.724	.803	.546	.592
log of land rent (TK)	.807	.874	.663	1.00	.541	.739	.826	.599	.615
log of labour (Hours)	.738	.741	.739	.541	1.00	.711	.691	.334	.613
log of manure and fertilizer (TK)	.845	.810	.724	.739	.711	1.000	.798	.576	.560
log of seed	.928	.954	.803	.826	.691	.798	1.00	.669	.740
log of irrigation (TK)	.642	.666	.546	.599	.334	.576	.669	1.000	.540
log of pesticide (TK)	.727	.730	.592	.615	.613	.560	.740	.540	1.000

Table 31 Correlation between the independent variables included in regression analysis for yard long bean

	log of output (kg)	log of farm size (acre)	Log of land preparation (TK)	log of land rent (TK)	log of labour (Hours)	log of manure and fertilizer (TK)	log of seed (TK)	log of irrigation (TK)	log of pesticide (TK)
log of output (kg)	1.00	.870	.513	.639	.701	.569	.682	.778	.529
log of farm size (acre)	.870	1.00	.647	.797	.796	.584	.687	.729	.597
Log of land preparation (TK)	.513	.647	1.000	.341	.585	.437	.551	.408	.384
log of land rent (TK)	.639	.797	.341	1.00	.568	.304	.467	.622	.564
log of labour (Hours)	.701	.796	.585	.568	1.00	.335	.563	.592	.413
log of manure and fertilizer (TK)	.569	.584	.437	.304	.335	1.00	.450	.471	.361
log of seed	.682	.687	.551	.467	.563	.450	1.000	.588	.426
log of irrigation (TK)	.778	.729	.408	.622	.592	.471	.588	1.000	.475
log of pesticide (TK)	.529	.597	.384	.564	.413	.361	.426	.475	1.000

Table 32 Correlation between the independent variables included in regression analysis for BG

	log of output (kg)	log of farm size (acre)	Log of land preparation (TK)	log of land rent (TK)	log of labour (Hours)	log of manure and fertilizer (TK)	log of seed (TK)	log of irrigation (TK)	log of pesticide (TK)
log of output (kg)	1.000	0.860	0.761	0.653	0.645	0.500	0.672	0.405	0.197
log of farm size (acre)	0.860	1.0	0.853	0.814	0.791	0.512	0.715	0.542	0.366
Log of land preparation (TK)	0.761	0.853	1.000	0.598	0.721	0.405	0.523	0.330	0.116
log of land rent (TK)	0.653	0.814	0.598	1.0	0.579	0.320	0.754	0.600	0.569
log of labour (Hours)	0.645	0.791	0.721	0.579	1.0	0.329	0.584	0.413	0.250
log of manure and fertilizer (TK)	0.500	0.512	0.405	0.320	0.329	1.0	0.259	0.182	0.231
log of seed	0.672	0.715	0.523	0.754	0.584	0.259	1.000	0.667	0.472
log of irrigation (TK)	0.405	0.542	0.330	0.600	0.413	0.182	0.667	1.000	0.387
log of pesticide (TK)	0.197	0.366	0.116	0.569	0.250	0.231	0.472	0.387	1.000

Table 33 Number of sample producers linked with exporter

Name of the district	Name of the Village	No. of Contract farmer to exporter	No. of contract farmer getting technical support from exporter	Sale of vegetable to exporter
Rangpur	Durgamati	-	-	-
	Avirampur	-	-	-
Comilla	Sreemantapur	47 (85.45)	46 (83.64)	48 (87.27)
	Tulatoli	24 (72.73)	22 (66.67)	21 (63.64)
Tangail	Kuragacha	-	-	-
	Lokdao	-	-	-
		-	-	-
Narshingdi	Khorokmora	12 (48.00)	17 (68.00)	10 (40.00)
	Bramondi (South)	7 (21.21)	14 (42.42)	6 (18.18)
	Total	90 (40.18)	99 (44.20)	85 (37.95)

Table 34 Area and production of vegetables (tuber and non-tuber) in Bangladesh for last thirteen years

Year	Area('000' acre)	% share to annual change	production ('000' MT	% share to annual change
1991-92	745	-	2480	-
1992-93	760	1.9	2524	1.8
1993-94	771	1.5	2604	3.2
1994-95	782	1.5	2672	2.6
1995-96	798	2.0	2735	2.4
1996-97	818	2.4	2797	2.2
1997-98	833	1.9	2859	2.2
1998-99	1202	44.3	4289	50.0
1999-2000	1211	0.7	4493	4.8
2000-01	1226	1.3	4679	4.1
2001-02	1202	-2.0	4561	-2.5
2002-03	1212	0.8	4980	9.2
2003-04	1312	8.3	5587	12.2

Table 35 Calculation of the ratio of the respondents to the assumed number of sample vegetable producers in Rangpur

No. of villages	Total no. of vegetable producer (A)	Assumed no. of sample vegetable producer (A*50%)	Total sample vegetable producer	FB-Resp.	Assumed no. of FB producer	YLB-Resp.	Assumed no. of YLB-producer	BG-Resp.	assumed no. of BG-producer
2-villages	158	79	34	3	7	14	33	17	40
Ratio for 2-villages					2.32		2.32		2.32
Ratio for 4-villages (FB)					4.65				
Ratio for 10-villages (YLB and BG)							11.62		11.62

Table 36 Computation of market power for producer in Rangpur

FB-sale (kg)	Market share	Square of market share	YLB-sale (kg)	Market share	Square of market share	BG - sale (kg)	Market share	Square of market share
323	0.307	0.094	245	0.016	0.000	798	0.026	0.001
376	0.358	0.128	876	0.056	0.003	342	0.011	0.000
352	0.335	0.112	146	0.009	0.000	564	0.019	0.000
			1183	0.076	0.006	4510	0.150	0.022
			2998	0.192	0.037	563	0.019	0.000
			650	0.042	0.002	1549	0.051	0.003
			1617	0.103	0.011	562	0.019	0.000
			1509	0.097	0.009	1500	0.050	0.002
			1637	0.105	0.011	678	0.022	0.001
			389	0.025	0.001	5796	0.192	0.037
			530	0.034	0.001	940	0.031	0.001
			1173	0.075	0.006	2784	0.092	0.009
			1308	0.084	0.007	940	0.031	0.001
			1376	0.088	0.008	3048	0.101	0.010
						2990	0.099	0.010
						1518	0.050	0.003
						1080	0.036	0.001
1051	1	0.335	15637	1	0.101	30162	1	0.101

Table 37 Calculation of the ratio of the respondents to the assumed number of sample vegetable producers in Comilla

No. of villages	Total vegetable producer (B)	Assumed number o sample vegetable producer (A*70%)	Total sample vegetable producer	FB Res.	Assumed number of FB producer	YLB Resp.	Assumed number of YLB producer	BG Resp.	Assumed number of BG producer
2-survey villages	490	343	88	35	136	26	101	27	105
Ratio for 2- villages		3.90			3.90		3.90		3.90
Ratio for 4-villages (FB)					7.80				
Ratio for 10- villages (YLB+ BG)		19.49					19.49		19.49

Table 38 Computation of market power for producer in Comilla

French bean sale (sale volume) (kg)	market share	Square of market share /market power	YLB sale (kg)	market share	Square of market share/ market power	BG sale (kg)	market share	Square of market share/market power
1080	0.015	0.000	740	0.028	0.001	940	0.028	0.001
3632	0.049	0.002	742	0.028	0.001	667	0.020	0.000
5268	0.071	0.005	644	0.025	0.001	5317	0.160	0.025
1035	0.014	0.000	417	0.016	0.000	1218	0.037	0.001
755	0.010	0.000	1395	0.053	0.003	350	0.011	0.000
845	0.011	0.000	558	0.021	0.000	470	0.014	0.000
1502	0.020	0.000	2835	0.108	0.012	2350	0.071	0.005
1035	0.014	0.000	697	0.027	0.001	989	0.030	0.001
1690	0.023	0.001	540	0.021	0.000	1128	0.034	0.001
850	0.012	0.000	836	0.032	0.001	657	0.020	0.000
3177	0.043	0.002	1295	0.050	0.002	1128	0.034	0.001
800	0.011	0.000	507	0.019	0.000	466	0.014	0.000
849	0.012	0.000	750	0.029	0.001	3760	0.113	0.013
548	0.007	0.000	460	0.018	0.000	583	0.018	0.000
1128	0.015	0.000	745	0.029	0.001	1128	0.034	0.001
610	0.008	0.000	1585	0.061	0.004	1456	0.044	0.002
390	0.005	0.000	915	0.035	0.001	789	0.024	0.001
562	0.008	0.000	947	0.036	0.001	809	0.024	0.001
14380	0.195	0.038	610	0.023	0.001	640	0.019	0.000
2070	0.028	0.001	835	0.032	0.001	1142	0.034	0.001
903	0.012	0.000	750	0.029	0.001	453	0.014	0.000
2788	0.038	0.001	737	0.028	0.001	750	0.023	0.001
282	0.004	0.000	750	0.029	0.001	940	0.028	0.001
7006	0.095	0.009	3705	0.142	0.020	709	0.021	0.000
564	0.008	0.000	1300	0.050	0.002	735	0.022	0.000
470	0.006	0.000	835	0.032	0.001	2625	0.079	0.006
452	0.006	0.000				1110	0.033	0.001
1544	0.021	0.000						
774	0.010	0.000						
658	0.009	0.000						
1113	0.015	0.000						
2065	0.028	0.001						
1500	0.020	0.000						
5824	0.079	0.006						
5675	0.077	0.006						
73824	1	0.076	26130	1	0.058	33309	1	0.066
	2-villages	0.019		2-villages	0.015		2-villages	0.017
	4-villages	0.010		10-villages	0.003		10-villages	0.003

Table 39 Calculation of the ratio of the respondents to the assumed number of sample vegetable producers in Tangail

No. of villages	Total Vegetable producer (C)	50% of total vegetable producer (C*50%)	Assumed number Of sample vegetable producer	FB Resp.	Assumed number of FB producer	YLB Resp.	Assumed number of YLB producer	BG Resp.	Assumed number of BG producer
2-survey villages	148	74	44	10	17	17	29	17	29
Ratio of 2-villages		1.68			1.68		1.68		1.68
Ratio of 4-villages					3.36				
Ratio of 10-villages							8.41		8.41

Table 40 Computation of market power for producer in Tangail

French bean sale (sale volume) (kg)	Market share (FB)	Square of market share/ market power (FB)	YLB sale (kg)	Market share (YLB)	Square of market share/ market power (YLB)	BG sale (kg)	market share (BG)	Square of market share/market power (BG)
1080	0.015	0.000	740	0.028	0.001	940	0.028	0.001
3632	0.049	0.002	742	0.028	0.001	667	0.020	0.000
5268	0.071	0.005	644	0.025	0.001	5317	0.160	0.025
1035	0.014	0.000	417	0.016	0.000	1218	0.037	0.001
755	0.010	0.000	1395	0.053	0.003	350	0.011	0.000
845	0.011	0.000	558	0.021	0.000	470	0.014	0.000
1502	0.020	0.000	2835	0.108	0.012	2350	0.071	0.005
1035	0.014	0.000	697	0.027	0.001	989	0.030	0.001
1690	0.023	0.001	540	0.021	0.000	1128	0.034	0.001
850	0.012	0.000	836	0.032	0.001	657	0.020	0.000
3177	0.043	0.002	1295	0.050	0.002	1128	0.034	0.001
800	0.011	0.000	507	0.019	0.000	466	0.014	0.000
849	0.012	0.000	750	0.029	0.001	3760	0.113	0.013
548	0.007	0.000	460	0.018	0.000	583	0.018	0.000
1128	0.015	0.000	745	0.029	0.001	1128	0.034	0.001
610	0.008	0.000	1585	0.061	0.004	1456	0.044	0.002
390	0.005	0.000	915	0.035	0.001	789	0.024	0.001
562	0.008	0.000	947	0.036	0.001	809	0.024	0.001
14380	0.195	0.038	610	0.023	0.001	640	0.019	0.000
2070	0.028	0.001	835	0.032	0.001	1142	0.034	0.001
903	0.012	0.000	750	0.029	0.001	453	0.014	0.000
2788	0.038	0.001	737	0.028	0.001	750	0.023	0.001
282	0.004	0.000	750	0.029	0.001	940	0.028	0.001
7006	0.095	0.009	3705	0.142	0.020	709	0.021	0.000
564	0.008	0.000	1300	0.050	0.002	735	0.022	0.000
470	0.006	0.000	835	0.032	0.001	2625	0.079	0.006
452	0.006	0.000				1110	0.033	0.001
1544	0.021	0.000						
774	0.010	0.000						
658	0.009	0.000						
1113	0.015	0.000						
2065	0.028	0.001						
1500	0.020	0.000						
5824	0.079	0.006						
5675	0.077	0.006						
73824	1	0.076	26130	1	0.058	33309	1	0.066
	2-villages	0.019		2-villages	0.015		2-villages	0.017
	4-villages	0.010		10-villages	0.003		10-villages	0.003

Table 41 Calculation of the ratio of the respondents to the assumed number of sample vegetable producers in Tangail

No. of villages	Total vegetable producer (D)	50% of total vegetable producer (D*50%)	Assumed number of sample vegetable producer	FB Resp.	Assumed number of FB producer	YLB Resp.	Assumed number of YLB producer	BG Resp	Assumed number of BG producer
Ratio of 2survey villages	247	124	58	14	30	21	45	23	49
Ratio of 2-survey villages		2.13			2.13		2.13		2.13
Ratio of 4-survey villages					4.26				
Ratio of 10-survey villages							10.65		10.65

Table 42 Computation of market power for producer in Narshingdi

FB sale (kg)	Market share	Square of market share/ power	YLB (kg)	Market share (YLB)	Square of market share/ power (YLB)	BG sale (kg)	Market share (BG)	Square of market share/ power (BG)
940	0.115	0.013	920	0.041	0.002	907	0.016	0.000
464	0.057	0.003	2760	0.122	0.015	789	0.014	0.000
244	0.030	0.001	2000	0.089	0.008	585	0.011	0.000
758	0.093	0.009	920	0.041	0.002	2058	0.037	0.001
273	0.033	0.001	855	0.038	0.001	548	0.010	0.000
757	0.092	0.009	4176	0.185	0.034	4309	0.078	0.006
429	0.052	0.003	610	0.027	0.001	846	0.015	0.000
2125	0.259	0.067	554	0.025	0.001	750	0.014	0.000
675	0.082	0.007	452	0.020	0.000	258	0.005	0.000
222	0.027	0.001	453	0.020	0.000	1695	0.031	0.001
398	0.049	0.002	628	0.028	0.001	2291	0.042	0.002
475	0.058	0.003	699	0.031	0.001	1018	0.019	0.000
185	0.023	0.001	739	0.033	0.001	696	0.013	0.000
248	0.030	0.001	738	0.033	0.001	1037	0.019	0.000
	0	0	454	0.020	0.000	1500	0.027	0.001
	0	0	1436	0.064	0.004	4481	0.082	0.007
	0	0	920	0.041	0.002	10400	0.189	0.036
	0	0	605	0.027	0.001	6617	0.120	0.014
	0	0	735	0.033	0.001	2840	0.052	0.003
	0	0	966	0.043	0.002	3760	0.068	0.005
	0	0	920	0.041	0.002	2250	0.041	0.002
	0	0				940	0.017	0.000
	0	0				4396	0.080	0.006
8193	1	0.120	22540	1	0.079	54971	1	0.086
	2-survey villages	0.056			0.037			0.040
	4-villages-(FB)	0.028						
	10-villages-(YLB+BG)				0.007			0.008

Table 43 Suggestion provided by the producers

Major heads	Major suggestions	Frequency
Exporters role	Exporters should increase export of vegetable in peak period	131 (58.5)
	Exporters should organize contract farmers	87 (38.8)
	Linkage between producer, middleman and exporter should be developed	17 (7.6)
Government initiative	Government should provide price support	71 (31.7)
	Government should setup multipurpose cold storage	27 (12.1)
	Seed company should provide quality seed	60 (26.8)
Inputs and credit	Government should provide credit to farmer without mortgage	49 (21.9)
	Price for pesticide and fertilizer should be reduced and quality needs to be maintained	41 (18.3)
	Government should take necessary steps to produce inputs at low price	21 (9.4)
Marketing	Marketing channel should be developed	24 (10.7)
	Buyer should pay good price	19 (8.5)
	Middleman should supply cartoon to keep the freshness	9 (4.0)
	Public awareness should be developed to eat non-traditional vegetables like French bean to increase local consumption	17 (7.6)
Producer promotion	Cooperative society should be organized so producers could sell without middlemen	21 (9.4)
	Producer should be trained up about production technology	23 (10.3)

Appendix II
Middlemen level

Table 1 Marketing cost of all vegetables by the middlemen (TK per MT)

Description of The Cost Items	Name of the survey areas					
	Dhaka	Rangpur	Comilla	Tangail	Narshingdi	All
Transportation from the purchase point to the exporter's godown	1274	1100	1450	889	1100	1163
Grading Charge	98	50	283	189	150	154
Packaging materials	71	50	350	266	230	193
Carton/Packet	38	210	0	78	340	133
Labour cost for loading and unloading	221	100	125	278	300	205
Market tolls	82	60	83	139	150	103
Packaging charge	26	20	0	33	90	34
Wastage / weight loss	486	140	667	600	370	453
Shop rent	93	110	167	6	0	75
Tips and donation	19	0	0	11	0	6
Bagging	0	0	100	11	0	22
Personal expenses	184	90	250	178	90	158
Entertainment	17	50	25	11	140	49
Salary and wages	0	0	0	167	0	33
Miscellaneous	29	170	0	0	388	117
Total Marketing Cost	2638	2150	3500	2854	3348	2898

Table 2 Average weighted purchase price of vegetables by the middlemen at different markets (TK per MT)

Name of the vegetables	Name of the survey markets				
	Dhaka	Rangpur	Comilla	Tangail	Narshingdi
Sweet gourd	7800	2000	9000	3333	8200
Palwal	10000	5600	-	6556	-
Cucumber	8889	5000	10167	4889	9200
Radish	7333	3600	-	3111	5000
Bitter gourd	12583	8300	14667	12000	13600
Potato	9750	5800	10000	11200	-
Chilly	15625	-	15000	10400	20400
Yard long bean	11000	5000	13000	8000	12000
Lady's finger	10000	-	17500	7000	5333
Amaranth	8000	-	-	-	-
Wax gourd	15000	-	-	-	-
Papaya	7000	-	-	-	-
Taro	3500	-	-	-	-
French bean	10000	-	-	16000	-
Average weighted purchase price	10647	5194	13473	6243	11924

Table 3 Average weighted sale price of vegetables to the exporters by the middlemen from different markets (TK per MT)

Name of the vegetables	Name of the survey markets				
	Dhaka	Rangpur	Comilla	Tangail	Narshingdi
Sweet gourd	13000	5750	7000	6444	16000
Palwal	14000	9600	-	11000	-
Cucumber	13250	9000	15833	9000	17750
Radish	12000	7400	-	10000	-
Bitter gourd	17364	13400	25000	18400	21750
Potato	14000	9700	16000	15600	-
Chilly	21429	-	22000	14000	25500
Yard long bean	15000	9500	18667	14800	16000
Lady's finger	14750	-	23500	17000	12500
Amaranth	13000	-	-	-	-
Wax gourd	18000	-	-	-	-
Papaya	10000	-	-	-	-
Taro	6000	-	-	-	-
French bean	-	-	-	-	-
Average weighted sale price	15281	9366	20257	10616	18502

Table 4 Average weighted sale price of vegetables to the wholesalers by the middlemen from different markets (TK per MT)

Name of the vegetables	Name of the survey areas				
	Dhaka	Rangpur	Comilla	Tangail	Narshingdi
Sweet gourd	11667	4750	14500	-	14400
Palwal	12500	8600	-	-	-
Cucumber	11833	8000	13800	-	14600
Radish	9000	6400	-	6938	10000
Bitter gourd	16000	12400	18167	-	18600
Potato	12250	8700	15000	-	-
Chilly	21400	-	21000	-	21800
Yard long bean	14500	8500	17500	17000	14500
Lady's finger	14500	-	22000	9500	10000
Amaranth	-	-	-	-	-
Wax gourd	-	-	-	-	-
Papaya	-	-	-	-	-
Taro	-	-	-	-	-
French bean	15000	-	-	27000	-
Average weighted sale price	14009	8366	17740	10959	16177

Table 5 Major suggestions provided by the middlemen

Major heads	Major suggestions	All
Government initiatives	Government should provide credit to the middlemen without mortgage	33 (71.7)
	Government or private sector should construct multipurpose cold storage in the production areas	28 (60.9)
	Middlemen should be provided trade license	18 (39.1)
	Government or private sector should arrange refrigerator container refervan at the producing area	15 (32.6)
	Transportation should be developed	5 (10.9)
	Government should make vegetable production plan so that different items of vegetable could be available round the year	1 (2.2)
Exporters' payment	Exporter should pay the middlemen regularly	21 (45.7)
	Middlemen should take legal action against the defaulter exporters	4 (8.7)
	Agreement should be made between exporter and middlemen	2 (4.3)
	Exporter should maintain transparency in business	1 (2.2)
Marketing	Linkage between exporter and middlemen and producer needs to be ensured at the field level	8 (17.4)
	Middlemen should make linkage with the producer at the producing area so that the farmer could obtain real price directly from the middlemen	6 (13.0)
	Government should fix up the minimum price of vegetable in peak harvesting period as paddy, wheat	3 (6.5)
	Organizing middlemen for export quality vegetable	1 (2.2)

Appendix III

Exporter level

Table 1 Year wise production status of 24 leading vegetable producing countries of the world for last four years (MT)

Country	2000	Country	2001	Country	2002	Country	2003	Rank
CHNA	121553141	CHNA	128973479	CHNA	136029943	CHNA	138000510	1
IND	28630000	IND	35340000	IND	27180000	IND	34740000	2
VTM	5632100	VTM	6277898	VTM	6235315	VTM	6326274	3
PHLP	4100000	PHLP	4200000	PHLP	4300000	PHLP	4300000	4
NGRA	3945000	NGRA	4000000	NGRA	4276000	NGRA	4300000	5
KORA	3679000	KORA	3818000	KORA	3493000	KORA	3642000	6
RSA	3296000	RSA	3276000	RSA	3045000	RSA	3426000	7
FRNC	3000000	MNMR	2850000	FRNC	3000000	FRNC	3000000	8
JPN	2900000	JPN	2800000	MNMR	2900000	MNMR	3000000	9
MNMR	2800000	FRNC	2500000	JPN	2800000	JPN	2700000	10
ITLY	2400000	ITLY	2400000	DKORA	2425000	DKORA	2425000	11
DKORA	2400000	DKORA	2400000	ITLY	2400000	ITLY	2400000	12
BRZL	2200000	BRZL	2200000	BRZL	2250000	BRZL	2250000	13
IRN	1739000	IRN	1685000	NPL	1736418	NPL	1889667	14
NPL	1489660	NPL	1648500	IRN	1700000	IRN	1750000	15
GMNY	1484000	GMNY	1370000	POLN	1454000	POLN	1504000	16
POLN	1300000	POLN	1305000	GMNY	1350000	GMNY	1200000	17
PAK	1200000	PAK	1200000	PAK	1200000	PAK	1200000	18
USA	1054000	USA	1012580	THAI	977000	THAI	998000	19
THAI	970000	THAI	970000	TANZ	950000	TANZ	950000	20
TANZ	940000	TANZ	940000	BNGDS	920000	BNGDS	907000	21
BNGDS	911000	BNGDS	911000	USA	849890	USA	873430	22
ARGT	640000	ARGT	640000	LAOS	762540	LAOS	662678	23
LAOS	636000	LAOS	630649	ARGT	645000	ARGT	648000	24
Tot. 24	198898901		213348106		212879106		223092559	
Share of world	91..31		91..36		91..1514648		91..153284	
World	217818590		233521311		233544361		244744401	

Source: FAO database, Internet version, 2005

Table 2 Status of production share of ten leading countries of world fresh vegetable production for six years

Country	1998	Country	1999	Country	2000	Rank
China	52.57	China	52.40	China	55.80	1
India	12.37	India	13.95	India	13.14	2
Viet Nam	2.68	Viet Nam	2.78	Viet Nam	2.59	3
Poland	2.13	Philippines	2.07	Philippines	1.88	4
Pakistan	2.09	Nigeria	2.00	Nigeria	1.81	5
Laos	1.91	RKorea	1.73	RKorea	1.69	6
Russia	1.68	Russia	1.70	Russia	1.51	7
France	1.64	Japan	1.56	France	1.38	8
Japan	1.63	France	1.55	Japan	1.33	9
Nepal	1.48	Myanmar	1.42	Myanmar	1.29	10
Bangla (22)	0.37	Bangla (22)	0.46	Bangla (22)	0.42	
	79.91		80.17	Share of world	82.42	
Country	2001	Country	2002	Country	2003	Rank
China	55.23	China	58.25	China	56.39	1
India	15.13	India	11.64	India	14.19	2
Viet Nam	2.69	Viet Nam	2.67	Viet Nam	2.58	3
Philippines	1.80	Philippines	1.84	Nigeria	1.76	4
Nigeria	1.71	Nigeria	1.83	Philippines	1.76	5
RKorea	1.63	RKorea	1.50	RKorea	1.49	6
Russia	1.40	Russia	1.30	Russia	1.40	7
Myanmar	1.22	France	1.28	France	1.23	8
Japan	1.20	Myanmar	1.24	Myanmar	1.23	9
France	1.07	Japan	1.20	Japan	1.10	10
Bangla (22)	0.39	Bangla (21)	0.39	Bangla (21)	0.37	
	83.09		82.75		83.12	

Source: FAO database, Internet version, 2005

Table 3 Fresh vegetable export status of 33 - leading countries for last six years (MT)

Country	1998	1999	2000	2001	2002	2003	Rank in 2003
MEXCO	47009	69600	55922	71029	100000	439239	1
CHNA	536840	424397	370498	363842	445417	410252	2
USA	215472	216941	223565	222824	217356	235584	3
ITL	147743	146462	151718	172604	170855	163280	4
NTHR	100650	121483	103432	83512	94973	131307	5
SPN	70700	68745	72305	131607	78431	88233	6
FRNC	43634	55463	61916	54773	59326	57743	7
MALY	43937	47996	50727	53496	50330	52271	8
BELGM	0	0	38149	37504	43377	41533	9
CSTR	24487	26303	28865	31282	34026	40446	10
IND	39010	40523	55686	94518	67730	34789	11
THAI	24254	26427	27198	33950	36978	33713	12
PAK	864	1930	6115	8888	5016	32127	13
KEN	14769	21583	25238	25446	12580	30233	14
CAND	12835	14020	18851	18524	22575	24887	15
BRZL	15416	26325	31897	44715	15785	22915	16
ISRL	12000	18961	13718	14600	15702	20711	17
NZLD	19364	24429	32339	28393	23516	20414	18
UZBK	3526	3369	3617	8900	9787	17478	19
GMNY	8924	9200	8216	14775	14409	16128	20
UK	5867	9020	9065	8306	9662	14380	21
JORD	6941	8748	9946	7282	7364	13778	22
GUETM	7250	12611	17456	18460	15496	11197	23
HNGR	8679	9408	8254	8796	8075	10112	24
ASTRL	719	5550	4406	3378	4855	9971	25
INDNS	14746	11493	8577	12689	11372	7625	26
IRN	9867	14609	8135	11317	7990	7496	27
MRCO	4027	6330	6815	3730	4097	7249	28
BANG	5200	4000	7000	9000	10484	6779	29
SAFR	2859	3318	3337	4336	4940	6654	30
CYPR	4960	5312	5506	6243	6000	6091	31
ASTR	3268	4889	4321	5170	5707	5904	32
Total	1457815	1461444	1474790	1615890	1616213	2022522	
% to world	84.12	88.91	89.64	90.21	91.17	93.64	
World	1733054	1643793	1645241	1791341	1772825	2159831	

Source: FAO database, Internet version, 2005, Country having annual export of 5000MT or above in 2003 is included.

Table 4 Status of export share of ten leading countries of world fresh vegetable export for last nine years

Exporting country	1995	Rank	Country	1996	Rank	Country	1997	Rank
China	21.23	1	China	28.21	1	China	28.60	1
USA	12.77	2	USA	13.79	2	USA	12.24	2
Italy	8.70	3	Italy	9.88	3	Italy	9.15	3
Mexico	8.30	4	Nether	7.88	4	Nether	5.91	4
Nether	7.02	5	Spain	4.73	5	Malay	4.22	5
Iran	4.08	6	Mexico	2.76	6	Spain	4.02	6
Spain	4.00	7	France	2.52	7	India	2.90	7
Malay	3.92	8	Costa	1.55	8	Mexico	2.87	8
France	2.35	9	Malay	1.43	9	France	2.26	9
Costa	1.54	10	India	1.12	10	Syria	1.41	10
Bangla	0.20	28	Bangla	0.23	26	Bangla	0.20	28
	73.91			73.87			73.58	
Country	1998	Rank	Country	1999	Rank	Country	2000	Rank
China	30.98	1	China	25.82	1	China	22.52	1
USA	12.43	2	USA	13.20	2	USA	13.59	2
Italy	8.53	3	Italy	8.91	3	Italy	9.22	3
Nether	5.81	4	Nether	7.39	4	Nether	6.29	4
Spain	4.08	5	Mexico	4.23	5	Spain	4.39	5
Mexico	2.71	6	Spain	4.18	6	France	3.76	6
Malay	2.54	7	France	3.37	7	Mexico	3.40	7
France	2.52	8	Malay	2.92	8	India	3.38	8
India	2.25	9	India	2.47	9	Malay	3.08	9
Syria	1.81	10	Thai	1.61	10	Belg	2.32	10
Bangla	0.30	26	Bangla	0.24	30	Bangla	0.43	26
Share to world export	73.65			74.10			71.96	
Country	2001	Rank	Country	2002	Rank	Country	2003	Rank
China	20.31	1	China	25.12	1	Mexico	20.34	1
USA	12.44	2	USA	12.26	2	China	18.99	2
Italy	9.64	3	Italy	9.64	3	USA	10.91	3
Spain	7.35	4	Mexico	5.64	4	Italy	7.56	4
India	5.28	5	Nether	5.36	5	Nether	6.08	5
Nether	4.66	6	Spain	4.42	6	Spain	4.09	6
Mexico	3.97	7	India	3.82	7	France	2.67	7
France	3.06	8	France	3.35	8	Malay	2.42	8
Malay	2.99	9	Malay	2.84	9	Belg	1.92	9
Brazil	2.50	10	Belg	2.45	10	Costa	1.87	10
Bangla	0.50	23	Bangla	0.59	21	Bangla	0.31	29
Share of world export	72.18			74.90			76.85	

Source: FAO database, Internet version, 2005

Table 5 Brief name of the leading vegetable producing, exporting and importing countries used in different tables

Name of the country	Brief name of the country	Name of the country	Brief name of the country
China	CHNA	Poland	POLN
India	IND	Pakistan	PAK
Viet Nam	VTM	USA	USA
Philippines	PHLP	Thailand	THAI
Nigeria	NGRA	Tanzania	TANZ
Republic of Korea	KORA	Bangladesh	BANG
Russian Federation	RSA	Argentina	ARGT
Japan	JPN	Indonesia	INDNS
France	FRNC	Laos	LAOS
Myanmar	MNMR	Italy	ITL
Italy	ITLY	Mexico	MXCO
Brazil	BRZL	Nether	NTHR
Dem People's Rep of Korea	DKORA	Iran, Islamic Rep of	IRN
Iran, Islamic Rep of	IRN	Malaysia	MALY
Germany	GMNY	Spain	SPN
Nepal	NPL	France	FRNC
Russian Federation	RSA	Spain	SPN
Costa Rica	CSTR	Malaysia	MALY
Belgium	BLGM	Nigeria	NGRA
Syria	SYRA	Cyprus	CYPR
Kenya	KEN	Israel	ISRL
Canada	CAND	New Zealand	NZLD
Uzbekistan	UZBK	Jordan	JORD
Guatemala	GUETM	Hungary	HNGR
Australia	ASTRL	Austria	ASTR
Morocco	MRCO	South Africa	SAFR

Table 6 Export status of Bangladeshi vegetables by ten leading importing countries for last eight years ('000' US$)

1996-97			1997-98			1998-99			1999-00			
Country	US$	share	Country	US$	share	Country	US$	share	Country	US$	share	Rank
UK	8349	33.52	UK	8879	27.35	UK	6041	34.17	UK	3657	26.12	1
KSA	4742	19.04	KSA	7068	21.77	KSA	3139	17.76	KSA	2728	19.48	2
UAE	2917	11.71	UAE	3907	12.03	Bahrain	2715	15.36	UAE	1785	12.75	3
Kuwait	2613	10.49	Bahrain	3667	11.29	Kuwait	1860	10.52	Kuwait	1748	12.48	4
Bahrain	2196	8.82	Kuwait	3351	10.32	UAE	1378	7.79	Qatar	1401	10.01	5
Qatar	1885	7.57	Qatar	2773	8.54	Qatar	970	5.49	Bahrain	1118	7.99	6
Oman	875	3.51	Oman	970	2.99	Oman	378	2.14	Oman	508	3.63	7
Italy	148	0.59	Italy	111	0.34	Italy	230	1.30	USA	329	2.35	8
USA	130	0.52	USA	87	0.27	USA	97	0.55	Singapore	168	1.20	9
Singapore	105	0.42	Singapore	23	0.07	Singapore	83	0.47	Italy	104	0.74	10
Sub total	23960	96.19		30836	95		16891	95.54	Sub total	13546	96.75	
Grand total	24909	100		32467	100		17679	100	Grand total	14001	100	

Table 6 Continued

	2000-01			2001-02			2002-03			2003-04		
Country	US$	share	Country	US$	share	Country	US$	share	Country	US$	share	Rank
UK	3228	25.24	UK	3733	24.38	UK	3728	28.16	UK	9505	38.48	1
KSA	2433	19.03	KSA	3205	20.93	KSA	3030	22.89	KSA	5028	20.36	2
UAE	2065	16.15	UAE	2706	17.67	UAE	1846	13.94	Kuwait	2195	8.89	3
Kuwait	1859	14.54	Kuwait	1642	10.72	Kuwait	1681	12.70	UAE	2182	8.83	4
Qatar	793	6.20	Qatar	1036	6.77	Bahrain	763	5.76	Qatar	2058	8.33	5
Oman	731	5.72	Oman	924	6.03	Oman	675	5.10	Bahrain	1565	6.34	6
Bahrain	602	4.71	Bahrain	832	5.43	Singapore	209	1.58	Oman	636	2.57	7
Singapore	238	1.86	Singapore	243	1.59	Italy	113	0.85	Italy	389	1.57	8
Italy	158	1.24	Italy	135	0.88	USA	17	0.13	USA	300	1.21	9
USA	29	0.23	USA	44	0.29	Qatar	0	0.00	Singapore	233	0.94	10
Sub total	12136	94.91		14500	94.69		12062	91.10		24091	97.53	
Grand total	12787	100		15313	100		13240	100		24700	100	

Source: Different issues of annual reports of EPB

Table 7 Production and export status of fresh vegetable of Bangladesh in respect of the world (MT)

Year	World production (FAO)	Bangladesh production	Share to world producti on (FAO)	Bangladesh production (BBS)	Share to World producti on (BBS)	World export (MT)	Bangladesh export (FAO)	Share to world export (FAO)	Bangladesh export (EPB)	Share to world export (EPB)
1995	168728688	640000	0.38	1204119	0.71	1585225	3200	0.20	8270	0.52
1996	174684662	661000	0.38	1243919	0.71	1503146	3500	0.23	12931.1	0.86
1997	175684615	679000	0.39	1288730	0.73	1684074	3400	0.20	20449	1.21
1998	182741431	682000	0.37	1305615	0.71	1733054	5200	0.30	23597.4	1.36
1999	193768653	894000	0.46	1527015	0.79	1643793	4000	0.24	13106	0.80
2000	217818590	911000	0.42	1560175	0.72	1645241	7000	0.43	10270.3	0.62
2001	233521311	911000	0.39	1553000	0.67	1791341	9000	0.50	9509.29	0.53
2002	233544361	920000	0.39	1567000	0.67	1772825	10484	0.59	12751.4	0.72
2003	244744401	907000	0.37	1594000	0.65	2159831	6779	0.31	9792	0.45

Source: FAO database, internet version, Different issues of BBS, EPB.
Note: Data of FAO, BBS and EPB for Bangladesh is presented due to variation.

Table 8 Export performance of major primary agro-products and vegetables (value in million)

Commodity	2004-2005 US$	% share to total export	% of annual change	2003-2004 US$	% share to total export	% of annual change	2002-2003 US$	% share to total export	% of annual change	2001-2002 US$	% share to total export	% of annual change	2000-2001 US$	% share to total export
Frozen fish	54.92	0.63	100.51	27.39	0.36	10.58	24.77	0.38	3.51	23.93	0.40	77.56	13.48	0.21
Frozen shrimps	365.82	4.23	0.81	362.87	4.77	22.16	297.04	4.54	17.79	252.18	4.21	-27.90	349.75	5.41
Fish (dried and salted)	7.84	0.09	22.88	6.38	0.08	41.36	4.52	0.07	45.34	3.11	0.05	-43.65	5.52	0.09
Agricultural products	67.81	0.78	64.94	41.11	0.54	61.53	25.45	0.39	12.96	22.53	0.38	22.69	18.36	0.28
Vegetables	**43.33**	**0.50**	**75.43**	**24.70**	**0.32**	**86.56**	**13.24**	**0.20**	**-13.52**	**15.31**	**0.26**	**19.73**	**12.79**	**0.19**
Raw jute	96.19	1.11	17.30	79.70	1.50	-3.36	82.46	1.26	34.89	61.13	1.02	-9.01	67.18	1.04
Major primary agro-products	**635.91**	**7.35**	**17.29**	**542.15**	**7.13**	**21.16**	**447.48**	**6.83**	**18.32**	**378.19**	**6.32**	**-23.50**	**467.08**	**7.22**
Knitwear (A)	2819.47	32.58	12.78	2148.02	28.25	29.88	1653.83	25.26	13.34	1459.24	24.38	-2.48	1496.36	23.14
Woven garments (B)	3598.20	41.58	-6.54	3538.07	46.54	8.59	3258.27	49.76	4.28	3124.56	52.20	-7.12	3364.20	52.02
RMG (A+B)	6417.67	74.15	12.87	5686.09	74.79	15.76	4912.10	75.01	7.16	4583.80	76.58	-9.60	4860.56	75.16
Total export	8654.52	100	1.04	7602.99	100	16.10	6548.44	100	9.39	5986.09	100	-7.44	6467.30	100

Source: Annual reports and statistical section of EPB, Ready made garment (RMG) includes knitwear and woven garments
Agricultural products mainly include vegetables, potato, rice, cotton, tobacco, raw cotton, spices (By EPB)
Major primary agro-products include agricultural products, frozen fish and shrimp, dried and salted fish, raw jute (By researcher)

Table 9 Export share to the annual production of Bangladeshi fresh vegetable for last eight years

Year	Production of fresh vegetable (MT)	Data from EPB (net weight) (MT)	Export share to production (EPB)	Vegetable carried by Biman (MT)	Vegetable Carried By foreign airlines (MT)	Data from Biman (gross weight) (MT)	Variation in export volume ofBiman with EPB (%)
1997-98	1305615	23597	1.81	14029	3017	17406	-26
1998-99	1527015	13106	0.86	13675	3602	17277	32
1999-00	1560175	10270	0.66	16786	4658	21444	109
2000-01	1553000	9509	0.61	16985	4283	21268	124
2001-02	1567000	12751	0.81	18816	4806	23622	85
2002-03	1594000	9792	0.61	18470	5996	24466	150
2003-04	1680000	16144	0.96	18529	8217	26746	66
2004-05	NA	29100	NA	19248	8440	27688	-5

Source: Different issues of BBS, Statistics section, Export Promotion Bureau (EPB) and GM, Cargo office, ZIA, Bangladesh Biman.

Table 10 Marketing Cost for Exporter considering air freight rate of Bangladesh Biman (TK per MT)

Cost items	Name of the export market				
	UK	Italy	KSA	UAE	All
Transportation from production point to exporters go down	485 (0.46)	250 (0.25)	323 (0.43)	1007 (1.74)	516 (0.61)
Grading and packaging	685 (0.65)	613 (0.60)	745 (1.00)	540 (0.93)	646 (0.76)
Packaging materials	322 (0.31)	393 (0.39)	343 (0.46)	353 (0.61)	353 (0.42)
Cartoon	4100 (3.91)	1425 (1.40)	6336 (8.52)	2033 (3.51)	3474 (4.10)
Transportation from go down point to airport	1081 (1.03)	1000 (0.99)	1350 (1.82)	767 (1.32)	1049 (1.24)
Air freight	90730 (86.55)	90090 (88.76)	58559 (78.78)	45689 (78.78)	71267 (84.18)
Airway bill	122 (0.12)	122 (0.12)	122 (0.16)	122 (0.21)	122 (0.14)
Terminal and handling	1170 (1.12)	1170 (1.15)	1170 (1.57)	1170 (2.02)	1170 (1.38)
General system of preference (GSP) certificate	350 (0.33)	350 (0.34)	255 (0.34)	210 (0.36)	291 (0.34)
Bank service	225 (0.21)	250 (0.25)	273 (0.37)	120 (0.21)	217 (0.26)
Export pro form (EXP)	208 (0.20)	200 (0.20)	255 (0.34)	79 (0.14)	185 (0.22)
Labour	660 (0.63)	575 (0.57)	568 (0.76)	450 (0.78)	563 (0.67)
Clearing and forwarding (C& F)	1217 (1.16)	1075 (1.06)	1223 (1.65)	922 (1.59)	1109 (1.31)
Salary and wages	1038 (0.99)	1425 (1.40)	809 (1.09)	1257 (2.17)	1132 (1.34)
Office rent	721 (0.69)	1000 (0.99)	422 (0.57)	1095 (1.89)	809 (0.96)
Telephone, fax	270 (0.26)	213 (0.21)	206 (0.28)	460 (0.79)	287 (0.34)
Entertainment	100 (0.10)	75 (0.07)	82 (0.11)	149 (0.26)	101 (0.12)
Cold storage	38 (0.04)	0 (0.00)	0 (0.00)	67 (0.11)	26 (0.03)
Phytosanitary	50 (0.05)	50 (0.050	50 (0.07)	50 (0.09)	50 (0.06)
Computer scanning	1170 (1.12)	1170 (1.15)	1170 (1.57)	1170 (2.02)	1170 (1.380
Any other cost	19 (0.02)	0 (0.00)	45 (0.06)	87 (0.15)	38 (0.04)
Miscellaneous	67 (0.06)	50 (0.05)	23 (0.03)	199 (0.34)	85 (0.10)
Total	104828	101494	74328	57993	84661

Figures in parentheses indicate the percentage of cost items over the total cost

Table 11 Marketing Cost for Exporter considering 10% enhanced air freight rate of Bangladesh Biman (TK per MT)

Cost items	Name of the export market UK	Italy	KSA	UAE	All
Transportation from production point to exporters go down	485 (0.43)	250 (0.23)	323 (0.40)	1007 (1.61)	516 (0.56)
Grading and packaging	685 (0.60)	613 (0.55)	745 (0.93)	540 (0.86)	646 (0.70)
Packaging materials	322 (0.28)	393 (0.36)	343 (0.430	353 (0.56)	353 (0.38)
Cartoon	4100 (3.60)	1425 (1.29)	6336 (7.90)	2033 (3.25)	3474 (3.78)
Transportation from go down point to airport	1081 (0.95)	1000 (0.90)	1350 (1.68)	767 (1.23)	1049 (1.14)
Air freight	99803 (87.62)	99099 (89.68)	64414 (80.33)	50257 (80.33)	78393 (85.41)
Airway bill	122 (0.11)	122 (0.11)	122 (0.15)	122 (0.19)	122 (0.13)
Terminal and handling	1170 (1.03)	1170 (1.06)	1170 (1.46)	1170 (1.87)	1170 (1.27)
General system of preference (GSP) certificate	350 (0.31)	350 (0.32)	255 (0.32)	210 (0.34)	291 (0.32)
Bank service	225 (0.20)	250 (0.23)	273 (0.34)	120 (0.19)	217 (0.24)
Export pro form (EXP)	208 (0.18)	200 (0.18)	255 (0.32)	79 (0.13)	185 (0.20)
Labour	660 (0.58)	575 (0.52)	568 (0.71)	450 (0.72)	563 (0.61)
Clearing and forwarding (C and F)	1217 (1.07)	1075 (0.97)	1223 (1.52)	922 (1.47)	1109 (1.21)
Salary and wages	1038 (0.91)	1425 (1.29)	809 (1.01)	1257 (2.01)	1132 (1.23)
Office rent	721 (0.63)	1000 (0.90)	422 (0.53)	1095 (1.75)	809 (0.88)
Telephone, fax	270 (0.24)	213 (0.19)	206 (0.26)	460 (0.74)	287 (0.31)
Entertainment	100 (0.09)	75 (0.07)	82 (0.10)	149 (0.24)	101 (0.11)
Cold storage	38 (0.03)	0 (0.00)	0 (0.00)	67 (0.11)	26 (0.03)
Phytosanitary	50 (0.04)	50 (0.05)	50 (0.06)	50 (0.08)	50 (0.05)
Computer scanning	1170 (1.03)	1170 (1.06)	1170 (1.46)	1170 (1.87)	1170 (1.27)
Any other cost	19 (0.02)	0 (0.00)	45 (0.06)	87 (0.14)	38 (0.04)
Miscellaneous	67 (0.06)	50 (0.05)	23 (0.03)	199 (0.32)	85 (0.09)
Total	113901	110503	80184	62562	91787

Figures in parentheses indicate the percentage of cost items over the total cost

Table 12 Marketing Cost for Exporter considering 10% reduced air freight rate of Bangladesh Biman (TK per MT)

Cost items	Name of the export market UK	Italy	KSA	UAE	All
Transportation from production point to exporters go down	485 (0.51)	250 (0.27)	323 (0.47)	1007 (1.88)	516 (0.67)
Grading and packaging	685 (0.71)	613 (0.66)	745 (1.09)	540 (1.01)	646 (0.83)
Packaging materials	322 (0.34)	393 (0.42)	343 (0.50)	353 (0.66)	353 (0.45)
Cartoon	4100 (4.28)	1425 (1.54)	6336 (9.25)	2033 (3.81)	3474 (4.48)
Transportation from go down point to airport	1081 (1.13)	1000 (1.08)	1350 (1.97)	767 (1.44)	1049 (1.35)
Air freight	81657 (85.28)	81081 (87.67)	52703 (76.97)	41120 (76.97)	64140 (82.73)
Airway bill	122 (0.13)	122 (0.13)	122 (0.18)	122 (0.23)	122 (0.16)
Terminal and handling	1170 (1.22)	1170 (1.27)	1170 (1.71)	1170 (2.19)	1170 (1.51)
General system of preference (GSP) certificate	350 (0.37)	350 (0.38)	255 (0.37)	210 (0.39)	291 (0.38)
Bank service	225 (0.23)	250 (0.27)	273 (0.40)	120 (0.22)	217 (0.28)
Export pro form (EXP)	208 (0.22)	200 (0.22)	255 (0.37)	79 (0.15)	185 (0.24)
Labour	660 (0.69)	575 (0.62)	568 (0.83)	450 (0.84)	563 (0.73)
Clearing and forwarding (C and F)	1217 (1.27)	1075 (1.16)	1223 (1.79)	922 (1.73)	1109 (1.43)
Salary and wages	1038 (1.08)	1425 (1.54)	809 (1.18)	1257 (2.35)	1132 (1.46)
Office rent	721 (0.75)	1000 (1.08)	422 (0.62)	1095 (2.05)	809 (1.04)
Telephone, fax	270 (0.28)	213 (0.23)	206 (0.30)	460 (0.86)	287 (0.37)
Entertainment	100 (0.10)	75 (0.08)	82 (0.12)	149 (0.28)	101 (0.13)
Cold storage	38 (0.04)	0 (0.00)	0 (0.00)	67 (0.12)	26 (0.03)
Phytosanitary	50 (0.05)	50 (0.05)	50 (0.07)	50 (0.09)	50 (0.06)
Computer scanning	1170 (1.22)	1170 (1.27)	1170 (1.71)	1170 (2.19)	1170 (1.51)
Any other cost	19 (0.02)	0 (0.00)	45 (0.07)	87 (0.16)	38 (0.05)
Miscellaneous	67 (0.07)	50 (0.05)	23 (0.03)	199 (0.37)	85 (0.11)
Total	95755	92485	68472	53424	77534

Figures in parentheses indicate the percentage of cost items over the total cost

Table 13 Average weighted purchase price of vegetables for exporters (TK/MT)

Name of the vegetables	Volume	Average purchase price (TK /KG)	Weighted average purchase price (TK/KG)	Weighted average purchase price (TK/MT)
Sweet gourd	5280	12.41	18.42	18416
Palwal	21640	17.5		
Cucumber	24740	17.44		
Radish	6820	13.14		
Bitter gourd	26840	20.19		
Potato	20205	12.39		
Chilli	18930	26.23		
Lady's finger	16240	17.77		
Yard long bean	29920	21.09		
French bean	16463	16.5		

Table 14 Export market wise average weighted sale price of vegetables for exporters (TK/MT)

Name of the vegetables	Volume	Market wise average sale price				Market wise average weighted sale price			
		UK(£)	Italy (Euro)	KSA (US$)	UAE (US$)	UK	Italy	KSA	UAE
Sweet gourd	5280	1.43	2.05	1.69	1.25	1.43	2.11	1.68	1.35
Palwal	21640	1.41	2.05	1.51	1.28	(141717)	(143610)	(98053)	(78664)
Cucumber	24740	1.41	2.05	1.69	1.33				
Radish	6820	1.39	2	1.7	1.3				
Bitter gourd	26840	1.45	2.08	1.63	1.39				
Potato	20205	1.45	2	1.7	1.3				
Chilli	18930	1.44	2	1.86	1.33				
Lady's finger	16240	1.42	2	1.7	1.33				
Yard long bean	29920	1.44	2.08	1.83	1.41				
French bean	16463	1.41	-	1.41	1.41				

Figures in parentheses indicate sale price (TK / MT)

Table 15 Profitability for BRAC for sample and major vegetable (TK/MT)

	FB		YLB		BG	
Description	UK	UAE	UK	UAE	UK	UAE
A. Sale price	148800	81816	148800	81816	148800	81816
B. Purchase price	14000	14000	20000	20000	20000	20000
C. Gross marketing margin (A-B)	134800	67816	128800	61816	128800	61816
D. Marketing cost	120192	75150	120192	75150	120192	75150
E. Net marketing margin (C-D)	14608	-7334	8608	-13334	8608	-13334
F. Gross marketing ratio (C/A)	0.91	0.83	0.87	0.76	0.87	0.76
G. Net marketing ratio (E/A)	0.10	-0.09	0.06	-0.16	0.06	-0.16
H. Capital invested (B+D)	134192	89150	140192	95150	140192	95150
I. Net marketing margin (C-D)	14608	-7334	8608	-13334	8608	-13334
J. Return on investment (F/E%)	10.9	-8.2	6.1	-14.0	6.1	-14.0

Table 16 Major suggestions provided by the exporters

Major heads	Major suggestions	Frequency
Air cargo space	Government should provide air cargo plain specialized for perishables such as vegetables	30 (75.0)
	Foreign air crafts should cover 20-30% of vegetable shipment, government should take necessary initiatives	16 (40.0)
	Government should contact chartered Biman to carry vegetables for Middle East, Europe and other markets	10 (25.0)
	Airport facilities should be developed for shipment	1 (2.5)
	Government can reduce the airfreight of Bangladesh Biman for vegetables	1 (2.5)
Packaging and cool chain	Government (BADC) owned cold storage at airport area should be converted in to multipurpose cold storage maintaining different temperatures for different commodities	20 (50.0)
	Government can arrange packaging house at the airport and provide agricultural loan to the exporters to install cold storage as well packaging house in the production areas	15 (37.5)
	Government should provide cool chain system	2 (5.0)
Finance	To Provide credit / incentives to the exporter to maintain cool chain management for quality control	18 (45.0)
	To Provide financial and technical support from the government for vegetable exporters needed for competitive export market	2 (5.0)
	Government should fix-up minimum price of vegetable in harvesting time	5 (12.5)
	To Provide required agricultural credit to the vegetable producers for produce exportable item	1 (2.5)
Price / Market promotion	Market intelligence unit should developed by the government so that the exporter could collect information about demand of international market	4 (10.0)
	Contract between exporter and importer should be made once a year for constant vegetable supply	2 (5.0)
	Buyers of the super markets should be attracted through international export fair	1 (2.5)
	Government should arrange facility so that exporter get visa to visit the importing countries	1 (2.5)
	Government organization should provide the buyers list	1 (2.5)
	Government should make a body to fix vegetables price in the harvesting time	1 (2.5)
Research	Government research institutes should release improved variety of vegetables as per demand of export market	1 (2.5)
Export village	To establish vegetable export villages with cold storage facilities within 30-40km of Dhaka airport	3 (7.5)

Appendix IV Importer level

Table 1 Share of 24- leading importing countries of the world import of fresh vegetable for last five years

Country	1999	Rank	Country	2000	Rank	Country	2001	Rank	Country	2002	Rank	Country	2003	Rank
CHN, HNKG	14.20	1	HNKG	18.36	1	HNKG	18.39	1	HNKG	19.37	1	HNKG	19.03	1
Canada	9.12	2	Canada	7.93	2	France	8.34	2	Canada	7.99	2	France	7.97	2
France	8.94	3	France	7.84	3	Canada	7.52	3	France	7.67	3	UK	7.84	3
Germany	8.71	4	Germany	6.87	4	UK	7.07	4	UK	7.07	4	Canada	7.61	4
USA	6.49	5	UK	6.42	5	Germany	6.93	5	Germany	6.57	5	Germany	6.12	5
Japan	6.13	6	Japan	6.12	6	USA	5.85	6	USA	6.39	6	Japan	5.93	6
UK	6.03	7	USA	5.73	7	Japan	5.78	7	Japan	5.29	7	USA	5.47	7
Nether	2.54	8	Russia	3.25	8	Argen	2.6	8	UAE	2.24	8	Russia	2.58	8
China	2.13	9	Argen	1.83	9	China	1.77	9	Malaysia	2.00	9	Nether	1.97	9
UAE	1.74	10	Nether	1.67	10	Nether	1.73	10	Nether	1.71	10	Malaysia	1.91	10
Argentina	1.74	11	Italy	1.65	11	Malaysia	1.62	11	Italy	1.49	11	Italy	1.75	11
Malaysia	1.56	12	Malaysia	1.44	12	Russia	1.26	12	Russia	1.44	12	UAE	1.31	12
Italy	1.51	13	Switze	1.11	13	Italy	1.25	13	China	1.12	13	China	1.14	13
Russia	1.43	14	China	1.10	14	Switze	1.10	14	Switze	1.11	14	Argen	1.14	14
Switze	1.34	15	Nepal	0.80	15	Sweden	0.86	15	Austria	0.83	15	Austria	0.96	15
Austria	0.82	16	KSA	0.79	16	Austria	0.85	16	KSA	0.75	16	Switze	0.95	16
Denmark	0.82	17	Mexico	0.72	17	UAE	0.81	17	Argentin a	0.73	17	Mexico	0.70	17
Mexico	0.80	18	Austria	0.72	18	KSA	0.71	18	Mexico	0.71	18	Sweden	0.66	18
Sweden	0.61	19	Denmark	0.58	19	Mexico	0.65	19	Bahrain	0.69	19	Bahrain	0.65	19
Spain	0.27	20	UAE	0.55	20	Nepal	0.58	20	Sweden	0.65	20	Spain	0.59	20
Norway	0.25	21	Sweden	0.54	21	Bahrain	0.53	21	Denmark	0.49	21	KSA	0.45	21
KSA	0.24	22	Bahrain	0.50	22	Denmark	0.44	22	Spain	0.40	22	Denmark	0.43	22
Bahrain	0.18	23	Spain	0.22	23	Spain	0.26	23	Nepal	0.39	23	Nepal	0.33	23
Nepal	0.00	24	Norway	0.21	24	Norway	0.21	24	Norway	0.21	24	Norway	0.22	24
Total share	77.60			76.96			76.97			77.32			77.72	

Source: FAO database, internet version, 2005

Table 2 Average weighted purchase and sale price of the importer in London (Pound sterling)

Name of the vegetable	Average monthly purchase / sale volume at importer level (MT)	Average purchase price at importer level	Average weighted purchase price at importer level	Average sale price to retailer	Average weighted sale price to retailer	Average sale price to consumer	Average weighted sale price to consumer
Sweet gourd	2.23	1400	1467	1765	1799	1933	2054
Palwal	2.77	1475	-	1803	-	2038	-
Cucumber	3.67	1458	-	1788	-	2050	-
Radish	2.75	1400	-	1770	-	2025	-
Bitter gourd	4.07	1492	-	1803	-	2088	-
Chilli	4.57	1550	-	1858	-	2138	-
Lady's finger	3	1413	-	1800	-	2033	-
Yard long bean	3.6	1467	-	1775	-	2038	-
French bean	0	0	-	0	-	0	-

Table 3 Average marketing cost for importers in UK (pound per MT)

Description of cost items	£ per MT
Transportation cost from airport to ware house	41
office and ware house rent	24
Telephone , fax and e-mail	8
Salary and wages	108
Import clearance agent fee	20
Customs duty	0
Airport entry and handling charge	110
Miscellaneous	0
Total	310

Table 4 Major suggestions provided by the importers in the UK

Major heads	Major suggestions
Air cargo space/ timely supply	Bangladesh government should ensure sufficient air cargo space in Bangladesh Biman and other foreign airlines
	Regular shipment of vegetable should be ensured
	They should supply vegetable on time
	Government should hire private air cargo plan to ensure regular and constant supply of fresh vegetable to the export market
	Government should make arrangement to ensure air cargo space to avoid off load and constant supply
	Bangladesh Government should make arrangement to hire private air cargo plain to ensure constant and regular supply of vegetable
Flight schedule	Bangladesh Biman should sign memorandum with UK Government department related to airport to release the imported goods on time.
Regulatory functions	Government should control the shipment of band items namely cigarette, potato, mutton, dry fish in the cartoon of vegetables
	Bangladesh Biman should compensate to the exporter and importer for failure flight schedule to the UK
Packaging and grading	They should improve packaging, grading to maintain the freshness of vegetables
	Government should take initiative so that Bangladesh Biman could maintain the flight schedule to ensure regular supply of vegetable
Storage	Cold storage should be built near Dhaka airport and within the airport in the handling cargo area
	Government should build multipurpose cold storage at the Dhaka and other international airport to keep the fresh vegetable for timelines
Production of Quality vegetable	Exporters of Bangladesh should make arrangement to produce quality vegetable
	Government should assist farmers to produce export quality vegetable
	So meet up the demand of Bangladeshi communities as well as other communities includingEnglish people, the quality vegetable should be produced and packaged under special supervisions
	Exporter should organize contract farmers to produce export quality vegetable as per demand of export market

Appendix V

No.

Date

Questionnaire for the vegetable producers in Bangladesh

1. Location

Village------------------------------ Upazilla----------------------------- District---------------

2. Respondent

Name---Age-----------Sex-------------Religion-----------------

Occupation------------------------Educational level: Illiterate---------- Primary------------------

Secondary----------------------Higher secondary---------------------------Graduate---------------

3. Family size---------------------------and family information

Age------ Relation----------------Sex--------- Education

4. Land Resources

1. Owned (acre) --
2. Leased in(acre)--
3. Leased out(acre)-------------------------------------
4. Homestead area (acre) -------------------------------------
5. Net cropped area(acre)------------------------------
6. Rent for leased in (TK)-----------------------
7. Rent for leased out (TK)----------------------

5. Total family income (annual)

(1) Own ------------------------

(2) Other family members ----------------------

(3) Total ----------------------

6. Farm Equipments

Particulars	No	Life	Value	Depreciation rate
Country plough				
Tractor				
Power tiller				
Sprayer				
Electric motors				
Power pump				
Shallow machine				
Tube well				

7. Agriculture credit

Sl.no.	Agency	Amount of credit (TK)	Type of credit	Rate of Interest (%)
1	Government			
2	Cooperatives			
3	State owned commercial banks			
4	Money lenders			
5	Exporters			
6	Middlemen			
7	Others			

8. Human labour for field operations for sample vegetables: Area : Acre

Agriculture operation	Time (Month)	Human labour (payment in TK)			Bullock Labour (payment in TK)		Machine Labour (payment in TK)	
		Owned (hrs)	Attached labour (hrs)	Hired payment (TK)	Owned (hrs)	Hired payment (TK)	Owned (hrs)	Hired payment (TK)
Preparatory tillage								
Sowing/ Transplanting								
Manuring								
Irrigation								
Plant protection								
Inter cultivation								
Harvesting								
Sorting								
Cleaning								
Transport from field to sorting house								
Others								

9. Charge for field operation (TK/ acre)

Land preparation/Tillage	Irrigation	Pesticide	Comment

10. Inputs and machinery repair costs for sample veegtables

No.	Name of the Inputs/ cost heads	Description	Unit	Quantity	Cost	
					Free	purchase
1	Seed		kg			
2	Manure		maund			
3	Fertilizer	Urea	kg			
4		TSP	kg			
5		MP	kg			
6	Tractor/ power tiller	Fuel				
		Repairs and maintenance				
7	Irrigation equipment	Fuel				
		Repairs and maintenance				
8	Pesticide equipment	Fuel				
		Repairs and maintenance				
9	Trellis					
10	Others					

11. Production period of sample vegetables and other crops in the same plot in 2002-03

Name of the vegetable	Time of plantation (month)	Time of harvesting (month)	Time of sale		Comments
			Peak month	Lean month	

12. Total area and production of Sample vegetables in 2002-03

Area (acre)		Production (kg)		Yield (kg per acre)		Average price (TK per kg)	
Present year (2002-03)	Previous year	Present year (2002-03)	Previous year	Present year (2002-03)	Previous year	Present year (2002-03)	Previous year

13 . Disposal pattern of the sample vegetables

Name of the vegetable	Production (kg)	Family Consumption (kg)	Wastage (kg)	Gift (kg)	Sale (kg)

14. Information about sale (2002-03)

Time of sale	Total sale	Farm gate price from exporter (Tk/ kg)	Farm gate price from Middlemen or exporter's agent (Tk/ kg)	Farm gate price from Wholesaler (Tk/ kg)

15. Net income from some other major vegetables /Crops(2002-03)

Name of some major vegetable/ Crops	Total cropped area(acre)	Yield (kg /acre)	Total production (kg)	Production Cost (Tk per acre)	Farm gate price (Tk per kg/ maund)	Net income (Tk per acre)
Sweet gourd						
Palwal						
Cucumber						
Radish						
Potato						
Rice						
Wheat						
Jute						
Tobacco						
Chilli						
Ladies finger						

16. Human labour involvement in other major crops and vegetables (2002-03) : Area: acre

Name of the crops	Owned (hrs)	Attached labour (hrs)	Hired labour (TK)	Comment on labour availability
Rice				
Jute				
Wheat				
Tobacco				
Sweet gourd				
Palwal				
Cucumber				
Radish				
Chilli				
Potato				
Ladies finger				

17. How do you transport vegetables to the local market or sorting house? ---------------------

18. Technology adoption in vegetable production: Did you adopt the following technology?

1. Improved variety----------------------- ☐ Yes = 1 , No = 2

2. Irrigation ------------------------- ☐

3. Organic fertilizer----------------------- ☐

4. IPM Technology --------------------- ☐

19. Are you contract farmer of the exporter/middlemen? ---------☐ Yes = 1 , No = 2

If yes, do you get credit from them?------------------------ ☐

Do you get technical support from them ? ------------------ ☐

20. Do you sell vegetables to the exporter ?----- ☐ Yes = 1 , No = 2

21. How many years are you involved in vegetables production ? ------------

22. Why do you produce exportable vegetables?---------------------------------

23. Constraints : In your opinion , what are the major constraints?

- ---
- ---
- ---
- ---
- ---

24. Suggestions: In your opinion, to enhance quality production of vegetables, what measures should be taken?

- ---
- ---
- ---
- ---
- ---

Thank you

Appendix VI

No.

Date

Questionnaire for Middlemen for vegetable in Bangladesh

1. Location:

Building no.------------, Road no.---------------, Area---------------------------, Thana/Upazilla -----
----

District-------------------------, Bangladesh.

2. Respondent:

Name--- Age----------- sex-----------------Religion-

Occupation----------------------

Educational level-------------Primary-------- Secondary-----------Higher secondary----------
Graduate-----

3. Family size and information:

Family size ------------

Name-------------------------------- Age--------Relation-----------------Sex---------Education---

4. French bean purchase details:

Time of purchase	Place of purchase	No of purchase per week	Volume of each purchase (kg)	Farm gate Price (TK per kg)	Destination

5. Other vegetables purchase details including YLB and BG:

Name of the vegetables	Place of purchase	Time of purchase	No of purchase of vegetables per week	Volume of each purchase (kg)	Farm gate Price (TK per kg)	Destination
Sweet gourd						
Palwal						
Cucumber						
Radish						
Bitter gourd						
Potato						
Chilly						
Yard Long Bean						
Lady's Finger						

6. Weekly demand of vegetable from the exporters (kg) :---------------------------(kg)

7. Marketing cost of middlemen for all vegetables (per kg):

Description of the cost items	Value (TK per kg)
Transportation from the purchase point to the exporter's godown/airport	
Grading charge	
Packaging materials	
Carton /Packet	
Labour cost for loading and unloading	
Market tolls	
Packaging charge	
Wastage /loss of weight	
Rent	
Tips and donation	
Bagging	
Personal expenses	
Entertainment	
Miscellaneous	

8. Middlemen's average sale price of French bean.

Average sale price to wholesaler (TK per kg)	Average sale price to exporter (TK per kg)

9. Middlemen's average purchase and sale price of some major vegetables:

Name of the vegetables	Average sale price to wholesaler (TK per kg)	Average sale price to exporter (TK per kg)
Sweet gourd		
Palwal		
Cucumber		
Radish		
Bitter gourd		
Potato		
Chilly		
Yard Long Bean		
Lady's Finger		

10. Credit programme with the producers:

I. Do you provide credit to the producers ? ☐ Yes =1 No = 2

II Do you provide inputs to the producers ? ☐

11. Do you have any storage facilities in the producing area ? ☐ Yes =1 No = 2

12. How do you transport vegetables to the wholesale market or the go down of the exporter? --

13. How many years are you involved in vegetable business?------------

14. Constraints faced by the Middlemen :

1.--

2.--

3.--

4.--

5.--

15. Suggestions : In your opinion, what are the possible solutions?

1.--

2---

3.--

4.--

5.--

Thank you

Appendix VII

No.
Date

Questionnaire for vegetable exporters in Bangladesh

1. Location :

Building no-------------Road no--------------Area---------------------Thana-----------------Dhaka.

2. Respondent :

Name--Age-----------Sex-------------Religion-----

Occupation-----------------------

Educational level: Primary---------Secondary-----------Higher secondary-----Graduate-------------- ---   Masters----------------

3. Family size and family information:

Family size---------------

Name---------   Age---------Relation----------------Sex---------Education--------

4. Shipment details:

Name of vegetables	No. of shipment of vegetables per week	Volume of each shipment (kg)	Destination
Sweet gourd			
Palwal			
Cucumber			
Radish			
Bitter gourd			
Potato			
Chilly			
Yard Long Bean			
Lady's Finger			

5. Weekly demand of vegetables from the importers :---------------------------(kg)

6. Name of the main vegetables exported and the importing countries :

Name of the vegetables market	Name of the importing countries	Super market	Wholesale market	Ethnic market

7. Marketing cost of vegetables (per qtl) :

Sl.No	Description of the cost items	Value (TK per qtl)
1	Transportation from the production point or primary market to exporter's go down	
2	Grading and packaging charge	
3	Packaging materials	
4	Carton/Packet	
5	Transportation from the exporter's go down to the air port	
6	Air freight charge(including cartoon weight)	
7	Air way bill charges (documentation)	
8	Terminal and handling charges	
9	Generalized System of Preference (GSP) certificate charge	
10	Bank service	
11	Export proform (EXP) charge	
12	Labour cost for loading and unloading	
13	Clearing and Forwarding cost	
14	Salary and wages	
15	Office and go down rent	
16	Telephone, fax, e-mail, Photostat etc	
17	Entertainment	
18	Cold storage or refervan cost	
19	Phytosanitary certificate	
20	Computer scanning	
21	Miscelleneous	

8. Exporter's average purchase price of French bean (TK per kg):

Time of Purchase	From Producer	From middlemen/selected agent	From whole sale market	Comment

9. Exporter's average sale price of French bean (per kg)) :

			Country wise sale price		
Name of the importing country	Name and address of the importer	Total volume (kg)	US$	pound	Euro

10. Exporter's average purchase price of some major vegetables:

Name of the vegetables	Place of purchase	Time of purchase	No of purchase of vegetables per week	Volume of each purchase (kg)	Price (Tk per kg)	Destination
Sweet gourd						
Palwal						
Cucumber						
Radish						
Bitter gourd						
Potato						
Chilli						
Lady's finger						
Yard long been						

11. Exporter's average sale price of some major vegetables (per kg) :

Name of the vegetables	Name of the importing country	Name and address of the importer	Total volume (kg)	Country wise sale price		
				US$	£	Euro
Sweet gourd						
Palwal						
Cucumber						
Radish						
Bitter gourd						
Potato						
Chilli						
Lady's finger						
Yard long been						

12. Mode of payment with the importers:

Consignment sale /Letter of credit system (LC) / Purchase order/ personal agreement/ advance encashment/any other.

13. Form/state of exportable vegetables :

Name of the Importing Country	Name of the vegetable	Fresh	Processed	Canned

14. Where most of your vegetables are sold?

Name of the vegetables	Supermarkets	Wholesale markets	Ethnic markets

15. Reduced rate of air freight charge of vegetables:

Do you avail this opportunity ? ☐ Yes = 1, No = 2

16. How do you transport vegetables to the importer? ------------------------------

17. Cash Incentive :

Do you avail cash incentives from the Government organizations

☐ Yes = 1, No = 2

18. Do you perform the standard packaging, grading and labeling ?
Yes = 1, No = 2 ☐

19. Do you have sorting house and cold storage? ☐ Yes = 1, No= 2

20. How do you contact your buyer ?----Telephone/fax/e-mail/letter/ your visit /buyer's visit

21. How do you obtain the following information about the export market?

Subject	Importer	Printed materials	Visits	Website	Others
Consumer's preferences					
Quality standards					
Import regulations					
Market competition					

22. Are you running a joint venture with the importer ? ☐ Yes = 1, No= 2

23. Do you provide credit to the producers ? ☐ Yes = 1, No= 2

24. Do you organize the contract farmers? ☐ Yes = 1, No= 2

25. How many years are you involved in vegetable export?------------------------

26. Constraints faced by the exporters

1.--

2.--

3.--

4.--

5.--

27. Suggestions: In your opinion, to enhance the export of vegetables, what measures should be taken ?

1--

2. --

3 ---

4 ---

5 ---

Thank you

Appendix VIII

No.

Date.

Questionnaire for the vegetable Importers of the UK

1. Location:

Building no.---------------------- Road no.---------------------------,Area-----------------------

City--- UK.

2. Respondent :

Name--Age------------Sex----------

Designation----------------------------------- --

Name of the company---

3. Vegetable import details:

Period (month)	Monthly demand (MT)	No. of Import per month	Volume of each import (MT)	Name of the exporting Country with it's share to total monthly import	
				Name of the exporting country	Share to the total monthly import (MT)

4. Do you import vegetable from Bangladesh? ☐ Yes -1
No- 2

If yes, In what form of vegetable you import ? ☐
Fresh-1,Frozen-2,Canned-3

5. Where do you sell vegetable? ☐

super market –1, wholesale market-2, distributor-3, ethnic retail outlet-4, green grocery-5, consumer-6

6. Importer's average import and sale price of major vegetables from Bangladesh (£)

Name of the vegetables	Import Period (month)	Monthly import (MT)	Monthly sale (MT)	Import price (per MT)	Average sale price(per MT)					
					Super market	Whole sale market	Distributor	Ethnic Retail outlet	Green grocery	Consumer
French bean										
Yard long bean										
Bitter gourd										
Sweet gourd										
Palwal										
Cucumber										
Radish										
Chilli										
Lady's finger										

7. Importer's average import and sale price of major vegetables from other countries (£)

Name of the vegetables	Import period (month)	Monthly import (MT)	Monthly sale (MT)	Import price (per MT)	Average sale price(per MT)					
					Super market	Whole sale market	Distributor	Ethnic Retail outlet	Green grocery	Consumer
French bean										
Yard long bean										
Bitter gourd										
Sweet gourd										
Palwal										
Cucumber										
Radish										
Chilli										
Lady's finger										

8. Importer's marketing cost of vegetables (per MT) :

Sl.no .	Description of the cost items	Value(£)
1	Transportation from the airport to the warehouse	
2	Office and ware house rent	
3	Telephone, fax, e-mail etc	
4	Salary and wages	
5	Import clearance agent fee	
6	Customs duty	
7	Airport entry and handling charge	
8	Miscellaneous	

9. Form of imported vegetable :

Name of the major vegetable	Fresh	Frozen	canned	Comment
French bean				
Yard long bean				
Bitter gourd				
Sweet gourd				
Palwal				
Cucumber				
Radish				
Chilli				
Lady's finger				

10. How do you transport vegetables from the airport to the ware house, super market , whole sale market ,Distributor?

Ware house	Supermarket	Wholesale market	Ethnic market	Distributor	Ethnic Retail outlet	Green grocery

11. Investment for vegetables in joint venture:

Name of the exporting country	Name of the exporting Firm / Company	Share of the investment (%)	Providing technical support for production (yes /No)	Providing technical support for marketing (yes /No)	Comments

12. Mode of payment :

Consignment sale	Personal agreement	Letter of Credit (LC)	Cash payment	Others

13. Experience in vegetable import business:

Form of the vegetables	Starting year	Total no. of years	Name of the exporting countries	Comment
Fresh vegetable				
Processed vegetable				

14. Do Bangladeshi vegetables generally meet satisfactorily the grading, packaging, and labeling demanded by your firm?

Yes-1 , No-2

Grading ☐

Packaging ☐

Labeling ☐

15. Problems : What other problems are you experienced to import the vegetables particularly the Bangladeshi vegetables ?

(1) --

(2) --

(3) --

(4) --

(5) --

16. Suggestions : In your opinion, to increase the export of Bangladeshi vegetables, what measures should be taken by the exporters of Bangladesh?:

(1)---

(2)---

(3)---

(4)---

(5)---

Thank you

Appendix IX

No.
Date.

Questionnaire for opinion survey for experts in Bangladesh

1. In your opinion, Do the Bangladeshi vegetables particularly French bean, Yard long been and Bitter gourd meet the international quality standard in the export market?
----yes or no
Please explain your opinion.

2. Do you think that transport of exportable vegetables of Bangladesh from the producer to the importer is adequate? --------yes or no

What measures should be taken?

3. Is export market demand led agricultural research for vegetables being conducted?
--------yes or no
Please describe the requirements for such research.

4. Do you think that vegetable producers particularly French bean, Yard long bean and Bitter gourd producers are being supported technically by the public as well as private sector organizations? -----------yes or no

How the producers can be supported?

5. What is the most suitable farming system to produce export quality vegetables? How that system could be implemented?

6. Are the storage facilities for the fresh vegetables adequate?---yes or no

How this facility could be made available?

7 . Is there any organizations for exploring the export market intelligence of vegetables? yes or no,

How the export market intelligence could be explored?

8. In your opinion, is it possible to promote the export of Bangladeshi vegetables through joint venture between exporter and importer of vegetables yes or no

what steps should be taken?

9. What are the constraints that make the Bangladeshi vegetables less competitive in the international market?

10. What advantages are available for export of vegetables particularly French bean, Yard long bean and Bitter gourd of Bangladesh?

11. In your opinion, what measures should be taken by the public as well as private sector to increase the quality production of exportable vegetable and its export?

Name and designation,
organization

Thank you