Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

SAARC Agriculture Centre (SAC)
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SAARC Agriculture Centre (SAC)
Foreword

The fruits and vegetables sub-sector is playing a vital role in farm income enhancement, poverty alleviation, food security and sustainable agriculture in SAARC countries. The high value crops, however, suffers greatly from postharvest losses of about 25-40% and is facing some crucial challenges related to development of services, capacity building, market access, technology information, and policy advocacy. Marketing of fruits and vegetables is quite complex and risky due to the perishable nature of the horticultural produce. The inefficient marketing system, seasonality, poor transportation, underdeveloped infrastructure, insufficient post-harvest handling and storage facilities and practices can intensify the price instability.

Market access and value chain analysis of the high value products of smallholder farmers are the very crucial issues in SAARC countries. A value chain analysis is a method that facilitates an improved understanding of competitive challenges, helps in the identification of relationships and coordination mechanisms, and assists in understanding how chain actors deal with powers and who governs or influences the chain. Developing value chains is often about improving access to markets and ensuring a more efficient product flow while ensuring benefit to all actors in the chain.

Marketing of fruits and vegetables crops is quite complex and risky due to the perishable nature of the produce, the seasonality of production, and the logistics challenges of high weight-to-value shipments. The spectrum of prices from producer to consumer, which is an outcome of demand and supply of transactions between various intermediaries at different levels in the marketing system, is also unique for fruits and vegetables. Moreover, the marketing arrangements at different stages also play an important role in price levels at various stages as product moves from farm gate to the ultimate user. These features make the marketing system of fruits and vegetables quite different from other agricultural commodities, particularly in providing time, form and space utilities.

Adoption of value chain approach for improving marketing efficiency and reducing transaction cost in fruits and vegetables has become a necessity in South Asia. In order to develop viable value chains for fruits and vegetables, more should be done to promote regional integration at each stage of the value chain. This would also facilitate entry into global value chains and promote regional development.

Considering the improvement of nutritional status, food security and assure food safety, SAARC Agriculture Centre conducted a study on "Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries" and subsequently organized a regional consultation workshop as well a publication containing recommendations, synthesis reports and country papers expected to promote intensive and appropriate agricultural research for development (ARD) on post-harvest and value addition of horticultural produce also linking farmers to markets so as to reduce losses, diversify product utilizations, enhance incomes and employment generation of the people in South Asia. The beneficiaries will be the policy makers in the Governments of SAARC countries, scientists and extension service providers, NGO, private sector, donor agencies and ultimately the farmers and other chain actors.

I acknowledge the hard work of my colleagues and the distinguished contributing focal point experts from SAARC countries for completing this task. My good wishes to the members for synthesizing the book and bringing it in the present form.

SAC always appreciates receiving feedback, comments, criticisms and suggestions from the users of our products and services to help us enable to do better in future.

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Abbreviations and Acronyms

AARI Ayub Agricultural Research Institute, Faisalabad
ABPMDD Agribusiness Promotion and Market Development Directorate
AEC Agro-Enter Support Project
API Agricultural Policy Institute
APP Agriculture Perspective Plan
B/C Ratio Benefit Cost Ratio
BARC Bangladesh Agricultural Research Council
BARI Bangladesh Agricultural Research Institute
BBS Bangladesh Bureau of Statistics
BINA Bangladesh Institute of Nuclear Agriculture
BSTI Bangladesh Standard and Testing Institute
CA Commission Agent
CADP Commercial Agriculture Development Project
CPU Central Processing Unit
CRI Citrus Research Institute, Sargodha
CSP Community Support Project
DADO District Agriculture Development Office
DAE Department of Agricultural Extension
DAM Department of Agricultural Marketing
DDC District Development Committee prizes Center
DDEC Dambulla Dedicated Economic Centre
DECs Dedicated Economic Centers
DPP Department of Plant Protection
FDD Fruits Development Directorate
FSC&RD Federal Seed Certification and Registration Department
FYM Farm Yard Manure
GAP Good Agricultural Practices
GDP Gross Domestic Product
GoB Government of Bangladesh
GoP Government of Pakistan
HACCP Hazard Analysis and Critical Control Analytical Point
HVCs High Yielding Crops
ICAR Indian Council of Agricultural Research
ICM Integrated Crop Management
IPM Integrated Pest Management
ISO International Standard Organization
ITC International Trading Corporation
KPK Khyber Pakhtunkhwa
LGED Local Government Engineering Department
MFI  Micro Finance Institutes
MOAC  Ministry of Agriculture and Cooperatives
MRI  Mango Research Institutions, Multan
MRI  Medical Research Institute
NAAF  National Accreditation for Agriculture and Food
NARC  Nepal Agriculture Research Council
NARDF  Nepal Agriculture Research and Development Fund
NATP  National Agricultural Technology Project
NFS&R  Ministry of National Food Security and Research
NGO  Non-Government Organization
PACT  Project for Agriculture Commercialization
PAD  Punjab Agriculture Department (Marketing Wing)
PARC  Pakistan Agricultural Research Council
PDB  Power Development Board
PDD  Plant Protection Directorate
PHDEB  Pakistan Horticultural Development and Export Board
PHM  Post Harvest Management
R & D  Research and Development
SAARC  South Asian Association for Regional Cooperation
SAC  SAARC Agriculture Centre
SMEDA  Small and Medium Enterprises Development Authority
SPS  Sanitary and Phyto-Sanitary Standards
TCP  Trading Corporation of Pakistan
TDAP  Trade Development Authority of Pakistan
TMF  Traditional Market Channel Farmers
UAF  University of Agriculture Faisalabad
VCA  Value Chain Analysis
WTO  World Trade Organization
Technical Synthesized Report

on

Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

By

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1. Introduction

1.1 Overview of global scenario of fruits and vegetables

The global food markets are undergoing significant changes over time. On the one hand, we have factors such as population growth, rising incomes and the process of rapid urbanization (especially in emerging markets such as China, India and Brazil) fuelling growth in demand for food. On the other, we have rising consumer discern regarding food related issues such as safety, hygiene, health consciousness and cooking convenience which are dramatically changing the food consumption patterns across the globe. This is resulting in increased demand for high value food such as fruits and vegetables, milk and milk products and animal proteins.

Fruits and vegetables play an important role in providing essential vitamins, minerals, and dietary fibre to the world feeding populations in both developed and developing countries. Fruits and vegetables is one of the fast growing sub-sectors of the food processing sector, as they form an indispensable part of healthy diet. China, India, Brazil, USA, Italy, Philippines, Mexico, Spain, Indonesia and Turkey are the top ten aggregate fruit producers in the world (see Annexure 1). Asia dominates the world vegetables accounting for nearly 60% of global production, with China and India ranking as 1st and 2nd. European Union and U.S.A follow next (see Annexure 2).

The global fruit and vegetables consumption increased by an average of 4.5% per annum between 1999 and 2009 which is much higher than the world population growth rate. In response to ever increasing demand for fruits and vegetables, area under horticultural crops is increasing over the years. Ongoing consumer demand for new fruits and vegetables in developed countries has contributed to an increase in trade volume of fresh produce in developing countries. Cultivation of fruit and vegetables is substantially more labor-intensive than growing traditional cereal crops and offers more post-harvest opportunities to add value (Joshi et al., 2004; Weinberger and Lumpkin, 2005; World Bank, 2009). Today, packing and processing services such as washing, chopping, and mixing, as well as bagging, branding, and applying bar codes are often carried out at the source rather than at the end-market destination. These processes, which were previously based in the developed world, have created considerable new employment opportunities in developing countries (Humphrey et al., 2004).

Over the last quarter of a century (1980-2004), the fruit and vegetable market has been one of the fastest growing of all agricultural markets. Since the 1980s, international trade of fruit and vegetables has been characterized by tremendous growth, driven by rising incomes and the expansion of the middle class worldwide (Karina et al., 2011). At the beginning of the 21st century, the global industry accounted for US$56.1 billion, and by 2008, exports reached more than twice that value at US$139.6 billion (UN Comtrade, 2011). Motivated by this growing global demand, developing countries have actively pursued the production and export of this high-value agricultural subsector and have successfully captured a large portion of the horticultural market. Fruit and vegetable products (both fresh and processed)
accounted for 22% of total agricultural exports from developing countries. USA is the largest exporter of fresh fruits and vegetables followed by Mexico having overtaken EU in the past decade. Other big exporters are China, Chile, Ecuador and South Africa. The top 10 exporters together accounted for 66% of the total world's fresh fruits and vegetables exports. On the import side, the EU is the largest importer. The US follows closely behind, while other countries, like Canada, Japan and China have significantly smaller imports. The top 2 importers (EU and USA) account for in 50% of the total global imports (http://www.megafoodpark.com/pdf/1.pdf).

Regional integration and free trade is one of the most important building blocks for economic growth of a region. One of the most striking developments in the world trading system since the mid 1990s is a surge in the regional trade agreement (RTA) (Pal, 2008). Most industrial and developing countries in the world are members of a regional integration agreement. European Union, Association of Southeast Asian Nations (ASEAN), North American Free Trade Agreement (NAFTA), Asia Specific Economic Cooperation, South Asian Association for Regional Cooperation (SAARC) etc these are the best examples of such agreements.

1.2 About SAARC

The South Asian nations have formed South Asian Association for Regional Cooperation (SAARC) in 1985 comprising seven countries of South Asia, namely Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka (Prasad and Das, 2007). Later on, Afghanistan joined as a full member of SAARC on April 3, 2007 at the Association’s fourteenth Summit.

Before establishing SAARC, the idea of regional cooperation in South Asia was first mooted in May 1980. The Foreign Secretaries of the seven countries met for the first time in Colombo in April 1981. This was followed a few months later, by the meeting of the committee of the whole, which identified five broad areas of regional cooperation. The Foreign Ministers, at their first meeting in New Delhi in August 1983, formally launched the Integrated Programme of Action (IPA) in nine agreed areas through an adoption of the declaration on South Asian Regional Cooperation (SARC). At the first summit held in Dhaka on 7-8 December 1985, the Charter was adopted establishing the organization of South Asian Association for Regional Cooperation (SAARC) (Prasad and Das, 2007).

The Association provides a platform for the peoples of South Asia to work together in a spirit of friendship, trust and understanding. It aims to promote the welfare of the peoples of South Asia and to improve their quality of life through accelerated economic growth, social progress and cultural development in the region. SAARC countries have many common economic features like poverty, income inequality, large population, low productivity, illiteracy and mass unemployment. (Manjula, 2005)

Agriculture sector is still forms the backbone of the economy of all SAARC members. Rice and Wheat are the staple food crops in the SAARC countries. The SAARC region has a rich topographic, climatic and natural resource endowments where wide varieties of horticultural crops, such as vegetables, fruits, roots and tubers, ornamental, medicinal and aromatic plants, plantation crops, spices and other are grown (Balasaheb, 2010).
SAARC region has enormous opportunity to grow tropical, sub-tropical and temperate horticultural crops of commercial importance. All these countries are trying hard to improve the nutritional security of millions of poor people. Horticulture sector is vital to bring positive change in the socio-economic life of the millions of people in SAARC countries. These crops play an important role in balancing the diet of people by providing not only energy-rich food, but also supply of vital protective nutrients like minerals and vitamins. They not only adorn the table, but also enrich health from the most nutritive menu and tone up energy and vigor of people of these countries. This sector has the potential to provide opportunities to increase income and alleviation of hunger and poverty and curve down the socio-economic problems of the region (Alam, 2001).

1.2.1 Importance of fruits and vegetables in SAARC countries

Fruits and vegetables are an important component in the agricultural economy of the SAARC countries. The region grows a diverse indigenous and exotic fruits and vegetables. An estimated 2% of the South Asian fruits and vegetables are exported currently.

Most of the member countries of SAARC for the past several years, maintained positive growth in production of fruits and vegetables indicating the increasing role that they play in enhancing farmer incomes, alleviating poverty and improving quality of diet. It is expected that the demand for both fresh and processed fruits and vegetables produce will continue to expand in line with the rise in per capita income, better standards of living and increasing awareness about their health benefits. The diversity of agro-ecological conditions and climates across the region provide ideal environment not only for cultivation of a wide range of fruits and vegetables but also a vast potential for inter-regional trade and industry. The SAARC countries have also abundant availability of indigenous fruits and vegetables many of which are known for their therapeutic/medicinal and nutritive value and have excellent flavour and colour. The demand for such speciality produce is likely to increase in the international market both in fresh and processed form.
2. Value chain Management

2.1 Global Value Chain

The Global value Chain initiative is particularly interested in understanding value chains that are divided among multiple firms and spread across wide swaths of geographic space, hence the term "global value chain". The global value chains have become much more prevalent and elaborate in the past 10 to 15 years. While many firms have had international operations and trading relationships for decades and a few for more than a century, global value chains now contain activities that are tightly integrated and often managed on a day-to-day basis. Global value chain research consists of learning the details of jobs, technologies, standards, regulations, products, processes, and markets in specific industries and places. Global value chain research is challenging, interesting, relevant, and important.

2.1.1 Factors making Global value chain different

The patterns and effects of Global value chains tend to vary in specific industries and places. Because of this, Global value chain research often has a sectoral or geographic focus. There are many factors that influence Global value chains to grow and develop over time they are as follows;

1. The complexity of transactions: More complex transactions require greater interaction among actors in Global value chains and thus stronger forms of governance than simple price-based markets. Thus, complex transactions will likely be associated with one of the three network governance patterns (modular, relational, or captive) or integrated within a single firm (hierarchy).

2. The codifiability of transactions: In some industries schemes have been worked out to codify complex information in a manner in which data can be handed off between GVC partners with relative ease, often using advanced information technologies. If suppliers have the competence to receive and act upon such codified information, and if the codification schemes are widely known and widely used, then we would expect to see modular value chains emerge. If not, then lead firms might either keep the function in-house, leading to more vertical integration (hierarchy) or outsource it to a supplier that they tightly control and monitor (the captive network type) or have a dense, idiosyncratic relationship with suppliers (the relational governance type).

3. The competence of suppliers: The ability to receive and act upon complex information or instructions from lead firms requires a high degree of competence on the part of suppliers. Only in such a situation can the transfer of complex but codified information be achieved (as in modular networks) or intense interaction is worthwhile (as in relational networks). Where competent suppliers do not exist, lead firms either must internalize the function (hierarchy) or outsource it to suppliers that they tightly monitor and control (captive suppliers).
2.2 Value Chain Management

Value chain management is a business philosophy based on taking advantage of opportunities to create and capture value that traditional supply systems cannot. It is about all businesses wherever they operate in relation to the end market, leveraging their combined competencies and strengths to more effectively and efficiently, supply consumers in a rapidly evolving business environment (Paul, 2008).

Value chain refers to the relationship established between actors who involved directly and indirectly in a productive activity with the aim of adding value in each stage of the value chain. Value chain involves processors, producers, traders, distributors, institutions. They are willing to share the associated risks and benefits and investing the time, energy and in resources in meeting their goals. The value chain is also defined as the range of activities that firms and workers perform to bring a product to its end use. This value chain activity includes design, production, marketing, distribution and final consumer support. Value chain activities could be contained within a single firm or it may be divided among the different firms and produce or goods or services and limited within a single geographical location or spread over wide areas (Christopher, 2006).

Kaplinsky and Morris 2001 describes value chain as the full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use.

Value chains generally include three or more of the following: producers, processors, distributors, brokers, wholesalers, retailers and consumers. The partners within the value chain work together to identify objectives, they are willing to share risks and benefits, and invest time, energy and resources to make the relationship work. A value chain is therefore regarded as an actor oriented approach and considered very effective in tracing product flows, showing the value adding stages, identifying key actors and the relationships with other actors in the chain (Schmitz, 2005).

One of the dimensions of a value chain is its flow, which is also called its input-output structure. In this sense, a chain is a set of products and services linked together in a sequence of value-adding economic activities. In other words, a value chain is a series of participants along the entire marketing spectrum who collaborate to satisfy market demands for specific products or services to their joint and collective mutual benefit (Joshi and Gurung, 2009).

The participants in the case of a fruits and vegetables value chain would be:

- Seed and associated input suppliers
- Growers
- Packer/ graders/transporters
- Bulk buyers/ bidders at auction yard
- Retailer/ food service sector

The advantages of being a participant in a value chain would be:

- Reduction in the cost of doing business
- Increase in bargaining power
- Improved access to advanced technology, information and capital
• Transport and logistics  
• Formation of alliances  
• “Trueness to promise” that strengthen backward and forward linkages  
• Inventory management including the quality of the inventory storage

**Benefits of Value Chain**

![Benefits of Value Chain Diagram](http://www.slideshare.net)

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**Creating a Profit**

Primary and secondary activities in a business relate to production, distribution and support. Primary services focus on producing and distributing a product or service. Secondary activities support production and distribution. If managers can successfully manage the connections between all of these primary and secondary activities and keep total costs in the value chain (including production, delivery and support) below the total a customer will pay, a value is created for the customer and a profit is created for the company.

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**Cooperation**

A Company in a value chain such as a food market might work with other producers, processors and retailers to create a better connection with customers. Working together, different players in the same market benefit the customer and each other. They generate interest in their products and services in the market, and each player develops a specialty. The relationships with all businesses in the value chain work to maximize value for customers. These companies also maximize their profits within their specialty.

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1 Source: [http://www.slideshare.net](http://www.slideshare.net)
Return on Investment

Any business with a producer/supplier, processor, distributor retailer will seek return on investment for its participation in a value chain. This investment might seem far off when an organization first joins a value chain. Remember, the success of the value chain depends on the ability of its different members to work together toward common goals, such as increasing product value for customers. Get a bigger return on investment by improving communication among members of the value chain, by getting more players involved and by suggesting new ideas that will benefit customers.

Increasing Competition and the Primacy of Strategy

The value chain is first and foremost a strategic concept, arising from a strategic theory of firm competition. As companies struggle to compete in an era of globalization and intense competition, the focus shifts to alternative strategies to remain competitive. This creates an increasing interest in Value Chains as a tool to model the extended enterprise and formulate strategies for how to remain competitive.

Evolving Governance Models for the Extended Enterprise

The information era spurred on by the recent focus of capital investment on internet technologies and “dot-com” business models has increased general business and research interest in alternative value chain and business models. This has been promoted in the research literature by the focus on Core Competencies and the Resource Based View (RBV) of the firm. This growth in modular/virtual collaborative enterprise business models has increased interest in the Value Chain as a primary construction for analysis of new models for business governance.

Globalization of Supply and Production

The growth in global sourcing and supply has begun a long-term process of levelling the playing field for adding value worldwide. This leads to the need to model global value chains as the predominant mode of business in many industries.

Manufacturing and the Supply Chain

The Industrial Engineering and Operations Management disciplines, combined with management and operations improvement initiatives such as lean manufacturing, TQM, and Six Sigma, have been improving the efficiency of manufacturing and supply chain operations for many years. Improving the operational capability of other value added activities in the enterprise, such as product development, requires shifting perspective from the supply chain to the value chain.

2.3 Difference between Supply and Value chain management

Supply Chain Management: By definition, supply chain is a network of facilities and distribution options that performs the function of procurement of materials, transformation of these materials into intermediate and finished products and the distribution of these finished products to consumers. The features of supply chain are;
- Supply driven
- Operational concept
- Producer oriented
- Rarely operates between more than two firms
- Gain efficiency by cost minimization and timely supply

**Value Chain Management:** A series of companies or collaborating players who work together to satisfy market demand for specific products and services. Unlike supply chain it is;
- Demand driven
- Management concept
- Consumer oriented
- Operates in coordination between more than two firms
- Gain competitive advantage

---

Fruits and vegetables processing, trading, sorting, grading and marketing require some vital support of integrated value chain management system. Because of its perishable nature and more consistent application of quality standards, the organizations involved in business of these horticultural commodities have to face enormous quality problems. This paper deals with possible options to develop efficient value chains for fruits and vegetables in SAARC countries.
3. **Value /Supply Chain Analysis of Fruits and Vegetables**

Value chain (VC) analysis is a method for accounting and presenting the value that is created in a product or service as it is transformed from raw inputs to a final product consumed by end users. VC analysis typically involves identifying and mapping the relationships of four types of features:

a) The activities performed during each stage of processing/product flow;
b) The value of inputs, processing time, outputs and a final value added;
c) The spatial relationships, such as distance and logistics, of the activities; and
d) The structure of economic agents, such as suppliers, the producer and the wholesaler (FIAS, 2007).

According to Richter (2005) a value chain systematically takes all steps of a production process into perspective, it analyses the links and information flows, it reveals strengths and weaknesses, even losses in the process, the boundaries between the national and the international chain, the buyer’s requirements, international standards, it allows international benchmarking, etc. A value chain analysis helps to strengthen production relationships to find solutions to the so-called critical success factors, which determine if a product meets the requirements with regard to quality, price, dependability, volume, design and speed of delivery and consequently improves competitiveness (Joshi and Gurung, 2009). In fruits and vegetables, a value chain begins up stream with the production of goods by individual farmers, cooperatives or farming corporations, and broadens downstream as the product is transformed or repacked to be sold either through retailers or be served in restaurants where the final consumer is reached.

### 3.1 Production of fruits and vegetables

**India**

Among SAARC countries, India is the largest producer of fruits and vegetables and stands second in world production after China (Graph 1). The total production of fruits has been estimated at around 71.5 million tonnes grown in 6.3 million hectares and vegetables occupy an area of 8 million hectares with a production of 134 million tonnes (2009).
The growth in both area and production of fruits and vegetables in India is quite perceptible, especially, in the recent decade (Graph 2). It is evident; the production growth rate of vegetable is higher than the fruits, while growth in area under fruits cultivation is more than the vegetable cultivation. Clearly, higher cropping intensity in vegetables has contributed to growth in production (Baba et. al., 2010). Increased production of fruits and vegetables has increased the importance of value chain management to reduce loss, improve marketing efficiency and make them available to final consumers in the required form. About 75% of total fruit production in the country is contributed from the five fruits, i.e. mango, banana citrus, guava and apple. The other important fruits are grapes, papaya, pomegranate, ber, aonla, sapota, and custard-apple.

Pakistan

Fruits and vegetables play an important role in the agricultural economy of the Pakistan as it contributes 12% to agricultural GDP. Area under fruit and vegetables is about 1.24 million hectares, which forms about 6% of total cultivated area of the country. Area under fruit is 0.85 million hectares and Vegetable 0.39 million hectares. The total production of fruits and vegetables is estimated at 13.13 million tonnes, where fruit production is about 6.9 million tonnes and Vegetables 6.2 million tonnes.

The major fruits grown in Pakistan are citrus, mango, Guava and apple. Citrus is the leading fruit crop of Pakistan. The share of citrus, mango and Guava in total production is 31%, 27%, and 7% respectively. Production of different fruits and their share in total fruit production are presented in Table 1.
Table 1: Production of fresh fruits and share of different fruits in total fruit production in Pakistan, 2009-10 (production in tonnes)

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<td>441600</td>
<td>441000</td>
<td>366400</td>
<td>5</td>
</tr>
<tr>
<td>Guava</td>
<td>552200</td>
<td>555300</td>
<td>538900</td>
<td>512300</td>
<td>509200</td>
<td>7</td>
</tr>
<tr>
<td>Apricot</td>
<td>197200</td>
<td>177200</td>
<td>240200</td>
<td>237900</td>
<td>193900</td>
<td>3</td>
</tr>
<tr>
<td>Peach</td>
<td>70300</td>
<td>71200</td>
<td>82400</td>
<td>83700</td>
<td>54000</td>
<td>1</td>
</tr>
<tr>
<td>Plum</td>
<td>60000</td>
<td>60400</td>
<td>73000</td>
<td>66900</td>
<td>57500</td>
<td>1</td>
</tr>
<tr>
<td>Grapes</td>
<td>48800</td>
<td>46500</td>
<td>75300</td>
<td>76100</td>
<td>64700</td>
<td>1</td>
</tr>
<tr>
<td>Pomegranate</td>
<td>50100</td>
<td>48100</td>
<td>56600</td>
<td>61100</td>
<td>52400</td>
<td>1</td>
</tr>
<tr>
<td>Other fruits</td>
<td>1441900</td>
<td>1362200</td>
<td>1464600</td>
<td>1555100</td>
<td>1492900</td>
<td>22</td>
</tr>
<tr>
<td>Total Fruits</td>
<td>7147600</td>
<td>6011300</td>
<td>7178800</td>
<td>7051500</td>
<td>6941300</td>
<td>100</td>
</tr>
</tbody>
</table>


Similarly in tomato, turnip, radish, spinach and cauliflower from main vegetable (excluding potato) grown in Pakistan. The share in production of tomato is 16%, turnip 9%, spinach, carrot, and cauliflower are about 7% each. Production of different vegetables and their share in total vegetable production of 2009-10 are presented in Table 1A.

Table 1A: Production of vegetables and share of different vegetables in total vegetable production in Pakistan, 2009-10 (production in tonnes)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Lady Finger</td>
<td>112154</td>
<td>111565</td>
<td>103659</td>
<td>114657</td>
<td>116096</td>
<td>4</td>
</tr>
<tr>
<td>Squash (Tinda)</td>
<td>94438</td>
<td>98032</td>
<td>98116</td>
<td>97686</td>
<td>100627</td>
<td>3</td>
</tr>
<tr>
<td>Brinjal</td>
<td>88434</td>
<td>86528</td>
<td>87434</td>
<td>88148</td>
<td>89972</td>
<td>3</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>54246</td>
<td>53966</td>
<td>52732</td>
<td>56239</td>
<td>56994</td>
<td>2</td>
</tr>
<tr>
<td>Bottle gourd</td>
<td>59296</td>
<td>59192</td>
<td>59153</td>
<td>60824</td>
<td>63173</td>
<td>2</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>468146</td>
<td>502292</td>
<td>536217</td>
<td>561891</td>
<td>476826</td>
<td>16</td>
</tr>
<tr>
<td>Radish</td>
<td>163420</td>
<td>164359</td>
<td>161464</td>
<td>163806</td>
<td>156422</td>
<td>5</td>
</tr>
<tr>
<td>Turnip</td>
<td>270249</td>
<td>266855</td>
<td>270784</td>
<td>265600</td>
<td>259837</td>
<td>9</td>
</tr>
<tr>
<td>Carrot</td>
<td>244279</td>
<td>236869</td>
<td>236590</td>
<td>245531</td>
<td>219339</td>
<td>7</td>
</tr>
<tr>
<td>Spinach</td>
<td>244279</td>
<td>236869</td>
<td>236590</td>
<td>245531</td>
<td>219339</td>
<td>7</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>208548</td>
<td>212228</td>
<td>215629</td>
<td>234664</td>
<td>213414</td>
<td>7</td>
</tr>
<tr>
<td>Cabbage</td>
<td>74649</td>
<td>75695</td>
<td>71731</td>
<td>71988</td>
<td>69080</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>1042625</td>
<td>1033523</td>
<td>1006774</td>
<td>998913</td>
<td>1003739</td>
<td>33</td>
</tr>
<tr>
<td>Total Vegetables</td>
<td>3124763</td>
<td>3137973</td>
<td>3136873</td>
<td>3205478</td>
<td>3044858</td>
<td>100</td>
</tr>
</tbody>
</table>

Bangladesh

Cultivation of horticultural products about only 7% of the total cultivated area (Siddique and Azad, 2010). Vegetable growing area in the country is about 0.358 million ha and fruits 0.145 million ha. Besides, about 19.4 million homesteads cover about 0.45 million ha for fruits and vegetables. Production of vegetables has increased from 1.79 to 3.00 million tons in 2005-06 to 2009-10. Similarly, the production of fruits during the same period has increased from 3.17 million tons to 4.52 million tons (Table 2).

Among fruits, banana occupied the highest area (42.2%), followed by mango (19.6%), pineapple (12.8%), jackfruit (7.0%) and guava (4.8%). Among vegetable crop brinjal occupied the highest area (16.9%) followed by radish (8.4%), pumpkin (6.8%), aroids (6.4%), tomato (6.2%), and bean (4.7%). Although horticultural occupies only 7% of Bangladesh’s agricultural land, production generates more than 18% of its agricultural GDP.

Fruits and vegetables are grown in all over Bangladesh but the extent of cultivation varies from one region to another. Some crops have concentrated areas for production because of favourable agro-ecological condition and better marketing facilities.

Table 2: Production of horticultural crops in Bangladesh during 2001-02 to 2009-10

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>3171.0</td>
<td>3457.0</td>
<td>3431.0</td>
<td>4224.0</td>
<td>4525.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1905.0</td>
<td>2047.0</td>
<td>2247.0</td>
<td>2908.0</td>
<td>3000.0</td>
</tr>
<tr>
<td>Spices</td>
<td>1181.0</td>
<td>1406.0</td>
<td>1334.0</td>
<td>1213.0</td>
<td>1350.0</td>
</tr>
<tr>
<td>Potato</td>
<td>4161.0</td>
<td>5167.0</td>
<td>6648.0</td>
<td>5268.0</td>
<td>7930.0</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>308.0</td>
<td>304.0</td>
<td>307.0</td>
<td>305.0</td>
<td>260.0</td>
</tr>
<tr>
<td>Coconut</td>
<td>326.0</td>
<td>352.0</td>
<td>334.0</td>
<td>316.0</td>
<td>402.0</td>
</tr>
</tbody>
</table>

Source: Statistical Year Book of Bangladesh, 2010

Nepal

Horticultural crops are the major sector of Nepalese agriculture. Horticulture contributes about 14 percent to the total agricultural gross domestic products (Thapa, 1998). Among the horticultural crop, the vegetable sector has the most significant contribution to total horticultural GDP. At present, more than two hundred vegetable species are grown in the different climatic zones of Nepal, of which 50 species are grown on the commercial basis (Shrestha et al., 2004).

Vegetable is one of the short seasonal and important components of Nepalese agricultural system. The developmental activities of vegetables in Nepal were started during early forties (Awasthi, 2011). During fifties a wide range of temperate and tropical vegetables were introduced and tested for their adaptability and seed production in different ecological zones of Nepal (Pun, 1995). However, the vegetable development activities received priority since the Fifth Five year Plan (NPC, 1995).

In Nepal, vegetables are an obvious priority because they are much more important than any other high value commodity (a small number of vegetables dominate the group), they are less risky to grow than fruits as they are an annual crops. And since twice as many as men participate vegetable production they provide women an opportunity to increase their income.
proteins are the most important constituents of Nepalese diet.

Tomato, cauliflower, cabbage, cucumber, onion and chilly are the major off-season vegetables of Nepal. Among them, the cultivation of tomato, cauliflower, and, cabbage are the most popular and the most profitable (NARC, 2006). In terms of production, cauliflower is the most cultivated vegetable (404,580 mt) followed by tomato (317,657 mt) and cabbage (302,067 mt) (Prasain, 2011). Off-season vegetable has played a vital role contributing to the rise in economic status of the farmers of the hills, in part by providing regular employment and income to the marginal farmers throughout the year. The Terai region produces and sells more vegetables. However, the vegetables grown in the hilly region have greater value, as these vegetables are produced during the rainy season when prices are higher (Prasain, 2011). The production of vegetables increased from 1127884mt from an area of 140500 ha to 3203563 mt from an area of 244102 ha during 1991 to 2011 period (Graph 3).

![Graph 3: Trends of vegetable production over the last 20 years](image)

Fruits, in Nepal can broadly be grouped into three categories as citrus fruits, summer fruits, and winter fruits. The summer (tropical) fruits have a share of 52% in total area and 55% in total production followed by citrus fruits with 27% and 26% share in total area and total production of fruits respectively. Remaining 21% of total area and 19% of the total production is the contribution of winter fruits. The individual fruits also vary greatly in their share to the total area and production. The “king of fruits” mango has a share of 27% and 20% to the total area and production of fruits in Nepal. According to the study conducted by Market Development Directorate, among the fruits, banana has the highest productivity of 14.11 mt/ha and mango has the lowest productivity level of 7.44 mt/ha.

**Sri Lanka**

In the Sri Lankan economy, the vegetable sector occupies a prominent place which has a contribution of 20% to the agricultural GDP (Department of Census and Statistics, 2011). Main vegetables grown are classified into two main categories such as upcountry vegetables and low country vegetables. The upcountry vegetables are leeks, beans, cabbage, beetroot, carrot, cauliflower, lettuce etc., which are mainly cultivated in hilly areas located in the...
central part of the country. The low country vegetables are brinjal, ladies finger, bitter gourd, snake gourd, long bean, leafy vegetables, luffa, drumstick, capsicum, etc., which are mostly cultivated in low lands and paddy fields. Entire local demand for the vegetables is met through local production. Only negligible share of vegetables has been imported to meet the special demand of tourist hotels. The extent of cultivation was 81,993 ha (2010) under both types of vegetables of which 63 % of the area is occupied under low country vegetables while 37 % of the total area was under up country vegetables. Total annual production in 2010 was 810,869 mt (@9.8 mt/ha). Contribution of low country vegetables to total production is around 53% while share of up country vegetables is around 47%. However, the productivity of low country vis-à-vis up country vegetables has no apparent difference where it was 10.4 mt/ha and 9.6 mt/ha respectively.

The country has 40 tropical, sub tropical and temperate fruit cultivars. The extent of area under fruit crops is 132,191 ha (Socio Economics and Planning Centre, 2011) of which 40%, 20% and 8% are under banana, mango and lime cultivation respectively. Total annual production of fruits in Sri Lanka is 604,725 mt. Most of this production is consumed locally and only about 2 percent is exported. Fresh fruit exports are mainly limited to banana, pineapples, papaya, cashew nuts and mango. The commercial cultivation is reported only for few numbers of fruits such as banana, pineapple, papaya, passion fruit, cashew, lime and rambutan. Other fruits such as mango, wood apple, guava, pomegranate, avocado, etc. are supplied mainly from home gardens. The demand for local fruits is met mainly through local production. However, the local demands for certain fruits such as apples, oranges, grapes and dates are met through imports.

**Bhutan**

The variety of soil, climate, topography and extremes of weather creates opportunities as well as challenges to promote fruits and vegetables in Bhutan since careful selection of location specific varieties or cultivars play an important role in developing vibrant fruit and vegetable industry in Bhutan. Fruits and Vegetables are an important source of livelihood in almost all twenty dzongkhags of Bhutan and are the primary source of income for a majority of the subsistence and small farmers.

The vegetable production has made tremendous achievements over the past decade. The area, as well as the production has increased by manifolds. In 2000, the total area under major vegetable cultivation was 4,140 acres, with a total production of 13,042 mt (RNR Census 2000). By the year 2010, the area has increased to 23,495 acres with a production of 30,595 mt (Agriculture Statistics, DoA 2010). The increase in production was achieved through adoption of high yielding varieties and improved production technologies and also through increase in area under cultivation. Because of varied agro-ecological zones in Bhutan, almost all the important vegetables can be grown.

More than 31 kinds of vegetables belonging to different groups, namely cucurbits, cole crops, solanaceous, root and leafy vegetables are grown in different agro-climatic conditions of the country. Except for a few, namely radish, chilly, turnips, most of the vegetables have been introduced. Chilly is the most widely grown vegetable crop in the country. The total area under chilly is 6,985 acres with a total production of 6,696 MT (Agriculture Statistics, 2010). Radish and green leafy vegetables are also grown in large scale, followed by beans, cabbage and turnip. An increasing volume of cabbage, cauliflower and broccoli are also
produced in the country. However, the total quantity of vegetables produced is less than the total potato production.

Amongst the fruit crops, citrus covers the largest area under cultivation and is one of the highest income generating fruit crop. Citrus production and marketing is an important source of income not just for farmers and traders, but also generates revenues for government bodies like the Food Corporation of Bhutan (FCB). Even though land use under the orchard category accounts for only 1% of the total arable land, in terms of export of cash crops, citrus ranks first in earnings and second in volume after potato. Citrus orchards in Bhutan range from a few trees to large commercial orchards. According to the RNR Statistics 2000, 57% households growing citrus have 1 to 50 trees, while 31.2% households have 5 to 25 trees. The CCA Survey conducted in 2006 shows that 75% households are backyard farmers and small orchard owners and only 8% fall under the category of large farmers. However, it is important to note that the area owned by small and backyard citrus farmer is only about 25% of the total area under citrus cultivation, whereas the large orchard owners have 50% of the citrus area. Apple production and marketing is another important source of income not just for farmers and traders, but also for the government to earn hard currencies. There are 3,580 acres of land under apple cultivation in Bhutan, next to citrus in acreage and production. Most orchards are confined to the four dzongkhags of Thimphu, Paro, Haa and Bumthang. There are over 3,096 apple growers, of which 1,830 are concentrated in Thimphu and Paro.

Among SAARC countries India is the largest producer of fruits and vegetables. Mango, and onion are the major fruits and vegetables grown in India, whereas in Pakistan citrus and tomato while in Bangladesh banana and brinjal occupies the highest area of production. In Nepal, vegetables are an obvious priority because they are much more important than any other high value commodity; they are less risky to grow than fruits. Tomato and citrus fruits occupied the highest area under vegetables and fruits in Sri Lanka, whereas, in Bhutan chilli and citrus were important.

### 3.1.1 Economic Analysis

The costs and profitability analysis was carried out on the economic viability of fruit and vegetables. The analysis of the economic viability of fruits and vegetable was carried out by calculating costs value chains and assessing their profitability. This includes the bifurcation of cost including production, transaction and operational to profitability, value addition at different stages along the chains.

#### 3.1.1.1 Farm level production cost

Farms through investment of scare resources on various inputs and production process produce crops of their choice and supply the products to market. Such actions by farmers for a commodity depend on price signal (demand chain) and physical transmission (supply chain) functions of marketing systems (Ellis, 1996). Production and marketing cost information is essential for planning financial stability and profitability.

Due to huge differences in production intensity, the expenses for the cultivation of fruit and vegetables are quite different. The cultivation of vegetables is relatively more production intensive and thus requires more inputs. Inputs necessary for the production of fruit and vegetables are seed and plants, pesticides, fertilizers, labour, energy, water and services (i.e. insurance, consultation) etc.
In Sri Lanka, cost of cultivation was estimated under the major components of labour, machinery and material. Vegetable production is a labour intensive activity and the share of labour cost to total cost ranged from 43% for pole bean to 65% for brinjal (Graph 4)

The highest B/C ratio in fruits was recorded for dragon fruit. Yet, fruit supply of which is limited to the local market, and commands a high price of around Rs. 400 per kilogram. There is a good demand for the fruit from hotels and internationally renowned for its therapeutic nutritionists.

**Table 3: Benefit/Cost ratios of fruit cultivation in Sri Lanka**

<table>
<thead>
<tr>
<th>Type of fruit</th>
<th>Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange (Variety : Bibile Sweet)</td>
<td>3.59</td>
</tr>
<tr>
<td>Lime</td>
<td>2.25</td>
</tr>
<tr>
<td>Passion fruit</td>
<td>1.92</td>
</tr>
<tr>
<td>Pineapple</td>
<td>4.4</td>
</tr>
<tr>
<td>Papaya (Variety : Red lady)</td>
<td>1.3</td>
</tr>
<tr>
<td>Cashew</td>
<td>1.9</td>
</tr>
<tr>
<td>Pomegranate</td>
<td>6.6</td>
</tr>
<tr>
<td>Dragon fruit</td>
<td>16.74</td>
</tr>
<tr>
<td>Rambutan</td>
<td>5.9</td>
</tr>
<tr>
<td>Banana (Variety-Kolikuttu)</td>
<td>2.5</td>
</tr>
<tr>
<td>Banana (Variety-Ambul)</td>
<td>1.27</td>
</tr>
<tr>
<td>Banana (Variety-Ambon)</td>
<td>3.59</td>
</tr>
<tr>
<td>Banana (Variety-Seen)</td>
<td>1.34</td>
</tr>
<tr>
<td>Pears</td>
<td>5.98</td>
</tr>
<tr>
<td>Durain</td>
<td>5.3</td>
</tr>
</tbody>
</table>

*Source: Socio Economics and Planning Centre, 2012*

Whereas, in Nepal production cost is very high for both vegetables and fruits. Indian product is found cheaper in Nepalese market. Nepalese farmers bound to compete with Indian and Chinese fruits, (especially Apple) which are cheaper as compared to Nepalese fruits. Vegetables production in remote area of the country, has high cost of production. Farmers
are not aware of value addition practices for their product and such dispose their product realising lower prices.

In Bangladesh, Fruit and vegetable crops in general are profitable (Table 4) and thus farmers prefer to grow them for realising higher income. Moreover, there exists scope to strengthen the national economy by exporting fresh as well as processed fruits and vegetables. In all cases, grower’s profitability is significantly higher on a per-hectare basis for each of the five focus commodities (mango, pineapple, potato, brinjal and okra) than for Boro rice. Modern varieties of potato display strong comparative advantage even under existing farming practices, which will improve further with technological innovations. The profitability estimates show that fruits and vegetables appear to be highly competitive in terms of returns. All fruits and vegetables have highly favourable financial returns when compared with rice, even those of high value crops (HYVs). The financial returns of vegetable products for export appear to be fabulously high as compared to that of most other crops. However, their exports are constrained by lack of experience with these crops in Bangladesh, as well as by a variety of marketing problems including product quality, acceptable packaging, high transport costs and market access. Intensive and well-organized efforts are needed to exploit the comparative advantage and profitability of high value crops. Comparative advantage can be improved through reducing production costs, by raising yields, or by reducing import costs. This can be achieved through introduction of modern technologies in production, marketing and processing of these crops.

### Table 4: Cultivation Cost and Net Returns of Boro Rice vs. Focus Commodities in Bangladesh

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total Cost of Production (Tk/ha)</th>
<th>Gross return (Tk/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boro Rice</td>
<td>83,100.00</td>
<td>15,900.00</td>
</tr>
<tr>
<td>Mango</td>
<td>80,0225.00</td>
<td>230,225.00</td>
</tr>
<tr>
<td>Pineapples</td>
<td>92,912.00</td>
<td>99,415.00</td>
</tr>
<tr>
<td>Potato</td>
<td>128,000.00</td>
<td>15,200.00</td>
</tr>
<tr>
<td>Tomato</td>
<td>156,051.00</td>
<td>199,431.00</td>
</tr>
<tr>
<td>Brinjal</td>
<td>184,420.00</td>
<td>308,166.00</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>114,360.00</td>
<td>111,240.00</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>241,952.00</td>
<td>60,448.00</td>
</tr>
<tr>
<td>Chilli</td>
<td>79,072.00</td>
<td>64,028.00</td>
</tr>
<tr>
<td>Cabbage</td>
<td>94,715.00</td>
<td>106,357.00</td>
</tr>
</tbody>
</table>

*Source: DAE, 2010 & 2012*

In Sri Lanka production cost is very high due to labour intensive nature of production and high wage rates. Subsidy is not provided to the farmers. In Bangladesh, Fruit and vegetable crops in general are profitable and thus farmers prefer to grow them for realising higher income.

#### 3.1.1.2 Cost and profit under different chains

The costs incurred and net profits earned by vegetable growers are different in different chains.
Horizontal and vertical coordination

In Pakistan, comparing the cost by different chains for farmers, it was observed to be highest in case of self marketing in the traditional chain of commission agent in the whole sale market mainly due to the high operational cost. The second case was also self marketing but in the vertical coordinating market directly to the processors/exporters. In this case, operational cost was less than the whole sale marketing system but production cost was little high as compared to the farmers working with the horizontal chain. However, transaction cost was less due to few actors along the vertical coordination. The third case is the pre-harvest contract system which is mainly dominated practiced at farm level, no operational cost for harvesting and post harvesting practices was involved at farmers’ level. The cost of production was almost similar to farmers doing self marketing while transaction cost was at its lowest than the other two chains.

The cost of production was lower under horizontal coordination with more operational cost as compared to vertical coordination in vegetables. The transaction cost was lower in vertical coordination resulting in low cost to the vegetable farmers selling their commodity directly to the processors. Looking at the higher per acre income from the vertical coordination between farmers and processor, it is worthwhile to promote this marketing channel. Moving the product smoothly from production to marketing through processing and value addition along the value chain ensures farmer level profitability.

Backward integration (vegetable)

In India, a comparative study of the costs incurred and net profits earned by vegetable growers under backward integration practiced by Food Retail Chain Farmers (FRCF) and Traditional Market Channel Farmers (TMF) has shown that the former group was better off than the later, i.e, traditional market channel farmers (Chengappa et. al. 2012). These are typical examples of backward integration by emerging value chains developed with corporate – the Food Retail Chain in the lead. The farmers involved in such an institutional arrangement realised higher net returns mainly due to higher yield and reduced transaction costs. Thus, institutional arrangements play a crucial role in value chain management of fruits and vegetables (Table 5).

Table 5: Comparison of net returns from vegetables production between food retail chain farmers (FRCF) and traditional market channel farmers (TMF)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Cabbage</th>
<th>Cauliflower</th>
<th>Carrot</th>
<th>Tomato</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FRCF</td>
<td>TMF</td>
<td>FRCF</td>
<td>TMF</td>
</tr>
<tr>
<td>Yield (tonne/acre)</td>
<td>33</td>
<td>30</td>
<td>12.5</td>
<td>12</td>
</tr>
<tr>
<td>Market price (Rs/tonne)</td>
<td>3490</td>
<td>3000</td>
<td>8430</td>
<td>7000</td>
</tr>
<tr>
<td>Input cost (Rs/tonne)</td>
<td>897</td>
<td>(83)</td>
<td>187</td>
<td>(91)</td>
</tr>
<tr>
<td>Transaction cost (Rs/tonne)</td>
<td>180</td>
<td>(17)</td>
<td>189</td>
<td>(9)</td>
</tr>
<tr>
<td>Total cost (Rs/tonne)</td>
<td>1077</td>
<td>(100)</td>
<td>2060</td>
<td>(100)</td>
</tr>
<tr>
<td>Net returns (Rs/tonne)</td>
<td>2413</td>
<td>1261</td>
<td>6370</td>
<td>3781</td>
</tr>
<tr>
<td>Increase in net returns (%)</td>
<td>48</td>
<td>40</td>
<td>18</td>
<td>34</td>
</tr>
</tbody>
</table>

Note: Figures in the parentheses are percentages to the total cost
Source: Chengappa et. al., 2012
In Pakistan, comparing the cost by different chains for farmers, it was highest in case of self marketing in the traditional chain called (horizontal coordination) of commission agent in the wholesale market mainly due to the high operational cost. In India, farmers involved with food retail chains realised higher net returns mainly due to higher yield and reduced transaction costs vis a vis farmers selling vegetables through traditional marketing channel.

3.2 Marketing of fruits and vegetables

Marketing plays an important role not only in stimulating production and consumption, but in accelerating the pace of economic development. The marketing system plays a dual role in economic development in countries whose resources are primarily agriculture. The agricultural marketing is not confined to merely buying and selling activities. The agricultural marketing is a complex process with series of services and functions involved in moving a product or commodity from the producer to the consumer. In the process of movement of product from point of its production to final consumption various marketing functions are involved.

Marketing of fruits and vegetables is quite complex and risky due to the perishable nature of the produce, seasonality in production and bulkiness. The spectrum of prices from producer to consumer, which is an outcome of demand and supply of transactions between various intermediaries at different levels in the marketing system, is also unique for fruits and vegetables. Moreover, the marketing arrangements at different stages also play an important role in price levels at various stages viz. from farm gate to the ultimate user. These features make the marketing system of fruits and vegetables to differ from other agricultural commodities, particularly in providing time, form and space utilities.

3.2.1 Marketing infrastructure

Marketing infrastructure is most important not only for the performance of various marketing functions and for the expansion of the size of the market but also for transfer of appropriate price signals leading to improvement in marketing efficiency. Market infrastructure improved through loading, weighing facilities, road network, and cold-chain facilities substantially improve physical efficiency in marketing. The market efficiency can be improved by making up-to-date market information available to all participants through various means, including a good network of market information systems, internet and good telecommunications facilities at the markets. The existing marketing arrangements for fruits and vegetables are far from adequate in majority of the countries like India.

India

India has four million kilometres road length but it connects only 49 per cent of the villages. There are 7566 regulated markets operating in the country mainly concentrating on food grains and commercial crops (2008-09). The numbers of regulated markets is increasing over time (Graph 5). These regulated markets are engaged in improving infrastructure and regulating marketing practices. However, the trading practices of fruits and vegetables are hardly regulated in these markets as they mainly focus on food grains and commercial crops. Grading at primary market level is grossly inadequate. Only around seven percent of the total quantity of agricultural commodities sold by farmers is graded before sale.
Currently, in India the scientific storage capacity is available for about 30 percent of the requirement. Cold storage facility is available for only 10 percent of fruits and vegetables produced. Existing processing capacity is inadequate and inefficient with outdated technologies. Similarly, available physical facilities to handle fruits and vegetables in market yards are inadequate. There are about 25,000 rural periodic markets in the country but with practically no infrastructure. Due to lack of proper handling (cleaning, sorting, grading and packaging) at the village level, about 30 percent of fruits and vegetables are lost before reaching the market (Acharya, 2005).

Source: Ministry of Agriculture and Ministry of Road Transport and Highways, GoI

Graph 5: Road length and number of regulated markets in India

Nepal

In Nepal, marketing of fruits and vegetables has received little attention. The central government agency on its own and in support of various donor agencies have developed physical marketing infrastructures at more than 50 market places. In district and local level, few small infrastructures have been developed by agencies like District Agriculture Development Office (DADO), District Development Committee (DDC), Municipalities, various donor assisted projects and NGOs.

Communities in the Mountain region significantly lag behind the other regions regarding access to infrastructure and services. Even small, “local” markets are not easily accessible in the mountain communities. Nearly, three-quarters of the mountain settlements reported having to walk 24 hours or more to reach the nearest all-weather road. That compares to only 5 percent of settlements in the Hills and zero percent in the Terai (WFP, 2000). For some communities in Humla, the nearest markets were as far as four to five days’ walking distance. The government is unable to provide subsidized food grain in this region. Poor infrastructure and high transportation costs are the major causes of the high market prices and food insecurity in Nepal.

Pakistan

Pakistan has large domestic market for fresh produce. However, the domestic marketing system for fruits and vegetables is very complex. There are regulated as well as unregulated markets. Under the regulated markets, there are about 203 markets in Pakistan, whereas there are many unregulated markets that are not documented. The marketing system in Pakistan
lacks proper cold storage facilities with no integrated cold chains, thereby causing substantial post harvest losses (20-40%) with reduced shelf life and quality of fresh produce. The absence of cold storage facilities in production areas thus force the growers to immediately dispose of the produce once harvested, which often results in glut formation and lower prices. In vegetables, self marketing system prevails but still the markets are controlled by the commission agents for price determination and further disposal to terminal markets through their linkages.

**Bhutan**

One of the main impediments to agriculture marketing in Bhutan is lack of infrastructure. This limits the farmers in producing more that is actually required for their consumption. The lack of cold storage facilities necessitates the farmers to sell at times below average market price as there is no large scale bulking or cold storage facilities in the production areas or at auction markets. In recent times, Government has felt the need for such facilities and have directed the ministry of Agriculture and Forests to establish cold storage in the country. Lack of weighing, grading, packaging and storage facilities contributes to market inefficiency. In Bhutan, there are 35 Sunday markets spread over the 20 Dzongkhags to facilitate domestic marketing of fruits and vegetables. There are some 14 collection sheds and 6 storage facilities owned by producers, besides the Food Corporation of Bhutan (FCB) owned storage facilities which are geared towards distribution of imported food and other corporate products.

**Bangladesh**

The lack of storage facilities and immediate need for cash forces the farmers to sell the fruits and vegetables immediately after harvest. According to the FAO survey, about 82% of farmers in all the regions sell horticultural crops immediately after harvest. They carry on head loads and make use of rickshaw vans to move the produce to markets. Traders, wholesalers and buyers mainly use rickshaw vans and trucks. About 66% of the farmers sell their produce in weekly markets and 22%, in the daily markets. Seasonality, under developed marketing and transportation system, poor infrastructure and insufficient storage facilities intensify price volatility. Farmers usually get price information from other farmers, traders, radio, television and newspapers.

**Sri Lanka**

The infrastructures provided for fruits and vegetable sectors are not adequate. The farmers are lacking information on market, quality of products and organised marketing system. The inadequate processing facilities and agro based industries, improper storage and transport facilities are leading to huge post harvest losses. Except for banana and pineapple, the organised commercial sale is not seen in other fruits. The collection of fruits during handling is very poor. In India the numbers of regulated markets is increasing over time. However, the trading practices of fruits and vegetables are hardly regulated in these markets as they mainly focus on food grains and commercial crops. Grading at primary market level is grossly inadequate. Cold storage facility is available for only 10 percent of fruits and vegetables produced. Existing processing capacity is inadequate and inefficient with outdated technologies. The Nepal communities resided in mountain region lack in access to infrastructure and services. The marketing system in Pakistan, Bhutan and Bangladesh lacks
proper cold storage facilities, weighing, grading, and packaging and storage facilities which leads to heavy post harvest losses and necessitates the farmers to sell at times below average market price.

3.2.2 Marketing channel for fresh fruits and vegetables

Marketing channel is a set of practices or activities necessary to transfer the ownership of goods, and to move goods, from the point of production to the point of consumption and, as such, consists of all the institutions and all the marketing activities in the marketing process. Tracing marketing channel is a useful tool for management. A typical marketing channel prevalent in most SAARC countries is depicted in Figure 3.

![Marketing Channel of Fresh Fruits and Vegetables](image)

**Fig. 3: Marketing Channel of Fresh Fruits and Vegetables**

**India**

In India, the marketing of fruits and vegetables is highly unorganized with large number of superfluous middlemen without making much value addition. The main channel of marketing consists of Producer → Commission agent → Wholesaler → Retailer → consumer. The farmers bring their produce to the shops of commission agents operating at the primary wholesale markets (called as Mandis) who arrange for the display and sale of produce for which he is authorized to collect 6 to 10 percent commission charges. Similarly, the farmer/ producers also sell their fruits and vegetables making use of cooperatives to a small extent.

![Marketing Channel for Fruits and Vegetables in India](image)

**Fig 4: Marketing Channel for Fruits and Vegetables in India**
Pakistan
There are three different types of markets and many market intermediaries are involved in moving produce from producers to consumers. The various market types include small rural markets, primary markets at the sub-divisional level and wholesale markets at the district level. The three different marketing channels include large scale buyers for processing plants and some public sector institutions, regulated agricultural markets and unregulated or weekly regulated private markets. These three different marketing channels interact by supplying each other at different times, yet procedurally and organizationally they are distinct. Some large buyers purchases for the needs of processors or public institutions. The government owned Agriculture Marketing and Storage Limited (ASML) for example has a mandate to intervene in the market when prices are considered to have fallen below the cost of production.

Bangladesh
In Bangladesh, the major marketing channel flow of fruits and vegetables from the farmers to the consumers is summarized below:

1. Farmers → Own family consumption
2. Farmers → Hat/Bazar → Local Trader → Retailer → Consumer
3. Farmers → Hat/Bazar → Faria → Wholesaler → Retailer
4. Farmer → Hat/Bazar → Faria → Wholesaler → Processor/Exporter

These farmers mostly consume very little portion of his produce and large portion they supply to the market for consumption through different stakeholders.

Nepal
The major marketing channel/flow of fruits from the production pockets to the consumer involve forward contractors, wholesalers and retailers (fruits). The contractor or the assembler collects the produce from the pockets or the farmers, which is supplied to the wholesaler (or retailer). The wholesalers supply it to the retailers who in turn supply it to the consumers. The most common marketing channels are:

i. Producers – Forward contractor/ Wholesaler – Retailer - Consumers
ii. Producers – Assembler/ Contractors – Wholesaler – Retailer – Consumers
iii. Producers–Pre-harvest Contractor/Wholesaler–Wholesaler– Retailer - Consumer

For the marketing of the vegetables in Nepal, there are three main marketing channels depending on the category of the vegetables. The leafy vegetables follow the first channel, the other fresh vegetables follow the second channel and potatoes, onion and garlic which fall in similar category follow the third marketing channel.

- Farmer – Retailer/ consumer (leafy vegetables)
- Farmer/ Group/ Cooperative - Collection Centre - Intermediary – Urban wholesaler market - Retailer/ hawker/Indian wholesaler – consumer/exports to India (all fresh vegetables)
- India, Tibet, Bhutan – Importer – Urban Wholesale Market – Retailer – Consumer (mainly for potato, onion, garlic)
Sri Lanka

The Middlemen are the key persons in the Sri Lankan vegetable marketing channel who connect the farm product to the ultimate consumer. There are different channels involved in marketing of the fruits and vegetable produce in Sri Lanka they are as follows;
Farmer - Dedicated Economic Centres - Retailer - Consumer
Farmer - Collectors - Public Retailer - Consumer
Farmer - Collecting centres for Supermarket - Central Purchasing Units - Supermarkets - Consumer
Farmer - Collectors - Wholesale Markets - Roadside retailers - Consumers
Farmers - Contract Supplier - Hospitals/Hotels

Bhutan

The Marketing channels for the fruits and vegetables in Bhutan are depicted in Fig 5. Vegetables in Bhutan are marketed domestically by the farmers themselves mostly through wholesalers to middlemen in small quantities at the main markets. Only a very few middlemen actually go to the production sites to procure the produce. The wholesalers then sell the vegetables to retailers in the urban markets. Farmers themselves also sell their produce at weekend markets but that constitutes a very low percentage. A very small portion of surplus vegetables is sold through the auction mechanism through the Food Corporation of Bhutan (FCB) who implements the auctioning throughout Bhutan. Export of vegetables to India is mainly through this auctioning system wherein FCB facilitates between the buyers and sellers.

Figure 5: Marketing Channel of Fruits and Vegetables in Bhutan

The major marketing channel for fresh fruits and vegetables consist of flow from farmers to the consumers involving collector, commission agent, wholesaler, retailer and exporter level in all SAARC countries.

3.2.3 Marketing cost and margin

Marketing cost is the total cost associated with delivering of goods or services to customers (or) expenditure entirely met by the supply chain players to move the product from different levels and ultimately to respective consumers. In general, the cost involved at the time of
marketing are packing, storage, transport and commissions to be charged and incurred by the intermediaries. The marketing cost of the fruits and vegetables mainly involves the cost of post-harvest activities that is incurred before disposing it to the terminal market (to the consumer), cost of harvesting, packaging (material and labour cost) handling (sorting, cleaning, grading, loading and unloading), transportation and tariff, tax and unseen cost etc. Generally, these components constitute a large share in the total margin between the final retailer price and the cost of production (or farm gate price) especially when the production pockets are at a considerable distance from the market linking roads. The marketing cost and margin should be assessed from two different angles. One would be assessing the marketing cost and margin for shipping the produce from the production area to domestic markets and another for the exporting of these produce to near by markets of the neighbouring countries.

India

There are various costs involved in the marketing of vegetables and fruits in India which are considerably higher due to transport cost, loading/unloading, market fee and commission charges. There is substantial variation in total marketing cost across commodities, e.g. ranging from Rs.400 per quintal for apple to Rs.74 per quintal for potato, on a spot basis. The highest marketing costs are seen in the case of apple at Rs.400 per quintal, in which Rs.233 is contributed by commission and Rs.100 by transport costs. At the other extreme there is potato at Rs.71 per quintal, in which transportation contributes Rs.20 and commission charges Rs.28.

Nepal

The study conducted by MDD, 2000, to assess the cost of marketing mandarin orange and apple from the two major transit points of Nepal namely Birgunj and Bhairhawa to nearby Indian markets at Patna and Gorakhpur revealed that the purchasing price at Nepalese market represents 25 to 33% of the wholesale market price prevailed at Indian wholesale markets. Similarly, marketing cost ranged between 39 to 40%, in which transportation cost stood between 14 to 16% while loss during transportation at 8 to 9% resulting in marketing margin that varied between 28 to 36% of the price received at the near by Indian wholesale market centres (Table 6)

Table 6: Marketing Cost and Margin for the Mandarin Orange and Apple Marketing from Nepal to nearby Indian Markets (Patna and Gorkhpur).

<table>
<thead>
<tr>
<th>Particulars/markets</th>
<th>Percentage of purchasing price at Nepalese market</th>
<th>Marketing cost (%)</th>
<th>Transportation cost (%)</th>
<th>Loss during transportation (%)</th>
<th>Marketing margin (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birgunj to Patna India</td>
<td>32.95</td>
<td>39.55</td>
<td>16.14</td>
<td>9.09</td>
<td>27.50</td>
</tr>
<tr>
<td>Bhairhawa to Gorakhpur India</td>
<td>25.00</td>
<td>38.85</td>
<td>14.42</td>
<td>8.08</td>
<td>36.15</td>
</tr>
</tbody>
</table>

Source, Calculated from MDD, DOA, Study of High Value commodities marketing in Indian market centers, hariharbhawan, Lalitpur, 2000.
Bangladesh

In case of Bangladesh, the price margin for tomato varies according to varieties and quality of the produce from location to location and season. It usually remained higher at the early harvest period and then gradually declined. It was reported that average price /kg were at Tk.4.88/-, Tk. 9.65, Tk.14.50 and Tk.24.50 for farmers, traders, wholesalers and retailers. On an average, the marketing cost/ha of produce worked out to be Tk. 15893/-. The growers share in the consumer price of mango stood at 32.0%. The margins of the traders and wholesalers/retailers worked to at 1.5% and 16.2% respectively. The marketing costs were estimated at 2.20%, 28.06% and 145% at farmers, local assembly traders and wholesaler/retailer levels respectively.

In SAARC countries the marketing costs and marketing margin of fruits and vegetables are considerably higher due to underdeveloped marketing and transport system, poor infrastructure and high price volatility.

3.3 Post harvest management and value addition of fruits and vegetables

Post harvest management

Increasing productivity is an essential component of a vibrant agricultural sector. Similarly improved post-harvest handling and processing is essential to ensure the product quality and right form of product producing to the end user. Too often, producers loose income due to poor post-harvest practices. The constraints post harvest management in developing countries relate to inadequate information, poor skills in harvesting and postharvest handling, lack of infrastructure, high transportation costs, poor access to markets information to farmers, limited access to financial resources and lack of awareness on improved postharvest management techniques.

However, recently more attention is increasing towards R&D on post harvest and value addition of horticultural products. Several organizations are now involved in developing technologies related to post harvest and value addition. Value addition of horticultural commodities requires a strong post harvest support. Some initiatives in this direction include establishment of research centres and cooperative institutes for development, demonstration and transfer of technology to the stakeholders. The various measures adopted include development of infrastructure like farm to market roads, storage facilities, cold chain, cargo and shipment convenience, marketing and export documentation. The steps also including adopting Global GAP and HACCP to improve and maintain quality of horticultural produce.

India

In India about 30 per cent post harvest loss is witnessed in fruits and vegetables A recent study undertaken by the Central Institute of Post Harvest Engineering and Technology (CIPHET) has estimated the wastage at around 6 to 18 per cent due to inappropriate post harvest handling. It is interesting to note that fruits and vegetable have more wastage than other perishable products like milk, meat and fisheries. Effective post-harvest management of fruits and vegetables allows not only the minimization of losses but also increasing the value of the market products by transforming the primary agricultural commodities in to juice, jam, sauce, jelly etc. Good processing enables preservation of product quality at every stage of the marketing process. Attractive packaging makes the product more appealing to consumers who in turn are willing to pay more if the product offered is of good quality and easy to use.
Pakistan

The fruits and vegetables are marketed traditionally without sorting and grading in Pakistan. Post harvest losses take place due to farmers’ small land holding, non availability of cold chain infrastructure and processing facilities in production catchments. The establishment of modern agro-processing industries requires appropriate and affordable cold storages and processing equipment. There is lack of proper handling and lack of packing and grading facilities, especially in the production areas, to efficiently handle produce and preserve its quality after harvest, grading and packing procedures as per market requirements. High transport cost and non-availability of refrigerated transport facilities are forcing traders to use non-refrigerated open trucks for domestic market and non-refrigerated containers for export, resulting in reduced shelf life, high postharvest losses and deterioration of produce quality. These result in realising lower prices which together its low yields have made horticultural enterprises less sustainable and uncompetitive, both in local and export markets.

Bangladesh

The post harvest handling of fruits and vegetables is under developed in Bangladesh due lack of cold storage facilities and refrigerated transport for fruits and vegetables. Currently, only cold storage facilities for potatoes are available in different parts of the country. Post-harvest losses of some important fruits and vegetables are presented in Table – 7. The post harvest losses varied from crop to crop. Among the selected crops, the highest loss was recorded in tomato (37%) followed by okra (34%) and lowest loss was found in chillies (14%). Post harvest spoilage of fruits and vegetables are enormous and vary from 18-44% that causes a loss of Tk. 339.2 million. About 2.2 million tons of produce is lost due to post-harvest spoilage in focused crops that provides enormous negative impact on the economy of the country (Hossain, 2010).

Table 7: Post-harvest losses of some important fruits and vegetable in Bangladesh

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area (ha)</th>
<th>Production (MT)</th>
<th>PH Loss (%)</th>
<th>Total PH loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>31658</td>
<td>304187</td>
<td>33.0</td>
<td>1181</td>
</tr>
<tr>
<td>Pineapple</td>
<td>16978</td>
<td>238360</td>
<td>18.0</td>
<td>42905</td>
</tr>
<tr>
<td>Banana</td>
<td>53294</td>
<td>877123</td>
<td>20.0</td>
<td>175424</td>
</tr>
<tr>
<td>Papaya</td>
<td>1991</td>
<td>38120</td>
<td>35.0</td>
<td>13342</td>
</tr>
<tr>
<td>Lime</td>
<td>1688</td>
<td>21632</td>
<td>28.0</td>
<td>6057</td>
</tr>
<tr>
<td>Beans</td>
<td>15595</td>
<td>82872</td>
<td>28.0</td>
<td>23204</td>
</tr>
<tr>
<td>Carrot</td>
<td>1154</td>
<td>10430</td>
<td>25.0</td>
<td>2608</td>
</tr>
<tr>
<td>Cabbage</td>
<td>16232</td>
<td>211097</td>
<td>25.0</td>
<td>52774</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>8599</td>
<td>39648</td>
<td>27.0</td>
<td>10705</td>
</tr>
<tr>
<td>Tomato</td>
<td>19651</td>
<td>143058</td>
<td>37.0</td>
<td>52931</td>
</tr>
<tr>
<td>Okra</td>
<td>9786</td>
<td>38508</td>
<td>34.0</td>
<td>13093</td>
</tr>
<tr>
<td>Eggplant</td>
<td>18387</td>
<td>122730</td>
<td>20.0</td>
<td>24546</td>
</tr>
<tr>
<td>Chillies</td>
<td>93638</td>
<td>117765</td>
<td>14.0</td>
<td>16487</td>
</tr>
<tr>
<td>Potato</td>
<td>402026</td>
<td>6647778</td>
<td>25.0</td>
<td>1661945</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>8893308</td>
<td></td>
<td>2196403</td>
</tr>
</tbody>
</table>

Source: (BARI, 2006).
Nepal

Post-harvest management practices in Nepal are very poor. Most of the fruit producers adopted traditional type of post-harvest activities like, cleaning, grading, packaging, transporting, loading, unloading, and storing. Fruits which are consumed fresh should be transported immediately to the market centres for sale and consumption. However, development of storage, road network and agro-industry is very poor in Nepal. Very few cold storages are used for mandarin orange storage, while bamboo baskets are used for packaging. Several study reports show that the post-harvest losses are as high as 30-40% in general and 29% in orange and 25-30% in apples (CRDS, 2009) mainly due to improper method of harvesting, packaging, and storage of fruits.

Sri Lanka

In Sri Lanka, the post harvest losses of fruits and vegetables also has greatly hindered the overall growth of the fruits and vegetable industry adding considerable losses not only to the farmers but also to other actors of the fruits and vegetable value chain who share the risk created primarily by the high perishable nature of fruits and vegetables. During the peak supply season, the fresh fruit and vegetable supply system typically records wastage of around 30 to 40 percent (HARTI, 2005). As a means of breaking away through dependence on the traditional export and prevailing wastage during glut periods, emphasis should be on preservation and processing technologies of fruits and vegetables.

Bhutan

The National Post Harvest Centre has established standards for apples and oranges that are export bound in Bhutan. It has also developed and distributed extension material to promote production and post harvest handling of fruits and vegetables. It has successfully promoted the zero-energy cool chamber storage developed in India in many part of the country. The agency has also established Integrated Food processing Plants in various regions of the country to minimize post harvest losses by encouraging processing and value addition of fruit and vegetable at the community level.

Fruits and vegetable have more wastage than highly perishable products like milk, meat and fisheries. Among SAARC countries post harvest management of fruits and vegetables is very poor due to small land holding of farmers, non availability of cold chain infrastructure and processing facilities in production catchments.

Value addition

Value addition sector has been identified as a thrust area for development needs, huge investments in logistics for supporting the value chain from farm to plate are needed. Value addition offers an opportunity for the creation of sustainable livelihoods and economic development for rural communities and it has come a long way in the last few decades (Gulati et al., 2007; Miehlbradt and McVay 2005). It should promote clustering of the farmers to undertake cleaning, grading, primary processing activities at production level and linking this with processing and marketing. Processed food can be customized to suit the nutritional requirements of groups such as the elderly, pregnant women, infants, young children and athletes. Such foods are characterized by a balanced composition of energy
suppliers in the form of fats, carbohydrates and proteins, and by a combination of vitamins and minerals composed according to the current state of scientific knowledge.

**India**

In India due to the complexity of weak firm-farm linkages and inefficiency in the value chains, level of value addition is quite low (Gulati, 2009). However, value addition segment of food market (including fruits, vegetables and livestock products) is growing rapidly and attracting investments since the launch of economic reforms (1991). In order to make horticulture a viable enterprise, value addition is essential. Harvest indices, grading, packaging and storage techniques have been developed and standardized for major horticultural crops in India. Value addition through dehydration of fruits and vegetables including freeze drying are being undertaken. Potato chips, flakes, fingers and French fries are becoming popular as fast food business. Development of new products like juices, chips, essential oils, fruit wines are gaining popularity. Packing materials like Corrugated Fibreboard Boxes (CFBs), perforated punnettes, cling film wraps, sachets, etc. have been standardized for packaging of different fresh horticultural produce.

**Pakistan**

The processing of vegetables and fruits products as a viable and profitable business opportunity is yet to be fully exploited in Pakistan. Currently growers are not familiar with latest processing techniques that can add value to the products and bring lot of foreign exchange through exports. So there is tremendous scope for introduction of agro food based industries and value addition centres that enable minimisation of the post harvest losses. Introduction of such facility can increase the income of the growers and as well as exports from the country.

**Bangladesh**

In Bangladesh, the role of processed fruits and vegetables in the domestic and export quite small, although there are a number of large-scale enterprises (PRAN, Square, Eurasia Food Processing, BD Foods and Golden Harvest etc among them) who appear committed to expanding this sector. The modern organized fruit processing industry comprises relatively small volumes of canning, freezing and dehydration. However, jams, jellies, and pickles are made in large quantities, chiefly by small entrepreneurs at the home or cottage scale. In addition, extruded snacks, puffed rice and potato chips are made and sold in the domestic market by small and medium enterprises. Some units, especially larger ones, have modern facilities operating hygienically in conformity with Good Manufacturing Practices (GMP). On the whole, most existing facilities need up-grading and personnel require considerable training on a wide range of aspects of manufacturing, sanitation and efficiency. To put agro-processing into perspective, Bangladesh produces 4-5 million metric tons of horticultural produce each year. PRAN, which accounts for more than half of the horticultural produce which moves through processed channels, consumes an estimated 12,000-15,000 metric tons per year. Even under the most liberal of assumptions, then, it would appear that transformation of horticultural products into processed food products accounts for less that 1% of total horticultural production.
Nepal

Traditional practices adopted by the Nepal farmers like wooden box and cartoon packaging is used for mango and apple fruits, whereas, other fruits are packed in bamboo basket (Dokos). Subsidy for packaging materials is provided by the government to Apple producer farmers, to reduce post-harvest losses and to create awareness to the farmers for value addition practices.

Sri Lanka

The impact of the local fruit processing industry to the economy is significant while for vegetable it is negligible in Sri Lanka. Gherkin has contributed as the main part of the total processed vegetable exports which is around 8,000 mt in 2009 (Sri Lanka Customs, 2005-2009). Gherkin preserved by vinegar/acetic acid, chilled tomato and chilled cucumber are the major processed vegetables used for export purpose. Fresh and dried banana, dried lemon, prepared/preserved/dried pineapple, grape fruit juice, mixture of juices, dried mangoes are the forms of processed fruits that are exported from Sri Lanka. However, less than 3 percent of total production of fruits and vegetables are exported as fresh and processed products.

Bhutan

The domestic market for fruit and vegetable processing is dominated by two agro-based industries in Bhutan, which use the export rejected fruits for processing value added products like orange squash, apple juice, juice, jam, marmalade and pickles. About 75% of the processed fruit products are exported to India and Bangladesh, while the remaining is sold in the local markets. The product range of both the agro-based industries is the same, except for the volume of the different orange products. The Bhutan Fruit Factory (BFF) in Samtse is a large producer compared to BAIL. Vegetables, especially, chilli, radish, green vegetables etc are processed and sun dried at the house hold level in rural areas. The processing at community level is picking up through groups and cooperatives.

In India and Pakistan processing of vegetables and fruits products is a viable and profitable business opportunity but the level of value addition is quite low. In Bangladesh too the role of processed fruits and vegetables in the domestic and export trade is quite small, although there are a number of large-scale enterprises. In Nepal, commercial farmers uses value addition practices, like grading, cleaning, packaging and transport to markets to realise higher price. However, smallholders who are unaware of value addition dispose their product in the market and get lower prices. In Sri Lanka, the impact of the local fruit and vegetable processing industry is limited to gherkin processing. In Bhutan, the domestic market for fruit and vegetable processing is dominated by two agro-based industries, which use the export rejected fruits for processing value added products like orange squash, apple juice, juice, jam, marmalade and pickles. Vegetables especially chilli, radish, green vegetables etc are processed and sun dried at the house hold level in rural areas.
Chapter - IV

4. Existing Value chain, Identification the stakeholders and their role

4.1 Existing Value Chains across SAARC countries

This section deals with the existing value chains, identify the stakeholders, and their role in the value chain of fruits and vegetables in SAARC countries. The value chain system of the fruits and vegetables is almost the same across the countries as there is no much difference of market players and the commodity handled except the change in share in the flow of volume among the players of the value chain of different fruits and vegetables.

India

Traditional value chains have more stakeholders than modern retail chain. The recent studies have shown, modern value chains (Fig 6.) being more efficient than traditional value chains in many ways. Modern value chain is superior as it has scope for market function integration, financial flow management, supply-demand matching, collaborative forecasting, information sharing, goods movement synchronization through efficient transport scheduling and integration of input suppliers (Asthana, 2012). Modern value chain is a two way process where as traditional system is a one way process.

Fig. 6: Modern Value Chain for fruits and vegetables India
A comparative study on both traditional and modern value chains conducted by Reddy et al., (2010) clearly shows the relative higher efficiency of modern value chain. The traditional value chain farmers, on an average, received a higher share than other stakeholders. Also, the farmers linked to the modern value chain received not higher price for each of the commodities. These integrated farmers received inputs and technical support; there is a reduction in production risks due to the vertical relationship. Similarly, modern vendors buy the products from integrated farmers at a price correlated to prices in supermarkets. Integrated farmers are likely to face less price fluctuations and lower transaction costs compared to their traditional counterparts. Since they know their buyers, there is no search involved in the transaction. In addition, they also incur low monitoring and enforcement costs due to repeated transactions with the same vendor(s). Therefore, reductions in price and production risks and transaction costs due to the vertical relationship have enhanced the overall return to farmers linked to the modern value chain.

**Pakistan**

The supply chain of mango in Pakistan follows one of the following two basic channels as given in Figure 7. The details of each of the channel are described briefly.

Channel 1 involves pre-harvest contractors as an intermediary between growers and Commission agents/exporters or processors, wholesalers. The majority of the farmers sell their orchard as a whole to contractors before harvest. It entirely depends on the trust on each other who have long term relationship. These contractors tend to be regular buyers in certain pockets of production or from certain groups of farmers. The contractors perform transactional functions that involve buying arrangements, harvesting, sorting, grading, packing and transport of fruits to markets etc. Generally, the contractors make a profit because of their risk-taking ability but certain times they also incur loss due to market uncertainties. Nearly 71 percent of farmers sold their produce to contractors and get some advance payments (20-25%) at pre-harvest stage.

Channel 2 is the traditional rout wherein growers themselves sell their produce after harvesting packing in local markets through commission agents. Nearly, 29 percent mango growers sold their produce in the wholesale market.
Source: Based on discussion with mango supply chain stakeholders

Fig. 7: Supply Chain for fruits in Pakistan (Mango)
Value chain for vegetable is little bit different from fruits wherein most of the vegetables are sold by the growers themselves. The growers supply the vegetables on daily basis to the wholesale markets in the main vegetable growing regions. Small scale vegetable production also takes place in other parts by specialized farming by certain farm families. They sell in the local market as well as in the wholesale market depending upon the scale of production. Most farmers (99 percent) sold their produce in wholesale market through commission agent and the remaining percent sold to processors for preparing tomato products. There is hardly any processing of other vegetables except potato to small extent.

Source: Based on discussion with stakeholders

Fig. 8: Supply chain for vegetable in Pakistan (Tomato)

**Bangladesh**

A sub-sector map of fruits and vegetables is developed to graphically represent the relationship between the actors in reaching the final product to the consumer. The supply chain map of fruits and vegetables is presented in Figure 9.
The map shows the channels currently operating in different ways and degrees in the markets. There are a number of ways the fruits and vegetables are sold right from the field to the urban markets. The producers are living around the urban areas sell their produce in urban retail markets through different channels to reach the consumers. The general supply chain map of vegetables and fruits showing different actors, physical flow of the product and various links to the markets are depicted in Fig. 9.

**Nepal**

Dhankuta is the major production area of vegetables in eastern region of Nepal. The vegetables produced in this area reach the market mainly through Dhankuta-Dharan-Biratnagar-Siliguri (India) corridor. Around 60 percent of off-season vegetables produced by farmers in Dhankuta are collected at the collection centers. The remaining 40 percent are collected by road head traders. Both collection centers and road head traders supply the major part (60 percent and 40 percent respectively) to big traders. Besides, selling to big traders, the collection centers also supply directly to the commission agents in India. The big traders give 70 percent of their vegetables to regional wholesalers and 30 percent to the commission agents in India. Regional wholesalers also receive directly from road head traders. From the regional wholesalers, more than 85 percent of the vegetables reach the retailers in the major domestic market hubs. The regional wholesalers also supply some quantity (around 15 percent) to the wholesaler in India. The Indian commission agents works
collect 6 to 7 percent as commission charges for supplying to Indian wholesalers and retailers. The detail supply chain map of the eastern corridor is presented in Figure 10.

Source: ANSAB, 2011,

Fig. 10: Supply Chain Map of fruits and vegetables in Eastern Corridor of Nepal
Sri Lanka

Sri Lanka has two major traditional fruit and vegetable value chains. The first one is “Colombo Manning Market” located in the Colombo district; the capital city in Sri Lanka and the other is the “Dambulla Dedicated Economic Centre (DDEC)”\(^2\) in Matale district. For this report the second value chain in Dambulla was considered.

**Traditional value chain through DDEC**

The amount that passes through the Dambulla wholesale market is higher than the amount which passes through any other wholesale market. Approximate vegetable lorries reached to the DDEC per day range from 18 to 20 million mt (700-800 lorries per day) and 100 lorries of fruits.

\[\text{Fig. 11: Traditional value chain for fruits and vegetables in Sri Lanka}\]

The DDEC has around 150 commission agents and most of the farmers have a preference for a particular commission agent. Vegetables/fruits arrive in to the DDEC in two ways; farmers

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\(^2\) There are 12 Dedicated Economic Centres (DECs) in Sri Lanka. The setting up of Dedicated Economic Centres was started in 1998, as a means of implementing marketing development strategy to provide marketing facilities for producers in the rural areas. Coordination and supervision of operation of all DECs are carried out by the Ministry of Co-operative and Internal Trade.
harvest their produce and bring either by own or hired lorry. This is followed by the farmers who live surrounding to Dambulla area. Farmers who live far away from the DDEC area specially, farmers in hill country region transport their produce (up country vegetables) by making use of transport agents/collectors to Dambulla. In this channel the farmers arrive with their produce and unload the same at the commission agents shop and wait until the arrival of wholesalers. Wholesaler and farmer negotiate the sale in front of the commission agent. The commission agent weighs the produce and releases to the wholesaler after collecting his commission charges. Farmers receive cash on the spot so also the commission agents. Normally the vegetables are packed in poly sacks while for tomato wooden boxes are used.

Unlike vegetables, unloaded fruits at the commission agent shops are sorted based on the size, ripeness/maturity. The graded fruits are repacked. Major fruit types that move through Dambulla value chain are banana, papaya, mango, water melon, butter fruit and pineapple. Farmers transport bunches of banana covered with dried banana leave, while papaya, water melon, butter fruit and pineapple are transported without any cover, mango is transported in cardboard cartons.

**Bhutan**

The supply chain map of fruit and vegetable consists of three elements: functions, operators and promoters. There is a clear difference between operators and promoters/supporters of a value chain (Springer-Heinz, 2007). The people or enterprises performing the basic functions of a supply chain are operators (also called actors). At one stage in the supply chain, they become owners of the (raw, semi-processed or finished) product. Based on this definition, the fruits and vegetable value chain actors in Bhutan can be grouped into the following functions:

- **Production:** Actors whose functions are directly related to basic agricultural production, including pre-cultivation, cultivation, harvest, or extractive activities.
- **Post harvest handling and processing:** Actors whose functions are directly related to post harvest management (cleaning, sorting, packaging, etc) or processing of basic goods into value added products.
- **Trading:** Actors whose functions are related to the buying and selling of the Product.

As depicted in the map (Figure 12) of fruits and vegetable supply chain, many potato and citrus growers in Bhutan act as integrated supply chain operators and perform two or more functions. They often arrange farm inputs (FYM, seeds etc.) on their own, grow fruits and vegetables, harvest, grade and pack them, and then assemble to the road head and transport them to the auction yard for sale.
**Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries**

**Fig. 12: Value Chain Map of Potato in Eastern Bhutan**

**Inputs**
- Supply seeds, fertilizers, training, equipment etc

**Production**
- Prepare land, grow, protect, harvest, clean and store

**Collection & Transportation**
- Assemble, grade, pack, carry to the road head, or transport to the auction yard

**Trading (Wholesale & Retail)**
- Load, Pack, transport & Sell in the local market or export

**Consumption**
- Consume as vegetable, use for chips and crisp making or keep for seeds

**VC Functions**
- VC Operators
- VC Supporters

(Source: Joshi, S.R and Gurung, B.R, 2009)

**Fig. 13: Value Chain Map of Mandarin Orange in Eastern Bhutan**

**Inputs**
- Provision of seedlings, fertilizers, training, equipment etc

**Production**
- Prepare land, dig out pits, plant seedlings, grow, protect, harvest

**Collection & Transportation**
- Sort, grade, pack, carry to the road head, or transport to the auction yard

**Trading (Export or Retail) (Process in domestic market)**
- Load, Pack, transport & Sell in the local market or export

**Consumption**
- Consume as fresh fruit, make juice or use for jams, marmalade

**VC Operators**
- Local growers
- Consumers

**VC Promoters**
- BCCI/RTIO, RAMCO, Dz/AMEPP
- BDFC

**VC Functions**
- VC Operators
- VC Supporters

**VC Functions**
- VC Operators
- VC Supporters

**Major VC Functions**
- VC Operators
- VC Supporters

(Source: Joshi, S.R and Gurung, B.R, 2009)
4.2 Stakeholders and their Role in Supply Chains of Fruits and Vegetables

Stakeholders are the main participants of supply chain who are directly involved in the business. These stakeholders and their role remain almost same across SARRC countries. The primary stakeholders in the supply chain are input suppliers, producers, contractors, commission agents, wholesalers, retailers, processor/exporters, and consumers whose role is described in detail in table 8

Table 8: Primary actors, Functions and Description

<table>
<thead>
<tr>
<th>Primary Actors</th>
<th>Activities /Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Suppliers</td>
<td>Input suppliers are those who supply seed, fertilizer, weedicide and pesticide for fruit and vegetable growers.</td>
</tr>
<tr>
<td>Nursery Developers/Seed production</td>
<td>Public (limited level) /private sectors and some growers are involved in the nursery raising business.</td>
</tr>
<tr>
<td>Producers</td>
<td>There are two main categories of producers namely small and large farmers. Producers lack information and knowledge on scientific orchard/vegetable cultivation and management. Large farmers in general and small farmers in particular are working in adverse conditions.</td>
</tr>
<tr>
<td>Contractors</td>
<td>Majority of contractors buy most of the fruits orchards from the producers before harvesting. Likewise, in some cases village beopari purchased vegetable produce from growers.</td>
</tr>
<tr>
<td>Commission Agent</td>
<td>The role of commission agent is reaching fresh fruits and vegetables to consumers are quite prominent in all SAARC countries. Commission Agent has the pivotal role in the whole marketing system of SAARC. He provides finance to growers, contractors, beoparies, wholesalers and even retailers in the system. Due to his strong financial and entrepreneurial power, he exploits growers and wholesalers. Presently, the commission agents are charging at higher rates of commission violating the law. Some commission agents also work as traders.</td>
</tr>
<tr>
<td>Wholesalers</td>
<td>The wholesalers are based in the main fruit and vegetable markets in big cities. Wholesalers are bulk brokers. They purchase at the auctions auction in bulk, grade it and divide it into small lots, which are purchased by retailers and sometimes by directly by consumers.</td>
</tr>
<tr>
<td>Retailers</td>
<td>They are located in the local markets or at the street corners. In the rural areas, they source fruits and vegetables from producers or commission agents. They deal with a limited number of suppliers. In the urban areas, they buy from wholesalers.</td>
</tr>
<tr>
<td>Processors</td>
<td>Operate processing units, where fruits and vegetables are purchased, transported, washed, waxed, graded, packed and exported.</td>
</tr>
<tr>
<td>Exporters</td>
<td>Exporters purchase fruits and vegetable from growers, process them and export to countries where the demand is high for realising higher process.</td>
</tr>
<tr>
<td>Consumer</td>
<td>The final customer who consumes the produce.</td>
</tr>
</tbody>
</table>
The second type of actors in the fruits and vegetable markets consists of various supplementary service providers and institutions. The most important government institutions are; Ministry of National Food Security and Research, Agriculture Research Council, Seed certification agency and Registration Department, Research Institutions, Local Governments, District Councils, University of Agricultural Sciences, Horticulture Development and commodity Boards, Agriculture Research Institute, Agriculture Departments, Agriculture Policy Institute and Department of Plant Protection. These government agencies offer a wide range of support to Fruits and Vegetables supply chains, including training and extension services. The second category of supportive institutions includes NGOs, private sector horticultural associations and donor supported programs that offer farm-to-market chain facilitators and integrators (MMA Ltd., 2011). The description of activities and functions of these actors are briefly presented in Table 9.

<table>
<thead>
<tr>
<th>Secondary Actors</th>
<th>Activities/functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D institution</td>
<td>Conduct research and development on fruits and vegetables at national and provincial level</td>
</tr>
<tr>
<td>Transportation</td>
<td>Transporting of fruits and vegetables from farm to market</td>
</tr>
<tr>
<td>Market and communication</td>
<td>Disseminate market information</td>
</tr>
<tr>
<td>Government policy</td>
<td>Facilitate the production and marketing activities</td>
</tr>
<tr>
<td>Regulatory policy</td>
<td>Implementation of regulatory measures</td>
</tr>
</tbody>
</table>

In India, Modern value chains are comparatively more efficient than traditional value chains in many ways. Modern value chain is superior as it has scope for market function integration, financial flow management, supply - demand matching, collaborative forecasting, information sharing, goods movement synchronization through efficient transport scheduling and integration of input suppliers. Whereas, in Pakistan, the market players include farmer, contractor, commission agents, wholesalers, inter-market traders, retailers, Processors and exporters. In general, market intermediaries dominate the system and there is little direct market participation of the farmers, particularly small farmers. The general supply chain map of Bangladesh vegetables and fruits shows different actors, physical flow of the product and various links to the markets. In Nepal, due to country’s topography and dominance of smallholders most of the fruits and vegetable farmers rely on middlemen to supply their product. The major traditional fruit and vegetable value chain of Sri Lanka centers around the “Dambulla Dedicated Economic Centre (DDEC)”. The vegetable/fruits arrive to the market either through farmers owned or DDEC facilitated transportation depending on the distance. In Bhutan, the supply chain is underdeveloped. In the domestic market, most potatoes are sold by growers directly to consumers. Only a small quantity is sold through middlemen, local wholesalers or retailers/grocery shops. Especially in Eastern Bhutan, the local traders and middlemen/cooperative are not involved in the process of product delivery.
5. Regulatory measures (certification), quality assurance and public health hazards in fruits and vegetables value chain

Safety and hygiene is a very important area in any food industry. Food processing industries have to adhere to basic good housekeeping and hygiene standards as any lack in this area would result in very poor performance of the business throughout the value chain (Reardon, 2005; Hu et al., 2004). Nevertheless, health risks also arise from improper practices around the production, handling, preparation, or storage of food. The changing organizational structure of the agri-food system - inputs, production, distribution, and consumption is coupled with increasing concern about the reliability of such systems to deliver safe food to consumers in both developed and less developed countries.

The value-chain approach is an effective way to evaluate the performance of food safety systems and the varying level of risk as products move along the value chain (ODI, 2003; Kydd, 2002). Furthermore, the profit margin will vary as products move along the value chain, so different actors will have different incentives to alter food safety risks. In developing countries, there are numerous value chains serving formal and informal domestic markets as well as export markets, and the governance of these chains vary. Understanding the relationships, networks, skills, and coordination mechanisms to manage the flow of products is essential for ensuring the delivery of safe food (Rich and Narrod, 2005; Narayanan and Gulati, 2002). To understand how the value chains affect food safety, organization and governance is very crucial. Technology, regulation, financing, and other ancillary services play a role in reducing health risk and assuring food safety. The complexity of the health hazards that arise as a product moves along the value chain with drivers and showing possible sources of food contamination along the fruits and vegetables value chain in India is illustrated in figure 14.
As consumers get awareness on food safety standards and health safety, government has responded with more laws on food safety and regulations in India. It is highly recommended that processing industries invest good amount of funds to the food safety equipments and measures. To handle these issues, international standards are being followed. Food processing industries have opted for Hazard Analysis and Critical Control Points (HACCP) certification in India for export but not for domestic consumption.

India has its own food laws. It is important for every processor, exporter or importer to adhere to the rules of the land for food products as it affects health of the population. Numerous laws have been stipulated by Ministry of Food and health to protect consumer interests and stop malpractices by manufacturers.

Following are the major Acts enacted by Government of India:
- Food Safety and Standards Act, 2006 (Ministry of Consumer Affairs)
- Prevention of Food Adulteration Act (PFA) and Rules (Ministry of Health & Family Welfare), 1954
- Agriculture Produce (Grading & Marking) Act (Ministry of Rural Development).
- Fruit Products Order (FPO), 1995
- Export (Quality Control and Inspection) Act, 1963.

Pure Food Ordinance 1960 and Pure Food Rules 1965 form the legislative framework of food safety in Pakistan are enforced through health service delivery channels of the provincial government. The Pakistan Standard Institute (PSI) with its Food and Agriculture Division develops standard for foods and food products. The PSI standards are voluntary standards and they indirectly complement the implementation of Pure Food Ordinance,
which is mandatory regulatory framework for the entire country. The rules give authority to provincial governments to appoint public analysts for the investigation of quality and safety of food. There is no federal structure of food safety programme in Pakistan. Common food products like edible oils, biscuits, grapes, and bananas are enforced through Pure Food Ordinance 1960. Federal Ministry of Health monitors the quality on import and export of food products. The Agriculture Produce (Grading and Marking) Act 1937 is implemented by the Ministry of Agriculture. Some food products like marine products, oil cake, dry whole chillies, onions, potatoes, citrus fruits, mangoes and eggs are under mandatory certification scheme of national grade standard system.

In Nepal, to assess the quality assurance, Organic certification is provided to the producer farmers of fruits and vegetables. Integrated pest management activities have been launched throughout the country. Food Technology and Quality Control Department is responsible for food safety control within the country. In addition, plant quarantine offices are also responsible to control and monitor pesticide used in fruits and vegetables for import and export.

Specific legislation was enacted in Sri Lanka on prevention of contamination of food in 1949 with the name of Food and Drugs Act. This has been replaced by the Food Act No. 26 of 1980 with regulations given in food Act being cited as food regulations. Food safety assurance is one arena where SLSI provides certification services to the industry and commerce.

i. GMP Certification System

SLSI operates a GMP Certification Scheme for the food industry and services based on the Sri Lanka Standard on Code of practice for general principles of food hygiene (SLS 143). In case where a Sri Lanka Standard on code of practice for the industry or service concerned is available, that specific standard is also considered for granting certification in addition to SLS 143. Regular post certification inspections are be arranged by the SLSI to assess the effectiveness of GM practices.

ii. Hazard Analysis and Critical Control Point (HACCP) for food safety assurance

A certificate holder develops and maintains its food safety assurance program based on the internationally accepted principles of ISO 22000 and SLS 1266. Having obtained HACCP certificate from the SLSI implies that chemical, physical and biological hazards encountered during production or processing of the food item, as applicable to the scope of certification are controlled to make the food safe for human consumption.

In India it is highly recommended that processing industries invest good amount of funds to the food safety equipments and measures. Food processing industries have opted for Hazard Analysis and Critical Control Points (HACCP) certification for export but not for domestic consumption. Fresh fruits and vegetables quality control and standards in Bangladesh are virtually non-existent. Pakistan needs to work actively to meet food safety and quality compliance requirements. Setting-up standard food testing and inspection infrastructure, on priority basis, particularly in clusters involving exporters is required. Food Technology and Quality Control Department is responsible for food safety control in Nepal. In Sri Lanka food safety assurance is one arena where SLSI provides certification services to the industry and commerce.
Recommendations

I. Promotion of commercial horticultural farming

In SAARC countries, the small farms dominate the agrarian structure who generate relatively small quantities of marketable surpluses. It is necessary to link these small farmers to markets and agri-business to transform them from subsistence agriculture to sustainable commercial farms through specialized production.

II. Subsidy for production of fruits and vegetables

Production cost of fruits and vegetable is very high due to cost of planting material, labour and chemicals. A system of subsidy targeted to small and marginal farmers is necessary to make them sustainable.

III. Marketing

Provision of marketing information on prices, market destinations for produce and value addition through media such as radio, television and publications are necessary to enable effective decision making by all stakeholders. Facilitate access and development of new export exit points. Encourage proactive participation of farmers to comply with market requirements. Provide technical information to the middlemen, contractors and exporters regarding the handling and management of the fruits.

IV. Market access and price system

There is need to develop demand based and service oriented competitive market environment with regulations for monopoly control at micro level. This would enhance market access and free entry for more players in the system. Fair price objective oriented system should be promoted at all levels. Through: a) promotion of environmentally safe production practices and packing material; b) facilitate stakeholders involved in horticulture business in getting credit from banks, other institutions on easy terms and conditions and as quickly as possible; c) establishment and development of modern wholesale markets, cold storage facilities, grading facilities in the production areas on private public participation made. And d) availability of technical expertise to the private sector for the preparation of viable business models related to activities in horticulture sector.

V. Post Harvest Technology

Post harvest management is the weakest link in the fruit and vegetable value chain management. Fragmented supply base with superfluous middlemen forms the major challenge for consolidation of produce and compressing the supply chain. In the present system, around 30 percent of the fruits and vegetable are lost due to the inefficiencies in the post harvest management. In fact, these inefficiencies offer tremendous scope for investment, to overcome problems relating to poor marketing infrastructure, unorganized and traditional transport models, lack of viable scale (especially to introduce innovative cold chain) and unfriendly marketing policies for investors. These impediments can be addressed through building organizational and market intelligence capital through PPP model, promotion of
commodity specific clusters among growers, facilitate honouring of contract farming agreements, rationalization of marketing laws and compliance to food safety standards.

VI. Promotion of Advanced Tools for Harvesting

Promote the use of advanced tools for harvest, determine appropriate harvesting time to reduce post harvest losses during transportation, introduce low cost post-harvest treatment to reduce losses and ensure better quality of fruits, create awareness regarding proper grading and sorting of fruits and vegetables amongst the various agents in the value chain. Given the increasing demand for good quality fruits and vegetables by consumers in both domestic and export markets, the maintenance of cold chain from grower to the consumer is of crucial relevance. The key issues in development of the cold chain industry are; diverse requirement for different horticultural produce, non-standard pricing, limited financial capabilities of the transporters and lack of critical scale for organized player participation. In order to set up a cold chain infrastructure for fruits and vegetables it is prudent to focus on selected crops in selected locations. Further, fruits and vegetables cannot be addressed in combination as the economics are different. Fruits lend themselves to cold chain better than vegetables. Hence, there is a need to develop crop specific cold chains for both fruits and vegetables.

VII. Efficient, equitable and viable fruits and vegetables regional and global value chains

In order to develop viable value chains for fruits and vegetables more should be done to promote regional integration at each stage of the value chain. This would also facilitate entry into global value chains and promote regional development. Regional value chains of fruits and vegetables can also identify efficiency gains that can be captured through integrated markets. This would result in the provision of support services and infrastructure required for connecting domestic private sector service providers to regional and global supply chains.

VII. Creating Awareness on quality, safety and nutritional security aspects

The awareness among consumers regarding quality, safety and nutritional security aspects of fruits and vegetables should be increased. Increased demand for high quality, safety certified produce could result in other upstream factor to fall in place. It is, thus essential to focus on differentiating produce based on traceability and quality as value addition rather than just price. In this context, retailers need to give renewed focus on value proposition and value creation through quality and safety rather than just focus on wastage reduction and price competitiveness.
Conclusion

Fruits and vegetables play a major role in the agricultural economy of the SAARC countries. These countries grow a large variety of indigenous and exotic fruits and vegetables. Most member countries of SAARC for the past several years, maintained positive growth in production of fruits and vegetables indicating the increasing role that they play in enhancing farmer incomes, alleviating poverty and improving quality of diet. In most of the SAARC countries vegetables are an obvious priority as they are less risky to grow as compared to fruits. Provision of improved extension services to farmers will help them to adopt most efficient techniques of production and marketing fruits and vegetables. So that, they achieve sustainability.

Production cost of fruits and vegetable is very high due to high cost of planting material, labour and chemicals. The marketing costs of fruits and vegetables were found to be higher than other crops to seasonality in production, underdeveloped marketing and transport systems, poor infrastructure, and insufficient cold chain facilities and high price volatility.

Fresh fruits and vegetables are highly perishable with some estimates suggesting a post-harvest loss of 30 to 50%. At present, there is considerable gap between the gross production and net availability of fruits and vegetables due to heavy post harvest losses. The loss occurs due to poor pre-production and post-harvest management as well as lack of appropriate processing and marketing facilities. These losses have several adverse impacts on farmer income, consumer prices and nutritional quality of the produce. Because of the poor planting material, cultural practices including harvesting methods and handling practices, the quality of harvested produce is below standard. Absence of on farm storage facility and proper pack house/packing station results in the perishable produce being marketed immediately after harvesting without primary processing and adequate packaging. Small farmers with limited access to markets as well as financial resources are discouraged from adopting improved post harvest management techniques.

Value chains for fruits and vegetables are different from food grains. These are highly perishable commodities and there are issues of food safety both for domestic and international markets. There is a need to envision a complete agri-food system. Agricultural processors and retailers are scaling up very fast while farmers continue to be small and fragmented. The question of economic viability of small farmers arises which could be tackled by developing horizontal and vertical coordination (domestically and globally) through efficient and equitable fruits and vegetables value chains development with respect to competitiveness, inclusiveness, scalability and sustainability to ensure fair prices to farmer and agribusiness participants to improve the income and livelihood of the chain actors.
References


Anonymous, 2012, Status report on Value chain Analysis and market study on fruits and vegetables in Bhutan, Department of Agriculture Marketing and cooperatives, Ministry of Agriculture and forests, Thimphu, Bhutan.

Anonymous, 2012, Value chain Analysis and Market study on fruits and vegetables in Pakistan

ANSAB, 2011, Value chain/ market analysis of the off-season vegetable sub sector in Nepal, Asian Network for Sustainable Agriculture and Bioresources


Awasthi Datt Bishnu, 2012, Value Chain Analysis and Market Study on fruits and vegetables in Nepal


Balasaheb Vaishali, 2010, Performance of Indian Agricultural Exports among SAARC Countries, Master of Business Administration in Agribusiness Management, University of Agricultural Sciences, Dharwad (India).


Christopher L. Gilbert, 2008, Value chain analysis and market power in commodity processing with application to the cocoa and coffee sectors, discussion paper No. 5, Universita Degli Studi Di Trento- Dipartimento Di Economia.

CII and Yes Bank, 2008: Recommendation Paper on Developing Globally Competitive Fruit and Vegetable Value Chains in India, Prepared in Summit organised by Confederation of Indian Industry (CII)

DAE, 2011, Annual report, PIU, DAE, NATP, Khamarbari, Dhaka


GOP(Government of Pakistan), 2009-10 “Agricultural Statistics of Pakistan”, Ministry of Food, Agriculture & Livestock, Economic Wing, Islamabad

GOP(Government of Pakistan), 2009-10 “Fruits Vegetables and Condiments Statistics of Pakistan”, Ministry of Food, Agriculture & Livestock, Economic Wing, Islamabad

GOP(Government of Pakistan), 2011-12 “Pakistan Economic Survey, 2011-12, Economic Adviser’s Wing, Finance Division, Islamabad

Guru Shankerlal, 2000, *Market infrastructure, and agricultural marketing reforms*, Government of India, Department of Agricultural & Cooperation, Krishi Bhavan, New Delhi, Dated the 19th December, 2000


NAAS, 2012: *State of Indian Agriculture 2011-12*, National Academy for Agricultural Sciences, New Delhi


### Major fruits producing countries in the World (2010-11)

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<tr>
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</thead>
<tbody>
<tr>
<td>China</td>
<td>11402073</td>
<td>122184944</td>
<td>10.7</td>
</tr>
<tr>
<td>India</td>
<td>6383000</td>
<td>74878000</td>
<td>11.7</td>
</tr>
<tr>
<td>Brazil</td>
<td>2441430</td>
<td>39286781</td>
<td>16.1</td>
</tr>
<tr>
<td>United States of America</td>
<td>1145475</td>
<td>25383917</td>
<td>22.2</td>
</tr>
<tr>
<td>Italy</td>
<td>1277347</td>
<td>16907895</td>
<td>13.2</td>
</tr>
<tr>
<td>Philippines</td>
<td>1155871</td>
<td>16181731</td>
<td>14.0</td>
</tr>
<tr>
<td>Mexico</td>
<td>1212387</td>
<td>15255598</td>
<td>12.6</td>
</tr>
<tr>
<td>Spain</td>
<td>1562160</td>
<td>15184420</td>
<td>9.7</td>
</tr>
<tr>
<td>Indonesia</td>
<td>662800</td>
<td>14867762</td>
<td>22.4</td>
</tr>
<tr>
<td>Turkey</td>
<td>1092623</td>
<td>13945604</td>
<td>12.8</td>
</tr>
<tr>
<td>Others</td>
<td>26751915</td>
<td>245223757</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>World Total</strong></td>
<td><strong>55087081</strong></td>
<td><strong>599300409</strong></td>
<td><strong>10.9</strong></td>
</tr>
</tbody>
</table>

*Source: Indian Horticulture database, 2011*

### Major fruits producing countries in the World (2010-11)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>21047200</td>
<td>473062941</td>
<td>22.5</td>
</tr>
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<td>India</td>
<td>8495000</td>
<td>146554000</td>
<td>17.3</td>
</tr>
<tr>
<td>United States of America</td>
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<td>35293556</td>
<td>31.4</td>
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<td>25.1</td>
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<td>Mexico</td>
<td>656124</td>
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<td>242049765</td>
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<td><strong>World + (Total)</strong></td>
<td><strong>53977066</strong></td>
<td><strong>1012524165</strong></td>
<td><strong>18.8</strong></td>
</tr>
</tbody>
</table>

*Source: Indian Horticulture database, 2011*
Keynote Paper
on
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

By
Ms. Janaki Kuruppu
Advisor, Cabinet Sub-Committee on Food Security Office of the President, Sri Lanka
Even though the 2008 price spike has since subsided, none of the underlying agricultural problems that caused the crisis have gone away.

World Bank New Release, 30/7/2012

“The impact of the US drought on global markets is exaggerated by other countries also suffering from weather related production issues. Other drought related issues, wheat crops in Russia, Ukraine, and India. Should the current situation escalate The World Bank Group is ready to assist.........

FAO warns of a pending food crisis…..

CNN, August 12, 2012
### Background to Study

- Currently in the Sri Lankan vegetable market, there is very high annual price volatility both at the farm gate level and at the consumer level.

- It is believed that while some of this volatility arises directly from unplanned increases and decreases in supply, some of the volatility arises from inefficiencies in the value chain, particularly with respect to pricing and operations which affects the market functioning itself.

- The effect of this on the agriculture producer will have a long term negative impact on the growth of agriculture and thereby on food security of the country.

Hence the study

### The Research

**A Value Chain Analysis for the Sri Lankan Vegetable Market from a Food Security Perspective**

### Research Objectives

The study attempts to examine

- (a) the market structure affecting value chains from producer to consumer for vegetables in Sri Lanka
- (b) the relationship, if any, between these market structures and their changes over time on the one hand, and production, operational and pricing efficiencies and product price behavior on the other.

The study would further examine

- (c) the impact of various agriculture and trade policy instruments of the past affecting the structure of agriculture markets and product price behavior as well as food security conditions and briefly study the same used by other comparable countries pre and post the 2008 food crisis.

### Theoretical Framework

The study will use the following theoretical framework:

- Firstly, use a Value Chain Analysis (VCA) approach to identify the economic subsectors in the vegetable value chain and understand the dynamics between these identified subsectors
- Secondly, use the Structure-Conduct-Performance (SCP) approach in order to understand the sub sectors in detail

#### The SCP approach:

- This is a widely used methodology for commodity system analysis. In the agriculture produce marketing system, the structure can be defined as to how the market is organized which includes the type of market participants, the degree of the seller-buyer concentration, market entry conditions and product differentiation.

#### The VCA Approach:

- A value chain analysis is a method that facilitates an improved understanding of competitive challenges, helps in the identification of relationships and coordination mechanisms, and assists in understanding how chain actors deal with powers and who governs or influences the chain. Developing value chains is often about improving access to markets and ensuring a more efficient product flow while ensuring that all actors in the chain benefit.

### Research Methodology and Design

The study methodology will consist of the following:

- **Part 1:** A desk research component which will review and analyse published information and secondary data available on key information areas.
- **Part 2:** An empirical research using a stakeholder survey

The study will mainly focus on vegetables and geographically cover 2 main areas for vegetables production namely Nuwara Eliya and Dambulla. Further, even though these 2 geographies are not heavy fruit producing areas, most of the fruits also go through these areas in transit. Hence, the study will also identify which findings on vegetables will be applicable to the fruits market and value chain as well, for this purpose the geographical area of Embilipitya will be covered.
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

Research Methodology and Design

Part 2: An empirical research using a stakeholder survey
Geographical Coverage: Nuwara Eliya, Dambulla and Embilipitiya

- Sample Design: A total of 300 interviews conducted with the following broad sample breakdown.
  - Farmers – 100
  - Farmer groups/Collectors - 35
  - Wholesalers – 35 (producer/ non producer areas)
  - Transporters – 35
  - Retailers – 75 (mix of urban and rural areas in 30 towns)
  - Agri Business institutions/ Experts – 20

Reference to Previous Research

From a Policy Perspective

- Kohl et al (2005) finds a similar outcome in the free market economy in the US where over a period of over 20 yrs when farm prices showed high volatility with frequent increases and decreases, the retail prices remain stagnant or showed much less fluctuations, which could be interpreted as that the benefit of low farm prices have not been transferred to the consumer, thereby causing both the farmer and the consumer to loose in this scenarios. This could probably be due to the inefficiencies in the value chain.

- Weerahewa (2004) analyses the potential impacts of elimination of the oligopsony power of the paddy collectors on the well-being of paddy farmers. The author theorises based on the simulations that the losses to the paddy producers due to trade liberalisation can be minimised if oligopsony power can be eliminated at the same time. The author recommends that further research to estimate the degree of oligopsony power and impact of new domestic market reforms on same.

Reference to Previous Research

From a Value Chain Efficiency Perspective

- Vidanapathirana (2008) finds that in the vegetable trade the wholesaler margins are around 30-32% while the retailer margins are around 28-35% of the retail price, and the producer's share is below 50% when analysing prices over a 10 yr period 1997-2007. Of the total cost from the producer to the consumer, 90% is for margins and only 10% is the cost of the wholesalers/ collectors and the retailer. He concludes that there is no sign of decline on these margins over the years even with the increase in supply.

- Gunatilleke (2001) has analysed the trends from 1979-1996 in real producer prices and agricultural market integration and the study's findings on trends in market integration shows that there is little evidence of improved efficiency either in consumer markets or between producer markets and consumer markets.

Reference to Previous Research

From a Value Chain Efficiency Perspective

- Dixie (2007) states that there are 3 factors of particular importance to strengthen market linkages in Sri Lanka: Namely, improving rural roads infrastructure, improving farmer coordination to aggregate volumes to exploit economies of scale and facilitate integration with agribusinesses and strengthening market information systems, including establishment of commodity exchanges.

- Abeysekera et al (2006) in a study of alternative supply chain management practices for fresh fruit and vegetables (FFV) concludes that excessive and direct public sector involvement retards the evolution of domestic FFV marketing systems and hence a better balance in public and private sector involvements is emphasized. Shorter, more cohesive supply chains, functioning with higher efficiency, more focus on consumer needs/convenience/quality requirements, better farm gate prices for the growers involved, emergence of new products, increased processing/value addition , new supply chain partners with new responsibilities at all levels are identified as further areas for improvement.

Preliminary Results

- Components along the value chain and the value added at each stage
  - Structure of the Economic sub sectors
  - Conduct and Performance of the sub sectors
  - Problems faced and improvements suggested by stakeholders
**The Food Security Perspective**

**What is a Value Chain?**

- Agricultural commodities are produced by large numbers of farmers and consumed by a large number of households. With the exception of food consumed on-farm or sold locally, they are bought and sold a number of times between farm gate and the final consumer. While moving between these 2 points, the commodity is loaded, off-loaded, transported, stored, cleaned, graded and processed. The conduit that runs from a farmer down to a final user, through which the commodity passes and which embodies these transactions and activities is conveniently referred to as a "marketing and processing chain: or a "supply chain" or a "value chain". (FAO, 2005a).

**Current Value Chain for Vegetables in Sri Lanka**

- **Producers**: Farmers, Agri Business company owned farms
- **Collectors**: Farmers organizations, Just collectors, Transporters / collectors
- **Wholesalers**: In producer areas, Economic centers (owned by government), Collection centers (owned by Agri businesses), Independent wholesalers
- **Retailers**: Near markets, Govt owned wholesale centres (Welisara, Manning)
- **Consumers**: Hotels/ Government
- **Processors**: Institutions
- **Input Suppliers**: Seed/Fertilizer companies, Retail shops (selling seeds/fertilizer), Chemical companies/ shops

**A Value Chain Analysis of the Vegetable Market in Sri Lanka from a Food Security Perspective**

**Structure of the Economic Sub Sectors**

- Producer Area Economic Centers: Dambula, Nuwara Eliya, Nawalapitiya, Kappetipola, Ambalapitaya, Weerawila
- Wholesale Centers near Markets: Welisara, Veyangoda, Meegoda, Manning Market

**Presented by**

Janaki Kuruppu
Advisor, Cabinet Sub Committee on Food Security
Office of the President, Sri Lanka
Structure of the Market

<table>
<thead>
<tr>
<th></th>
<th>No of Transporters</th>
<th>No of Collectors</th>
<th>No of Wholesalers</th>
<th>No of Retailers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village</td>
<td>7</td>
<td>5</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Town/City</td>
<td>29</td>
<td>20</td>
<td>58</td>
<td>43</td>
</tr>
</tbody>
</table>

- 7-8 players from each sub sector in a typical village
- 20-25 transporters and collectors in towns
- double that number (50) of wholesalers and retailers in towns
- A fairly competitive market model with respect to these sub sectors at both village and city level.

Input Suppliers

Fertilizer

Approx. 62 companies in business
The top 6 companies controlling over 80% Market Share

Vegetable Seeds

About 76 companies in business.
The top 11 companies controlling over 80% Market Share

Pesticides

About 45 companies in business
The top 11 companies controlling over 80% Market Share

Conduct of the Economic Sub Sectors

Value Addition by Sub Sectors

<table>
<thead>
<tr>
<th></th>
<th>Sorting/Grading</th>
<th>Cleaning</th>
<th>Packing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmers</td>
<td>50%</td>
<td>48%</td>
<td>51%</td>
</tr>
<tr>
<td>Collectors</td>
<td>46%</td>
<td>57%</td>
<td>54%</td>
</tr>
<tr>
<td>Transporters</td>
<td>23%</td>
<td>20%</td>
<td>37%</td>
</tr>
<tr>
<td>Wholesalers</td>
<td>44%</td>
<td>50%</td>
<td>47%</td>
</tr>
<tr>
<td>Retailers</td>
<td>52%</td>
<td>58%</td>
<td>56%</td>
</tr>
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</table>
**A Supply Chain Cost Analysis**

*Extract from “Production Resources in hiking Regions” World Bank Report: case study - Sri Lanka, June 2007*

*Source: Estimated from the Wholesale and Retail Price of Marketing, Food Policy and Agri-Business Division/HARTI*

---

**Cost of Value Addition of 1 kg Beans Supplied from Keppetipola to Colombo**

- **Producer Price**: Rs. 30.00 - Rs. 35.00
- **43% - 44%**

**Cost of Value Addition of 1 kg of Tomato Supplied from Balangoda to Kadawatha**

- **Producer Price**: Rs. 49.00 - Rs. 50.00
- **29% - 36%**

---

**Current Supply Chain Costs**

<table>
<thead>
<tr>
<th>Product</th>
<th>Producer's Price</th>
<th>Wholesalers' Margin</th>
<th>Retailers' Margin</th>
<th>Consumer's Price</th>
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<tr>
<td>Case Study 1 (Luga to Colombo)</td>
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</tr>
<tr>
<td>15.00</td>
<td>8.20</td>
<td>6.80</td>
<td>15.00</td>
<td>10.00</td>
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<tr>
<td>55.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a % of Retail Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27%</td>
<td>15%</td>
<td>13%</td>
<td>27%</td>
<td>18%</td>
</tr>
<tr>
<td>Case Study 2 (Keppetipola Colombo)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>4</td>
<td>16</td>
<td>4</td>
<td>21</td>
</tr>
<tr>
<td>75</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>As a % of Retail Price</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td>5%</td>
<td>22%</td>
<td>5%</td>
<td>28%</td>
</tr>
<tr>
<td>Average share Of each link</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-40%</td>
<td>15-25%</td>
<td>20-35%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Source: HARTI Survey Data, 2020*

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**Producer's Share of Vegetables from 1997 -2007 (Percentage)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Beans</td>
<td>23%</td>
<td>27%</td>
<td>31%</td>
<td>35%</td>
<td>39%</td>
<td>43%</td>
<td>47%</td>
<td>51%</td>
<td>55%</td>
<td>59%</td>
<td>63%</td>
</tr>
<tr>
<td>Tomato</td>
<td>21%</td>
<td>25%</td>
<td>29%</td>
<td>33%</td>
<td>37%</td>
<td>41%</td>
<td>45%</td>
<td>49%</td>
<td>53%</td>
<td>57%</td>
<td>61%</td>
</tr>
<tr>
<td>Bitter Gourd</td>
<td>23%</td>
<td>27%</td>
<td>31%</td>
<td>35%</td>
<td>39%</td>
<td>43%</td>
<td>47%</td>
<td>51%</td>
<td>55%</td>
<td>59%</td>
<td>63%</td>
</tr>
<tr>
<td>Snake Gourd</td>
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<td>25%</td>
<td>29%</td>
<td>33%</td>
<td>37%</td>
<td>41%</td>
<td>45%</td>
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<td>53%</td>
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<tr>
<td>Luffa</td>
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<td>25%</td>
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<td>33%</td>
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<td>45%</td>
<td>49%</td>
<td>53%</td>
<td>57%</td>
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<tr>
<td>Long Beans</td>
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<td>33%</td>
<td>37%</td>
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<td>45%</td>
<td>49%</td>
<td>53%</td>
<td>57%</td>
<td>61%</td>
</tr>
</tbody>
</table>

*Source: Estimated from the Wholesale and Retail Price of Marketing, Food Policy and Agri-Business Division/HARTI*
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

### Price Spread of Beans in 2007

<table>
<thead>
<tr>
<th>Month</th>
<th>Producer Price (Rs/Kg)</th>
<th>Wholesale Price (Rs/Kg)</th>
<th>Retail Price (Rs/Kg)</th>
<th>Producer’s Share (%)</th>
<th>Wholesaler’s Margin (%)</th>
<th>Retailer’s Margin (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>53.83</td>
<td>74.28</td>
<td>113.57</td>
<td>47.6</td>
<td>18.06</td>
<td>34.31</td>
</tr>
<tr>
<td>February</td>
<td>57.53</td>
<td>70</td>
<td>101.99</td>
<td>50.63</td>
<td>18.11</td>
<td>31.37</td>
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<td>March</td>
<td>73.64</td>
<td>44.43</td>
<td>72.37</td>
<td>40.73</td>
<td>20.35</td>
<td>30.54</td>
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<td>April</td>
<td>64.15</td>
<td>36.93</td>
<td>67.62</td>
<td>38.3</td>
<td>18.89</td>
<td>38.63</td>
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<td>May</td>
<td>41.42</td>
<td>31.44</td>
<td>75.03</td>
<td>53.16</td>
<td>7.92</td>
<td>36.25</td>
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<tr>
<td>June</td>
<td>82.18</td>
<td>74.78</td>
<td>109.06</td>
<td>57.02</td>
<td>11.53</td>
<td>31.43</td>
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<tr>
<td>July</td>
<td>56.0</td>
<td>65.48</td>
<td>102.71</td>
<td>54.43</td>
<td>5.33</td>
<td>35.25</td>
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<tr>
<td>August</td>
<td>78.78</td>
<td>69.71</td>
<td>78.18</td>
<td>49.65</td>
<td>10.14</td>
<td>40.23</td>
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<tr>
<td>September</td>
<td>73.95</td>
<td>73.93</td>
<td>75.06</td>
<td>57.95</td>
<td>18.85</td>
<td>23.19</td>
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<tr>
<td>October</td>
<td>84.62</td>
<td>81.42</td>
<td>88.88</td>
<td>55.04</td>
<td>17.0</td>
<td>31.48</td>
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<tr>
<td>November</td>
<td>78.6</td>
<td>61.07</td>
<td>80.99</td>
<td>53.03</td>
<td>6.89</td>
<td>46.14</td>
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<tr>
<td>December</td>
<td>89.24</td>
<td>83.55</td>
<td>85.78</td>
<td>58.38</td>
<td>10.51</td>
<td>39.2</td>
</tr>
</tbody>
</table>

Source: Estimated from the Wholesale and Retail Price of Marketing, Food Policy and Agri-Business Division/HARTI

### Price Spread of Carrot in 2007

<table>
<thead>
<tr>
<th>Month</th>
<th>Producer Price (Rs/Kg)</th>
<th>Wholesale Price (Rs/Kg)</th>
<th>Retail Price (Rs/Kg)</th>
<th>Producer’s Share (%)</th>
<th>Wholesaler’s Margin (%)</th>
<th>Retailer’s Margin (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>57.28</td>
<td>95.39</td>
<td>125.26</td>
<td>45.58</td>
<td>22.44</td>
<td>31.68</td>
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<tr>
<td>February</td>
<td>51.38</td>
<td>74.89</td>
<td>113.94</td>
<td>45.13</td>
<td>20.74</td>
<td>34.15</td>
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<tr>
<td>March</td>
<td>43.57</td>
<td>55.75</td>
<td>95.92</td>
<td>47.57</td>
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<td>30.68</td>
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<tr>
<td>April</td>
<td>34.83</td>
<td>40.96</td>
<td>75.03</td>
<td>45.8</td>
<td>8.83</td>
<td>47.31</td>
</tr>
<tr>
<td>May</td>
<td>25.55</td>
<td>32.96</td>
<td>62.93</td>
<td>38.37</td>
<td>12.97</td>
<td>46.9</td>
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<tr>
<td>June</td>
<td>32.55</td>
<td>37.96</td>
<td>62.97</td>
<td>49.93</td>
<td>6.39</td>
<td>46.91</td>
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<tr>
<td>July</td>
<td>45.28</td>
<td>46.28</td>
<td>87.51</td>
<td>46.14</td>
<td>7.16</td>
<td>43.68</td>
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<tr>
<td>August</td>
<td>40.47</td>
<td>42.75</td>
<td>82.69</td>
<td>46.6</td>
<td>4.42</td>
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<td>September</td>
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<td>40.94</td>
<td>75.68</td>
<td>45.22</td>
<td>8.88</td>
<td>45.9</td>
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<tr>
<td>October</td>
<td>36.27</td>
<td>45.95</td>
<td>75.36</td>
<td>48.04</td>
<td>6.39</td>
<td>45.98</td>
</tr>
<tr>
<td>November</td>
<td>35.95</td>
<td>56.32</td>
<td>106.17</td>
<td>52.76</td>
<td>10.05</td>
<td>38.24</td>
</tr>
<tr>
<td>December</td>
<td>47.7</td>
<td>58.35</td>
<td>95.05</td>
<td>62.25</td>
<td>8.91</td>
<td>45.47</td>
</tr>
</tbody>
</table>

Source: Estimated from the Wholesale and Retail Price of Marketing, Food Policy and Agri-Business Division/HARTI

### Performance of the Economic Sub Sectors

### Average Producer, Wholesale and Retail Prices of Big Onion - Rs/Kg

Source: Estimated from the Wholesale and Retail Price of Marketing, Food Policy and Agri-Business Division/HARTI

### Average Producer, Wholesale and Retail Prices of Tomato - Rs/Kg

Source: Estimated from the Wholesale and Retail Price of Marketing, Food Policy and Agri-Business Division/HARTI
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries
Conclusions

Socio Economic Indicators

• 41% of farmers, 51% retailers, 58% of collectors, 51% transporters say income has decreased over last 5 yrs
• 26% of transporters and 54% of collectors have other sources of income which is mainly cultivation for both segments while transporters also engage in buying/selling vegetables as well.
• 27% farmers cultivate vegetables throughout the year as compared to 30% for fruits
• 84% cultivate on their own land and 22% burrow money for cultivation every season

Problems Faced

• A problem mentioned by all sub sectors was the rising transport cost and the lack of a more organised transport mode
  – 58% of transporters use small/medium lorries while 52% of retailers use 3-wheelers for transport
• A fixed price for vegetables was preferred by many sectors including transporters and wholesalers
• Quality of final product reaching the retailer and quality infrastructure at retail sales locations an issue to retailers
• Lack of higher yielding vegetable varieties and better quality seeds were another shortcoming
• While the unfair prices offered by collectors and the shortage of collectors and the dis-functioning farmer groups were issues for farmers
• Vehicles, fuel, financing and quality of roads are issues for transporters and collectors

Possible Conclusions and Areas for further Investigation

• The market control by a few players in the input supply sub sector should be addressed in order to control cost of production
• The lack of an organised transport method will have to be addressed possibly through modes such as trains
• Possibility of shortening the supply chain through more regional hubs and re-distribution
• A fixed price for vegetables or a more transparent pricing mechanism such as auctions to be explored
• Quality infrastructure at retail sales locations and road infrastructure to be looked at
• Higher yielding vegetable varieties and better quality seeds
• Getting more farmer organisations to function
• Reducing post harvest losses in order to improve quality of final product
• The unprecedented increase in retailer margins (costs?) to be investigated and possible solutions need to be derived
Value Chain Analysis and Market Studies on Fruits and Vegetable in Bangladesh

By

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Executive Summary

SAARC Agriculture Centre (SAC) has commissioned a “Value Chain Analysis and Market Study on Fruits and Vegetables in SAARC countries” to determine the value chain profiles and identify the major constraints and potential areas for intervention to promote growth and opportunities in fruits and vegetables sub-sector. The present study was conducted in Bangladesh during the period from April and May, 2012. The study involved a combination of field survey for both qualitative and quantitative investigation using projective techniques. The study framework consisted of review of relevant reports and literatures, semi-structured interview of key informants, and interview of different input suppliers and services providers.

The fruits and vegetables sub-sector is playing a vital role in farm income enhancement, poverty alleviation, food security, and sustainable agriculture in Asia including the Bangladesh. Present vegetable growing area in the country is about 0.358 million ha and fruits is about 0.145 million ha. Besides, about 19.4 million homesteads cover about 0.45 million ha for fruits and vegetables. Total production of vegetables, fruits and potato are 3.0, 4.5 and 7.9 million tons respectively. This sub-sector, however, suffers greatly from postharvest losses of about 30-40%. There exists a big gap between production and requirements. Both fruits and vegetables are seasonal crops distributed mainly in the summer and winter seasons. About 10 million farmers grow fruits and vegetables in the country.

Marketing of fruits and vegetables is quite complex and risky due to the perishable nature of the produce. The inefficient marketing system, seasonality, poor transportation, underdeveloped infrastructure, insufficient post-harvest Holdings and storage facilities and practices intensify the price volatility. Most of the producers are small and marginal types and produce fruits and vegetables following poor technological and management systems. Retail and wholesale prices fluctuate substantially from year to year and also from month to month, depending on the supply situation. The gaps between the prices paid by the consumers in the urban areas and those received by the producers are wide. The producers and traders are lacking market information and facing problems of working capital. Market information flows among the actors of value chain are not homogeneous. The middlemen predominantly control marketing channels.

Post-harvest management is poor resulting huge loss and lower quality. Over maturity, lack of attractiveness and uniformity, mixing of varieties, high pesticide residues and admixture of good and rotten items are some of the major problems. Spoilage of produce during marketing is reportedly very high, although precise data are not available, it is estimated that spoilage constituted over 40% of the produces in some crops e.g. tomatoes. Fresh fruits and vegetables quality control and standards in Bangladesh are virtually non-existent. Uses of agro-chemicals are increasing day by day. In most cases pre-harvest index are not followed.

Export of fruits and vegetables from Bangladesh rose from 19,805 metric tons from in 2006-07 to 48,428 metric tons in 2010-11 and are being exported to more than 30 market destinations. Out of seven key markets as a single country the UK is the most important and lifting more than 48% of total volume of export of fruits and vegetables. The majority of the export is still packed in bamboo baskets and second hand paper cartons and confined in
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

There exists scope for the expansion of export volume of fruits and vegetables in EU and other markets if the emerging challenges are addressed appropriately. Traditional exporters collect fresh produces from the local market directly and also from the wholesale markets in Dhaka city. The exporter’s sorts, grades and packs the vegetables in bamboo baskets and used paper carton boxes and sends to airport without maintaining any cool chain for air-shipment to the destination markets. The ethnic markets fetch low prices due to supply of low quality produces in a poor packaging. Quality improvement of produces and packaging may increase the export value. Due to high airfreight cost and limited freight space for fresh produces in the Bangladeshi airlines, exporters have initiated alternate supply chain of vegetables in frozen form through ocean going vessels.

Different organizations/institutions are currently providing R & D services which include technology, credit access and technical training. There are few services available to small and medium scale agribusiness enterprises and most of them are provided through individual professionals, NGOs or donor supported subsidized projects. The public sector organizations/agencies are providing limited trainings for skill development and technological information. In private sector some organizations/enterprises and seed and pesticides companies are also providing services in limited scales as embedded services. Likewise, NGOs are also rendering services to address the constraints of the sub-sector as a part of their micro credit net work. There are no functional producers or traders associations in the rural area. The BFVAPEA-as associations of fruits and vegetable exporters are not strong enough to support the whole range of required activities of the members. In the course of study a broad review of the sub-sector along with value chain actors, physical flow of the products, existing practices in the value chains in terms of production, marketing and facilitating agencies was made. Attention was also made to the major cross-cutting issues which encourage or impede the growth and potentials of the sub-sector seen from view point of producers, traders and consumers. Based on this study, some services or facilitation activities and recommendation for interventions are suggested.

The fruits and vegetables sub-sector is facing some crucial challenges related to development of services, capacity building, market access, technology information, and policy advocacy. The major constraints identified relating to general awareness are: (i) lack of improved production technique of vegetables (ii) inadequate knowledge and skills on soil, fertilizer, seeds and pest management (iii). lack of knowledge of seed production, collection and preservation.(iv) inadequate knowledge on harvesting, post-harvest handling, storage and transportation (v) limited research and poor dissemination of research findings, and (vi) insufficient extension services and poor delivery system. The constraints relating to market access are: (i) inadequate market information (ii) lack of poor marketing initiative and market linkages. The major constraints relating to inputs are: (i) prevalence of sales of poor quality and adulterated inputs (seeds, fertilizers and pesticides) by the input supplier (ii) lack of organic fertilizer and pesticides resulting in poor quality vegetables, (iii) inadequate knowledge and skills in adhering to the use of recommended pesticides and ignorance of environmental concerns as demanded by importing countries. (iv) lack of awareness on the quality and environmental issues (v) lack of sufficient air cargo space and unexplored sea vessel exports vi) high royalty, handling charge, cost of aviation and fuel etc., and (vii) poor packaging of perishables and (viii) finally the absence of functional SME’s associations. In order to strengthen the capacity and dynamism of the sub-sector, the following priority intervention areas are recommended:
• Skill development and capacity building, addressing all aspects relating to fruits and vegetable production following the code of Good Agricultural Practices (GAP);
• Improve knowledge on maturity indices, harvesting, grading, packaging, transportation and storing of vegetables;
• Develop awareness on quality inputs and ensure quality seed, fertilizers and pesticides;
• Create awareness on the food safety issues for international trade;
• Support development of private sector service providers for quality assurance and market research for identifying appropriate markets;
• Support for establishing good quality packaging for easy export market access;
• Assist in establishing a data base on market information of perishables;
• Arrange policy dialogue with GOB to formulate horticultural export policy, increase air cargo space options in national and international airlines and allowing foreign cargo plane to operate from Bangladesh; and
• Support strengthening of SME’s Associations to create direct linkage for the small farmers, traders and processors with the urban markets as well as export markets.
Chapter -1

Overview of the Study

1.1 Background of the study

This report has been prepared through an assignment given by the SAARC Agriculture Centre (SAC) to conduct country study on "Value Chain Analysis and Market Studies on Fruits and Vegetable in Bangladesh" to assess the present status of fruits and vegetables production, marketing and supply chain constraints and opportunities facing the sub-sector in Bangladesh. The services defined in accordance with the objectives and scopes of work set in the TOR (Annexed-I) have been implemented during April and May, 2012.

1.2 Objectives of the study

The specific objectives of the study are to:

1. To review the current status of production, marketing system, market infrastructure, present post harvest management practices and value addition in fruits and vegetables.
2. To analyze the existing supply chains, identify the stakeholders, and their role in the supply chain of fruits and vegetables in SAARC countries.
3. To highlight the recent technologies on post-harvest, value addition, food safety and development of information management.
4. To assess the quality assurance system including regulatory measures (certification) in fruits and vegetables supply chain and food safety issues that causes hazard for public health and the environment.
5. To analyze farm level production costs, prices, value addition and the performance of important actors of supply chain and examine if there is any scope to increase their value added activities.
6. Identify best practices of supply system in the region including
7. To suggest policy intervention for improving supply chain, market access and thereby facilitating fair price to the farmers in order to promote high value produce based agribusiness and improve income and livelihood of the farmers.

1.3 Methodology

The research study was conducted in combination of desk review of various sources like reports, journals, book documents, and others, and field interview with relevant stakeholders, functionaries and others involved in the entire value chain through semi-structured questionnaire to get an understanding on the current status of fruits and vegetables, their marketing systems, constraints and opportunities facing the sub-sector including the potentiality of high price market access and the relative importance of the various participants in terms of volume of flow, the types of market players and the level of their participation, the buying and selling behavior of the different market players, the buying areas and seasonality and transactions, etc. Assessment was also made to determine the
challenges and identify the potentials for future interventions. The data collected were analyzed for preparing the report.

### 1.4 Structure of the Report

The report is divided in eight chapters. Following this introduction, chapters two describe the overview of fruits and vegetables sub-sector. Chapter three discusses the marketing of fruits and vegetables fresh produce export market including value chain analysis and marketing costs and price spread. Value chain analysis of five focus crops has been illustrated in chapter four. Chapter five contains the facilitating agencies and their services and chapter six describes the key constraints and opportunities fruits and vegetables. Chapter seven contains value chain development strategies and proposed services. Chapter eight illustrates the recommendations and conclusion. Annex one contains a list of references used and annexes two includes the terms of reference for this study.
Chapter-2

Overview of Fruits and Vegetables Sub-sector

2.1 Growth of Horticulture and Crop Sub-sector

The agriculture sector consists of crop, forestry, fisheries and livestock sub-sectors. The crop sub-sector represents 57% of agricultural GDP, and accounts for 55% of sectoral employment. However, crop sub-sector growth is decreasing gradually, varying from 5.23% in 2006-07 to 4.10% in 2009-10 (Table-1). The growth instability from year to year indicates that crop sub-sector remains highly vulnerable to natural disasters and unpredictable climatic conditions. Growth of crops also depends on input supply, input quality and input price factors.

Table 1: Growth Rate of Agriculture (%) and its Sub-sectors at constant (1995-96) price

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Agriculture &amp; forestry</td>
<td>5.23</td>
<td>4.69</td>
<td>3.47</td>
<td>2.93</td>
<td>4.10</td>
</tr>
<tr>
<td>a) Crops &amp; horticulture</td>
<td>5.03</td>
<td>4.43</td>
<td>3.44</td>
<td>2.67</td>
<td>4.02</td>
</tr>
<tr>
<td>b) Animal farming</td>
<td>6.15</td>
<td>5.49</td>
<td>2.41</td>
<td>2.44</td>
<td>3.48</td>
</tr>
<tr>
<td>c) Forest &amp; related/ services</td>
<td>5.18</td>
<td>5.24</td>
<td>5.42</td>
<td>5.47</td>
<td>5.69</td>
</tr>
<tr>
<td>d) Fishing</td>
<td>3.92</td>
<td>4.07</td>
<td>4.11</td>
<td>4.18</td>
<td>4.16</td>
</tr>
<tr>
<td>Total Agriculture (1 + 2) as % of GDP</td>
<td>23.08</td>
<td>22.27</td>
<td>21.84</td>
<td>21.37</td>
<td>20.48</td>
</tr>
</tbody>
</table>

Source: BBS, 2010

Crop agriculture in Bangladesh is dominated by cereal crops, which account for an estimated 80% of the 14.2 million hectares under production nation-wide. Cultivation of horticultural products takes up only about 7%. As for example, fruits covered only about 0.98% and vegetables covered 2.18% of the total cultivated area (Siddique and Azad, 2010). Banana occupied the highest area (42.2%), followed by mango (19.6%), pineapple (12.8%), jackfruit (7.0%) and guava (4.8%) while brinjal occupied the highest area (16.9%), followed by radish (8.4%), pumpkin (6.8%), aroids (6.4%), tomato (6.2%), and bean (4.7%). Although it occupies only 7.27% of Bangladesh’s agricultural land, horticultural production generates more than 18% of its agricultural GDP.

Bangladesh is blessed with many fruits and vegetable crops. More than 90 vegetables and 70 fruits are grown in Bangladesh (Bhuyan and Hossain, 2011). Major vegetables include potato, tomato, brinjal, cabbage, cauliflower, aroids, pumpkin, bottle gourd, cucumber, pointed gourd, bitter gourd, hyacinth bean, and yard long bean. In the case of fruits, banana, jackfruit, mango, pineapple, papaya, guava, lemons, pummelo, litchi and ber (jujube) are important. Fruits and vegetables are grown in all over Bangladesh. But the extent of cultivation varies from one region to another. Some crops have concentrated areas for production because of favorable agro-ecological condition and better marketing facilities.
Table 2: Production of horticultural crops in Bangladesh during 2001-02 to 2009-10

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>3171.0</td>
<td>3457.0</td>
<td>3431.0</td>
<td>4224.0</td>
<td>4525.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1905.0</td>
<td>2047.0</td>
<td>2247.0</td>
<td>2908.0</td>
<td>3000.0</td>
</tr>
<tr>
<td>Spices</td>
<td>1181.0</td>
<td>1406.0</td>
<td>1334.0</td>
<td>1213.0</td>
<td>1350.0</td>
</tr>
<tr>
<td>Potato</td>
<td>4161.0</td>
<td>5167.0</td>
<td>6648.0</td>
<td>5268.0</td>
<td>7930.0</td>
</tr>
<tr>
<td>Sweet Potato</td>
<td>308.0</td>
<td>304.0</td>
<td>307.0</td>
<td>305.0</td>
<td>260.0</td>
</tr>
<tr>
<td>Coconut</td>
<td>326.0</td>
<td>352.0</td>
<td>334.0</td>
<td>316.0</td>
<td>402.0</td>
</tr>
</tbody>
</table>

Statistical Year Book of Bangladesh, 2010

Production of vegetables has increased from 1.79 to 3.00 million tons in 2005-06 to 2009-10. Similarly, the production of fruits during the same period has increased only from 3.17 million tons to 4.52 million tons. Potato production has made a quantum jump from 4.16 million tons in 2005-06 to 7.93 million tons in 2009-10 (Table-2).

Table 3: Cultivation Cost and Net Returns of Boro Rice vs. Focus Commodities

<table>
<thead>
<tr>
<th>Crop</th>
<th>Total Cost of Production (Tk/ha)</th>
<th>Gross return (Tk/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boro Rice</td>
<td>83,100.00</td>
<td>15,900.00</td>
</tr>
<tr>
<td>Mango</td>
<td>80,022.00</td>
<td>230,225.00</td>
</tr>
<tr>
<td>Pineapples</td>
<td>92,912.00</td>
<td>99,415.00</td>
</tr>
<tr>
<td>Potato</td>
<td>128,000.00</td>
<td>15,200.00</td>
</tr>
<tr>
<td>Tomato</td>
<td>156,051.00</td>
<td>199,431.00</td>
</tr>
<tr>
<td>Brinjal</td>
<td>184,420.00</td>
<td>308,166.00</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>114,360.00</td>
<td>111,240.00</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>241,952.00</td>
<td>60,448.00</td>
</tr>
<tr>
<td>Chilli</td>
<td>79,072.00</td>
<td>64,028.00</td>
</tr>
<tr>
<td>Cabbage</td>
<td>94,715.00</td>
<td>106,357.00</td>
</tr>
</tbody>
</table>

Source: DAE, 2010 & 2012

In addition to its disproportionate contributions to agricultural growth and agricultural GDP, the horticultural sector also provides differentially higher net returns per hectare than do the conventional paddy crops, which occupy primacy of place within the context of agricultural land use. Fruit and vegetable crops in general are profitable (Table-3) and thus farmers prefer to grow them for higher income. Moreover, there exists scope to strengthen the national economy by exporting fresh as well as processed fruits and vegetables.

In all cases, grower’s profitability is significantly higher on a per-hectare basis for each of the five focus commodities (mango, pineapple, potato, brinjal and okra) than for Boro rice. Modern varieties of potato display strong comparative advantage even under existing farming practices, which will improve further with technological innovations. The profitability estimates show that fruits and vegetables appear to be highly competitive in terms of returns.
All fruits and vegetables have highly favourable financial returns when compared with rice, even those of high value crops (HYVs). The financial returns of vegetable products for export appear to be fabulously high as compared to that of most other crops. However, their exports are constrained by lack of experience with these crops in Bangladesh, as well as by a variety of marketing problems including product quality, acceptable packaging, high transport costs and market access. Intensive and well-organized efforts are needed to permit the exploitation of comparative advantage and profitability of high value crops. Comparative advantage can be improved through reducing production costs, by raising yields, or by reducing import costs. This can be achieved through introduction of modern technologies in production, marketing and processing of these crops.

Table 4: Yield gap between average yield and good farmer’s yields of vegetables (ton/ha)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Current average yield</th>
<th>Good farmers yield (GFY)</th>
<th>Yield gap (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cucumber</td>
<td>10.44</td>
<td>20.0</td>
<td>9.56</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>9.87</td>
<td>20.0</td>
<td>10.13</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>14.38</td>
<td>20.0</td>
<td>5.62</td>
</tr>
<tr>
<td>Indian Spinach</td>
<td>15.94</td>
<td>40.0</td>
<td>24.06</td>
</tr>
<tr>
<td>String bean</td>
<td>8.08</td>
<td>12.0</td>
<td>3.92</td>
</tr>
<tr>
<td>Brinjal</td>
<td>15.90</td>
<td>50.0</td>
<td>34.10</td>
</tr>
<tr>
<td>Okra</td>
<td>8.50</td>
<td>14.0</td>
<td>5.50</td>
</tr>
<tr>
<td>Aroids</td>
<td>13.96</td>
<td>16.0</td>
<td>2.04</td>
</tr>
<tr>
<td>Tomato</td>
<td>18.94</td>
<td>60.0</td>
<td>41.06</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>16.65</td>
<td>25.00</td>
<td>8.35</td>
</tr>
<tr>
<td>Cabbage</td>
<td>22.45</td>
<td>30.00</td>
<td>7.55</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>14.10</strong></td>
<td><strong>27.90</strong></td>
<td><strong>49.46</strong></td>
</tr>
</tbody>
</table>

*Source: DAE Demonstrations, 2010*

Researchers should prioritize their agenda in the light of crop management problems faced by the farmers, such as development of varieties to reduce duration of the crops, so as to better fit the crop(s) in existing rotations, mitigate the pest pressure on crops, and develop attributes in crops that meet market demands and consumer preferences. For instance, the export of potatoes has been recently started to Singapore, Malaysia and Sri Lanka. In order to expand exports, the varieties of potatoes should meet the preferences of foreign consumers, along with solving farmer’s constraints. Similarly, introduction and adoption of processing varieties of potatoes will surely help in manufacturing more processed products from potatoes in the country.

The yield gap between average national yield and good farmer’s yield of fruits and vegetables are 49.46% and 43.28% for vegetables and fruits respectively (Table-4 & 5) which is might be due to variety and management practices. Eliminating the current yield gap between actual and potential yields holds tremendous promise for Bangladesh agriculture, especially with regard to fruits and vegetable crops.
Table 5: Yield gap between present yield and good farmer’s yield of fruits (ton/ha)

<table>
<thead>
<tr>
<th>Crop</th>
<th>Current average yield</th>
<th>Good farmers yield (GFY)</th>
<th>Yield gap (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>7.70</td>
<td>15.00</td>
<td>48.67</td>
</tr>
<tr>
<td>Litchi</td>
<td>2.86</td>
<td>12.00</td>
<td>76.20</td>
</tr>
<tr>
<td>Banana</td>
<td>17.75</td>
<td>20.00</td>
<td>11.25</td>
</tr>
<tr>
<td>Papaya</td>
<td>17.75</td>
<td>25.00</td>
<td>49.00</td>
</tr>
<tr>
<td>Guava</td>
<td>10.50</td>
<td>20.00</td>
<td>47.50</td>
</tr>
<tr>
<td>Lemon</td>
<td>7.75</td>
<td>12.00</td>
<td>35.41</td>
</tr>
<tr>
<td>Jujube</td>
<td>7.18</td>
<td>20.00</td>
<td>64.10</td>
</tr>
<tr>
<td>Hogplum</td>
<td>12.00</td>
<td>15.00</td>
<td>20.00</td>
</tr>
<tr>
<td>Pumelo</td>
<td>6.60</td>
<td>20.00</td>
<td>67.00</td>
</tr>
<tr>
<td>Sapota</td>
<td>12.00</td>
<td>20.00</td>
<td>40.00</td>
</tr>
<tr>
<td>Coconut</td>
<td>1.00</td>
<td>2.00</td>
<td>50.00</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>9.33</strong></td>
<td><strong>16.45</strong></td>
<td><strong>43.28</strong></td>
</tr>
</tbody>
</table>

Source: DAE Demonstrations, 2010

The gap can be narrowed by demonstrating improved management practices for improved varieties, and by improving the production and supply of quality seeds. Cooperative marketing and contract marketing may be developed and promoted. Further development of agro-processing and marketing networks should also be pursued through effective means of enhancing competitiveness.

### 2.2 Production Trend of Fruits and Vegetables

Fruits covered only about 0.98% and vegetables covered 2.18% of the total cultivated area in 2009-10 and about 4.52 million metric tons of fruits and 3.00 million metric tons of vegetables were grown during the same period. The area and production is on increasing trend in both fruits and vegetables (Table-6).

Table 6: Area and production of fruits and vegetables

<table>
<thead>
<tr>
<th>Year</th>
<th>Fruits</th>
<th>Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (ha)</td>
<td>Production (MT)</td>
</tr>
<tr>
<td>2005-06</td>
<td>86,289</td>
<td>3171,000</td>
</tr>
<tr>
<td>2006-07</td>
<td>147,725</td>
<td>4156,466</td>
</tr>
<tr>
<td>2007-08</td>
<td>147,956</td>
<td>4092,005</td>
</tr>
<tr>
<td>2008-09</td>
<td>146,240</td>
<td>4224,214</td>
</tr>
<tr>
<td>2009-10</td>
<td>242,811</td>
<td>4525,000</td>
</tr>
</tbody>
</table>

Recently potato has become major food crop in Bangladesh because of its multiple uses as vegetable and processed product. However, a significant change in the area and production of different vegetables during the period from 2005-06 to 2009-10 was noticed (Table-2).

### 2.3 Seasonality of Fruits and Vegetables

Most of the fruits are available during short period of the year due to their seasonality in fruiting and therefore, availability of fruits in Bangladesh is very poor beyond summer and
rainy season. Based on the growing seasons, vegetables are categorized as summer/rainy season vegetables, winter season vegetables and all-season vegetables. Of the summer vegetables, various cucurbits, vegetable cowpea, hyacinth bean, stem amaranth, several aroids and Indian spinach are predominant. Winter vegetables include tomato, cabbage, Chinese cabbage, cauliflower, brinjal, carrot, spinach, bottle gourd, bush bean and radish among many others. Crops like okra, heat tolerant tomato, brinjal, carrot, spinach, many leafy vegetables, small onion, etc. can be grown any time of the year. Summer vegetables are cultivated during the monsoon season from May to October. On the other hand, winter vegetables are grown during cold season from November to April. There is more consumption of vegetables in this season and most districts produce marketable surplus.

Like vegetables, fruits are also seasonal crops, the most important season being the summer/rainy season. In this season, most of the fruits are grown in Bangladesh. This includes mango, pineapple, jack fruit, carambola, blackberry, guava, wood-apple, litchi, watermelon, etc. Compared to this, winter fruits are very few and far between. Some types of palms and some quantity of oranges and different varieties of citrus fruits are the main crops of this season. Among all season fruit crops, mention may be made of coconut, betel nut, papaya, and some types of citrus fruits. Although most of the fruits are grown in the summer/rainy reason, many of them can be made all season crops through proper research and development activities.

2.4 Domestic Requirement of Fruits and Vegetables

Current production of fruits is about 4.52 million tons and the national requirement estimated at 4.65 million tons. This gap is likely to increase further with the increase of population. The consumption of fruit per head per day is about 64g as against the minimum requirement of 85g per head per day which indicates that the present production can meet only about 75% of our requirement. Most of the fruits produced in the country are consumed at domestic level. For a population of 150 million, the consumption of fruits per head per year is staggeringly low, only about 12.0 kg/head/year. This is about one quarter of the fruit consumption in Europe and one-ninth of the fruit consumption in Australia, Hong Kong and Taiwan. This explains why a large number of fruits, particularly in the winter season, are imported to Bangladesh every year. Current production of vegetables is considerably below the domestic requirement. There is, therefore, a big gap between the vegetable productions estimated as 3.0 million tons and the national vegetable requirement estimated at 11.0 million tons. This gap is likely to expand further with progressive increases of population. The availability of vegetables is only about 70g (including potato) per head per day as against the minimum requirement of 200g/head/day from nutritional point of view (Hossain, 2004).

2.5 Post Harvest Management and Value Addition

2.5.1 Post-harvest Management

Post harvest handling of fruits and vegetables is under developed. Some estimates suggest that about 30-40% of fruits and vegetables are lost or abandoned after leaving the farm gate. Huge postharvest losses result in diminished returns for producers. The major constraints include in sufficient handling and transportation; poor technologies for storage, processing,
and packaging; involvement of too many diverse actors; and poor infrastructure. There is significant lack of cold storage facilities and refrigerated transport for fruits and vegetables.

Only cold storage facilities for potatoes are available in different parts of the country. The traditional post-harvest handlings, marketing system of fruits and vegetables is one of the major hindrances for the increased production. Distress sale during harvest period, defective packing, handling and carrying system, lack of appropriate transportation facilities such as covered and refrigerated van, lack of efficient market management system, non-availability of accurate up to-date market information, lack of physical facilities of the small market such as sanitation, drainage, latrine, loading and un-loading space, approach road, link road etc. are the major obstacles for marketing of fruits and vegetables in the country. Post harvest losses of fresh horticultural produce occur at different points in the entire supply chains. These losses are quantitative, qualitative and economic.

Post-harvest losses of some important fruits and vegetables are presented in Table-7 and Figure-3. The post harvest losses varied from crop to crop and within different stages. Among the selected crops, the highest loss was recorded in tomato (37%) followed by okra (34%) and lowest loss was found in chillies (14%). Post harvest spoilage of fruits and vegetables are enormous and vary from 18-44% that causes a loss of Tk. 339.2 million. About 2.2 million tons of produce is lost due to post-harvest spoilage in focused crops that provides enormous negative impact on the economy of the country (Hossain, 2010).

Table 7: Post-harvest losses of some important fruits and vegetables

<table>
<thead>
<tr>
<th>Crop</th>
<th>Area (ha)</th>
<th>Production (MT)</th>
<th>PH Loss (%)</th>
<th>Total PH loss (MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>31658</td>
<td>304187</td>
<td>33.0</td>
<td>1181</td>
</tr>
<tr>
<td>Pineapple</td>
<td>16978</td>
<td>238360</td>
<td>18.0</td>
<td>42905</td>
</tr>
<tr>
<td>Banana</td>
<td>53294</td>
<td>877123</td>
<td>20.0</td>
<td>175424</td>
</tr>
<tr>
<td>Papaya</td>
<td>1991</td>
<td>38120</td>
<td>35.0</td>
<td>13342</td>
</tr>
<tr>
<td>Lime</td>
<td>1688</td>
<td>21632</td>
<td>28.0</td>
<td>6057</td>
</tr>
<tr>
<td>Beans</td>
<td>15595</td>
<td>82872</td>
<td>28.0</td>
<td>23204</td>
</tr>
<tr>
<td>Carrot</td>
<td>1154</td>
<td>10430</td>
<td>25.0</td>
<td>2608</td>
</tr>
<tr>
<td>Cabbage</td>
<td>16232</td>
<td>211097</td>
<td>25.0</td>
<td>52774</td>
</tr>
<tr>
<td>Bitter gourd</td>
<td>8599</td>
<td>39648</td>
<td>27.0</td>
<td>10705</td>
</tr>
<tr>
<td>Tomato</td>
<td>19651</td>
<td>143058</td>
<td>37.0</td>
<td>52931</td>
</tr>
<tr>
<td>Okra</td>
<td>9786</td>
<td>38508</td>
<td>34.0</td>
<td>13093</td>
</tr>
<tr>
<td>Eggplant</td>
<td>18387</td>
<td>122730</td>
<td>20.0</td>
<td>24546</td>
</tr>
<tr>
<td>Chillies</td>
<td>93638</td>
<td>117765</td>
<td>14.0</td>
<td>16487</td>
</tr>
<tr>
<td>Potato</td>
<td>402026</td>
<td>6647778</td>
<td>25.0</td>
<td>1661945</td>
</tr>
<tr>
<td>Total</td>
<td>-</td>
<td>8893308</td>
<td>-</td>
<td>2196403</td>
</tr>
</tbody>
</table>

(BARI, 2006).

The salient points of existing post-harvest handling practices are summarized below;

a) Growers often grow the same commodity, same variety and plant at almost same time inviting glut at production due to which prices fall sharply and loss stands high after harvest;

b) Harvesting is done at any time of the day and knowledge on maturity indices is often inadequate. Sometimes immature and over mature produce are harvested. Removal of field heat is seldom practiced. Dumping produce in piles causes bruising;
c) Produce are prepared for market without or minimum sorting and grading;

d) Produce are not washed with potable water in all cases;

e) Packaging is done using gunny bags, used fertilizer sacks, bamboo baskets etc. that provide little protection to perishables;

f) Head loads, rickshaw van, bicycles, etc. carry heavy loads of haphazardly packed produce from production sites to market. Trucks and launch boat carrying tightly packed produce in unventilated heavy loads. Traders/workers use full sacks and basket of produce as seats while transporting the produce to distant markets;

g) In the wholesale markets of city/town, unloading, reloading and handling are made roughly that cause substantial post-harvest loss.

h) Retail markets are unpaved, open to dust, rain and sun. Sometimes, produce are sprinkled with dirty water while on display.

i) Fruits like, mango, papaya, tomato and banana are forced ripened treating the immature ones with calcium chloride/Ethrel for attractive colour;

j) No storage facilities are available in the production areas or rural and urban markets. Commodities are kept in open space for sale;

k) Superstores in the city markets, however, sell their produce keeping in cool environment to minimize post-harvest losses and sometimes packed nicely to attract the customers.

2.5.2 Value Addition in Fruits and Vegetables

Agro-processing activities comprise two major categories namely, primary and secondary operations. Primary processing operations involve activities such as crop drying, shelling/threshing, cleaning, grading and packaging and these activities are mainly carried out at the farm and only transform the commodity into a slightly different form prior to storage, marketing or further processing. Secondary processing operations entail increasing nutritional or market value of the commodity and the physical form or appearance of the commodity is often totally changed from the original.

Agro-processing is an important manufacturing industry in Bangladesh. The sector accounts for over 22% of all manufacturing production and employs about 20% of the labour force (Burhan et.al., 2007). All food processing enterprises account for 5% of GDP (around 4.48 billion US$). There are nearly 700 processed food manufacturing enterprises in the country. These include processing of bakery confectionery, cereals, dairy, carbonated and non-carbonated fruit juices, drinks, other beverages and various other food products. Although the industry is small in Bangladesh compared to many other Asian countries, it has been growing at almost 8 percent per year, comparable to growth rates in India (7.8 percent) and China (9.4 percent) (World Bank, 2008).

The vast majority of agro-processing firms in the country are very small, with fewer than 50 workers (World Bank, 2008; BBS, 2007). Neither BBS nor EPB maintain separate statistics on export of processed products. Export of processed horticultural are in their infancy (World Bank, 2008). According to a recent estimate, less than 0.5% of total Bangladesh horticultural production is processed. Recent studies of FAO and the IFAD forecast the demand for fresh and processed foods to rise steadily over the next 5 years at a rate of 7.4% per annum.
The role of processed fruits and vegetables in the domestic and export economies is also quite small, although there are a number of large-scale enterprises (PRAN, Square, Eurasia Food Processing, BD Foods and Golden Harvest etc among them) who appear committed to expanding this sector. In Bangladesh, the modern organized fruit processing industry comprises relatively small volumes of canning, freezing and dehydration. However, jams, jellies, and pickles are made in large quantities, chiefly by small entrepreneurs at the home or cottage scale. In addition, extruded snacks, puffed rice and potato chips are made and sold in the domestic market by small and medium enterprises. Some units, especially larger ones, have modern facilities operating hygienically in conformity with Good Manufacturing Practices (GMP). On the whole, however, most facilities are in need of up-grading and personnel require considerable training on a wide range of aspects of manufacturing sanitation and efficiency. To put agro-processing into perspective, Bangladesh produces 4-5 million metric tons of horticultural produce each year. PRAN, which is believed to account for more than half of the horticultural produce which moves through processed channels, consumes an estimated 12,000-15,000 metric tons per year. Even under the most liberal of assumptions, then, it would appear that transformation of horticultural products into processed food products accounts for less that 1 % of total horticultural production.
Chapter-3

Marketing of Fruits and Vegetables

3.1 Marketing System

Marketing of fruits and vegetables crops is quite complex and risky due to the perishable nature of the produce, the seasonality of production, and the logistics challenges of high weight-to-value shipments. The spectrum of prices from producer to consumer, which is an outcome of demand and supply of transactions between various intermediaries at different levels in the marketing system, is also unique for fruits and vegetables. Moreover, the marketing arrangements at different stages also play an important role in price levels at various stages as product moves from farm gate to the ultimate user. These features make the marketing system of fruits and vegetables quite different from other agricultural commodities, particularly in providing time, form and space utilities. While the market infrastructure in Bangladesh is better developed for food grains, fruits and vegetables markets are not well developed and markets are congested and unhygienic.

Multiple actors such as local collectors, local traders, local market *aratdars* and their agents, urban wholesalers and their commission agents, rural and urban retailers -- constitute the important components of the marketing system. The wholesalers and their agents mainly determine the market price of fresh produces. This is the most popular and common marketing structure. It is estimated that, in the process of marketing, as much as 10-40% of the produce is lost due to mishandling, improper packing and transportation. Market price is determined by the marginal cost of supply and demand. The wholesalers are able to pass on their entire risks, partly to farmers in terms of lower farm gate prices, and partly to consumers in terms of higher wholesale prices than what would have been the outcome had the farmers been able to sell their produces directly to consumers. This partially explains the large differential between farm gate price and wholesale/retail price as observed in the market. The more elastic is the demand, the higher would be the farm gate wholesale price differential. The pattern of agricultural markets in Bangladesh consists of the following:

- **Primary rural markets:** this market is composed of farmers and small retail traders having few permanent shops. This market operates usually twice in a week.

- **Rural assembly markets:** traders from distant places gather in these markets with a view to collecting marketable surplus. Because of the presence of sizeable number of traders, commercial trading takes place in these markets. Significant numbers of permanent shops (i.e., “mokam”) and processors are found in these markets. The presence of commission agents, banks and easy transport systems make these markets more useful to the operators. This type of market operates every day, or every other day.

- **Secondary markets:** this market is large and composed of traders who operate nationally. Commission agents, *jothdars*, wholesalers, processors, exporters – all are active in this market. Normally, such markets are easily accessible by various means of transport. With large numbers of permanent shops and service institutions, these markets operate on all working days.
- **Urban wholesale markets**: these are specialized markets operating in a particular line of products (e.g., rice, vegetable, and fruits). These markets bridge the gap between distant wholesalers and large number of retailers. Commission agents called *aratdars* organize and operate these markets.

- **Urban retail markets**: in these markets, consumers collect their necessary items directly. The retailers present a variety of items in these markets to meet the daily necessities of the consumers. There are about 13,319 markets (Table-8) in the country. The markets located in the rural or semi-urban areas are mostly in poor condition with limited logistics, infrastructural, management and institutional facilities. Roads, especially the link and approach roads of the rural markets, are not in good condition. Road transportation has relatively improved, but the cost remains very high which, in turn, raises the product price.

### Table 8: Markets in Bangladesh

<table>
<thead>
<tr>
<th>Division</th>
<th>Primary/Retail assembling</th>
<th>Wholesale</th>
<th>Wholesale cum-Retail</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhaka</td>
<td>2911</td>
<td>234</td>
<td>670</td>
<td>3815</td>
</tr>
<tr>
<td>Chittagong</td>
<td>1795</td>
<td>77</td>
<td>527</td>
<td>2399</td>
</tr>
<tr>
<td>Rajshahi</td>
<td>2001</td>
<td>271</td>
<td>963</td>
<td>3235</td>
</tr>
<tr>
<td>Khulna</td>
<td>1458</td>
<td>120</td>
<td>367</td>
<td>1945</td>
</tr>
<tr>
<td>Barisal</td>
<td>815</td>
<td>57</td>
<td>199</td>
<td>1071</td>
</tr>
<tr>
<td>Sylhet</td>
<td>650</td>
<td>66</td>
<td>138</td>
<td>854</td>
</tr>
<tr>
<td><strong>Grand total</strong></td>
<td><strong>9630</strong></td>
<td><strong>825</strong></td>
<td><strong>2864</strong></td>
<td><strong>13319</strong></td>
</tr>
</tbody>
</table>

*Source: DAM, 2006*

Fruits and vegetables are generally sold by farmers immediately after harvest because of their need for cash and lack of storage facilities. According to the FAO survey, about 82% of farmers in all the regions sell horticultural crops immediately after harvest. They use head loads and rickshaw vans to carry the produce to markets. Traders, wholesalers and buyers mainly use rickshaw vans and trucks. About 66% of the farmers sell their produce in weekly markets and 22%, in the daily markets. Farmers usually get price information from other farmers, traders, radio, television and newspapers. Marketing channels and involvement of intermediaries vary among regions (Hanemann & Ahmed, 2006).

The FAO survey indicates that about 19% of retailers, 41% of traders and 21% of consumers buy vegetables directly from farmers. The two major marketing channels are producer-trader-retailer-consumer and producer trader-wholesaler/commercial agent-small holder/retailer-consumer. The commission of intermediaries varies by region and from crop to crop. The margin between the trader’s price and the retailer’s price could be as high as 150% during peak season and 200% during off season. Retail and wholesale prices of vegetables fluctuate substantially from year to year and also from month to month, depending on the supply situation. Seasonality, under developed marketing and transportation system, poor infrastructure and insufficient storage facilities intensify price volatility.

Marketing system of fruits is similar to that of vegetables. FAO survey indicates that about 36% of retailers, 27% of traders and 22% of consumers buy fruits directly from the farmers.
who usually sell their crops mostly in the weekly markets and partly in the roadside and daily markets. In general, production of fruits is an attractive alternative for farmers, as gross margins may go up to 10-12 times compared to paddy. But the risk involved is much higher for many fruits, because of price volatility and market gluts during peak season. Like vegetable crops, retail and wholesale price of fruit crops also fluctuates substantially from year to year and also from month to month, depending on the supply situation. The reasons of this price volatility are also similar to those of vegetables.

A study by the Department of Agricultural Marketing (DAM) analyzed the cost of marketing and concluded that for the five spices in general, the producers get about 65% of the consumers price, with the remaining 35% divided among traders (5%) wholesalers/aratdars (20%) and retailers (10%). The total marketing cost was established at 12% (3% by producers, 3% by traders, 4% wholesalers and 2% by retailers). These statistics are encouraging but do not reflect the real situation in the field for high-risk fresh produce like tomato, as was discovered by the agriculture sector review team during recent field trips to different parts of Bangladesh. Obviously there are hidden barriers to entry into the market, which do not allow the marketing margins of non-rice agriculture to come down. There are associations/cartels on the buyers’ and transporters’ sides, but much less organization on the sellers’ side, especially for smallholders. Some would say a total institutional change in favor of the farmers is needed, in order to enhance the bargaining power of the farmer associations/cooperatives in the marketing of their products (Hanemaan and Ahmed, 2006).

3.2 Supply Chain Structure and Operation

- A sub-sector map of fruits and vegetables is developed to graphically represent the relationship between the actors in reaching the final product to the consumer. The supply chain map of fruits and vegetables is presented in Figure –1.
The map shows the channels currently operating in different ways and degrees in the markets. There are a number of ways the fruits and vegetables are selling right from the field to the urban markets. The beneficiaries are living around the urban areas sell in urban retail markets through different channels and ultimately reach to the consumers. Figure-4 presents the general supply chain map of vegetables and fruits showing different actors, physical flow of the product and various links to the markets.

3.2.1 Major Actors in the Supply Chains

The main actors in the fruits and vegetable sub sector are input suppliers, producers, small and large traders, transporters, associations, retailers and consumers. The short description of the actors and their functions are as follows:

- **Input suppliers:** The persons involved in supplying seeds, fertilizers, pesticides, packaging materials etc.
- **Producers/farmers:** The peoples engaged in cultivation of fruits and vegetables are the primary actors in the supply chain/value chain. Most of them are poor and belongs to marginalized groups.
- **Faria:** They are small rural traders who purchase vegetables and fruits from the producer in the village or in the local primary market and the same to the different intermediaries within the assembly markets viz. baparies/selected agents and paikers etc.
- **Paikers:** A group of intermediaries called Paikers, who purchase fruits and vegetables from the producers and Farias in the farm gate or in the local primary markets. They had no permanent staff.
- **Beparies:** Beparies are selected agents in the fruits and vegetables production area and in the wholesale market of the urban city. They perform most of the marketing activities of transporting. In course of his work a selected agent buys vegetables directly on the spot, on the basis of the purchase orders he has received from the exporter/wholesaler.
- **Aratdar:** Aratdar are big merchants and licensed traders having fixed business premise and godowns. Their business premises usually were situated at the well-communicated areas in the big wholesale market in Kawranbazar and Shambazar of Dhaka city and Riazuddinbazar of Chittagong city. They had some hired labours or part time/full time salaried men for performing various marketing functions. In the process of exporting vegetables, the exporters sometimes purchased vegetables from Aratder in the wholesale market of Kawranbazar, Shambazar of Dhaka city.
- **Transporters:** Person involved in carryings goods (fruits, flower, and vegetables) from market places to whole sale areas. The transport could be truck, van, rickshaw, bus etc.
- **Superstores:** A very large retail store that stocks highly diversified merchandise, such as groceries, fruits, vegetables, toys, camera etc.
- **Exporters:** In particular who collect fruits and vegetables from different sources and exports to foreign countries.
- **Retailers**: Comparatively small business trader who buys and sells fruits, vegetables, flowers etc in smaller quantity and generally sell directly to the consumers/end users.

- **Consumers/ End users**: The final customer who consumes the produce.

### 3.2.2 Physical Flow of Products

The major marketing channel/flow of fruits and vegetables from the farmers to the consumers is summarized below. The farmers mostly consume very little portion of his produce and large portion they supplied to the market for consumption through different stakeholders. The most common marketing channels are:

- Farmers ➔ Own family consumption
- Farmers ➔ Hat/Bazar ➔ Local Trader ➔ Retailer ➔ Consumer
- Farmers ➔ Hat/Bazar ➔ Faria ➔ Wholesaler ➔ Retailer
- Farmers ➔ Hat/Bazar ➔ Faria ➔ Wholesaler ➔ Processor/Exporter

The quality and quantity of fruits and vegetables are varied depending on actors involved in the whole supply chain. The price levels vary from channel to channel as well. Huge post harvest losses incurred in different segments of the supply chain due to poor post harvest management (lack of knowledge on sorting, grading, packaging and transportation).

### 3.2.3 Superstores and other Institutional Outlets

The development of supermarkets is a recent addition in the domestic retail section of Bangladesh started appearing is about 10 years. New outlets are coming up in quick succession. To date, there are about 87 super stores operating in the country as a whole of which 67 are located in Dhaka. Superstores are also coming up in the other cities such as Chittagong, Sylhet, Rajshahi etc. Mostly all types of vegetables depending on seasonality are sold in the supermarkets. Generally the super markets are collected fruits and vegetables from the whole sale market and directly place in the rack without sorting, grading while few have separate storage and sorting/grading facility.

![Supply chain map of superstores](image)

*Fig. 2: Supply chain map of superstores*
After sorting these few superstores place the produce in the rack. Some like Agora has contacted farmers in different areas and collect fruits and vegetables from them. The profitability also varies from store to store starting from 5%-15% (net profit).

Customers have the preference of quality, service, bargain less and shopping environment which is assured in the supermarkets. Although, the coverage of chains is still very low, not even 1% of the retail sector, Hossain (2004) reports that they are creating an impact on quality production of horticultural crops and that consequently farmer are getting increasingly exposed to requirements related to IPM and organic cultivation. Besides, the traditional way of fruits and vegetable marketing, a significant portion of these produce are consumed through superstores, hotels, restaurants, and hospitals etc. A generalized super market supply chain is shown in Figure-2.

### 3.3 Constraints in Operation and Management of Markets

#### 3.3.1 Policy Constraints

Markets of Bangladesh are operated and managed by the Agricultural Markets Produce Regulation Act of 1964 (amended in 1985). The act refers to one single market in one single city. As a result, only the 392 markets which existed when the Act was amended are notified where the government authority issues the license to the traders and fixing the market charges. This selective regulation and enforcement run counter to the intent of the act, which is supposed to be the governing legislation covering all aspects of marketing in Bangladesh. It does not outline a self-governing management system; provide guidelines for proper conduct of the operations; adherence to particular standards of operation; and the food safety and quality assurance mechanisms. Market participants usually do not play any role in the management of the markets. Even the existing act, good or bad, is not properly enforced. The government is more interested in revenue collection than in treating the markets as centers for economic growth and services. Market management is very weak, and the role of government organizations (including DAM, DMAC and Parishads at different levels) is simply for revenue collection. The government organizations have legislative control only over 392 notified markets, which is only 2.38% of all the markets in Bangladesh. Lessees appear interested only in collecting market tolls, and not in organizing and properly maintaining the market. High toll (market charges) collection inhibits the growers from selling their produce directly in the market. The gazette notification (6th volume) published on 22 September 1994 by DAM on market charges is not adequately followed. Revenue collected is rarely returned to the market for infrastructure development.

#### 3.3.2 Institutional Constraints

The institutional constraints are many in the existing marketing system. In terms of physical markets, there are problems of multiple ownership and control of the land on which the market is constructed. Market infrastructure development, market operations and market revenue collection systems are all beset with problems. There is no coordination among these operations. All operate independently and usually without any consideration of competing interests. Private sector organizations also have institutional problems. Individual firms practice a top-down approach to management that stifles innovation, while industry associations rely heavily on political patronage and the availability of a strong motivational leader.
3.3.3 Infrastructural Constraints

Infrastructural constraints are few, but they are chronic in nature. The markets are congested and developed in an unplanned manner. Most markets lack basic support facilities such as godowns, cold or cool storage, potable water, drainage, and vehicle access for loading and unloading. Storage facilities for food grains, fish and potatoes are relatively developed; but for perishable high value horticultural crops (vegetables, fruits and spices), storage facilities are badly lacking. Multipurpose cold storage and cold chain management are very new ideas in Bangladesh. However, small scale cold storage facilities of perhaps 10-20 tons within a market would be sufficient for day to day operations, and could be constructed with minimal cost by insulating existing buildings and installing the appropriate refrigeration. Most of these facilities could be created with appropriate use of the collected market revenues.

3.3.4 Human Resource Constraints

There is also shortage of adequate human resources with requisite skills and experience in market management. The weak performance of the Market Management Committee is partly due to a lack of experience and management skills. Most of those who are involved in market management have limited management background. No one has modern market management skills, including GO-NGO staff.

3.3.5 Information Constraints

There is no organized market information system. The majority of market participants rely on their own information network (traders, wholesalers, commission agents, etc.), including the private sector. Many traders and wealthy farmers now use mobile phones to collect market information, but the small and medium farmers have no access to such market information. They are not even aware of the importance of market information. Market intelligence services to all intents and purposes are non-existent in Bangladesh.

3.3.6 Quality Control System in the Markets

Most of the markets do not properly follow the standard weights and measures determined by BSTI (Bangladesh Standard and Testing Institutes). Different weights and measures are used, and the growers are usually cheated. The established monitoring system is not working properly. There is no standard grading system for different products in rural markets. Sorting and grading systems are under developed and outdated. Recently with the intervention of donor agency, an initiative has been undertaken to develop grading standards of some selected fruits and vegetables.

3.3.7 Recent Initiatives in Market Developments

Although the cultivation of horticultural crops is 3-4 times more profitable than rice, subsistence farmers are reluctant to grow highly perishable crops because of the risks involved in marketing. Therefore, within the markets themselves, measures could be introduced to assist farmer-sellers to better manage their market risks. For example, the Shoshyo Gudam Rin Prokolpo (SHOGARIP) for cereals could be extended to fruits and vegetables, allowing farmers to avoid distress sale during and after harvest. The Department of Agricultural Marketing (DAM) has taken an important initiative in renting 77 godowns, of
250 metric tons each in 36 districts, from the Local Government Engineering Department (LGED). Here DAM is working to develop good organization and management with the participation of the growers. There is also a need for a gradual transition of market hierarchy and balanced spatial distribution and stronger linkages between different levels of markets.

Major urban and peri-urban centers tend to be over-served by all types of markets. Due to market risks and economies of scale, urban markets have developed faster than rural markets, which tend to be scattered. All rural markets do not have equal access to urban markets. Links are tenuous, more so when one considers the supermarkets and upscale restaurants that are coming up in increasing numbers in many cities.

These establishments require regular and timely supply of quality products. Under the Agricultural Commodities Wholesale Market Infrastructural Development Project implemented by DAM, six markets (one in each division) have been developed. Another project NCDP (Northwest Crop Diversification Project), implemented by the GoB and the Asian Development Bank (ADB) has renovated and upgraded 16 wholesale and 61 growers’ markets throughout the Northwest region, consisting of one wholesale market per district and one grower’s market in each upazila in the project area.

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**Box-1: Review of Current Marketing Policy**

The emerging need for market research and intelligence does not reflect in the existing policy and the essentials for agricultural producers to be linked to the global market. Steps identified in the ‘National Agriculture Policy’ (sub-clause 11.1) were not followed. Government of Bangladesh has to do more in developing the agricultural marketing system to ensure fair benefits for the growers and the consumers. Reorganizing and strengthening of DAM and establishing “Krishi Mulla Kamishan” (Agriculture Price Commission) were not pursued vigorously as envisaged in the current policy. Programs identified in the ‘National Agriculture Policy’ sub-clause 11.2 mostly not yet implemented.

These programs include:

a) Storing of harvested agro produces (only cereals and potato) in the favorable environment throughout the year

b) Establishment of multipurpose cold storage for fresh horticultural produces

c) Promotion of demand and supply of agro produces through the development of transportation facilities (some progress has been made, but much more needs to be done)

d) Reduction of post harvest losses and agro-processing (received little attention despite the fact that there is serious lack of information in this area and that agricultural growth prospect will be truncated without substantial investments in post harvest management including processing)

e) Sorting, grading, packaging and quality control of the agricultural produces for domestic and international market (partially achieved by reducing bank interest but awareness building, filling the information gap, and developing skilled human resources still lag behind)

f) Hat/bazaars and associated infrastructures for smooth and effective marketing (not developed adequately).
Markets are provided with loading and unloading areas, covered areas for produce display and storage, a fresh water supply, sanitation, women corners, as well as packinghouse and waste disposal facilities. Moreover, 16 reefer vans are procured and established 16 mini-cold storages in the wholesale markets by the NCDP and to established a central market (Terminal market) in Dhaka for marketing perishable high value crops. NCDP has developed an alternate supply chain (Box-2) through the introduction of Farmers Marketing Group (FMG), in replacement of the traditional marketing system.

Direct marketing shall enable farmers to meet the specific requirements of wholesalers from the farmers' inventory of graded produce and of retail consumers based on consumers' preferences, thus enabling farmers to take advantage of favourable prices and improve their net margin. It encourages farmers to undertake grading of farm produce at the farm gate and obviates the need for farmers to haul produce to regulated markets that are not necessarily spaced on the principles of efficiency. In promoting marketing systems, the Government of Bangladesh need to examine existing policies, rules and regulations with a view to minimizing conflict between successful private sector operations. A review is required of all laws which regulate participation in markets, such as registration/licensing, commodities traded, controls on packaging and labeling, laws affecting market place access, and laws affecting supply including controls on movement of produce and volume of commodities traded.

A Task Force should be set up under the Ministry of Agriculture, Department of Agricultural Marketing (DAM) to undertake a review of all marketing legislations and suggest introduction of necessary legal reforms to promote free and fair marketing system for agricultural and allied products.

From the view point of a complete supply chain from farm to the market, basic infrastructure for all types of perishable horticulture produce is required at the following levels:
- Small pre-cooling units in the production areas where the field heat of the produce can be removed at a fast rate to bring down the temperature of the produce to the desired level before putting the product into cold storage. The refrigerated transport units from the farm to the cold storage may also be utilized as mobile pre-cooling units for this purpose;
- Collection centers near the farms;
- Medium to small cold storages having multi-product, multi-chamber facilities are the most popular segment where horticulture produce is stored as transit godowns;
- Specialized cold storage with facility of built in pre-cooling; high humidity and Controlled/Modified Atmosphere are required for storage of the produce for a longer period. These specialized storages are essential to extend the shelf life of the produce; without such storage the strategy of storing the product to meet the demand in the off season is not feasible;
- Other components like ripening chambers close to the markets and display cabinets at retail outlets;
- Linkages for conversion of fresh produce into other marketable forms;
- Integrated Pack Houses to serve farms in respective regions. Farms associated with each of the centers would collect farm produce and bring them to common cold storage centers, where these products could be given treatments, such as washing, sorting, grading and packing. These products will then be preserved in the appropriate cold storage facility. The services of these centers will not only increase the value of the farm product, but will also remove most of the unwanted biodegradable bio-mass from the horticulture products, which can be utilized as farm manure or even as cattle feed.

There has been concern in recent years regarding the inefficiency of the marketing system for fresh fruits and vegetables. It is generally believed that this is leading to high and fluctuating consumer prices, while only a small share of the consumer’s price is reaching the farmers. Marketing of horticultural crops is complex. The high percentage of mark-ups between farmgate price and consumer price is indicative of large inefficiencies and relatively poor marketing efficiency. There is a great need to improve the marketing of fruits and vegetables. One important measure would be to bring more markets under the regulation and supervision of a well-represented market committee. Another measure would be the promotion and perhaps the enforcement of open auctions in the markets. Yet another measure could be efforts to bring more buyers and sellers into the markets, bringing them closer to perfect markets. The direct participation of farmers should be increased. Market infrastructure should be improved through storage (go-down) facilities, cold storages, loading and weighing facilities. Improvement in the road network, and cold-chain facilities are also of substantial importance.

Market infrastructure is important not only for the performance of various marketing functions and expansion of the size of the market but also for transfer of appropriate price signals leading to improved marketing efficiency. High investment with entrepreneurial skills is required for creation and managing these infrastructures. Therefore, private investments in the market infrastructure development may be encouraged by modifying various procedure backed up by package of incentives. Nevertheless, for providing infrastructure in remote and difficult areas, the public sector would need to continue to play an important role. Greater transparency of the operations through supervisions and systems
can also help substantially. The market integration and efficiency can also be improved by making up-to-date market information available to all participants through various means, including a good market information systems, internet and good telecommunications facilities at the markets.

To promote agricultural growth and thereby maximizes benefits from exports of agricultural products in the face of the challenges arising from economic liberalization and globalization. The main objective of an efficient agricultural marketing system should be to ensure that a greater share of the ultimate price of the agricultural produce goes to the farmers. In the context of the increase in the production of agricultural commodities and the fast changing economic scenario, issues relating to the development of agricultural marketing have assumed great significance. Some of these issues related to development of infrastructure for agricultural marketing, establishing sound linkages between production and marketing, development of market intelligence for the benefit of farmers and consumers, promotion of direct marketing, application of Information Technology in marketing and encouraging public, private and cooperative sectors to make investments for the development of agricultural marketing.

### 3.4 Export Performance of Fresh Fruits and Vegetables

#### 3.4.1 Export pattern and market trend

Bangladesh primarily exports fresh fruits and vegetables in different countries since its independence. Export of frozen fruits and vegetables has started very recently. At present Bangladesh agricultural export market constitutes 0.54% of the total national export, out of which, the contribution of fruits and vegetables alone is 0.32%. The last five years export data is presented at Table-10. During the last five years (2006-07 to 2010-11) the total export volume of fruits and vegetables ranged from 19,805 tons to 48,428 tons and the supply was irregular. Table-9 shows that minimum export (19,805 tons) was recorded during the year 2006-07, but in the next year however, export resumed its upward slope reaching to a level of 33,626 tons. But in the following year again the figure declined to 24,670 tons. A tremendous growth of fruits and vegetables export of 48,428 tons was recorded in the year 2010-11. A positive trend of export growth has been observed during the period from 2006-2007 to 2010-2011 with a decline in the period of 2005-2006. More than 100 horticultural crops are exported from Bangladesh. Export of fresh fruits and vegetables (FFVs) from Bangladesh increased from 9,000 tons in 1992-93 to 48,428 tons in 2010-2011.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantity Exported (MT)</th>
<th>Export Value (in Million US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-07</td>
<td>19,805</td>
<td>40.530</td>
</tr>
<tr>
<td>2007-08</td>
<td>33,626</td>
<td>69.120</td>
</tr>
<tr>
<td>2008-09</td>
<td>24,670</td>
<td>50.710</td>
</tr>
<tr>
<td>2009-10</td>
<td>29,370</td>
<td>64.210</td>
</tr>
<tr>
<td>2010-11</td>
<td>48,428</td>
<td>109.410</td>
</tr>
</tbody>
</table>

*Source: Export Promotion Bureau (EPB), 2011, Bangladesh*
The major export market comprises UK (48%), Italy (8%), other EU countries (3%) and Middle East countries (43%). More than 50 fresh fruits and vegetables are exported to UK alone. Exports are targeted for ethnic market. Besides, fresh fruits and vegetables, frozen products about 250-300 tons at a value of about 3 million US$ are exported for both ethnic and mainstream markets.

Bangladeshi fruits and vegetables are being exported to more than 30 market destinations. The major buyers are located in the UK and Middle East. In the Middle East region, the important outlets are Saudi Arabia, Kuwait, UAE, Qatar, Bahrain and Oman. The UK is by far the most important market outlet for Bangladeshi fresh fruits and vegetables, lifting more than 48% of the total export of horticultural crops. These seven markets (UK and six in Middle East countries) together contribute more than 95% of the total export earnings from fruits and vegetables from the country and as such, are considered as the most important market outlets for this sector.

The top ten items commodities: green chilli, jackfruit, lemon, stolon of taro, taro tuber, eggplant, snake gourd, yard long beans, bottle gourd and green papaya for the UK market, while bitter gourd, yard long beans, green chilli, potato, snake gourd, stolon of taro, pointed gourd, white/wax gourd, teasel gourd and green papaya are for the Middle East market (Hanemaan & Ahmed, 2006).

3.4.2 Export Supply Chain and Packaging

Based on the secondary information, a “map” of the sub-sector has been developed to graphically present all the actors in the value chain. The sub-sector map illustrates “channels” of activity with various scenarios as they proceed from input supply, to production, processing and distribution to the final consumer. The supply chain comprises that the middlemen collect the produce from farmers/local markets and arrange to deliver the same to the exporters on the day of shipment. The transportation used is mainly on bus top or heavily loaded truck. Neither cool chain is used nor any standard post-harvest handling practice followed. As a result, post-harvest handling losses are enormous; sometimes more than 30% and produce quality is remaining poor. The packaging materials are also of very poor quality, generally consisting of bamboo baskets or second hand paper cartons.

The supply chain map shows that assembly traders directly purchase fruits and vegetables from the producer in certain cases. Farmers of large holdings sell their produce through middlemen (farias) and store for future marketing. Some farmers of small holding also sell to farias. From the primary markets, middlemen take the product to assembly markets and from there to urban or semi-urban markets. The channel has hundreds of producers/growers, hundreds of primary and secondary markets of traders, farias, and wholesalers, and thousands of retailers. The exporters are gathered around the Bangladesh Fruits Vegetables and Allied Products Exporters Association (about 500 members in numbers of which about 30 are active in business). They operate in the overseas ethnic markets. Customers in the import countries are, by and large, of Bangladesh origin.

3.4.3 Air Transportation

Fresh and vegetables are exported through air transportation. It is considered as the major constraints on the way to expansion of fresh produce export because of acute shortage of air cargo space capacity. BFVAPEA frequently make complaint of inadequate access to air
cargo space. At present no regular cargo flight is available for exporting fresh produce. Only
the passenger flights carry fresh produce and other perishable products. Moreover, the
ready-made garment sector appears to be a serious competitor of fresh produces in the matter
of air space allocation in the passenger flights. Along with British Airways, the national
carrier, Bangladesh Biman is the only air company operating direct flights to Europe. Other
airlines, i.e., Gulf Air, and Emirates also carry perishable goods to Europe through
transhipment in the Middle East. Their rates of airfreight are quite competitive; still the
exporters have natural preference to use the direct Biman flights. The various destinations of
the Middle East, the transportation situation seems to be better as compared to other
destinations such as Europe or North America, as a large number of airlines including
Biman, Gulf Air, Emirates, Qatar Airlines and Iranian Airlines carry perishables (Hossain,
2004).

3.4.4 Pest management and use of agrochemicals

Major pets of fruits and vegetables are aphids, thrips, white fly, diamond back moths, leaf
miner etc. Seasonal variation insect infestation is observed. High temperature and humidity
in summer favor insect reproduction. Farmers generally depend on synthetic chemical
insecticides for their control. The overdose, improper insecticides, repeated application due
to insects resistance are some contributing factors in increasing frequency and amount of
insecticides application per unit area in many vegetables and fruits. The use of agro-
chemicals (pesticides, insecticides, rodenticides, fungicides and herbicides etc.) is increasing
day by day. In the year 2001 only 15,960 tons of pesticides was used in the country, which
increased to 25,479 tons and 45,172 tons in the year 2005 and 2009 respectively. In most
cases pre-harvest index are not followed by the growers. Usually in most cases farmers are
not using appropriate doses and following correct frequency of applications, norms and
methods of spraying.

But the consumers look for safe vegetables and fruits as many of them are consumed as fresh
or minimally processed. Production of safe fruits and vegetables is possible through adoption
of environment friendly IPM technology packages which include resistant variety,
mechanical control, use sex pheromone, bio-control agents, biopesticides, clean
cultivation etc. IPM will minimize the wide spread application of synthetic pesticides and
thereby saving huge foreign currency in importing pesticides.

3.4.5 Issuance of phytosanitary certificate

Plant Protection Wing of DAE is, however, directly involved in implementation of plant
health regulations through issuance of Phytosanitary certificates and providing quarantine
certificates. The Wing consists of five sections, i.e., Plant Quarantine Section, Pesticide
Administration and Quality Control Section, Operation (Aerial & Forecasting) Section,
Surveillance and Forecasting Section and Integrated Pest Management Section. Bangladesh
though a agricultural country, has to import bulk quantity of seeds and other plants and plant
products. Annually, on an average 150,000 tons of plants and plant products are imported
into Bangladesh, for which plant quarantine inspection is needed and this is provided
through 15 quarantine check posts of this Wing set up at 15 different entry/exit points to and
from the country.
The products are to be exported are inspected before export and Phytosanitary certificates issued. The practice followed for issuing phytosanitary certificates for fruits and vegetables is like this. The exporters notify the Plant Protection Wing in writing in prescribed form accompanied by the evidence of payment of required fee in a bank, at least 24 hours before the shipment time. The inspection team/inspector then visit the pack house of the exporter inspects the export consignment and issues the certificate. This inspection is, more or less, a visual observation and does not usually involve laboratory/chemical test. It also seriously lacks modern laboratory and testing facilities. It may be mentioned that Bangladesh is a signatory to International Plant Protection Convention (IPPC). It is also a member of Asia & Pacific Plant Protection Commission with express commitment to formulate rules and regulations appropriate for plant protection and quarantine measures. Accordingly, Plant Quarantine Legislation was formulated for the country and this Wing of DAE is the custodian and implementation agency of this Law. Updating of the Law through reenactment is also the responsibility of this Wing.

3.4.6 Market access/entry requirements

Any third country suppliers of fruits and vegetables intended for EU markets (growers, processors and exporters outside the EU) must meet the specifications of EU Food Law. Any reputable EU import business is required to ensure this level of standard as a condition of entry on the EU market.

a) Sanitary and Phytosanitary (SPS) measures

The regulatory framework for sanitary and phytosanitary measures (SPS) is designed to protect human and plant health within the EU by ensuring that imported fruits and vegetables are not contaminated with:

- harmful levels of pesticides or other chemical contaminants, micro-organisms capable of causing harm to human health,
- plant pests and diseases that could harm crops, ornamentals or wild plants in Europe.

b) Air and Ocean Freight Options

Air Freight

Biman Airways dedicates 80% of its lift capacity, at below-market rates, to fruit and vegetable exports destined for the Middle East and the United Kingdom. Over 85,000 tonnes of air cargo capacity depart from Dhaka’s Zia International Airport each year. For export markets, the subsidized air freight capacity of Biman Airlines meets only 30-40% of the estimated demand for Bangladesh’s principal export commodities to the principal destination markets served by Bangladeshi exporters. While additional lift is available from the numerous foreign flag carriers that service Zia International Airport, their unsubsidized rates are uncompetitive with those of Biman. Thus, the Biman rate structure serves both as an export stimulus, with respect to the cargo that it can accommodate, and as a “ceiling”, with respect to the other 60%-70% of demanded and exportable product which becomes unaffordable and uncompetitive were it to be carried at market rates into the same markets served by Biman. Furthermore, this subsidized rate depends upon the continuation of the government’s policy to support fruit and vegetable export growth, despite the growing deficits which Biman has recorded in recent years. The precarious foundation which Biman’s subsidized rate structure provides is well evidenced by a recapitulation of recent changes in Biman’s cargo rates.
c) **Overland Transportation**

In the internal market, there are virtually no refrigerated vehicles in common use for the domestic transportation of fresh fruits and vegetables. Most products are shipped from farm to market in loose stowage or mounded up in baskets on open trucks or river skiffs. Since most of the product shipped to Middle Eastern and UK markets are purchased by exporters at the urban markets of Dhaka, export and domestic product suffers equally from this tortuous transit. Unfortunately, exporter attention has been consumed by the struggle to maximize access to below-market air freight slots, leaving them with no organizational energy to push carriers and researchers to determine what commodities could be converted to ocean containers, what markets could be serviced by ocean bound deliveries, or what would be the appropriate carrying temperatures and transit time limits for each commodity. Another issue also constraining exports of agro-industrial products from the country is bureaucratic customs and shipping procedures, and informal taxes (speed money) that have to be paid to get clearance for commodities sent by sea. These constraints are severely affecting the agribusiness export potential of the country by adding considerable costs in some cases (estimated as high as 5-10% of F.O.B values). The informal tolls are usually paid in cash or by hired brokers available at the port area. Much greater attention needs to be paid to the issues of export procedures, tariffs and informal tolls.

d) **Infrastructure & Technology**

Infrastructural constraints constitute perhaps the single most important bottleneck to expansion of export activities in Bangladesh. Main roads are generally good, although access roads into production areas can be highly problematic, especially during the rainy season. Traffic conditions range from highly congested to death-defying. Packing plants with adequate sanitation, hygiene, processing and storage facilities are rarity. Cold storage, where it exists, appears to be dedicated to the storage of seed potatoes.

In agribusiness, assembly and wholesale markets play a vital role in the quality of primary products, smooth transactions, packaging, pre-shipment treatments and shipments to destination both inside and outside the country. Urban markets are generally old, dirty, bereft of cold storage facilities, and highly congested. Electric power is a leading infrastructure constraint. Load shedding/power failure is a common feature. Power breakdown is experienced several times a day. The lack of adequate infrastructure and post-harvest technology contributes to extraordinary losses along the progress of the product from farm to market. According to research information provided by the Post Harvest Technology Division of Bangladesh Agricultural Research Institute, post-harvest losses among 14 selected fruit and vegetable crops range from a low of 14% to a high of 46%.

With specific reference to the economic impact of post-harvest product loss on the economic performance of the six focus commodities, the findings are no less dramatic.

In most of the processing facilities we visited, the equipment and processes were old, unsophisticated, and only marginally adequate to meet export market requirements for sanitation, food safety, or certification. While such technology may have been appropriate for initial ventures designed to satisfy domestic demand, it does not represent a sufficient platform to launch competitive export operations. Neither public nor private sector resources offer any meaningful assistance in the areas of new product development, testing for food safety or hygiene, quality management nor certification to insure compliance with public and private requirements as practiced in Europe, North America, Australia or North Asia.
Chapter- 4

Value Chain Analysis of Fruits and Vegetables

4.1 Value Chain Analysis of Mango

Mango covers an area of 32,000 ha and produces 1047,840 metric tons rank third in fruit production in Bangladesh, behind bananas and jackfruit. Mango occupied about 26.4% of the total area covered by fruits in Bangladesh. The major mango producing districts are presented in Table-10. The approximate flowering period of mango in Bangladesh is during February, and harvesting period is during Mid April to Mid June. The important varieties are, Fazlee, Langra, Gopalbogh, Ashwina, Khirshapati, and Gooti (unnamed seedling mangoes).

<table>
<thead>
<tr>
<th>District</th>
<th>Area (000 ha)</th>
<th>Production (000 MT)</th>
<th>Average yield/tree (kg)</th>
<th>% of Total Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rajshahi</td>
<td>21.75</td>
<td>515.48</td>
<td>255.0</td>
<td>49.20</td>
</tr>
<tr>
<td>Kustia</td>
<td>2.52</td>
<td>44.01</td>
<td>60.0</td>
<td>4.20</td>
</tr>
<tr>
<td>Dinajpur</td>
<td>1.21</td>
<td>47.52</td>
<td>66.0</td>
<td>4.53</td>
</tr>
<tr>
<td>Barisal</td>
<td>1.32</td>
<td>34.77</td>
<td>19.0</td>
<td>3.31</td>
</tr>
<tr>
<td>Pabna</td>
<td>0.74</td>
<td>48.67</td>
<td>81.0</td>
<td>4.65</td>
</tr>
<tr>
<td>Faridpur</td>
<td>0.57</td>
<td>41.21</td>
<td>42.0</td>
<td>3.93</td>
</tr>
<tr>
<td>Others</td>
<td>3.93</td>
<td>316.18</td>
<td>58.0</td>
<td>30.20</td>
</tr>
<tr>
<td>Total</td>
<td>32.06</td>
<td>1,047.84</td>
<td>81.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

BBS, 2010

4.1.1 Supply chain of mango

There are several actors involved in the production and marketing of mango. Supply chains represent the participants involved in the flow of product from farm to market (including traders, processors and exporters). The supply chain of mango in Bangladesh is presented in Figure-3. At present various channels are operating in various scales and degrees in the markets.

Channel-1: Growers directly sell to pre-harvest contractors in advance who in turn sell to exporter or wholesaler/retailer

Channel-2: Commission agents collect from growers and sell to wholesalers who supply to processor or retailers;

Channel-3: Commission agents collect from growers and supply directly to the processor who sell to Exporters/retailers.

Channel-4: Growers to local traders who sell to village markets

Channel-5: Growers to local traders who supply to wholesalers who sell to processor retailers
4.1.2 The Period of Marketing

The domestically-supplied mango market operates mainly during four months (e.g., May, June, July and August), with the peak being in June and July, and much lesser quantity in August and May. This is the case with respect to superior quality, grafted mangoes, originating in the leading mango producing areas in the west. On the other hand, the mangoes known as *Gooti* in the west and *deshi* in the east can be found around the market in May and June only. According to some estimates, more than 70% of the growers sell their crops at blossoming or fruit-setting stage. Thus, the marketing of mango commences more or less from the blooming stage, if not earlier, and the ownership of fruits, even on the tree, changes hands at that time from producers to traders.

The sale of commercially valuable mangoes often takes place three times:

a) At first, from grower to 2nd party at pea/marble stage
b) Secondly, from 2nd party to 3rd party at mature stage on the tree, and
c) Thirdly, from 3rd party to wholesaler at Dhaka or elsewhere.

4.1.3 Marketing costs, margins and growers share of mango

The farmer’s share of the consumer’s price can be as little as 32.03%, and never be more than 50%. However, a large number of owners of mango gardens are absentee owners who live in cities and towns away from the garden, and prefer to leave the care of their gardens to the advanced buyers, selling the expected produce even at prices well below those that could be obtained by holding onto the production until harvest time.
Fig 4: Value chain analysis of mango

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
<th>Cost (Tk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Rent</td>
<td>25.5%</td>
<td>57,732/-</td>
</tr>
<tr>
<td>Land Preparation</td>
<td>9.8%</td>
<td>22,188/-</td>
</tr>
<tr>
<td>Planting</td>
<td>7.5%</td>
<td>16,980/-</td>
</tr>
<tr>
<td>Fertilizing</td>
<td>15.5%</td>
<td>35,092/-</td>
</tr>
<tr>
<td>Spraying</td>
<td>10.2%</td>
<td>23,093/-</td>
</tr>
<tr>
<td>Weeding</td>
<td>7.60%</td>
<td>17206/-</td>
</tr>
<tr>
<td>Irrigation</td>
<td>8.2%</td>
<td>18,565/-</td>
</tr>
<tr>
<td>Harvesting</td>
<td>3.5%</td>
<td>7924/-</td>
</tr>
<tr>
<td>Marketing</td>
<td>12.15%</td>
<td>27,507/-</td>
</tr>
</tbody>
</table>

A. Farmers and intermediaries share in consumer’s price
- Farmers share = 32.03%
- Local assembly trader’s share = 10.15%
- Wholesaler/Retailer's share = 22.25%

B. Marketing costs (transportation, handling, packaging, market charges, fees and tolls, wastage and other costs)

Marketing costs/120 mangoes:
- Farmer's = 2.20% of consumer’s price
- Local assembly trader's = 28.0% of consumer's price
- Wholesaler's = 14.5% of consumer’s price
- Retailer’s = 10.0% of consumer’s price

Total yield/ha: 14.25 tons
Cost of production/ha: Tk.226, 400.0
Total selling value/ha: Tk 292,125.0
Selling price/kg: Tk.20.50
Av. price/piece: Tk.4.36.0
No. of mangoes/ha: 51,860.0
Farmer’s net profit/ha: Tk.65, 725.0
When the fruits reach their destination, they are kept in the godowns of the *Aratdar* (the commission agents) for 2-4 days, in return for which the Aratdar receive a commission of 10.15% of the wholesale price received by the consignee on auctioning the product. The retailers buy baskets from the wholesalers and sell them to the consumers, either by number or by weight. The retailers do not use any fixed prices, and most sales involve bargaining with their customers. The grower's share in the consumer price of mango stands at 32.0%. The margins of the traders and wholesalers/retailers stand at 1.5% and 16.2% respectively. The margins of the intermediaries (faria/bepari, commission agent-cum wholesaler and retailers, transportation, handling, packing, market charges, fees, and tolls and the wastage in the process of marketing mango) are given in Figure-6. The marketing costs stand 2.20%, 28.06% and 145% at farmers, local assembly traders and wholesaler/retailer levels respectively.

### 4.1.4 Causes of low productivity and suggested remedies

The reasons for the decline in mango productions in the country are due to agro-ecological, technical and socio-economic, some of which are outlined below;

- Old age of many trees, with correspondingly low productivity
- A general lack of interest and attention from owners
- A lack of management and care of trees, the general attitude being that mangoes do not need to be taken care of or fertilized as with field crops
- General ignorance of the growers about proper methods of cultivation, and apathy regarding improved techniques of production
- Absence of adequate plant protection measures for control of insect, pests and diseases
- Planting of trees too closely, creating competition for sun-light and nutrition, compounding problems of low productivity
- Indiscriminate clearing of productive trees for house-building, road construction, field crops or for use as fuel wood
- Inadequate and improper use of fertilizer and other inputs
- Poor post-harvest management practices, including inadequate transportation, improper packaging
- Lack of storage and preservation facilities and processing industries; and
- Traditional marketing practices, which do not help producers to realize adequate, proceeds from the sale of their fruits.

To revive and improve the situation and to bring mango production on the right track, the following measures may be suggested;

- Increase the productivity of mango cultivation by adapting modern management practices
- Bring a general awareness for use of right varieties, manage properly, apply fertilizer judiciously, irrigate in proper manner
- Protect the trees from attack of insect-pests and diseases
- Harvest properly, handle carefully, and market in the proper manner
- When agro-ecological requirements of mango are understood, good varieties are chosen, propagated and planted in a systematic manner; inter crops are raised properly to offset the initial loss of money during the first few unproductive years; insect, pests and diseases are well identified and controlled, leading to good yields
Bangladesh is a net importer of mango and most of them are imported from India. Given the absence of any export culture among mango growers or handlers, the considerable room for expanded production without risk of over-supplying the domestic market, and the attractive grower margins which are shown in the value chain analysis, it seems reasonable to conclude that fresh mangoes do not represent any significant export opportunity for the foreseeable future. Considerable scope exists, on the other hand, to increase the national production of mangoes, both as import-substitution for fresh consumption, and as a key ingredient in the expanding processing sector for use in the formulation of mango pickles both for domestic and export distribution.

### 4.2 Value Chain Analysis of Pineapples

Pineapple is an economically important crop grown in different parts of Bangladesh. The area and production of pineapples is about 16.02 thousand ha and 234490 tons respectively during the year 2009-2010. The major producing districts are Tangail, Dhaka, Rangamati, Chittagong and Mymensingh (Table-11), which combine to account for 93% of the total production. Pineapples rank fourth among all fruits produced in Bangladesh, with 234493.0 MT produced during the year 2009-10 (Table-10).

#### Table 11: Pineapple area, production and yields by major region, 2009-10

<table>
<thead>
<tr>
<th>District</th>
<th>Area (000 ha)</th>
<th>Production (000 MT)</th>
<th>Yield/ha (tons)</th>
<th>% of Total Production</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangail</td>
<td>8.04</td>
<td>139.13</td>
<td>17.30</td>
<td>59.33</td>
</tr>
<tr>
<td>Dhaka</td>
<td>1.59</td>
<td>19.97</td>
<td>12.56</td>
<td>8.20</td>
</tr>
<tr>
<td>Rangamati</td>
<td>1.27</td>
<td>22.20</td>
<td>17.48</td>
<td>9.47</td>
</tr>
<tr>
<td>Chittagong</td>
<td>1.09</td>
<td>12.71</td>
<td>11.67</td>
<td>5.42</td>
</tr>
<tr>
<td>Mymensingh</td>
<td>0.89</td>
<td>13.74</td>
<td>15.43</td>
<td>5.86</td>
</tr>
<tr>
<td>Sylhet</td>
<td>0.78</td>
<td>6.86</td>
<td>7.80</td>
<td>0.33</td>
</tr>
<tr>
<td>Khagrachori</td>
<td>0.68</td>
<td>6.39</td>
<td>10.19</td>
<td>4.34</td>
</tr>
<tr>
<td>Others</td>
<td>1.68</td>
<td>212.39</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Total =</td>
<td>16.02</td>
<td>234.49</td>
<td>-</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*BBS, 2010*

With an estimated grower margin of Tk 53,000/ha, pineapple also rank high in terms of grower profitability. As was the case with mangoes, however, the export potential for pineapple, either fresh or processed, must be classified as limited. The major pineapple producing districts are presented in Table-10. The important varieties grown are; Honey Queen grows largely at Comilla, Chittagong, Chittagong Hill Tracts, Giant Kew, Kalanga and Calendar etc. The approximate flowering period of pineapple is during February to March and harvesting period is during May-September.
4.2.1 Supply chain of Pineapple

There are several factors involved in the production and marketing of pineapples. The supply chain of pineapple is similar to mango and presented in Figure-5. At present various channels are operating in various scales and degrees in the markets:

Channel-1 : Growers directly sell to pre-harvest contractors in advance who in turn sell to exporter or Wholesaler/retailer

Channel-2 : Commission agents collect from growers and sell to wholesalers who supply to processor or retailers;

Channel-3 : Commission agents collect from growers and supply directly to the processor who sell to Exporters/retailers.

Channel-4 : Growers to local traders who sell to village markets

Channel-5 : Growers to local traders who supply to wholesalers who sell to /processor or retailers.

Fig. 5: Value chain analysis of Pineapples

4.2.2 Marketing costs, margins and growers share of Pineapples

The grower's share in the consumer price of pineapple stands at 23.0% . The margins of the farias, beparis and retailers stand at 16.5%, 13.5% and 22.0% respectively. The margins of the intermediaries (faria/bepari, commission agent-cum wholesaler and retailers, transportation, handling, packing, market charges, fees, and tolls and the wastage in the process of marketing pineapple) are presented in Figure-5.
The marketing costs of farmer’s, farias, beparies and retailers stand at 10.8%, 16.5%, 13.5% and 22.0% respectively.

4.2.3 Identified problems in production and marketing of pineapples
   a) Scattered production and use of traditional production practices
   b) Short period of availability
   c) High costs of transportation and high percent of wastage
   d) Lack of proper storage and preservation facilities
   e) Absence of proper sorting and grading and any post-harvest treatments, and
   f) Inadequate processing facilities.

4.2.4 Causes of high percent of post-harvest losses are as follows;
   a) Harvesting at incorrect maturity stage (usually not suitable for distant market)
   b) No fungicidal/hot water treatment
   c) Rough handling, transportation and improper packaging
   d) Lack of storage facilities at different stages of marketing, viz assembling, wholesale and retail levels etc.

4.3 Value Chain Analysis of Bitter gourd

4.3.1 Introduction
Bitter Gourd (Momodia charantia) is an economically important crop grown in different parts of the country. The area and production of bitter gourd is about 6,600 ha and 25,650 tons respectively during the year 2009-2010. The major producing districts are Chittagong, Rangpur, Rajshahi, Dhaka and Jessore (Table-12), which combine to account for 46% of the total production. The fruits are ready for picking within 60-70 days after sowing. Tender, immature fruits are harvested manually.

Table-12: Bitter gourd area, production and yields by major region, 2009-10

<table>
<thead>
<tr>
<th>District</th>
<th>Area (000 ha)</th>
<th>Production (000 MT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dhaka</td>
<td>0.88</td>
<td>3.18</td>
</tr>
<tr>
<td>Rangpur</td>
<td>0.85</td>
<td>3.85</td>
</tr>
<tr>
<td>Jessore</td>
<td>0.70</td>
<td>5.15</td>
</tr>
<tr>
<td>Rajshahi</td>
<td>0.59</td>
<td>2.58</td>
</tr>
<tr>
<td>Chittagong</td>
<td>0.58</td>
<td>1.90</td>
</tr>
<tr>
<td>Dinajpur</td>
<td>0.58</td>
<td>3.06</td>
</tr>
<tr>
<td>Faridpur</td>
<td>0.52</td>
<td>1.74</td>
</tr>
<tr>
<td>Others</td>
<td>4.26</td>
<td>19.96</td>
</tr>
<tr>
<td><strong>Total =</strong></td>
<td><strong>8.96</strong></td>
<td><strong>41.42</strong></td>
</tr>
</tbody>
</table>

*BBS, 2010*

4.3.2 Supply and value chain of Bitter gourd
There is no simple market channel for Bitter gourd, and all market channels function differently. Marginal or small-holder farmers take their produce to the nearest village and
sell it immediately after harvest because of storage limitations, as well as a need for immediate cash money. The supply chain of Bitter gourd is presented in Figure-6. A part of the marketed vegetables move directly from the growers to the consumers. The other part moves through varying number of intermediaries or middlemen who have specific designations according to the role that they play in the whole chain.

![Supply chain map of Bitter gourd](image)

The intermediaries are Faria, Bepari, Aratdar, Paiker (wholesalers) and Retailers. The supply chain map shows that assembly traders purchase directly from the field in certain cases. Farmers of large holdings sell their produce through middlemen (Farias) and store for future marketing. Some farmers of small holding also sell to Farias. From the primary markets, middlemen take the product to assembly markets and from there to urban or semi-urban markets. These channels have hundreds of producers/growers, hundreds of primary and secondary markets of Traders, Farias, and Wholesalers, and thousands of Retailers.

![Value chain analysis of bitter gourd](image)

**Price variations (Tk/kg)**

<table>
<thead>
<tr>
<th>Price</th>
<th>Tk/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm gate</td>
<td>6.87</td>
</tr>
<tr>
<td>Trade</td>
<td>15.45%</td>
</tr>
<tr>
<td>Wholesale</td>
<td>20.50%</td>
</tr>
<tr>
<td>Retail</td>
<td>22.00</td>
</tr>
</tbody>
</table>

**Cost of production/ha = Tk.241952/- (Tk.5.50/kg)**

- Yield /ha: 44.0 tons
- PH losses: 18%
- Total selling price/ha = Tk. 302400/-
- Selling price/kg = Tk.6.87
- Farmer's net profit/bigha =Tk.60,448/-
The value chain analysis (Figure-8) indicates that maximum costs (43.6%) are incurred for inputs, which is followed by labour cost (19.8%). The post-harvest management costs are 4.9%. On an average, the marketing cost/ha was about 8.8% of total cost of production. Value chain analysis shows that farmers do not use recommended dose of fertilizers and pesticides. Moreover, intercultural operations are not done properly. Post harvest management like sorting, grading are not followed adequately. Although, the infestations of fruit flies are high, the farmers are not accustomed to use IPM technologies. The cost of production of bitter gourd was Tk. 241952/- per hectare. Average gross return was Tk. 6.87/-per kg. Average cost/ kg of bitter gourd was Tk.5.50/kg. It should be noted that low yield rate and low margin of profit of farmers is a reflection of non availability of high yielding varieties, improper and inadequate application of fertilizers, pesticides and poor quality of agro-chemicals, which limit the use of such inputs. This deserves attention for necessary intervention in production practices, application of pesticides and fertilizers and varietal development research.

4.3.3 Marketing costs and price spread of bitter gourd

On an average, the marketing cost per 40 kg of produce worked out to be Tk. 21,292/- per hectare (Figure-8). Price margin varies according to quality of the produce from location to location and differs from place to place. The farmer’s net selling price was Tk. 6.87/kg, which was 31.2% of the consumer’s price. The profit margin of traders, wholesalers and retailers was 15.45%, 20.50 %and 22.0% of consumer’s price, respectively. The price of bitter gourd is lower during April to June and starts to increase gradually with time and reached its maximum during November to March. The maximum price normally occurs in December, and decreases gradually with time. Such wide price fluctuations are mainly due to the seasonal character of production and supply. The transportation system plays an important role in the marketing of produce. Transportation is a key determinant of the availability of market produce at the proper time and place. Rickshaws, head loads and country boats are the main means of transportation from the farm gate to the local markets. Head loads, rickshaws, vans, push carts, and country boats are the major means of transportation used by Farias. On the other hands, Beparis mainly use trucks to carry fruits and vegetables from the local market to the urban wholesale market; sometimes they use country boats, trains, and passenger buses to shift their purchased produces.

The producer during interview stated that selling of produce at farm level or in the market directly to consumer’s gives better price remuneration of about 20-25% and this may be due to the absence of intermediaries between producer and consumer. The analysis of marketing cost and margin indicates that decreasing the number of intermediaries in the existing marketing system may increase the producers ‘share in consumers’ price. Seasonal variation, underdeveloped marketing and transport systems, poor infrastructure, and insufficient storage facilities intensify price volatility.

The transportation system plays an important role in the marketing of produce. Transportation is a key determinant of the availability of market produce at the proper time and place. Rickshaws, vans, head loads are the main means of transportation from the farm gate to the local markets. Head loads, rickshaws, and vans are the major means of transportation used by Farias. On the other hands, Beparis mainly use trucks to carry the crop from the local market to the urban wholesale market; sometimes they use trains, and passenger buses to shift their purchased produces. Similarly due to shortening of marketing
chain, additional benefit could be gained from reduction of marketing costs. The rate of increase of technological adoption in pesticide applications, or the use of IPM technologies would help in producing quality crop that may help in fetching high market prices. All these factors may collectively help to increase farmers’ income in the supply chain. Due to these inappropriate practices significant yield losses occurred. Farmer’s income can be accelerated addressing appropriate crop management practices Based on surveys of BFVAPEA members, Bitter Gourd is the most important export commodity in terms of demand from overseas Bangladeshi, representing some 20% of total vegetable volumes shipped to the Middle East. Generating total revenues of Tk 128 million, it also accounts for over 3% of total vegetable GDP during the 2003/04 season. Like okra, it lends itself to frozen processing as well as to fresh sale. In 2004, bitter gourd accounted for 4% of Eurasia’s total frozen vegetable exports for the year. At farm level, and at local markets, the visual appearance of this product creates a very favorable impression, although it suffers greatly from the rigors of transportation and handling, based on follow-up evaluations at Kawran and Sham Bazaars. Improvements in packaging, post-harvest cooling, and handling would appear to hold particular promise for the reduction of shrinkage and preservation of visual quality for bitter gourd.

4.3.4 Problems/constraints of Bitter gourd production
a) Lack of high yielding varieties
b) High costs of inputs and adulteration of inputs etc.
c) Poor research and extension activities.
d) Inadequate production technology packages for the year round supply of bitter gourd
e) Disease and pest problems; indiscriminate use of pesticides and inadequate IPM practices
f) Inadequate post harvest handling and under developed transportation
g) Poor packaging, handlings and transportation, and

4.3.5 Major opportunities
Adoption of improved production and low cost post harvest technologies, introduction of group marketing will help to increase productivity and reduce post harvest losses and marketing costs thereby maintaining produce quality, increasing bargaining power and raising income of the stakeholders. The following are main opportunities:
• Organizing the farmers in groups for production and marketing of crop, especially linking them with the city/urban markets;
• Linking farmers with good input suppliers
• Training for the service providers on improved crop management practices including post harvest management practices
• Yields and produce quality of Bitter gourd could be enhanced by addressing the issues related to GAP and SPS issues etc.

4.4 Value Chain Analysis of Tomato
4.4.1 Introduction
Tomato (Lycopersicon esculenta L) is an economically important crop grown in different parts of the country. The fruits are ready for picking 60-70 days after sowing. Tender,
immature fruits are harvested. The area and production of tomato were 23,820 hectare and 190,210 tons respectively during the year 2009-10. The major producing districts are Rajshahi, Dinajpur, Comilla, Chittagong, Dhaka, Faridpur and Barisal (Table-13).

Table 13: Tomato area, production and yields by major region, 2009-10

<table>
<thead>
<tr>
<th>District</th>
<th>Area (000 ha)</th>
<th>Production (000 MT)</th>
<th>Yield (tons)/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rajshahi</td>
<td>3.18</td>
<td>22.2</td>
<td>11.7</td>
</tr>
<tr>
<td>Dinajpur</td>
<td>2.70</td>
<td>25.9</td>
<td>13.6</td>
</tr>
<tr>
<td>Comilla</td>
<td>2.08</td>
<td>14.8</td>
<td>7.8</td>
</tr>
<tr>
<td>Chittagong</td>
<td>1.92</td>
<td>14.3</td>
<td>7.5</td>
</tr>
<tr>
<td>Dhaka</td>
<td>1.87</td>
<td>16.2</td>
<td>8.5</td>
</tr>
<tr>
<td>Faridpur</td>
<td>1.60</td>
<td>12.6</td>
<td>6.6</td>
</tr>
<tr>
<td>Barisal</td>
<td>1.39</td>
<td>6.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Others</td>
<td>9.08</td>
<td>77.9</td>
<td>42.1</td>
</tr>
<tr>
<td>Total =</td>
<td>23.82</td>
<td>190.21</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*BBS, 2010*

4.4.2 Supply chain of Tomato

In general the supply chain of okra can involve any of the following channels:

a) Direct marketing to consumers at primary markets by the producers to village traders of retail sales to rural consumers;
b) Farm gate sales to collectors, traders, commission agents or buyers, or
c) Sales to traders and wholesalers at assembly markets where greater quantities of produce are disposed of, either
   - By producers themselves or
   - By village traders who take the produce back to village markets, or
   - By commission agents and semi-wholesalers, who bring it to other secondary markets or to terminal markets (urban wholesale, wholesale/retail and retail markets of large consumption areas) within and outside the region.

![Fig.9: Supply chain map of Tomato](image-url)
4.4.3 Value chain analysis of Tomato

The value chain analysis (Figure-10) suggests, costs of fertilizing (28.8%) and marketing (7.1%) constitute over 35.8% of the total value added for tomato production. A breakdown indicates that 48.0% of total costs are being spent on inputs, breakdown of which indicates that 46.9% and 28.8% of cost are spent for trellis and fertilizers respectively. On an average, the marketing cost ha was worked out to be Tk. 15,893/- only.

Value chain analysis shows that farmers do not use recommended dose of fertilizers and pesticides. Moreover, intercultural operations are not done properly. Post harvest management like sorting, grading are not followed adequately. Although, the infestations of fruit flies and virus infestations are high, the farmers are not accustomed to use IPM technologies and manage the virus diseases that are causing devastating losses to production.

Average cost/ kg of tomato was Tk.3.87/kg. Average gross return was Tk. 1.01/- per kg. It should be noted that low yield rate and low margin of profit of farmers is a reflection of non availability of high yielding varieties (HYVs), improper and inadequate application of fertilizers, pesticides and poor quality of agro-chemicals, which limit the use of such inputs. This deserves attention for necessary intervention in production practices, application of pesticides and fertilizers and varietal development research.

Fig. 10: Value chain analysis of Tomato

The breakdown of post-harvest management costs are 4.8% (Tk.10745/- per ha). The cost of production of tomato was Tk. 223856/- per ha. An average post harvest loss was 32.0%. Farmer’s practices on post-harvest management are very poor and unscientific. Packaging and transportation is also poor and underdeveloped.
4.4.4 Marketing costs and price spread of Tomato

Price margin varies according to varieties and quality of the produce from location to location and season. It usually remains higher at the early harvests and then gradually falls. It was reported that average price /kg are Tk.4.88/-, Tk. 9.65, Tk.14.50 and Tk.24.50 for farmers, traders, wholesalers and retailers level. On an average, the marketing cost/ha of produce worked out to be Tk. 15893/-. Price margin varies according to quality of the produce from location to location and differs from place to place.

The farmer’s net selling price was Tk. 4.88/kg, which was 23.4% of the consumer’s price. The producer during interview stated that selling of produce at farm level or in the market directly to consumer’s gives better price remuneration of about 20-25% and this may be due to the absence of intermediaries between producer and consumer.

The analysis of marketing cost and margin indicates that decreasing the number of intermediaries in the existing marketing system may increase the producers ‘share in consumers’ price. Seasonal variation, underdeveloped marketing and transport systems, poor infrastructure, and insufficient storage facilities intensify price volatility. The price of Tomato is higher during October to April and starts to decrease gradually with time and reached its minimum during June-July. Such wide price fluctuations are mainly due to the seasonal character of production and supply.
The transportation system plays an important role in the marketing of produce. Transportation is a key determinant of the availability of market produce at the proper time and place. Rickshaws, vans, head loads are the main means of transportation from the farm gate to the local markets. Head loads, rickshaws, and vans are the major means of transportation used by Farias. On the other hands, Beparis mainly use trucks to carry the crop from the local market to the urban wholesale market; sometimes they use trains, and passenger buses to shift their purchased produces. Similarly due to shortening of marketing chain, additional benefit could be gained from reduction of marketing costs.

The rate of increase of technological adoption in pesticide applications, or the use of IPM technologies would help in producing quality crop that may help in fetching high market prices. All these factors may collectively help to increase farmers’ income in the supply chain. Due to these inappropriate practices significant yield losses occurred. Farmer’s income can be accelerated addressing appropriate crop management practices.

### 4.5 Constraints and Opportunities of Tomato at Chandina Upazila

#### 4.5.1 Major Constraints

The major constraints of tomato value chains are presented in the following Table 14:

**Table 14: Constraints in Tomato Production at Chandina**

<table>
<thead>
<tr>
<th>Areas of constraints</th>
<th>Constraints</th>
<th>Probable solution to remove the constraints</th>
</tr>
</thead>
</table>
| Product and market                 | • Farmers are not aware about modern post harvest management of crops.  
• Using pesticides indiscriminately  
• IPM technologies are not practicing by most of the farmers  
• No collection/and processing shed where farmers can assemble their produce, sort, grade and sale to the traders/wholesalers  
• Farmers are exploited by traders and not getting fair price  
• Lack of awareness on the group marketing benefits | • Provide training on post harvest management of crops  
• Disseminate IPM technologies  
• Physical improvement through establishment of Commodity Collection Centre (CCC)  
• Develop market linkage through group market approach |
| Technology and production including inputs | • Lower yields due to poor management practices  
• Adulteration of fertilizers, seeds and pesticides  
• Limited knowledge on PHM practices and very little sorting, grading and poor packaging is done  
• No established maturity index and grading standard  
• Not aware about the harmful affect of abuse of pesticides and other crop protection chemicals | • Linking farmers with good input suppliers  
• Provide production and PHM related training and extension service  
• Develop awareness on the impact of in-appropriate application of pesticides and impart training on IPM & ICM practices.  |
4.5.2 Major Opportunities

Adoption of improved production and low cost post harvest technologies, adoption of group marketing will help to reduce post harvest losses and marketing costs thereby increasing income of the stakeholders. The following are the main opportunities:

- Organizing the farmers in groups for production and marketing of crops, especially linking them with the city/urban markets;
- Linking farmers with good input suppliers
- Training for the service providers on improved crop management practices including PHM practices
- Yields and produce quality of Tomato could be enhanced by addressing the issues related to GAP and SPS issues etc.

4.6 Suggested Strategy for Interventions

The main intervention strategy for tomato production will be:

i) Introduce code of GAP;
ii) Reduction of post harvest losses through low cost post harvest management practices;
iii) Improve quality of tomato through interventions in both pre-harvest and post-harvest levels;
iv) Introduce contract farming and develop linkage with processing industries, and
v) Link farmers with markets to increase farmer’s income

Accordingly, the objectives of the interventions are as follows;

i) Introduction of modern production technologies
ii) Reducing post harvest losses and enhancing shelf life of the crop through practicing pre and post production improved management practices
iii) Reducing marketing costs through introduction of group marketing
iv) Facilitating the farmers in getting local market access directly with their crop through establishing market linkages.
v) Enhancing crop productivity and quality of the crop through adoption of Good Agricultural Practices (GAP).
Chapter- 5

Facilitating Agencies and their Services

Different organizations/institutions are currently providing services among the stakeholders which include technology, credit access and technical training. Some highlights of the services are stated below:

A general lack of knowledge has been observed among the stakeholders concerning supply chain management and good marketing practices. There are few agencies available to small and medium scale agribusiness enterprises and most of them are provided through individual professionals, NGOs or donor supported subsidized projects. Individual stakeholders are providing services on a commercial basis. These include renting of equipment (power tillers, threshers, and tractors etc), spraying of pesticides/fungicides for plant protection, laboratory testing (soil fertility analysis), business development services (accounting, feasibility studies, and human resource development), management consultation and market research for agribusiness enterprises. However, professionals and technicians provide most of these services on individual basis. With a very few exceptions, there are no corporate organizations with the mandate of rendering this type of services to agribusiness stakeholders.

The public sector services to encounter the sub-sector constraints are very much limited. The public sector organizations/agencies such as DAE, BADC, BARI, BARC, Agricultural Universities, DAM, EPB etc. are providing limited services like technology generation and dissemination or extension services including training for skill development and technological information. In private sector some organizations/enterprises such as BASC, BDS, Hortex Foundation and Seed and Pesticides Companies are also providing services in limited scales. Likewise, NGOs such as BRAC, PROSHIKA, RDRS, CARE, and TMSS etc. are also rendering services to address the constraints of the sub-sector. The organizations of both public and private sector are facing the problems of funds, facilities and appropriate technologies and technically sound resource persons. Coordination between GOs and NGOs, and among the NGOs are not as strong as required although there exist some examples of successful collaborations between the GOs and NGOs in research, extension, seed production and such other fields.

The marketing channel of the sub-sector is fragmented and complex. The producers and traders are lacking market information and facing problems of working capital. Market information flows among the actors of supply and value chain as embedded services. There is no existence of functional producers associations. The BFVAPEA-as associations of vegetable exporters are not strong enough to support the whole range of required activities of the members. There is a need to build social capital in the form of private sector organizations capable of resource mobilization, self-regulation and partnering with government as civil society institutions.
Chapter- 6

Key Constraints and Opportunities of Fruits and Vegetables

6.1 Constraints

The constraints and opportunities faced by the actors in fruits and vegetables were identified following seven critical areas and these are the following:

a) Market access; no alternate export channel, other than air shipment;
b) Non-availability of quality inputs;
c) Non-availability of technology/product development services;
d) Lack of appropriate supply chain organization and management;
e) Lack of infrastructure: grading and packing facility and cool chain management;
f) Government policy on airfreight handling and sea port management;
g) Lack of Bank finance for traders or farmers for commercial production, and
h) Lack of necessary incentives in appropriate time.

The constraints identified in vegetable sub-sector are stated below:

1. Constraints relating to awareness
   a) Lack of improved production techniques of fruits and vegetable production
   b) Inadequate knowledge and skills on soil, fertilizer, seeds and pest management
   c) Lack of knowledge of seed production, collection and preservation
   d) Inadequate knowledge on harvesting, post-harvest handling, storage and transportation
   e) Limited horticultural research and poor dissemination of research findings
   f) Insufficient extension services on Good Agricultural Practices (GAP), ineffective extension massages and poor delivery system. There exists serious gaps between technology generation and adoption and these gaps are a factor to low yield, quality and shelf life.

2. Constraints relating to market access
   a) Inadequate market information
   b) Lack of poor marketing initiative and market linkages
   c) Alternate vegetable export supply chain to air shipment is not well developed.

3. Constraints relating to input supply
   a) Prevalence of sales of poor quality and adulterated inputs (fertilizers and pesticides) by the input supplier
   b) Lack of product (input) knowledge of the local retailers
   c) Lack of organic fertilizers and pesticides resulting in poor quality fruits and vegetables
   d) Inadequate knowledge and skills in adhering to the use of recommended pesticides and ignorance of environmental concerns as demanded by importing countries. This has affected the safety of consumers and the environment. High residue levels may reduce the competitiveness of Bangladeshi produce in the international markets.
4. **Constraints relating to finance**
   a) Lack of easy access to financial market by the stakeholders leading to poor or no benefits from economy of scale.
   b) Inability to provide adequate collateral.

5. **Constraints relating to operating environment**
   a) Lack of organized packing house, market shed for post-harvest operations, trading vegetables within easy accessibility of the farmers.
   b) Lack of uninterrupted power supply by DESA/REB causing direct effect on production as well as at storage of produce.
   c) Lack of adequate storage facilities resulting in sales of vegetables by the farmers and traders’ during the harvesting season at a lower cost.
   d) Lack of awareness on the quality and environmental issues.
   e) Lack of cargo space and shortage of cargo handling facilities in the ports.
   f) Poor packaging of perishables.

6. **Constraints relating to association**
   a) Absence of collaboration among farmers and traders leading to poor bargaining power and loss of potential bulk discounting in terms of buying inputs and sales of vegetables access to financial markets etc.

6.2 **Opportunities**

- Developing awareness on use of quality inputs for fruits and vegetables cultivation.
- Developing capacities, provide knowledge and information on products and their appropriate usage.
- Provision for collection, collation and dissemination of market information.
- Identifying appropriate markets, initiating appropriate marketing and promotional activities and creating direct market linkage for the small farmers, traders and processors with the urban markets.
- Facilitating the packaging companies through providing technical and financial assistance and also creating awareness on the benefit of using improved packaging.
- Research and appropriate use of frozen products, blanching requirement and its process, appropriate packing, transportation, cool chain management and storing of frozen vegetables.
- Stimulating private sector highlighting the demand and market size.
- For awareness addressing all aspects relating to fruits and vegetables, post harvest management and processing.
  a) Developing capacities, provide knowledge and information on products and their appropriate usage;
  b) Stimulating private sector highlighting the demand and market size;
  c) Developing awareness about the harmful effects of indiscriminate use of pesticides;
  d) Facilitating easy access to capital and working capital through linkage with financial markets and credit providers appropriate to vegetable production and post-harvest processing;
  e) Stimulating private sector to provide packinghouse facilities as well as market shed facilities for business purpose in specific vegetables production areas;
f) Creating awareness on food safety regulations and identify the harmful effects of indiscriminate use of pesticides;
g) Stimulating private sector to provide power facilities as a business;
h) Facilitating the packaging companies through providing technical and financial assistance and also creating awareness on the benefit of using improved packaging;
i) Facilitating the formation of farmers’ and small traders groups for farmer to market linkages;
j) Facilitating air cargo space, allow air cargo services for perishables and discouraging the provision of off-loading.
Chapter- 7

Value Chain Developing Strategies and Proposed Services

7.1 Value Chain Developing Strategies

The opportunities that exist in Bangladesh for fruits and vegetables promotion must be exploited through undertaking pragmatic strategy formulation. In view of the high demand and high price in the markets, the up-grading strategy for the sub-sector should be focused on both local and foreign markets. Efforts should be made to increase the productivity through technology dissemination and providing other services so that supply of fresh and value added products could be raised from the present level to satisfy the market demands. Necessary attempts should be made to arrange easy loan or financial support to the poor and marginal farmers in any form with less interest, so that they can go for more production of fruits and vegetables tapping the true potentials.

There is a need to organize producers into a collective enterprise for timely, efficient and organized marketing of produces. The core strategy is to be the establishment of Producers Organization (PO) for which a master plan along with specific actions is to be formulated providing required technical supports and infrastructural facilities. The POs will work to consolidate producers in one umbrella so that the beneficiaries can received the required services for production of high quality produce and can market in a better and efficient way. The POs should be federated to increase bargaining power and to establish linkages with buyers. For expansion of the sub-sector, production, processing and quality assurance is utmost important. Produce quality is very much interrelated with the price. It is important to establish the quality standards in the value chain so that responsible buying practices are promoted and poor producers get fair benefits.

There is a need to improve quality of the produce following better management practices during production, practicing grading, packaging, transportation and marketing. It is necessary to develop skills and capacities of the stakeholders involved in the value chain. Sustainable production, harvesting, post-harvest management and processing guidelines has to be developed and training on cultivation, management and value adding technologies to be conducted. The possibility of linking producers with financial institutions and development programmes has to be explored so that the beneficiaries can get easy access to finance. An enterprise development plan for upgrading functions has to be developed with a focus on increasing benefits to primary producers.

Identification of potential markets, understanding demand and requirements to access the market and identifying potential buyers is to be considered in upgrading the market. Keeping the needs of primary producers in mind, the production, quality control, value adding activities transportation, financial management and marketing activities has to be analyzed to target the buyers and the markets. If the analysis suggest moving forward, exposure visits of the primary producers or traders will be helpful or improving understanding on market and their specific requirements. Upgrading market is successful once the contractual agreement with potential buyers is signed. There is a need to establish a trustworthy relationship between the actors to facilitate exchange of information and skills. Market information is
always important for primary producers and traders so that they can judge the offer they are receiving from the buyers.

Branding of products is a new concept in Bangladesh and that can be developed at both demand and supply sides which will not require many costs but will ensure profit in the long run through creating good image. At the same time this will also establish an alternate standard for others. Branding requires specialized knowledge and efforts of the stakeholders. Branding and certification of products could be established. It may include training, skills development and promotional campaigns etc. If local community can organize marketing of the produce as per the strategies outlined in upgrading, they can implement branding strategies for their products which reduce costs in building trust.

7.2 **Proposed Services/ Facilitation Activities**

a) Develop appropriate and demand driven technology through conducting research
b) Dissemination of improved technologies related to production, post-harvest management, value addition etc to the stakeholders
c) Provision for collection, collation and dissemination of market information
d) Develop appropriate market linkages through initiating promotional activities and establish direct market linkage for the small farmers with the high priced urban markets
e) Strengthen capacities, provide knowledge and information on products and their appropriate usage
f) Encourage private sector highlighting the demand and market size
g) Facilitate easy access to capital and working capital and working capital through linkage with financial markets and credit providers appropriate to fruits and vegetables production and value added activities, and
h) Create awareness on food safety regulations.
Chapter-8

Recommendations and Conclusion

8.1 Recommendations

In order to strengthen the capacity and dynamism of the fruits and vegetables sub-sector, the following priority intervention areas are recommended:

- Strengthen research to develop appropriate and market driven technologies;
- Increase extension services to disseminate modern technologies using ICT;
- Strengthen capacity of stakeholders, addressing all aspects relating to fruits and vegetable production following the code of Good Agricultural Practices (GAP);
- Improve knowledge on maturity indices, harvesting, grading, packaging, transportation and storing of vegetables;
- Develop awareness on quality inputs and ensure supply of quality seed, fertilizers and pesticides;
- Create awareness on the food safety issues for international trade;
- Support for development of private sector service providers for quality assurance and market research for identifying appropriate markets;
- Support for establishing good quality packaging for easy export market access;
- Support for the development of alternate supply chain for exporting frozen vegetables to increase volume of export through ocean going vessels;
- Arrange financing for the stakeholders and facilitate securing capital for enterprise development;
- Assist in establishing a data base on market information of perishables;
- Arrange policy dialogue with government of Bangladesh to formulate horticultural export policy, increase air cargo space options in national and international airlines and allowing foreign cargo plane to operate from Bangladesh;
- Support strengthening of SME’s Associations to create direct linkage for the small farmers, traders and processors with the urban markets as well as export markets.

8.2 Conclusion

The study has outlined the nature of Bangladeshi fruits and vegetables value chain, including the main actors in the chain and marketing structure. Sources of inefficiencies within the chain have also been explored and ways to improve competitiveness of the fruits and vegetables sub-sector have been presented. Complex and fragmented supply chain of fruits and vegetables constitutes the major challenge for production and marketing of produce and the presence of middlemen and a long chain that increases costs without adding much value. Side by side, transportation and storage facilities are not friendly for quick distribution of fruits and vegetables which results huge post-harvest losses and quality deterioration of the produce. Although, the prevailing situation reflects potentials of investment, factors of underdeveloped infrastructure, poor and traditional transport systems, lack of economies of scale and outdated marketing policies discourages private sector participation in investment.
There is great potential to make smallholder farmers competitive in the face of globalization. In order to promote the competitiveness of the sub-sector in the high value niche markets and improve farmers’ incomes, institutional and organizations innovations are required. These innovations would improve product quality and reduce transactions costs. It is important to note that technology innovation systems, seed systems, market institutional innovations, and capacity building are essential in contributing towards long term challenge of increasing the competitiveness of poor stallholder fruits and vegetables farmers in Bangladesh.

The underlying potentials to flourish the fruits and vegetables sub-sector could be achieved through technological interventions for increasing the productivity, strengthening organizations, market intelligence through public-private partnership and promoting specific commodity clusters by organizing the producers into common interest groups and those would be federated into producers organization, facilitating contract farming, rationalization of marketing policies. If successfully implemented, these innovations would lower transactions costs and foster transparency in market organization and coordination through providing a facility for bulking, implementation of grades and standards required by the high price local and international markets, and dissemination of production and market information. The benefits that would accrue from such innovations would transcend the small and marginal farmers. Economic welfare would be brought about through greater specialization in fruits and vegetables production leading to increased output from each unit of resource employed and more efficient allocation of resources. Furthermore, through the adoption of the new technologies farmers would be able to realize economies of scale in production, and possibly reduce price variability.

The study concluded that value chain integration for improving productivity, marketing efficiency and reducing transaction costs in fruits and vegetables sub-sector is urgently needed in Bangladesh. In order to develop viable value chains, more initiatives should be undertaken to promote regional coordination at each and every stage of value chain and that will help access into the global value chains and promote regional development.

8.3 References


Bhuyan and Hossain, 2011.

DAE, 2011. Annual report, PIU, DAE, NATP, Khamarbari, Dhaka


Ministry of Agriculture (MOA), 2004. Agriculture sector review (Sub-sector: Crop), Ministry of Agriculture.


Ministry of Commerce. 2007. A study to identify the required preparatory steps for developing traceability system in the fruits and vegetables sector in Bangladesh.


Rubayat, J. (2009). Financing the small scale industries in Bangladesh: The much-talked about, but less implemented issue. Proceedings of ASBBS Conference; Lasvegas, USA.

Siddique and Azad, 2010


Value Chain Analysis and Market Studies on Fruits and Vegetable in Bhutan

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Country status Report on Fruits Value Chain taking Citrus mandarin and apple as case studies

1. Introduction

Fruits are an important source of livelihood in almost all twenty districts of Bhutan and are the primary source of income for a majority of the subsistence and small farmers. It is also the highest value domestic and export crop of Bhutan. Some of the major export fruits are citrus and apples. A significant portion of the total produce of these two commodities is exported to India and Bangladesh.

Amongst the fruit crops, citrus/citrus covers the largest area under cultivation and is one of the highest income generating fruit crops. Citrus/Orange production and marketing is an important source of income not just for farmers and traders, but also generates revenues for government bodies like the Food Corporation of Bhutan (FCB). Even though land use under the orchard category accounts for only 1% of the total arable land, in terms of export of cash crops citrus ranks first in earnings and second in volume after potato. Citrus orchards in Bhutan range from a few trees to large commercial orchards. According to the RNR Statistics 2000, 57% households growing citrus have 1 to 50 trees, while 31.2 % households have 5 to 25 trees. The CCA Survey conducted in 2006 shows that 75% households are backyard farmers and small orchard owners and only 8% fall under the category of large farmers. However, it is important to note that the area owned by small and backyard citrus farmers is only about 25% of the total area under citrus cultivation, whereas the large orchard owners have 50% of the citrus area.

Apple production and marketing is another important source of income not just for farmers and traders, but also generates revenues for the government. There are 3,580 acres of land under apple cultivation in Bhutan, behind only citrus in acreage and production. Most orchards are confined to the four dzongkhags of Thimphu, Paro, Haa and Bumthang. There are over 3,096 apple growers, of which 1,830 are concentrated in Thimphu and Paro.

According to Vision 2020, Bhutan’s target is to achieve a 300% increase in horticultural exports by the end of the 10th plan.

2. Production

Table 1. Fruits production (in Tonnes) by commodities (2005-2010)

<table>
<thead>
<tr>
<th>Fruits</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>10387</td>
<td>12108</td>
<td>7078</td>
<td>5038</td>
<td>6523</td>
<td>7371</td>
</tr>
<tr>
<td>Banana</td>
<td>2019</td>
<td>5051</td>
<td>3980</td>
<td>1648</td>
<td>2155</td>
<td>2208</td>
</tr>
<tr>
<td>Guava</td>
<td>1048</td>
<td>2345</td>
<td>2276</td>
<td>792</td>
<td>942</td>
<td>864</td>
</tr>
<tr>
<td>Citrus</td>
<td>47937</td>
<td>82725</td>
<td>72319</td>
<td>38775</td>
<td>44295</td>
<td>52624</td>
</tr>
<tr>
<td>Mango</td>
<td>1047</td>
<td>1369</td>
<td>665</td>
<td>610</td>
<td>321</td>
<td>398</td>
</tr>
<tr>
<td>Peach</td>
<td>2523</td>
<td>3304</td>
<td>3130</td>
<td>2125</td>
<td>1227</td>
<td>779</td>
</tr>
<tr>
<td>Pear</td>
<td>1366</td>
<td>5852</td>
<td>2210</td>
<td>0</td>
<td>1104</td>
<td>758</td>
</tr>
<tr>
<td>Plum</td>
<td>1079</td>
<td>1794</td>
<td>1040</td>
<td>414</td>
<td>548</td>
<td>357</td>
</tr>
<tr>
<td>Walnut</td>
<td>946</td>
<td>796</td>
<td>817</td>
<td>345</td>
<td>241</td>
<td>213</td>
</tr>
</tbody>
</table>

Source: CountrySTAT-Bhutan
Table above shows data for 2005 and 2010. The production of some of the fruits increased because of the increase in the number of fruit bearing trees. The yield of major export commodities like citrus and apple declined slightly due to the spread of diseases and poor management practices. Over the past few years, the spread of diseases has become more prevalent and impacted negatively on the overall production of apple and citrus. However appropriate measures especially the control against the citrus greening disease is being taken care by the ministry. Education to growers about the best management practices has been given, and will hopefully contribute towards the growth of the fruit sector which has direct repercussions on the livelihood of the rural population.

3. Export Demand and Domestic Consumption

Citrus is among the most important agricultural commodities contributing to Bhutan’s economy generating export revenue, income and employment for at least 60% of the population. More than 80% of the produce is exported. As one of the top ten exports of Bhutan, it generates about Nu. 200 million annually. The bulk of the fruit is exported to Bangladesh, while limited quantities are sold in nearby Indian and local markets. Annually, an average of about 18000 MT citrus is exported with 85% going to Bangladesh.

Developing an appropriate marketing strategy is likely to increase the demand of Bhutanese citrus. According to exporters, there is high demand for Bhutanese citrus in India, even though India is the world’s sixth largest producer of citrus fruits. The preference for Bhutanese citrus in India is attributed to its large size and unique taste. Exporters feel that Bhutanese oranges would fare well in the regional markets and command higher prices. However, the biggest hindrance is the lack of road networks connecting the main citrus growing areas with the market.

The export market of apples is currently limited to two countries, Bangladesh and India. Annually, about 37% of the production is exported to Bangladesh and 19% to India. In 1992 and 1995, Bhutanese apples were also marketed to Sri Lanka, Thailand and Nepal but the trade was discontinued due to heavy competition and high transportation costs.

![Citrus export 2008-2010](image)

*Source: BAFRA, MoAF*

Fig. 1: Trend in the export of citrus from 2008 to 2010 (Quantity in MT)
Domestic consumption of fresh apple was 2,988 MT. The per capita consumption of fresh apple fruits was 4.7 kg annually. Marketing during the off-season to take advantage of higher prices have been recommended to growers and exporters. Despite efforts in the past three decades the yield of apple in Bhutan is still low compared with the regional level. The quality of the fruits in general is also poor. Other causes of poor yield were poor knowledge of orchard management, poor practical skills on apple production, unavailability of inputs and other services on time and illiterate caretakers of rich man’s orchard.

Figure 2 gives an overview of the marketing channels for fruits in Bhutan. Depending on the quality, quantity and number of fruit bearing trees, a farmer decides the mode of sale.

The export price to Bangladesh has always been higher than India. A floor price is agreed upon by the importers and exporters every year but the price trend does not reflect any steady increase. Since the price offered by the Bangladeshi importers is higher than the Indian buyers, about 85% of the citrus is exported to Bangladesh.

Domestic consumption ranges between 5500 - 6000 MT, which includes consumption in processed form as well. This amounts to a per capita consumption of 7 kg annually. Amongst the urban areas, Gelephu, located in the citrus producing belt has the highest consumption of fresh oranges while Trashigang has the lowest.

Amongst the processed products, the demand for orange squash and juice is higher than that of marmalade. The demand for bottled orange juice and squash is more because these can be diluted with water, tastes better and is cheaper than canned juices. However, the domestic consumption of orange marmalade is very low perhaps, because it is not a part of the traditional Bhutanese diet.

4. Marketing of fruits

Figure 2 gives an overview of the marketing channels for fruits in Bhutan. Depending on the quality, quantity and number of fruit bearing trees, a farmer decides the mode of sale.
If the trees are less and the quantity of fruits low, the farmer chooses to either sell by the road side, take it to the auction yard, or to the other retailers. If the quantity is more, the farmer sells it to either the middlemen, contractors, suppliers or the exporters. This depends on the rapport between the buyer and seller. Normally, a farmer sells it to the person who has been buying from him over the years, but at the same time prefers to sell it to anyone who offers a higher price.

![Diagram representing marketing channels](image)

The middlemen buy from the farmers and sell it either to the suppliers or exporters. Both the supplier and the middlemen have a fixed buyer, who is an exporter. The exporters pay cash advances to them and they in turn pay the farmers. Some suppliers as well as exporters purchase from the auction. In some instances, the growers give the entire orchard on a contract ranging from 1-5 years. If the farmer feels that the price paid by the contractor or the exporter is low, then he chooses to either take his produce to the auction market or sell to the wholesalers. However, to be able to do this the farmer should have the capability to harvest and transport the fruits. The most common practice is to sell to the contractors and exporters.

Immediately after the harvest, fruits are taken to the depot or packing house situated in the border towns in trucks. At the depot, the fruits are immediately unloaded, sorted, graded and packed into boxes, so that the consignment is ready for export at the earliest possible. In areas where there are no processing units, the rejected fruits are often sold to wholesalers and retailers both within and outside the country.

In order to support growers, the Food Corporation of Bhutan (FCB) runs auctions in some places where the contractors, middlemen, and exporters have to compete to procure the fruits. This is done to make up for the volume that contractors have agreed to supply to exporters and the exporters to make up for the volume agreed upon with the importers.

The contractors and middlemen supply the export quality fruits to the exporters and sell the rejected fruits to either the processors, wholesalers or the retailers in Bhutan or even outside the country. Interestingly, the exporters don’t have to search for buyers of the rejected fruits, as they come directly to the depot to procure the rejected fruits.
The processors, who are the end-market for the fruits rejected during the export process, are the only ones who add value to the citrus fruits in Bhutan. About 75% of the processed fruits like orange squash, marmalade, jam etc. are exported and 25% for the retained domestic market. Some wholesalers of processed fruits are also involved in the export of value added products. The smaller integrated food processing plants like the one in Dagapela process orange pulp, which is supplied to bigger processing units like the Bhutan Agro-Industries Limited (BAIL) at Wangchutaba, Thimphu.

5. Processing of fruits

The domestic market for fruits is dominated by two agro-based industries, which use the export rejected fruits for processing value added products like orange squash, apple juice, juice, jam and marmalade. About 75% of the processed fruit products are exported to India and Bangladesh, while the remaining is sold in the local markets. The products ranges of both the agro-based industries are the same, except for the volume of the different orange products. The Bhutan Fruit Factory (BFF) in Samtse is a larger producer compared to BAIL and the production cost per unit (Nu/ml) is different for these two.

6. Emerging Trends

6.1 Increasing production/lower yields

Fruit production in the country is increasing because of the increase in the total number of trees as well as the number of fruit bearing trees. However, a decline in yield particularly with regards to citrus has been observed in recent years because of diseases like the citrus greening disease, phytophthora rot, citrus fruit fly and powdery mildew. The initiatives adopted by the Ministry of Agriculture to revive the citrus industry can be achieved by working in tandem with the growers and other stakeholders. Efforts at generating employment and income for the rural communities are being made by setting up processing plants which would also encourage the growth of the citrus industry.

6.2 Higher exports

The citrus industry is increasingly becoming export-oriented and is one of the top ten export commodities of Bhutan. Over 60% of the total produce is exported and amount can be increased considerably if the remote orchards are connected with the main towns through an arterial road network. Often the surplus is consumed by the households, gifted to friends and relatives or left to rot, because the farmer cannot afford to sell the excess produce due to lack of road network or higher transportation costs. The volume of export particularly with regards to apple to Bangladesh and India is steadily increasing and the market is limited only by the production capacity of the country.

The demand for fresh fruits and processed fruit products is likely to increase with improvements in the living standards and health consciousness of the consumers.

7. Key Issues in the Chain

As is evident from the above discussion, fruits are one of the key export earners for the country. Bhutan’s fruit industry has a lot of potential for expansion because of the high
demand from the export market. Further, almost all twenty districts in the country have potential of growing one or the other fruits in their locality. Thus, this commodity chain can have a huge impact from the food security perspective if some key issues are addressed to upgrade the chain.

7.1 Planting materials

There is a need to explore more varieties of planting materials in the country. Almost all the fruits in the country are grown from seedlings, whereas grafted plants are almost nonexistent. On an average, the trees take 7-12 years to bear fruits after planting 18 months old seedlings. Generally, seedlings are supplied by the Druk Seed Corporation (DSC); however, many growers raise their own seedlings. Provision of good grafted planting materials can significantly enhance yields.

7.2 Research and extension (orchard management)

The general management of orchards is still very basic. In most instances, trees are grown under natural conditions with very minimum added inputs. Awareness regarding fertilization and pruning is limited. The production is further affected by pests and diseases which account for as much as 60% loss of the fruits. Specific focus on research and extension for orchard management is critical to enhance productivity.

7.3 Marketing of citrus

A large proportion of the fruits meant for the export market are sold by the farmer while still on the trees at any stage from flowering to maturity. The buyer is then responsible for harvesting, grading, packing and marketing of the produce. The advantages of this deal to the farmer include advance cash from the buyer; reduction in risks such as pest infestations, and natural calamities; and no involvement in harvesting and post-harvest operations. However, the price is generally lower if sold before the harvest, and most farmers get no information regarding the produce from their orchards. As a result, they are unable to assess variations in productivity and revenue generated from their orchards as a result of changes in price and production level. Therefore, they are unable to determine whether improved management practices have increased yields and affected their income. More efforts on group marketing by farmers will ensure better price realization by farmers.

8. Conclusion/recommendations

8.1 Recommendations on orchard management practices:

The Ministry of Agriculture & Forests should vigorously campaign to promote awareness regarding the benefits of best management practices in the orchards. Establish and support model orchards in every Geog to showcase the effectiveness of recommended technologies and to also disseminate information on the use of appropriate technology. Introduce and support alternative irrigation systems in citrus producing areas where there is a scarcity of water. Encourage growers to test and analyze soil nutrients and accordingly make a judicious use of inputs such as inorganic fertilizers to supplement nutritional requirements of the fruit trees.

Given the fact that many orchards are located in fragile and marginal eco-systems, soil
conservation should be integral to any initiative devised for the development of the orchards and also feature prominently in the annual work plan of the Dzongkhags. Research Centers should develop improved rootstocks and cultivars specific to different agro-ecological citrus growing zones.

8.2 Recommendations on Delivery of Support Services

Enhance the capacity of the extension officials through ongoing refresher courses and trainings on citrus production. Appoint subject matter specialists in major citrus growing areas to support the extension. Review, monitor and measure the impact of farmers’ training programs and their topics through developing feedback mechanisms.

Ensure participation of each member of the grower community while conducting training programs to ensure effective implementation and greater awareness about every aspect of fruit cultivation. It is also important to conduct extension programs on the farms or in the villages to encourage wider attendance. The training curriculum should be relevant to the farmers and the topics should be synchronized with issues being faced by the farmer’s at the time of the training to make them relevant for the farmers.

Support private nurseries in fruit growing areas to ensure adequate supply of quality materials and supplement the short supply of seedlings from the National Seed Center (NSC). It is also critical to improve the accessibility of nurseries and availability of inputs to growers.

Review the impact of the “cash-and-carry-system”. In the interim, the government should provide revolving funds to the input suppliers including, the NSC, National Plant Protection Center and the Dzongkhags. Maintain buffer stock especially, plant protection chemicals to counter pest and disease outbreaks until an appropriate forecasting mechanism is developed.

Consider providing support to the commission agents through advances to procure inputs, so that these are readily available to the farmers at all times. Additionally, private nurseries should be strengthened and supported to ensure the supply of quality planting materials.

8.3 Recommendations on abandoned Orchards and Absentee Orchard Owners

Given the limited arable agricultural land in Bhutan, absentee orchards could be redistributed amongst the landless or poor farmers to boost economic activity, instead of merging them into the forest land category. Institute legislative or regulatory measures to enable compliance with the Ministry of Agriculture’s recommendations on management practices which if ignored may have a negative impact on neighboring orchards. Develop mechanisms to plough back revenue generated from the auction of absentee orchards to cover the cost of their maintenance. In cases where the revenue generated is insufficient, the orchards should be destroyed.

8.4 Recommendations on Post Harvest Technology

Promote the use of advanced tools to harvest fruits, Determine appropriate harvesting time to reduce post harvest losses during transportation, Introduce low cost, post-harvest treatment to reduce losses and ensure better quality of fruits, Create awareness regarding proper grading and sorting of fruits amongst the various agents in the fruit chain, Establishing depots in major fruit growing areas will reduce losses during transportation, generate employment and ensure that the fruits reach the export destination in less time.
8.5 Recommendations on Marketing

Provide marketing information on prices, destination of the produce and marketing chains etc. through media such as radio, television and publications. Study and validate the claims of malpractices by exporters with LC accounts. Introduce trademark for Bhutanese fruits once the quality is assured and consistent standard is achieved. Facilitate access and development of new export exit points at SamdrupJongkhar and Geleyphug. Encourage proactive participation by farmers in meetings and ensure their representation in public and private forums like the BCCI. Provide technical information to the middlemen, contractors and exporters regarding the handling and management of the fruits.

8.6 Recommendations on Groups and Cooperatives

Campaign to promote the benefits of group marketing and cooperatives against the current backdrop of open market economy and global trade. Build the capacity of extension agents in the Dzongkhags to enable them to form groups and cooperatives. Support and promote self-help groups, producers’ and marketing bodies in major citrus growing areas. Support and strengthen the existing agricultural groups and cooperatives.
Value Chain Analysis and Market Studies on Fruits and Vegetable in India

By

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Executive Summary

India is endowed with a wide variety of agro climatic conditions and enjoys an enviable position in the horticultural map of the world. India is the second largest producer of fruit and vegetable in the world. The growth in both area and production of fruits and vegetables in India is quite perceptible, especially, in the recent decade. The growth rate of production of vegetable is higher than the fruits, while growth in area under fruits cultivation is more than the vegetable cultivation. Higher cropping intensity in vegetable cultivation has contributed to growth in production. Increased production of fruits and vegetables has increased the importance of value chain management to reduce loss, improve marketing efficiency and make them available to final consumers in the required form.

The total value of output (VoP) of horticulture sector in India is increasing constantly and moving closer to total value of food grains in recent years. Evidently, it is a clear indication of diversification of agriculture towards high value commodities like fruits and vegetables. Both demand and price factors have contributed to the growth of horticulture sector to grow rapidly in liberalized trade economy.

In India, the marketing of fruits and vegetables is highly unorganized with large number of superfluous middlemen without making much value addition in the channel. The main channel of marketing consists of Producer → Commission agent → Retailer→ Consumer. The system of marketing is dominated by the commission agents whose role is institutionalized as per the market regulation Act.

As food consumption patterns are changing towards more convenient foods, the demand for products like pre-packed salads, packed mushrooms and baby corn, frozen vegetables, etc. are on the increase.

The numbers of regulated markets in the country is increasing over time. However, the trading practices of fruits and vegetables are hardly regulated in these markets as they mainly focus on food grains and commercial crops. Grading at primary market level is grossly inadequate. Cold storage facility is available for only 10 percent of fruits and vegetables produced. Existing processing capacity is inadequate and inefficient with outdated technologies.

Given the increasing demand for good quality perishable produce by consumers in both domestic and export markets, the maintenance of cold chain from grower to the consumer is of crucial relevance for maintaining the quality of the product. The key issues in development of the cold chain industry are that of diverse requirement for different horticultural produce, non-standard pricing, limited financial capabilities of the transporters and lack of critical scale for organized player participation.

Value addition sector which has been identified as a thrust area for development needs huge investments in logistics for supporting the value chain from farm to plate. It should promote clustering of the farmers to undertake cleaning, grading, primary processing activities at production level and linking this with processing and marketing. The processors and retailers should be allowed and encouraged to get actively involved in linking farmers to the value chain. It is largely a private sector activity, but government should provide the needed support and incentives for faster investments. It is highly recommended that processing
industries invest good amount of funds to the food safety equipments and measures. Food processing industries have opted for Hazard Analysis and Critical Control Points (HACCP) certification in India for export but not for domestic consumption.

The organized food and grocery retail chains which made an entry almost a decade back has been growing at a phenomenal pace in India. A comparative study has shown that the farmers involved with food retail chains realised higher net returns mainly due to higher yield and reduced transaction costs vis a vis farmers selling vegetables through traditional marketing channel.

In India, the value chain has a weak print; it is a multilayered marketing channel lacking in infrastructure. Value chains require strengthening at all the levels of infrastructure such as input delivery, credit, irrigation, procurement, post-harvest management, creation of cold store chains, establishment of processing units and modern warehouses, adoption of marketing techniques, marketing information and intelligence. The infrastructure and linkages of the value chain are very poor, and are affecting the growth potential of the fruit and vegetable sector. Contract farming is successfully practiced in certain regions for certain fruits and vegetables with the contracting firm taking the lead for value chain development.

Modern value chains were found to being more efficient than traditional value chains in many ways. Modern value chain is superior as it has scope for market function integration, financial flow management, supply - demand matching, collaborative forecasting, information sharing, goods movement synchronization through efficient transport scheduling and integration of input suppliers. Modern value chain is a two way process where as traditional system is one way. The traditional value chain farmers, on an average, received a higher share than other stakeholders, but the integrated farmers linked to the modern value chain received not only a higher share but higher price for each of the commodities. These integrated farmers received inputs and technical support; there is a reduction in production risks due to the vertical relationship. Integrated farmers are likely to face less price fluctuations and lower transaction costs compared to their traditional counterparts.

The wholesale price indices for fruits, vegetables and food articles as whole depicted higher amplitude of fluctuations in recent periods. Price indices for fruits were mostly below that of food articles. Unlike fruits, vegetable group showed wide oscillations within year and steeper increase in their price over a period of time. The higher fluctuation in vegetable prices cause wide variation in income realized and hence is a matter of concern particularly for small and marginal farmers. Seasonal nature of production, imperfect flow of market information, non-integration of local markets with terminal and up country markets and lack of production planning are some of the reasons for such wider fluctuations apart from the prevailing market inefficiencies and post harvest losses worsening the situation of farmers. It is interesting to note the seasonality in prices of fruits and vegetables are in opposite direction. The indices of vegetable prices were generally low during the first half of the year which gradually picked up to reach a peak during the year end. On the contrary, fruit prices peak during the summer months and before monsoon season.

Post harvest management is the weakest link in the fruit and vegetable value chain management. Fragmented supply base forms the major challenge for consolidation of produce and a long chain results in maximum cost addition without much value addition. Adding to this complexity, logistics is not oriented for quick and safer distribution of fresh and perishable produce. These factors contribute to an estimated loss of around 30 per cent
value of fruit and vegetable production. Though these inefficiencies offer tremendous scope for investment, factors such as poor marketing infrastructure, unorganized and traditional transport models, lack of viable scale (especially to introduce innovative cold chain) and unfriendly marketing policies for investors have deterred private participation. These impediments can be addressed through building organizational and market intelligence capital through PPP model, promote specific commodity clusters among growers, facilitate honouring of contract farming agreements, rationalization of marketing laws, promote innovative aggregation models such as ITC lead e-choupal model and contract farming models adopted by many companies.

The paper concluded that adoption of value chain approach for improving marketing efficiency and reducing transaction cost in fruits and vegetables has become a necessity in India. In order to develop viable value chains for fruits and vegetables, more should be done to promote regional integration at each stage of the value chain. This would also facilitate entry into global value chains and promote regional development.
Introduction

The global food markets are undergoing significant changes over time. On the one hand, we have factors such as population growth, rising incomes and the process of rapid urbanization (especially in emerging markets such as China, India and Brazil) fuelling growth in demand for food. On the other, we have rising consumer discern regarding food related issues such as safety, hygiene, health consciousness and cooking convenience which are dramatically changing the food consumption patterns across the globe. This is resulting in increased demand for high value food such as fruits and vegetables, milk and milk products and animal proteins. Dovetailing these trends, the global consumption of fruits and vegetables has registered double digit growth in the last twenty five years. Domestic consumption of fruits and vegetables is growing at 2.3 per cent annually (CII and Yes Bank, 2008). Positive economic and demographic trends coupled with the Government’s intent to improve and develop the horticulture sector (especially by focusing on exports and processing) is expected to further fuel the growth in demand for fruits and vegetables in the years to come, both for domestic consumption as well as the export markets. In response to ever increasing demand for fruits and vegetables, area under horticultural crops is increasing over the years.

The vast agro-climatic diversity and production strength that India holds and the innate flexibility that fruits and vegetables offer in terms of value creation for the supply chain participants which includes distribution, processing and marketing will provide great opportunity for India to expand cultivation of fruits and vegetable in large scale. Keen interest has been evinced by private players to harness the potential offered by this sector, especially in organised retailing and exports with value addition. Their interest has been buoyed by the rapid change in demographic profile of India, which is expected to increase consumption of high value food items such as fruits and vegetables.

In addition, the process of globalization has brought far-reaching impacts on the structure and sourcing of production, as well as the nature of market opportunities and competitive pressures for producers and market players, around the world. Development of efficient value chains for fruits and vegetables is an urgent need to address the gap between per capita availability and demand at global level (Schmitz, 2005; Hellin et al., 2007). However, lack of proper strategies and inefficiencies in organizing effective value chains are resulting in huge value loss (both in terms of quality and quantity) and thereby further widening of the gap. The increasing demand provides great potential for maximizing values through horizontal and vertical integration of market functions at every level of the value chain strategy. In this backdrop, this paper deals with possible options to develop efficient value chains for fruits and vegetables in India.

Status of Fruits and Vegetables in India

Area and production: India is endowed with a wide variety of agro climatic conditions and enjoys an enviable position in the horticultural map of the world. The area under horticulture crops has increased from 16.6 million ha in 2001-02 to 22.25 million ha in 2011-12 with a corresponding increase in production from 145.8 million tonnes to 247.54 million tonnes. During the same period, the productivity increased from 8.8 to 11.13 tonnes per ha (NAAS, 2012).
Fruits and vegetables occupy about 65 per cent of the area under horticulture landscape and contribute to more than 90 per cent of total horticultural production of the country (NAAS, 2012). The vegetable production has recorded a growth rate of 4.5 percent per annum during 1991-2010 period as compared to the average growth of 2.5 percent per annum of the agricultural sector as a whole (Chengappa et al., 2012). Generally, cultivation of fruits and vegetables tend to generate higher farm incomes compared to field crops. With the persistent high growth trend, horticulture is expected to play a dominant role in the overall development of agriculture in the country in the coming years.

India is the second largest producer of both fruits and vegetables in the world after China as being in population (World Bank, 2012; Johnson et al. 2008). Total production of fruits has been estimated around 71.5 million tonnes grown in around 6.3 million hectare and vegetables occupy an area of 8 million hectare with a production of 134 million tonnes (2009). India contributes 12 per cent and 14 per cent to the world production of fruits and vegetables respectively (Fig. 1).

![Fruits and Vegetables Production](source.png)

**Fruits and Vegetables**

**Source:** FAO and National Horticulture Board, 2011

Fig 1: Share of major countries in the world fruits and vegetable production in 2009

The growth in both area and production of fruits and vegetables in India is quite perceptible especially in the recent decade (Fig. 2). It is evident; the production growth rate of vegetable is higher than the fruits, while growth in area under fruits cultivation is more than the vegetable cultivation. Clearly, higher cropping intensity in vegetables has contributed to growth in production (Baba et al., 2010). Increased production of fruits and vegetables has increased the importance of value chain management to reduce loss, improve marketing efficiency and make them available to final consumers in the required form.
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

The total value of output (VoP) of horticulture sector in India is increasing constantly and moving closer to total value of food grains in recent years. Evidently, it is a clear indication of diversification of agriculture towards high value commodities like fruits and vegetables, livestock and fishery (Fig. 3). Both demand and price factors have contributed to the growth of horticulture sector (Sharma and Jain, 2011; Chengappa and Yadava, 2011) to grow rapidly in liberalized trade economy.

In terms of relative (per cent) share, it is clearly evident; the contribution of food grains is declining while the share of horticulture and livestock is continuously increasing (Fig. 4). In fact, horticulture and condiments and spices accounted for about 21 per cent of the total value of agricultural output during in TE 2008-09 (Fig 4).
Marketing channel for fruits and vegetables

In India, the marketing of fruits and vegetables is highly unorganized with large number of superfluous middlemen without making much value addition (Fig 5). The main channel of marketing consist of Producer → Commission agent → Retailer → consumer. The farmers bring their produce to the shops of commission agents operating at the primary wholesale markets (called as Mandis) who arrange for the display and sale of produce for which he is authorized to collect 10 percent commission charges. These trading practices in the primary wholesale markets are regulated and hence are referred to as regulated markets. The commission agents organize the sale of produce through auctioning or private negotiation in which wholesalers, retailers and bulk buyers participate. The commission agent is responsible to pass on the sale proceeds to the seller (farmers). The system of marketing is completely dominated by the commission agents whose role is institutionalized as per the market regulation Act. The farmers are free to sell their produce making use of any commission agent in the market but in reality they are forced to go to a particular commission agent who invariably finances the farmer for cultivation. The pre-harvest contractors also make use of commission agents for sale of the produce which they have purchased from the farmers. Similarly, the processing units also make of commission agents for sourcing the required fruits and vegetables for processing in their units. The quantum of direct sourcing of fruits and vegetables from farmers by the processing units is very limited. Similarly, the farmer-producers sell their fruits and vegetables making use of cooperatives to a small extent.
Direct procurement of fresh fruits and vegetables by corporate entities offer better price, knowledge of market demand, technological inputs and access to credit on account of assured market to the farmers. While it is estimated that direct procurement of fresh fruits and vegetables reduced wastage by about 7 per cent and improve the chain efficiency by as much as 17 per cent. However, there is no consensus whether the upstream operation of supply chain would be inclusive and cover farmers of all sizes of landholdings.

The availability of marketing infrastructure affects the structure, conduct and performance of the market. Studies have shown that owing to considerable expansion in infrastructure, there has been significant increase in both horizontal and vertical integration of agricultural markets, which improved the process of price discovery and transmission of price signals from deficit to surplus area (Chengappa and Gracy, 2011; Gandhi and Namboodiri, 2003). Market infrastructure improved through loading, weighing facilities, road network and cold-chain facilities substantially improves physical efficiency in marketing. The market efficiency can be improved by making up-to-date market information available to all participants through various means, including a good network of market information systems, internet and good telecommunications facilities at the markets.

The existing marketing arrangements for fruits and vegetables are far from adequate. Even though India has four million kilometers road length, it connects only 49 per cent of the villages. There are 7566 regulated markets operating in the country mainly concentrating on food grains and commercial crops (2008-09). The numbers of regulated markets is increasing over time (Fig. 6). These regulated markets are engaged in improving infrastructure and regulating marketing practices. However, the trading practices of fruits and vegetables are hardly regulated in these markets as they mainly focus on food grains and commercial crops. Grading at primary market level is grossly inadequate. Only around seven percent of the total quantity of agricultural commodities sold by farmers is graded before sale. The scientific
storage capacity is available for about 30 percent of the requirement. Cold storage facility is available for only 10 percent of fruits and vegetables produced. Existing processing capacity is inadequate and inefficient with outdated technologies. Similarly, available physical facilities to handle fruits and vegetables in market yards are inadequate. There are about 25,000 rural periodic markets in the country but with practically no infrastructure. Due to lack of proper handling (cleaning, sorting, grading and packaging) at the village level, about 30 percent of fruits and vegetables are lost before reaching the market (Acharya, 2005).

As food consumption patterns are changing towards more convenient foods, the demand for products like pre-packed salads, packed mushrooms and baby corn, frozen vegetables, etc. are on the increase. Integration of food processing infrastructure from farm to market facilitates higher value addition to fruits and vegetables. Keeping this in view, Government is encouraging investment in processing sector (NAAS, 2012). In India, 6200 licensed fruits and vegetables processing units are operating (Fig. 7). In globalization era, demand for processed food like, ready to cook and instant preparation has increased a great deal. India is no exception and there is a need to tap this opportunity based on the consumer preference.

![Fig. 6: Road length and number of regulated markets in India](image)

*Source: Ministry of Agriculture and Ministry of Road Transport and Highways, GoI*

Fig. 6: Road length and number of regulated markets in India

![Fig. 7: Number of licensed processing industries of fruits and vegetables](image)

*Source: Ministry of Agriculture, GoI.*

Fig. 7: Number of licensed processing industries of fruits and vegetables
Given the increasing demand for good quality perishable produce by consumers in both domestic and export markets, the maintenance of cold chain from grower to consumer is of crucial relevance for maintaining the quality of the product. The key issues in development of the cold chain industry are that of diverse requirement for different horticultural produce, non-standard pricing, limited financial capabilities of the transporters and lack of critical scale for organized player participation. Having a strong infrastructure of cold storage is critical for any country to develop the processed food market. Unfortunately, in India, cold storage facilities are focused mainly on one commodity: potato. In order to enlarge the market for fruits and vegetables (total annual of close to 200 million tonnes) expansion of cold storages has become a necessity. At present, 5400 cold storages are operating in India with a capacity of around 24 million tonnes (Fig. 8).

The Task Force on Cold Chain set up by the Ministry of Agriculture has identified a huge gap of 9 to 10 million tonnes of cold storage capacity in the country. The Ministry of Food Processing Industries through its scheme for Cold Chain, Value Addition, and Preservation Infrastructure has been successfully addressing the above issue. The Scheme was approved in 2008 with an objective to provide integrated and complete cold chain, value addition and preservation infrastructure facilities without any break, for perishables from the farm gate to the consumer. Substantive value addition, reduction in wastage and enhancement in farmers’ income is the main objective of the scheme.

![Fig. 8: Cold storages and their capacity in India](image)

**Post harvest management practices and value addition in fruits and vegetables**

While increased productivity is an essential component of a vibrant agricultural sector, improved post-harvest handling and processing is equally essential to ensure the product reaches in the right form maintaining high quality to the end user. Too often, even when the yields are high, producers lose income due to poor post-harvest practices. In India, about 30 per cent loss in fruits and vegetables is evidenced by many studies. A recent study undertaken by the Central Institute of Post Harvest Engineering and Technology (CIPHET) has estimated the wastage at around 6 to 18 per cent. It is interesting to note that fruits and vegetable have more wastage than highly perishable products like milk, meat and fisheries (Table 1).
Table 1: Cumulative wastage in agriculture and allied sector

<table>
<thead>
<tr>
<th>Crop</th>
<th>Cumulative Wastage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals</td>
<td>3.9-6</td>
</tr>
<tr>
<td>Pulses</td>
<td>4.3-6.1</td>
</tr>
<tr>
<td>Oil Seeds</td>
<td>6</td>
</tr>
<tr>
<td>Fruits and Vegetables</td>
<td>5.8-18</td>
</tr>
<tr>
<td>Milk</td>
<td>0.8</td>
</tr>
<tr>
<td>Fisheries</td>
<td>2.9</td>
</tr>
<tr>
<td>Meat</td>
<td>2.3</td>
</tr>
<tr>
<td>Poultry</td>
<td>3.7</td>
</tr>
</tbody>
</table>

Source: CIPHET, ICAR, Ludhiana

Effective post-harvest management of fruits and vegetables allows not only the minimization of losses but also increases the value of the marketed products by transforming the primary agricultural commodities into juice, jam, sauce, jelly etc. Good processing enables preservation of product quality at every stage of the marketing process. Attractive packaging makes the product more appealing to consumers who in turn are willing to pay more if the product offered is of good quality and easy to use.

As income increases, consumer demand for safer and higher quality food, in turn, the willingness to pay more also increases. Several studies in various developed countries have found consumers willing to pay premiums for safer and hygienic food. In India, private standards and in-house branding are emerging which are driven by supermarkets and modern value chains, in large part to compete with traditional retail markets and create a competitive advantage over other suppliers and retailers. However, grading and standardization in India has not picked up for fruits and vegetables at farm and market levels.

Value addition sector which has been identified as a thrust area for development needs huge investments in logistics for supporting the value chain from farm to plate. It should promote clustering of the farmers to undertake cleaning, grading, primary processing activities at production level and linking this with processing and marketing. The processors and retailers should be allowed and encouraged to get actively involved in linking farmers to the value chain. It is largely a private sector activity, but government should provide the needed support and incentives for faster investments.

At present, given the complexity of weak firm-farm linkages and inefficiency in the value chains, level of value addition is quite low (Gulati, 2009). However, value addition segment of food market (including fruits, vegetables and livestock products) is growing rapidly and attracting investments since the launch of economic reforms in 1991. Processed food can be customized to suit the nutritional requirements of groups such as the elderly, pregnant women, infants, young children and athletes. Such foods are characterized by a balanced composition of energy suppliers in the form of fats, carbohydrates and proteins, and by a combination of vitamins and minerals composed according to the current state of scientific knowledge. Value addition offers an opportunity for the creation of sustainable livelihoods and economic development for rural communities and it has come a long way in the last few decades (Gulati et al. 2007; Miehlbradt and McVay 2005). The ever changing lifestyles, food habits and tastes of customers’ globally have altered the dynamics of the industry. The world food production and consumption patterns are evolving with a change in the needs of
the customer. Increasing demand for ethnic and different foods from customers across the world has redefined the market canvas for food processors across the world. With these changes, producers, processors, retailers and suppliers of food, world over, are reorienting their business plans to meet the new demands of the customers. In order to make horticulture a viable enterprise, value addition is essential. Harvest indices, grading, packaging and storage techniques have been developed and standardized for major horticultural crops in India. Value addition through dehydration of fruits and vegetables including freeze drying have been developed. Potato chips, flakes, fingers and French fries are becoming popular as fast food business. Development of new products like juices, chips, essential oils, fruit wines are gaining popularity. Packing materials like Corrugated Fibreboard Boxes (CFBs), perforated punnettes, cling film wraps, sachets, etc. have been standardized for packaging of different fresh horticultural produce.

In order to reduce the dependence on refrigerated storage, the low cost eco-friendly cool chamber for on farm storage of fruits and vegetables has been developed. Standardization of modified atmosphere packaging and storage systems with a greater emphasis on safety (pesticide free), nutrition and quality is being given a priority in research programmes.

Growth in food processing sector is expected to open up a lot of opportunities for players having strong linkages in the fruits and vegetables value chain. Historically, agriculture and food processing industries have been plagued by factors such as low public investment, poor infrastructure, inadequate credit availability and high levels of fragmentation.

### Table 2: Growth of Food Processing Sector

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits, Vegetables, Oils, Meat and Fish</td>
<td>92.4</td>
<td>86.8</td>
<td>95.5</td>
<td>103.5</td>
<td>120.4</td>
<td>122.2</td>
<td>7.29</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>35.1</td>
<td>43.4</td>
<td>43.2</td>
<td>46.1</td>
<td>54.2</td>
<td>47.6</td>
<td>6.66</td>
</tr>
<tr>
<td>Grain Mill Products</td>
<td>134.7</td>
<td>123.5</td>
<td>119.0</td>
<td>128.5</td>
<td>159.5</td>
<td>177.4</td>
<td>6.55</td>
</tr>
<tr>
<td>Other Food Products</td>
<td>147.2</td>
<td>177.9</td>
<td>209.0</td>
<td>225.2</td>
<td>257.8</td>
<td>236.6</td>
<td>10.71</td>
</tr>
<tr>
<td>Beverages</td>
<td>34.2</td>
<td>45.3</td>
<td>55.0</td>
<td>70.0</td>
<td>79.4</td>
<td>76.9</td>
<td>18.61</td>
</tr>
<tr>
<td>Total</td>
<td>443.6</td>
<td>476.9</td>
<td>521.6</td>
<td>573.2</td>
<td>671.2</td>
<td>660.8</td>
<td>9.3</td>
</tr>
</tbody>
</table>


However, in the last few years there have been significant improvements as the regulatory environment is now changing for the better. Growth of value addition in different sectors is presented in table 2. Beverages have recorded very high growth (around 19 %) against 7 per cent growth of fruits, vegetable and meat. However, in recent years value addition is relatively more for fruits and vegetables as compared to grains which has least growth rate in food processing sector.

Improved technologies have to be applied in the field for post-harvest operations to prevent losses and undertaking value addition efficiently. This would entail establishing cold chains consisting of pre-cooling units, refrigerated transport, establishment of cold storage at production as well as consuming centers, etc., especially for perishables, such as fruits and vegetables. This is particularly important for improving access to rapidly expanding international markets for fruits and vegetables exports.
Structural Transformation of Agri-Horti-system: Organized Retail Chains

The traditional agri-horti-system that stretches from input dealers to farmers to aggregators, wholesalers, processors and retailers, has witnessed a new trend during last decade namely, the entry of major corporate firms. These players are entering at the front end in organized food processing and retailing, as well as at the back end as input service providers through an innovative model of Rural Business/Service Hubs (Fig. 9). As a result of this growing integration, farmers are likely to experience much greater interface with corporate entities, some working very closely with them and others in tandem. But, it is a fact, that in the coming years, agriculture including horticulture (or farming in general) cannot remain insulated from the structural changes in larger agri-horti- system. The key issue for us is to see how it can benefit the farmers through value chain. Will the growing competition amongst the front-end players deliver better prices, markets and value chain services to the farmers? It will be interesting to observe if these processes of change generate positive synergies within the system that can catalyze a win-win situation to all stakeholders.

Source: Gulati and Ganguly, 2009

Fig. 9: Emerging dynamics in fruits and vegetables value chains in India

Food retailing forms 61 per cent of total retailing. Currently, organized retailing forms a meager 5 per cent of the total retail business. Direct procurement of fresh fruits and vegetables is estimated to reduce wastage by about 7 per cent and improve efficiency by 17 per cent. Since elasticity of demand for agricultural commodities, especially vegetables is very low, farmers not only lose by reduced prices due to glut, but also unable to increase their gain due to lower improvement in demand for it. Backward integration with farmers by retail chain will help in linking farmers to markets and technology: improve efficiency and better price realization. The emergence of this alternate channel not only provides an additional option to farmers but competition to the traditional channel players in terms of price and other services.
There is another new phenomenon on the Indian landscape; rise of the organized food and grocery retail sector. The organized food and grocery retail chains which made an entry almost a decade back has been growing at a phenomenal pace. This sector, perhaps has recorded the fastest growth in the Asian sub-continent albeit, India started from a low base. The sector is primarily driven by domestic conglomerates. If the government opens it to foreign direct investments, there will be a entry of foreign players who will not only bring in investible funds but also global expertise and knowledge, much needed to develop this growing value chain and retail market sector (Gulati, 2009). There is a big divide on whether this revolution in the organized food and grocery retail will eventually result in a large number of gainers or losers. While one cannot ignore the process of “creative destruction” (Schumpeter, 1942), there will emerge opportunities of mainstreaming and co-opting. As the share of organized retail reaches 20 percent to 30 per cent of the retail market chain, it will start impacting significantly various stakeholders in the agri-system. Also, as the system gets increasingly organized, it is likely to have a spill over effect on the unorganized segment in terms of generating greater employment opportunities for the commission agents, small traders and even modernization of the traditional segment (Gulati, 2009).

A comparative study of the costs incurred and net profits earned by vegetable growers under backward integration practiced by Food Retail Chain Farmers (FRCF) and Traditional Market Channel Farmers (TMF) has shown that the former group was better off than the later, i.e, traditional market channel farmers (Chengappa et. al. 2012). These are typical examples of emerging value chains developed with corporate – the Food Retail Chain in the lead. The farmers involved in such an institutional arrangement realised higher net returns mainly due to higher yield and reduced transaction costs. Thus, institutional arrangements play crucial role in value chain management of fruits and vegetables.

### Table 3: Comparison of net returns from vegetables production between food retail chain farmers (FRCF) and traditional market channel farmers (TMF)

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Cabbage</th>
<th>Cauliflower</th>
<th>Carrot</th>
<th>Tomato</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FRCF</td>
<td>TMF</td>
<td>FRCF</td>
<td>TMF</td>
</tr>
<tr>
<td>Yield (tonne/acre)</td>
<td>33</td>
<td>30</td>
<td>12.5</td>
<td>12</td>
</tr>
<tr>
<td>Market price (Rs/tonne)</td>
<td>3490</td>
<td>3000</td>
<td>8430</td>
<td>7000</td>
</tr>
<tr>
<td>Input cost (Rs/tonne)</td>
<td>897 (83)</td>
<td>1039 (60)</td>
<td>1871 (91)</td>
<td>2019 (63)</td>
</tr>
<tr>
<td>Transaction cost (Rs/tonne)</td>
<td>180 (17)</td>
<td>700 (40)</td>
<td>189 (9)</td>
<td>1200 (37)</td>
</tr>
<tr>
<td>Total cost (Rs/tonne)</td>
<td>1077 (100)</td>
<td>1739 (100)</td>
<td>2060 (100)</td>
<td>3219 (100)</td>
</tr>
<tr>
<td>Net returns (Rs/tonne)</td>
<td>2413</td>
<td>1261</td>
<td>6370</td>
<td>3781</td>
</tr>
<tr>
<td>Increase in net returns (%)</td>
<td>48</td>
<td>40</td>
<td>18</td>
<td>34</td>
</tr>
</tbody>
</table>

*Note: Figures in the parentheses are percentages to the total cost*

*Source: Chengappa et. al. 2012.*
Value chain development for fruits and vegetables India

In India, the value chain has a weak print, i.e. it is a multilayered marketing channel lacking in infrastructure. Successful value chains are organized in a way that distinguishes closely related business units in an industry as a collective entity with the goal of increasing the share of benefits accruing to each business unit. The value chain is considered as a single integrated entity through which business units collaborate because there are mutual benefits achieved only through collaboration (Kotelnikov, 2008). For a specific commodity, the share of each business unit in total value added could be assessed in terms of its contribution to aggregate inputs and outputs.

The value chain has several stakeholders and their share will be influenced by several factors, including the vertical and horizontal links in the commodity chain, the nature of competition within the value chain, technological diffusion and information exchange across units. In a global economy, collaboration allows business units to respond more rapidly to changing market environments than when business units are organized as functionally independent units that interact only through inter-industry linkages. In short, strategies for agricultural transformation need to be implemented in an economy-wide framework whereby productivity gains are accompanied by improvements in market conditions, taking into account the entire commodity value chain, from input acquisition to production, transformation, marketing and end use. Innovations along commodity value chains would be self-sustaining if agriculture forges inter-linkages with other sectors by taking advantage of reciprocal influences arising from shared infrastructure, logistics and market corridors across national borders.

Value chains require strengthening at all the levels of infrastructure such as input delivery, credit, irrigation, procurement, post-harvest management, establishment of cold store chains, establishment of processing units and modern warehouses, adoption of marketing techniques, marketing information and intelligence. The infrastructure and linkages of the value chain are very poor, and are affecting the growth potential of the horticultural sector. Contract farming is practiced in certain regions for fruits and vegetables with the contracting firm taking the lead for value chain development.

Timely availability of inputs and development of organized input market infrastructure will add to the productivity of fruit and vegetable crops as seen in contract farming. The development of cold chain network will help in reducing post-harvest losses, which means overall improvement in their per unit productivity. Heavy investment is required to build the cold storage chain for transporting the produce from the farm/orchard gate to the consumer. It requires pre-cooling chambers, cold area for porting and grading the produce, and refrigerated trucks for transferring the produce to the market of distribution. Due to weak linkages in the supply chain, the price received by the farmer and vegetable grower is only about one-fourth to half of the retail price the consumer pays.
Traditional value chains have more stakeholders than modern retail chain. All the stakeholders have their own role in the system (Fig. 10). Each stakeholder is performing according to their role for which they get share in the consumer rupee. But, share may differ from stakeholder to stakeholder. One of the key stakeholders is the farming community, whose average holding size has come down to 1.23 hectares in 2006 (Agricultural Census, GoI). Reduced size of landholding is becoming economically inefficient. Livelihood of farmers further worsens, if they do not get good portion in consumer rupee. Production and farm level cleaning and grading is the primary role of farmer in the value chain. Village level trader/pre-harvest contractor/cooperative society purchase produce at village level and transports to wholesale markets. Pooling, arranging logistics and adding little value by cleaning, drying, grading are the roles of village level traders in practice. Commission agents play an important role in linking farmers to the market as they are institutionalised as per the market Acts in India. Processing industries adds more value to produce by changing its form and packing. The final product goes to retail/wholesale markets and they add value by branding and facilitating consumer to buy the product.

Recent studies have shown, modern value chains (Fig. 10) being more efficient than traditional value chains (Fig. 11) in many ways. Modern value chain is superior as it has scope for market function integration, financial flow management, supply - demand.
matching, collaborative forecasting, information sharing, goods movement synchronization through efficient transport scheduling and integration of input suppliers (Asthana, 2012). Modern value chain is a two way process where as traditional system is one way.

A comparative study on both traditional and modern value chains conducted by Reddy et. al. (2010) clearly shows the relatively higher efficiency of modern value chain. The traditional value chain farmers, on an average, received a higher share than other stakeholders, but the farmers linked to the modern value chain received not only a higher share but higher price for each of the commodities. These integrated farmers received inputs and technical support; there is a reduction in production risks due to the vertical relationship. Similarly, modern vendors buy the products from integrated farmers at a price correlated to prices in supermarkets. Integrated farmers are likely to face less price fluctuations and lower transaction costs compared to their traditional counterparts. Since they know their buyers, there is no search involved in the transaction. In addition, they also incur low monitoring and enforcement costs due to repeated transactions with the same vendor(s). Therefore,
reductions in price and production risks and transaction costs due to the vertical relationship might have enhanced the overall return to farmers linked to the modern value chain.

**High variability in Prices – need for efficient value chains**

The movement of wholesale price indices for fruits, vegetables and food articles as a whole presented in figure 13 depicts higher amplitude of fluctuations in recent period for all groups. The food article group consists of vast number of agricultural commodities, all of which have different seasonality pattern in production. While fruits are mostly perennial in nature, vegetables are grown throughout the year and cereals, pulses and oilseeds have their own production pattern distributed throughout the year. Hence, the extent of price volatility for food articles as a whole is less as compared to fruits and vegetables. Price indices for fruits were mostly below that of ‘food articles’ with the exception of the period April 2011. Unlike fruits, vegetable group showed wide oscillations within year and steeper increase in their price over a period of time. The higher fluctuation in vegetable prices cause wide variation in income realized and hence is a matter of concern particularly for small and marginal farmers who produce very small marketable surplus. Seasonal nature of production, imperfect flow of market information, non-integration of local markets with terminal and up country markets and lack of production planning are some of the reasons for such wider fluctuations apart from the prevailing market inefficiencies and post harvest losses worsening the situation of farmers.

The seasonality pattern of wholesale price indices for fruits, vegetables and food articles depicted in figure 14 provides greater details of price movements within a year. It is interesting to note the seasonality in prices of fruits and vegetables are in opposite direction. The indices of vegetable prices were generally low during the first half of the year which gradually picked up to reach a peak during the year end. On the contrary, fruit prices peak during the summer months and before monsoon season. During most other months, it follows a normal trend. ‘Food article’ as a group depicted intra-year low variability behavior in its price movement, with relatively low level of prices prevailing during the pre-monsoon months. This is attributed to the prevalence of Minimum Support Price (MSP) food grains which do not change within a year.

Vegetable prices had low variability at 2.9 per cent in 2009, which increased to 20 per cent during 2010 and 2011 period. On the contrary, fluctuation in fruit prices reached a peak in the year 2009 (over 13%) which lowered to 3.6 per cent in the next year. It peaked again in 2011 at around 10 per cent. The variability in the food article prices was generally lower, as compared to fruit and vegetables group (Fig. 15). The price fluctuations can be evened out through value chain management by production planning, proper sourcing depending on demand supply situations, inventory and logistics management.
Fig. 13: Monthly Wholesale Price Index

Source: Office of the Chief Economic Adviser, GoI

India
Fig. 14: Seasonality in Wholesale Price Index at 2004-05 prices (April 2005 - May 2012)

Fig. 15: Temporal changes in intra-year variation in Wholesale Price Index (2004-05 = 100)
Regulatory measures (certification), quality assurance and public health hazards in fruits and vegetables value chain

Safety and hygiene is very important area in any food industry. Food processing industries have to adhere to basic good housekeeping and hygiene standards as any lack in this area would result in very poor performance of the business throughout the value chain (Reardon, 2005; Hu et al. 2004). Nevertheless, health risks also arise from improper practices around the production, handling, preparation, or storage of food. The changing organizational structure of the agri-food system - inputs, production, distribution, and consumption is coupled with increasing concern about the reliability of such systems to deliver safe food to consumers in both developed and less developed countries. The value-chain approach is an effective way to evaluate the performance of food safety systems and the varying level of risk as products move along the value chain (ODI, 2003; Kydd, 2002). Furthermore, the profit margin will vary as products move along the value chain, so different actors will have different incentives to alter food safety risks. In developing countries, there are numerous value chains serving formal and informal domestic markets as well as export markets, and the governance of these chains vary. Understanding the relationships, networks, skills, and coordination mechanisms to manage the flow of products is essential for ensuring the delivery of safe food (Rich and Narrod, 2005; Narayanan and Gulati, 2002). To understand how the value chains affect food safety, organization and governance is very crucial. Technology, regulation, financing, and other ancillary services play a role in reducing health risk and assuring food safety. The complexity of the health hazards that arise as a product moves along the value chain with drivers and showing possible sources of food contamination along the fruits and vegetables value chain in India is illustrated in figure 13.

![Fig. 13: Drivers of health risks along the value chain](source: Trench et. al., 2011)
As consumers get awareness on food safety standards and health safety, government responded with more laws on food safety and regulations in India. It is highly recommended that processing industries invest good amount of funds to the food safety equipments and measures. To handle these issues International standards are being followed. Food processing industries have opted for Hazard Analysis and Critical Control Points (HACCP) certification in India for export but not for domestic consumption.

India has its own food laws. It is important for every processor, exporter or importer to adhere to the rules of the land for food products as it affects health of population. Numerous laws have been stipulated by Ministry of food and health to check consumer interest and stop malpractices by manufacturers.

Following are the major Acts enacted by Government of India:

- Food Safety and Standards Act, 2006 (Ministry of Consumer Affairs)
- Prevention of Food Adulteration Act (PFA) and Rules (Ministry of Health & Family Welfare), 1954
- Agriculture Produce (Grading & Marking) Act (Ministry of Rural Development).
- Fruit Products Order (FPO), 1995
- Export (Quality Control and Inspection) Act, 1963

**Recommendations**

The adoption of value chain approach for improving marketing efficiency and reducing transaction cost in fruits and vegetables has become a necessity in India. In order to develop viable value chains for fruits and vegetables in India, more should be done to promote regional integration at each stage of the value chain. This would also facilitate entry into global value chains and promote regional development. Regional value chains of fruits and vegetables can also identify efficiency gains that can be captured through integrated markets. This would result in the provision of support services and infrastructure required for connecting domestic private sector service providers to regional and global supply chains. This would improve not only the competitiveness of national economies, but also regional logistics strategies and trade arrangements.

Encouraging lead firms in a value chain framework will provide the much needed services to the farmers: access to modern inputs and markets, adherence to standards, and the introduction of brands. Some specific interventions by governments may include co-financing of grant schemes for the private sector to engage in activities such as training and capacity-building for small farmers and small and medium enterprises (SMEs). This would attract critical private sector expertise in business development and management. Providing tax and other financial incentives can also help to bring larger firms closer to local suppliers or enhance contractual arrangements among the different players in the value chain.

It is of utmost importance to develop a strategy to create a Public-Private Partnership (PPP) mode in value chain development focused on building a strong foundation for a vibrant horti-industry, based on the principles of being globally competitive and locally inclusive. Such a model needs to enable inclusive growth for all the stakeholders including farmers, labour and small businesses, with large and global private players acting as catalysts. An integrated model for linking farmers to markets through a PPP frame work elucidating the
role and gains of various stake holders need to be implemented. Building linkages between small-scale rural producers, value-added processing firms, buyers in growing urban markets, and suppliers of critical inputs and supporting small-scale producers to associate, collaborate, and coordinate to achieve economies of scale in their transactions is of vital importance. The provision of business services will enable rural producers to understand and better satisfy the product, process, or delivery standards required by buyers in urban markets.

Post harvest management is the weakest link in the fruit and vegetable value chain management. Fragmented supply base forms the major challenge for consolidation of produce and a long chain results in maximum cost addition without much value addition. Adding to this complexity, logistics is not oriented for quick and safer distribution of fresh and perishable produce. These factors contribute to an estimated loss of around 30 per cent value of fruit and vegetable production. Though these inefficiencies offer tremendous scope for investment, factors such as poor marketing infrastructure, unorganized and traditional transport models, lack of viable scale (especially to introduce innovative cold chain) and unfriendly marketing policies for investors have deterred private participation. These impediments can be addressed through building organizational and market intelligence capital through PPP model, promote specific commodity clusters among growers, facilitate honouring of contract farming agreements, rationalization of marketing laws, promote innovative aggregation models such as ITC lead e-choupal model and contract farming models adopted by many companies.

Modernization and rationalization of Government controlled regulated markets in the states on the lines of a model marketing Act is suggested. The infrastructure of these markets needs to be improved by providing facilities for auctioning, price realization mechanism, better access roads, and hygiene with an effective waste disposal system. The regulated market law has adequate provision for establishment of special commodity markets exclusively for fruits and vegetables. However, few such markets have come into existence. The recent amendments provide for private participation in establishment of terminal markets and warehouses which needs to be pushed further.

Given the increasing demand for good quality fruits and vegetables by consumers in both domestic and export markets, the maintenance of cold chain from grower to the consumer is of crucial relevance. The key issues in development of the cold chain industry are; diverse requirement for different horticultural produce, non-standard pricing, limited financial capabilities of the transporters and lack of critical scale for organized player participation. In order to set up a cold chain infrastructure for fruits and vegetables it is prudent to focus on selected crops in selected locations. Further, fruits and vegetables cannot be addressed in combination as the economics are different. Fruits lend themselves to cold chain better than vegetables as they are of high value and involve pan India movement. Hence, there is a need to develop crop specific cold chains for both fruits and vegetables.

The research in fruits and vegetables is mostly private driven. There has been good technological advance in some crops. However, in adoption level of these technologies by the farmers has been low, mainly due to lack of awareness, especially, for value addition and post harvest handling. There is also a gap and disconnect between the knowledge of extension agents and the technology developments that are driving the industry. Given the complex requirements of fruits and vegetables sector, the mode of extension should be improved through participatory group approach and collaborative public - private participation. Contract farming facilitates accelerated technology transfer, capital inflow and
assured markets for the produce. Trust and confidence between parties is a prerequisite for the success of contract farming. However, certain measures are required to facilitate adherence to contract farming agreements. A model contract farming agreement needs to be developed taking into account the sensitivity of such contracts to quality, price fluctuation and safe guarding the interests of both the parties involved.

There is a need to initiate and formalize land lease agreement so as to help in aggregation of land to achieve scale economy.

The deterioration of a product starts immediately after the harvesting operation. However, the farmers may be unaware or indifferent to the condition of the product after harvest, and post harvest handling procedures may thus be rather careless. Until, farmers are convinced that careful handling will increase profits, it will be difficult to persuade them otherwise. The establishment of a common pack house facility (with pre-cooling facility) in an area accessible to the users must be accompanied by a sustained information and promotion campaign by the promoters of such pack houses.

There is a need to drive domestic consumption of processed fruits and vegetables. Though demographic change is stirring up demand for certain segments of the population for processed fruits and vegetables, the cost of the final product is out of reach of the common consumers. Given the positive impact that processing has on the upstream value creators, there is a need to identify innovative technology and processing methods so as to reduce price and make processed food affordable. In this direction, a policy shift to look at reducing the taxes on processed food, especially on packaging material (as packaging material contributes close to 20 per cent of the cost of product) is necessary.
multiple legislations such as Prevention of Food Adulteration Act (PFA), The Standards of Weights & Measures (Packaged Commodities) Rules, Fruit Products Order etc. has lead to conflicting approach. The setting up of Food Safety and Standards Authority in India is a positive initiative to implement an integrated food law.

References


Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries


Kotelnikov, 2008: Managing your value chain: Receiving raw materials as input, adding value, and selling finished products to customers, Ten3 Business e-coach, Moscow, Russia.

Kydd, J., 2002: Agriculture and rural livelihoods: is globalisation opening or blocking paths out of rural poverty? Agricultural Research and Extension Network (AgREN) Paper No. 121, Overseas Development Institute, London, UK.


NAAS, 2012: State of Indian Agriculture 2011-12, National Academy for Agricultural Sciences, New Delhi


Reardon, T. 2005: Retail companies as integrators of value chains in developing countries, Diffusion, procurement system change, and trade and development effects. GTZ, Eschborn, Germany.


Trench Pippa Chenevix, Narrod Clare, Roy Devesh and Tiongco Marites, 2011: Responding to Health Risks along the Value Chain, 2020 Conference: Leveraging Agriculture for Improving Nutrition and Health, February 10-12, 2011; New Delhi, India

Value Chain Analysis and Market Studies on Fruits and Vegetable in Nepal

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Executive Summary

Agricultural is one of the prime sectors of Nepalese economy as it contributes 33% to GDP, generates direct employment to 66% of population and is the major source of livelihoods of the Nepalese people. Thus, agriculture growth and development is inevitable for the development of the country. And development of agriculture is possible only through transformation of subsistence agriculture to agribusiness or commercialization. Promotion of high value agriculture through the production and marketing is one of the vital step for commercialization. However, development of Nepalese agriculture is fraught with number of difficulties like steep physical terrain, lack of infrastructural supports, prevalence of subsistence farming, poor irrigation and other input facilities, limited access to low cost agricultural technologies and high transportation costs etc.

Agricultural commercialization is a complex and dynamic process involving various linkages between the farm and the farm/industry, encompassing the areas related to technology, markets, finance, institutions, infrastructure and social structure. The key agent of commercialization are the farmers, traders and processors. The core problem for agribusiness development in Nepal is the lack of effective value chain linkages among input providers, farmers, traders, processors, and service providers in which all are aware of their mutual linkages and organize themselves in such way that they can benefit from such linkages in the network.

A demand-driven approach is needed, where the key players themselves make investment decisions related to technology, infrastructure, marketing and capacity. Further, methods to improve marketing channels require greater coordination in terms of contracts, vertical and horizontal integration, and joint efforts of stake holders.

Fruits

Among three categories of fruits in Nepal the tropical fruits are the most dominating one, however the citrus fruits and apple are considered to be promising items in this category. Both these items and the total fruits have shown the positive trend in terms of production growth for last eleven years. Similarly, the demands for total fruits are also ever increasing and are expected to surpass the domestic production till foreseeable future too. Also mango with increasing trend in production level as well as with reasonable level of industrial use show some significance in fulfilling domestic need. This crop, however, needs to be concentrated into bigger size pockets to produce required quantity of desirable quality and variety. Further, banana is also showing its potentiality for expansion.

The fruit marketing of Nepal comprises of both domestic as well as external marketing. External marketing is mainly with India, Tibet, Bhutan and Bangladesh. In fruit marketing, generally high marketing cost incurred due to high transportation cost and the cost due to damage incurred during the transportation. Similarly, the post harvest losses are quite high mainly due to improper method of harvesting, packaging and storage of fruits.

Studies reveal that the marketing cost in case of mandarin orange and apple within the country ranged between 200% to 300% of the cost of production and cost of marketing from the two major transit points of Nepal, Birgunj and Bhairhawa, to near by Indian markets at
Patna and Gorakhpur, indicate that the purchasing price at Nepalese market represents 25 to 33% of the wholesale market price received at Indian wholesale markets. This indicates highly positive market response of Nepalese fruits in Indian markets.

The domestic demand for the processed fruits and vegetables in Nepal seems substantial. The major items are jams, jellies, marmalades and pastes, and orange juice. There are reports that Nepal has earned substantial amount of foreign exchange from the exports of processed fruits too. This clearly indicates the market opportunity for processed Nepalese fruits in both the domestic and exports markets. However, there are only few number of industries that utilize domestic raw materials to meet their total demand. The key constraints have been reported as the non-availability of raw material or the required quality and variety of raw materials, higher price of domestic raw materials, small scale of scattered production, unfavorable tariff structure and several policy issues etc.

**Vegetables**

The diverse agro-climatic conditions of Nepal have provided nearly unlimited scope for growing all types of vegetables known in the world. Further, increase in general awareness of the nutritional values of vegetables among the people has increased tremendous scope of promoting the production and marketing of fresh vegetable in Nepal. Looking at the trend, the total demand for the vegetable is projected to swell in considerable amount for near future. Further, it has been widely realized by several researchers that Nepal has comparative advantage in some of the fresh vegetables as well as in the production of so many off-seasons vegetables. Thus exploring markets niches and with proper export promotion activities Nepal can harvest that potential benefit provided appropriate technology and adequate infrastructure, legal and policy environment for market oriented vegetable production. Some of the examples would be appropriate site selection, commercial size pockets, appropriate vehicles, all season transportation network, year round irrigation facilities, extension (both production and technology and market networking) post harvest activities, collection/ market centers, credit facility, information and communication.

Being perishable in nature fresh vegetables require greater attention during harvesting, packaging, and transporting from the initial point of production to the final consumers thus leading to large margin between the final retailer price and the cost of production especially when the production pockets are at a considerable distance from the market linking roads.

Value addition practices are very nominal both in fruits and vegetables even in commercial production pockets. Though, the total production of fruits is found in its increasing trend, whereas, due to poor orchard management, productivity of all fruits is found very low as compare to India.

Primary producer, collector, wholesaler, market retailers and consumers are the main actors in supply chain. Adoption of recent technology in fruits and vegetables is very nominal. Value chain analysis of vegetables in the Eastern corridor and Mid-western corridor of Nepal and Jumla apple value chain is presented in the paper Though GoN has been implementing various policies and programmes to increase high value products including fruits and vegetables, but expected output is not yet achieved. Development of market infrastructures and awareness programme for the stakeholders is necessary for the development of value chain process.
1. Introduction

Nepal is predominantly an agrarian society and the agriculture sector provides employment opportunities to 66 percent of the total population (MOAC 2010) and contributes about 33.5 percent to GDP. Geographically, the country is divided into three main ecological belts namely, Terai 23% (Flat Land) Hill 42% and Mountain 35% (Awasthi, 2011). However, farming is largely restricted to below 300masl for climatic reason. Due to its location and also because of sharp changes in topography caused by large variation in altitude, the country experiences a tropical climate in Terai, sub-tropical and warm temperate in the hills and cool and dry temperate in the mountains (CBS, 2010).

The diverse agro-climatic conditions of Nepal have provided nearly unlimited scope for growing all types of vegetables known in the world. Further increase in general awareness of the nutritional values of vegetables among the people has increased tremendous scope of promoting the production and marketing of fresh vegetables in Nepal. It has been widely realized by several researchers that Nepal has comparative advantage in some of the fresh vegetables as well as in the production of so many off-season vegetables. Thus exploring markets niches and with proper export promotion activities Nepal can harvest that potential benefit provided appropriate technology and adequate infrastructure, legal and policy environment for market oriented vegetable production. Some of the examples would be appropriate site selection, commercial size pockets, appropriate vehicles all season transportation network, year round irrigation facilities, extension (both production and technology and market networking) post-harvest activities, collection centres, credit facilities, information and communication.

The varied climatic conditions make possible to grow almost all types of fruits. Fruits trees can be planted in marginal lands of hills and provide a good source of income to farmers of hills. Fruit trees are not only used for firewood and timber but also fallen leaves for compost and conserve the soil and protect the environment as well. Due to the rapid urbanization and increased awareness of the public about nutrition and health, the demand for horticultural crops is increasing. Therefore Government of Nepal has so far, established 23 farms and stations for fruits research and development. Hills are found having largest fruit area and production in comparison to Terai and Mountains. In hills, major fruits are grown citrus, peas, plums and peaches.

1.1 High value commodities

The high value crops or commodities have been defined on the two major parameters i.e. high value low volume and production efficiency i.e. relatively higher economic return per unit area of land. Though it is a dynamic concept and to a large extent location specific and varies from time to time. Generally the livestock commodities (like milk and milk products, meat and eggs) and horticultural crops (vegetables, Vegetable seeds, fruits and floriculture), plantation crops and spices, non-timber forest product (NTEPs) and herbs are the most common items identified as the high value commodities in case of Nepal.

The six commodities identified by APP under the high value crops are apple, citrus, off-season vegetable, vegetable seeds, agriculture and sericulture.
1.2 Commercial agriculture & effective value chain system

Agribusiness is a complex set of activities cutting across the production, commerce and industry. Unless linkages among farmers, traders (including exporter and importer), processor, and service providers are coordinated and managed effectively, agribusiness development will be relatively slow, and will not fulfill its potential benefits. The core problem for agribusiness development in Nepal is the lack of effective value chain linkages among input providers, farmers, traders, processors and service providers.

Thus a value chain defined as the full range of activities required to bring a product or service from conception, through the intermediate phases of production, to delivery to final consumers and final disposal after use. A functional value chain means that key stakeholders (farmers, marketers and entrepreneurs) are aware of their mutual linkages which is a deviation from the generally accepted linear value chain model, make a deliberate effort to improve them, and organize themselves in such a way that they can benefit from such linkages in the network, including other stakeholders such as research and extension providers.

The analysis of linkages among different stakeholders reveals weak linkages. The paucity of effective farmer organizations, producer associations, trade associations and coordination mechanism among stakeholders (e.g. between research and extension) is seen as a major obstacle to further commercialization by stakeholders. The lack of functional value chain in the country is responsible for the current low state of agricultural commercialization.

Agricultural commercialization is a complex and dynamic process involving several dimensions related to technology, markets, finance, and institutions infrastructure and social structure. The farmers, traders and processors are the key agents of commercialization. A demand-driven approach is needed, where the key players themselves are motivated to make investment decisions related to technology, infrastructure and institutions rather than the investments being supply-driven by the public sector. The stakeholders in the commercialization process are poorly integrated, and attempts are to be made to provide institutional mechanisms that facilitate the emergence of effective networks and value chain.

A chaotic organization of marketing channels results in low quality of products, high post-harvest losses, and high price fluctuations. Methods to improve marketing channels require greater coordination in terms of contracts, vertical and horizontal integration, and joint efforts of stakeholders, these methods are rarely used because of lack of trust among the stakeholders and lack of capacity in value chain management. The weak linkages among commercial stakeholders do not result in increase value addition, competitiveness, and innovation.

2. Methodology of the work

The work was undertaken immediately after signing in May 02; 2012. As such, review was made through participatory approach by consultation with concern personnel within the Ministry and Department. Secondary source of information were collected from Ministry of and Fruit Development Directorate. Further executives of different organizations, fruits and vegetables wholesalers, retailers and producers and consumers were interviewed. Situation analysis and recommendations has been made based on findings from above activities.
3. Production Status and Development Approaches for Vegetables and Fruits in Nepal

Horticultural crops are the major sector of Nepalese agriculture. Horticulture contributes about 14 percent to the total agricultural gross domestic products (AGDP) (Thapa, 1998). The share of horticulture to the AGDP has increased in recent years. By realizing the importance and role of horticulture, the agriculture perspective plan (APP) has targeted the growth rate of horticulture GDP to 5.5 percent per annum by 2014/2015 and growth rate of vegetable GDP in particular to 5.42 percent per annum. Among the horticultural crop, the vegetable sector has the most significant contribution to total horticultural GDP. At present, more than two hundred vegetable species are grown in the different climatic zones of Nepal, out of which 50 species their varieties are grown on the commercial basis (Shrestha et al., 2004).

Fruits, in Nepal can broadly be grouped into three categories as citrus fruits, summer fruits, and winter fruits. The summer (tropical) fruits have a share of 52% in total area and 55% in total production followed by citrus fruits with 27% and 26% share in total area and total production of fruits respectively. Remaining 21% of total area and 19% of the total production is the contribution of winter fruits.

The individual fruits also very greatly in their share to the total area and production. The “king of fruits” mango has a share of 27% and 20% to the total area and production of fruits in Nepal. According to the study conducted by Market Development Directorate, among the fruits, banana has the highest productivity of 14.11 mt/ha and mango has the lowest productivity level 7.44 mt/ha.

3.1 Current status of vegetable production

The diverse agro climatic conditions of Nepal both among the different ecological regions, and within ecological regions have provided nearly unlimited scope for growing all types of Vegetables known in the world. At present, more than two hundred vegetable species are grown in the different climatic zones of Nepal, out of which fifty species and their varieties are grown on the commercial basis (Shrestha et al, 2004).

This would lead to export, imports substitution and serve as raw material base for the upcoming agro-industries. Further, increase in population and general awareness of the nutritional values of vegetables among the people has increased tremendous scope of promoting fresh vegetable production and marketing in Nepal.

Vegetables are an obvious priority because they are much more important than any other high value commodity (a small number of vegetables dominate the group), they are less risky to grow than fruits because they are an annual crop. And since twice as many as men participate vegetable production they provide women an opportunity to increase their income (in terms of marketing and cash incomes). Vegetables the source of minerals, vitamins and proteins are the most important constituents of Nepalese diet.

Vegetable is one of the short seasonal and important components of Nepalese agricultural system. The developmental activities of vegetables in Nepal were started during early forties (Awasthi, 2011). During fifties a wide range of temperate and tropical vegetables were introduced and tested for their adaptability and seed production in different ecological zones.
of Nepal (Pun, 1995). However, the vegetable development activities received priority since the Fifth Five year Plan (NPC, 1995).

The trend of vegetable production is increasing since 1999. From 2001 to 2011 the area and production level of vegetables increased significantly. However, the increase in yield per hectare was incremental by comparison. The area, production, productivity and growth rate of vegetable is shown in the following table 3.1.

Table 3.1: Area, Production and Yield of Vegetables in Nepal

<table>
<thead>
<tr>
<th>Year</th>
<th>Area (Ha)</th>
<th>Production (Mt)</th>
<th>Yield (Kg/Ha)</th>
<th>Growth Rate (%)</th>
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<td>11421</td>
<td>9.3</td>
</tr>
<tr>
<td>2005/06</td>
<td>189832</td>
<td>2190100</td>
<td>11537</td>
<td>6.0</td>
</tr>
<tr>
<td>2006/07</td>
<td>191922</td>
<td>2298689</td>
<td>11977</td>
<td>5.0</td>
</tr>
<tr>
<td>2007/08</td>
<td>208108</td>
<td>2538904</td>
<td>12200</td>
<td>10.5</td>
</tr>
<tr>
<td>2008/09</td>
<td>225154</td>
<td>2754406</td>
<td>12233</td>
<td>8.5</td>
</tr>
<tr>
<td>2009/10</td>
<td>235098</td>
<td>3003821</td>
<td>12777</td>
<td>9.1</td>
</tr>
<tr>
<td>2010/11</td>
<td>244102</td>
<td>3203563</td>
<td>13124</td>
<td>6.6</td>
</tr>
<tr>
<td>Average GR</td>
<td></td>
<td></td>
<td></td>
<td>5.7</td>
</tr>
</tbody>
</table>


In 2009/2010, production of vegetable was 3,003,821 mt from an area of 235,098 ha at an average yield of 12.77 mt/ha. Similarly in 2010/11 production of vegetable was 3203563mt from an area of 244102ha at an average yield 13.12 mt/ha. The above table shows that the average growth rate was 5.7 percent.
According to standards set forth by dieticians and nutritionists, the minimum per capita per day requirement of vegetables is 300gm. The vegetable intake by Nepali is very low compared to this standard, with a deficiency of 60 percent in relation to vegetable production.

Due to higher return per unit land, and major shift by the people living in the country to healthy food vegetable production is increasing day by day. Vegetables have become an integral part of a balanced diet, and play a vital role in providing nutritional security. A result has been an improvement in financial situation among a majority of small-scale farmers.

A wide range of agro-ecological variations creates a comparative advantage for the production of different vegetable crops. The production of off-season vegetables, utilizing these ecological niches, could be extremely beneficial in the context of nutrition, employment, and income generation. The Government of Nepal is also emphasizing the production of off-season vegetables in the hills of Nepal as an important cash crop that could enhance the income level of the farmers and thus help to reduce the incidence of poverty (APP, 1995).

Tomato, cauliflower, cabbage, cucumber, onion and chilly are the major off-season vegetables of Nepal. Among them, the cultivation of tomato, cauliflower, and, cabbage are the most popular and the most profitable (NARC, 2006). In terms of production, cauliflower is the most highly cultivated vegetable (404,580mt) followed by tomato (317,657mt) and cabbage (302,067mt) (Prasain, 2011).

**Table 3.2: Region wise Area, Production and Yield of Vegetable (2010/2011)**

<table>
<thead>
<tr>
<th>District</th>
<th>Area (ha.)</th>
<th>Production (mt.)</th>
<th>Yield (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eastern Region</td>
<td>124551</td>
<td>1572558</td>
<td>12626</td>
</tr>
<tr>
<td>Central Region</td>
<td>178980</td>
<td>2491409</td>
<td>13920</td>
</tr>
<tr>
<td>Western Region</td>
<td>64717</td>
<td>872139</td>
<td>13476</td>
</tr>
<tr>
<td>Mid-western Region</td>
<td>49323</td>
<td>618047</td>
<td>12531</td>
</tr>
<tr>
<td>Far-Western Region</td>
<td>28982</td>
<td>339049</td>
<td>11699</td>
</tr>
<tr>
<td>Total</td>
<td>446552</td>
<td>5893202</td>
<td>13197</td>
</tr>
</tbody>
</table>

Off-season vegetable has played a vital role contributing to the rise in economic status of the farmers of the hills, in part by providing regular employment and income to the marginal farmers and his/her family members throughout the year. Although the Terai region produces and sells more vegetables, but the vegetables grown in the hilly region have greater value, because these vegetables are produced during the rainy season when prices are higher (Prasain, 2011).

3.1.1 Marketing system and Marketing Channels

Marketing of vegetables in the production pockets are carried out in the following ways,

**Farm-gate selling**

This is not a prominent market practice; however some farmers sell their vegetables to the buyers at the farm gate. Buyers go to the farm, usually at a fixed time given by producers, though it can occur at any time without notice. In the case of fruits, sometimes, the produce can be sold, “in the field” and the buyer arranges for its harvesting.

**Direct Selling**

Very few of the farmers sell their products after harvesting by themselves, believing that they will get a better price for their produce this way. In this case, after harvesting, farmers do general grading and bring their produce in bamboo baskets to the near by market on foot.

**Selling to Middlemen**

Direct selling is decreasing as the volume of production increases, because high volume of product is not possible or profitable to sell directly to the consumers, so selling to a middleman is often adopted strategy by rural and small scale and marginal farmers.

**Group/ Collective Marketing**

Farmers in marketing groups or cooperatives bring their produce to collection centers that are managed by farmers marketing management groups or they wait for traders at collection centers.

For the marketing of the vegetables in Nepal there are three main marketing channels followed, according to the category of the vegetables. The leafy vegetables follow the first channel, the other fresh vegetables follow the second channel and for potatoes, onion, garlic which falls in similar category follows the third marketing channel

- Farmer-retailer/consumer(leafy vegetables)
- Farmer/Group/Cooperative- Collection Center-Intermediary-Urban wholesaler market-Retailer/hawker/Indian wholesaler-consumer/export to India (all fresh vegetables).
- India, Tibet, Bhutan-Importer-Urban wholesale market-Retailer-consumer (mainly for potato, onion, garlic).

The most common marketing channel is this sequence, middlemen to retailers to consumers.

Well organized marketing channels do not exist. Marketing of vegetables in the production pockets are carried out in the following ways.
3.1.2 Marketing Cost and Margins

Being a perishable in nature fresh vegetables requires greater attention during harvesting, packaging and transporting from the initial point of production to the final consumers. The cost of the vegetables mainly involves the cost of post-harvest activities that is incurred before disposing it to the terminal market (to the consumer). The cost includes cost of harvesting and packaging (material and labor cost) handling (sorting, cleaning, grading, loading and unloading), transportation and tariff, tax and unseen cost etc. Generally, these components constitute a large share in the total margin between the final retailer price and the cost of production (or farm gate price) especially when the production pockets are at a considerable distance (> one day walking distance) from the market linking roads. The marketing cost and margin should be assessed from two different angles. One would be assessing the marketing cost and margin for shipping the produce from the production area to domestic markets and another assessment would be for the exporting of these produce to near by markets of the neighboring countries.

3.1.3 Market infrastructures

Agricultural marketing has received little attention in Nepal. Physical marketing infrastructures have been developed at more than 50 market places through the central government agency by its own and in support of various donor agencies. At district and local level, far larger number of small infrastructures have been developed by agencies, like District Agriculture Development Office (DADO), District Development Committee (DDC), Municipalities, various donor assisted projects and NGOs. However, and institutional aspects such as software and capacity building activities of the people (who are involved in vegetable business) are not growing at the same pace. Legal environment of agricultural marketing is pretty weak. Different market centers of the country are operating under different rules and regulations. In absence of agricultural marketing act, Kalimati Fruits and
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

Vegetable Wholesale Market, the central and largest horticulture market of the country, has been operating under the “Development Board Act (2013B.S.). All other public regulated markets are being operated under the “Agriculture Produce Market Management Directives 1996” (Ministerial level executive order) having weak legal status.

Privately run markets are operating without registration or registering as the business units under cottage and small industries offices. Most community run markets (Haatbazaar and Retail markets) are regulated through Local Self Governance Act, 2055 B.S. by concerned VDCs and Municipalities. (Singh et. al., 2007). In Nepalese agricultural marketing system various marketing functions consummated by private, cooperative and public sectors varying proportions and different stages, with private sector largely dominating scenario in all respects.

3.1.4 Present post-harvest management practices

In most of the production pockets, grading is not practices for vegetables. This is due to no or minimal difference in the graded versus non-graded products, and the high labor requirement for grading. Also, storage of vegetables is not practiced and farmers prefer not to harvest vegetables when the price goes down.

For packaging, traditional practice such as use of Doko is common in these areas. However, farmers are slowly adopting improved packaging materials such as plastics crates. While using Doko, farmers lose about 10 percent of product during transportation. Wooden boxes are not used, as they add unnecessary volume and contribute to the additional care and weight. In the study area, many farmers do not use plastic crates due to the high initial investment (NPRs 300 per crate). Farmers like to use plastic crates if they are subsidized, as they minimize loss and maintain quality. Traders have begun using plastic crates for packaging of tomato and fruits. Traders normally use mini trucks for transportation from production sites to markets, though around 10 percent of the transportation is done in passenger buses. Traders estimate that they lose 5 to 8 percent during transportation from collection centers to wholesale markets by mini truck. The total post-harvest loss in vegetables from producer to retailer is estimated to be 25-50 percent. The post-harvest losses are mainly due to improper harvesting, handling, packaging, and poor facilities at collection centers.

3.1.5 Value addition in vegetables

Nepalese vegetable producer farmers are very traditional and they use their own practice during vegetable harvesting, gradating, packaging and transporting that result a lot of post-harvest losses. Improved technology for harvesting, grading and packaging to some how used in commercial farming. For value addition, most of the vegetable producer farmers are found using plastic crate for tomato packing and bamboo basket for fresh vegetable packing. None of the scientific or modern technology for value addition in vegetable marketing in used. It is because, vegetable producer farmers are small and they don’t have enough money to afford all these things for value addition.

3.2 Current status of fruits production

Nepal’s soil, climate and water resources provide important seasonal niches in the production of both temperate and tropical fruits for domestic consumption and also posses
huge export potentials. However, the review of progress in production and export reveals that the potential has not been harnessed. Due to climatic diversity Nepal is quite potential to grow all type of fruits, (tropical and sub tropical). Mango fruit is widely grown in plain areas (Terai), whereas citrus in the Hills and apples are in the high Hills. Government has developed many horticulture farms throughout the country. Apple farms are situated in the remote northern high hill areas where there is no road access. A quality of apples is grown in these areas. Due to the lack of transportation facilities apple producer farmers are unable to sell their product in the market in a fair price. Previously this situation was discouraging to the apple producer farmers to change their cropping pattern, but now government has built graveled road to link up apple farm in some areas.

Production scenario

The fruit in Nepal can broadly be grouped into three categories as sub tropical, tropical (or summer) and winter fruits (deciduous). In terms of production the tropical fruits are the most dominating one and then come the citrus fruits followed by the deciduous fruits. In the tropical fruits category the production of mango has biggest shares. Similarly, the mandarin orange has the biggest share in citrus production category and apple is major item in deciduous fruits category. Ranking each fruits in the total production of fruits, the mango shows the biggest share of production (20%) followed by mandarin orange (16%), banana (11%), sweet orange (6%), apple (7%), litchi (3.2%), and lemon (0.67%), among the major fruits.

Table 3.3 Production status over last five years

<table>
<thead>
<tr>
<th>Fruits type/Year</th>
<th>2006/07</th>
<th>2007/08</th>
<th>2008/09</th>
<th>2009/10</th>
<th>2010/11</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus</td>
<td>171875</td>
<td>226404</td>
<td>253766</td>
<td>259191</td>
<td>263710</td>
</tr>
<tr>
<td>Winter (Deciduous)</td>
<td>97716</td>
<td>99776</td>
<td>103103</td>
<td>107582</td>
<td>111882</td>
</tr>
<tr>
<td>Summer (Tropical)</td>
<td>305504</td>
<td>304383</td>
<td>329344</td>
<td>340199</td>
<td>418572</td>
</tr>
<tr>
<td>Total</td>
<td>575095</td>
<td>630563</td>
<td>686213</td>
<td>706972</td>
<td>794164</td>
</tr>
</tbody>
</table>

Source: Statistical Information on Nepalese Agriculture 2010/11

Looking at the trend of fruits production for last five years it is vivid from figures that the production of fruits has shown a gradual increase over last five years. The total production of fruits has increased by 3.17% per annum for period of last five years (2006/07 to 2010/11). Similarly, the mango, citrus and apple production has exhibited the growth of 6.7%, 6.38%, and 2.13% of per annum respectively.

Table 3.4 Trend of Major Fruits Production in Nepal.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mango</td>
<td>122785</td>
<td>145367</td>
<td>155789</td>
<td>165432</td>
<td>176766</td>
<td>3.67</td>
</tr>
<tr>
<td>Citrus</td>
<td>10932</td>
<td>11456</td>
<td>16543</td>
<td>18543</td>
<td>23609</td>
<td>9.67</td>
</tr>
<tr>
<td>Apple</td>
<td>22976</td>
<td>23987</td>
<td>29367</td>
<td>38967</td>
<td>42704</td>
<td>7.17</td>
</tr>
<tr>
<td>Total</td>
<td>156693</td>
<td>180810</td>
<td>201699</td>
<td>222943</td>
<td>243079</td>
<td>4.58</td>
</tr>
</tbody>
</table>

Source, MOAC, Statistical information on Nepalese Agriculture, 2011, and Various Issues
Study conducted by the JICA Study team in Nov 2000 shows that the total domestic demand for fruits in the year 2000 stand at 505 thousand Mt, which expected to grow to 538 thousand Mt by 2005, 600 thousand Mt by 2010 and 663 thousand Mt by 2015. In which large component would come from the domestic supplies, however, to meet our total demand (both domestic and exports) we still need to depend on imports from India. This clearly indicates the domestic market has an apple space to absorb the expended domestic production. The study has not projected any growth of the exports market, despite the fact that Nepal being potential to export some of fruits like citrus and apple. Thus, there is still room for the expanded production of the fruits especially in case of apple and citrus. The large portion of expanded production could come from the increased productivity as the fruit productivity of Nepal (10Mt/ha) is half of that of India i.e, 20Mt/ha (Thapa et al., 2004). Similarly, orange productivity for example is very low at 9Mt/ha as compared to other citrus growing countries with 43Mt/ha (Ranjit G. C. 1997). Poor orchard management and plantation of poor or unidentified genetic planting materials, improper site selection with respect to commercial cultivation and nemeses to the technical centers and other rural infrastructures contribute to lower production required for export, import substitutions and supply of raw materials to the agro-industries.

Table 3.5 Demand and Supply balance of Fruits in Nepal. (Unit: 000 Mt)

<table>
<thead>
<tr>
<th>Fruits</th>
<th>Demand</th>
<th>Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Domestic</td>
<td>Export</td>
</tr>
<tr>
<td>Year 2000</td>
<td>505</td>
<td>1</td>
</tr>
<tr>
<td>Year 2005</td>
<td>538</td>
<td>1</td>
</tr>
<tr>
<td>Year 2010</td>
<td>600</td>
<td>1</td>
</tr>
<tr>
<td>Year 2015</td>
<td>663</td>
<td>1</td>
</tr>
</tbody>
</table>

3.2.1 Marketing system and Marketing Channels

The fruit marketing of Nepal comprises of both domestic as well as external (export and import) marketing. External is mainly in India, Tibet, Bhutan and Bangladesh. However, Nepal is gross importer and major marketable surplus is marketed in domestic markets. In domestic marketing the most common types of marketing structures are farm-gate market, local level markets, collection centers/points, wholesale markets and retail markets. The major marketing channel/flow of fruits from the production pockets to the consumer can be summarized as follows with a little variation for each specific commodity (fruits).

The contractor or the assembler collects the produce from the pockets or the farmers, which is supplied to the wholesaler (or retailer). The wholesalers supply it to the retailers and retailers supply it to the consumers. The most common marketing channels are,

i. Producers – Forward contractors/ Wholesaler – Retailers - Consumers
ii. Producers – Assembler/ Contractors – Wholesaler – Retailer – Consumers
iii. Producers–Pre-harvest Contractor/ Wholesaler – Wholesaler – Retailer – Consumers

The channel number three is very common among mango and pear fruits producer farmers. The pre-harvest contractors visited to the farmers and negotiate with them at farm level price. Similarly orchards under government farms and private farms this type of activities commonly exist in Nepal.
3.2.2 Area, Production and Yield of Fruits in Nepal

Only after 1950 several promotional activities on fruit development were undertaken in Nepal. For the first time Horticulture Development section was established under the Department of Agriculture in 1955. Several improved cultivar of Asian pear, peach, pear, plum, persimmon, cherry and apple were introduced to Singh Durbar and Kakani farms and cultivar performance studies and propagation activities were started with bilateral assistance from USAID until 1963. From this time the Government of Nepal placed special emphasis on fruit development in the hills. The period 1960 to 1973 was a very crucial period because this is the time when six temperate horticultural stations were established at different locations of the country with support from the Indian Cooperation Mission (ICM). Many new cultivars of deciduous fruits were introduced into these stations from India. In these stations a number of activities were started including cultivar performance studies, planting material production and distribution, training of farmers’ etc. As a result, the area under deciduous fruits increased dramatically. A number of new temperate fruits and additional new cultivars were introduced and key horticultural stations were strengthened during 1977 to 1980 under the Hill Agriculture Development Project assisted by FAO.

Until the early seventies, the requirements of planting materials of these fruits were met mostly by imports form India but after the mid-seventies several private nurseries were established in the major growing areas and self-sufficiency was almost achieved.

No significant research work on fruits in general, and deciduous fruits in particular, was carried out in Nepal in the past. Only preliminary studies on cultivar evaluation, propagation and insect pest management were undertaken. Though the area, production and productivity of fruits is found increasing, but it is not enough to meet even the domestic demand. The following table shows the area, production and productivity of fruits in Nepal.

### Table 3.6 Area, Production and Productivity of Fruits in Nepal

<table>
<thead>
<tr>
<th>Fruits/year</th>
<th>Area (ha)</th>
<th>Production (Mt)</th>
<th>Yield (mt/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000/01</td>
<td>73775</td>
<td>487326</td>
<td>10.12</td>
</tr>
<tr>
<td>2001/02</td>
<td>77537</td>
<td>473621</td>
<td>9.51</td>
</tr>
<tr>
<td>2002/03</td>
<td>80426</td>
<td>518864</td>
<td>10.17</td>
</tr>
<tr>
<td>2003/04</td>
<td>86707</td>
<td>511406</td>
<td>9.45</td>
</tr>
<tr>
<td>2004/05</td>
<td>89312</td>
<td>552879</td>
<td>9.99</td>
</tr>
<tr>
<td>2005/06</td>
<td>91923</td>
<td>535449</td>
<td>9.47</td>
</tr>
<tr>
<td>2006/07</td>
<td>94901</td>
<td>575095</td>
<td>9.99</td>
</tr>
<tr>
<td>2007/08</td>
<td>100099</td>
<td>630563</td>
<td>9.94</td>
</tr>
<tr>
<td>2008/09</td>
<td>103651</td>
<td>686213</td>
<td>9.96</td>
</tr>
<tr>
<td>2009/10</td>
<td>107322</td>
<td>706972</td>
<td>10.00</td>
</tr>
<tr>
<td>2010/11</td>
<td>117932</td>
<td>794164</td>
<td>10.03</td>
</tr>
</tbody>
</table>

*Source: MOAC, Statistical information on Nepalese Agriculture, 2011*

The above table shows that fruit production over the last 11 years is found increasing; however the yield is very low in comparison to other countries. The following figure shows the trend of fruit production over the years.
JICA, report, mentioned that Nepal’s fruits productivity is very low as compared to neighboring country India. To meet the domestic demand and import substitution it is necessary to increase fruits productivity in future. The following figure shows the trend of fruits productivity over the years.

The above figure shows that productivity is not found increasing over the year, because of the poor orchard management in the country.
Table 3.7: Area, Production of deciduous fruits in Nepal (2010/11)

<table>
<thead>
<tr>
<th>Deciduous fruits</th>
<th>Area (ha)</th>
<th>%</th>
<th>Production (Mt)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple</td>
<td>10312</td>
<td>46</td>
<td>42704</td>
<td>40</td>
</tr>
<tr>
<td>Pear</td>
<td>4088</td>
<td>18</td>
<td>32565</td>
<td>30</td>
</tr>
<tr>
<td>Walnut</td>
<td>3696</td>
<td>16</td>
<td>6020</td>
<td>6</td>
</tr>
<tr>
<td>Peach</td>
<td>2624</td>
<td>12</td>
<td>14390</td>
<td>14</td>
</tr>
<tr>
<td>Plum</td>
<td>1817</td>
<td>8</td>
<td>10521</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>22537</td>
<td>100</td>
<td>106200</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Statistical Information on Nepalese Agriculture 2010/11

The above table shows that among deciduous fruits apple is found highest in area and production followed by pear, peach, plum and walnut respectively.

3.2.3 Marketing cost and Margin

Marketing cost of fruit produce comprise costs involved in all post-harvest activities upto final disposal in the market. In a study conducted by MDD, 2000, tried to assess the cost of marketing mandarin orange and apple from the two major transit points of Nepal Birgunj and Bhairhawa to nearby Indian markets at Patna and Gorakhpur revealed that the purchasing price at Nepalese market represents 25 to 33% of the wholesale market price received at Indian wholesale markets. Similarly, marketing cost ranges between 39 to 40%, in which transportation cost stood between 14 to 16% while loss during transportation at 8 to 9% resulting marketing margin from 28 to 36% of the price received at the near by Indian wholesale market centers.

Table 3.8: Marketing Cost and Margin for the Mandarin Orange and Apple Marketing from Nepal to Near by Indian Market

<table>
<thead>
<tr>
<th>Particulars/ markets</th>
<th>Percentage of purchasing price at Nepalese market</th>
<th>Marketing cost (%)</th>
<th>Transportation cost (%)</th>
<th>Loss during transportation (%)</th>
<th>Marketing margin (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birgunj to Patna India</td>
<td>32.95</td>
<td>39.55</td>
<td>16.14</td>
<td>9.09</td>
<td>27.50</td>
</tr>
<tr>
<td>Bhairhawa to Gorakhpur India</td>
<td>25.00</td>
<td>38.85</td>
<td>14.42</td>
<td>8.08</td>
<td>36.15</td>
</tr>
</tbody>
</table>

Source: Calculated from MDD, DOA, Study of High Value commodities marketing in Indian market centers, hariharbhawan, Lalitpur, 2000.

3.2.4 Market infrastructure

Physical infrastructures have been developed at more than 50 market places through the central government agency by its own and in support of various donor agencies. At district and local level, far larger numbers of small infrastructures have been developed by agencies,
like, District Agriculture Development Offices, District Development Committees, Municipalities and various donor assisted project and NGOs. However, institutional aspects such as software and human development are not growing at the same pace. Legal environment of fruits marketing is pretty weak. Different market centers of the country are operating under different rules and regulations.

### 3.2.5 Present post-harvest management practices

Although the Nepalese fruit is in the process of commercialization but it is largely a subsistent type with the domination of small holder farmers. The small holder farmers have little but forced sale mainly for meeting their immediate cash needs. However, there is a lack of market development which is focused on fruit production and post-harvest management system of small holder farmers. Generally, fruits are bulky and perishable. Most of such fruits require processing before consumption. Post-harvest management practices in Nepal are very poor. Most of the fruit producers adopted traditional type of post-harvest activities like, cleaning, grading, packaging, transporting, loading, unloading, and storing. Fruits which are consumed fresh should be transported immediately to the market centers for sale and consumption. However, development of storage, road network and agro-industry is very poor in Nepal. Very few cold storages and salar houses are used for mandarin orange storage, while bamboo basket used for packaging. It is well known facts that post harvest losses are quite high in Nepal. Several study reports show that the post-harvest losses are as high as 30-40% in general and 29% in orange and 25-30% in apples (CRDS, 2009) mainly due to improper method of harvesting, packaging, and storage of fruits.

### 3.2.6 Value addition in fruits

Regarding value addition traditional practices adopted by the farmers like wooden box and cartoon is used for mango and apple fruits, whereas other fruits are packed in bamboo basket (Dokos). Subsidy in packaging materials provided by the government to Apple producer farmers, to reduce post-harvest losses and to aware to the farmers for value addition practices. Some projects have treated to the Commercial farmers about value addition practices.

### 4. Existing supply chain of fruits and vegetables

In Nepal, fresh vegetables and fruits marketing has traditionally involved in supply chain operating through a service of wholesale and retail markets scattered in cities. In vegetables supply chain starts primary producer farmers- collectors-wholesalers-market retailers-consumers. Similarly, in fruits orchard owner-middleman (contractor)-Wholesaler-retailer-consumer. Due to country’s topography and smallholder producer farmers most of the fruits and vegetable farmers rely on middlemen to supply their product in the city market.

#### 4.1 Farm level production cost, prices and value addition

Production cost is very high in Nepal, both in vegetable and fruit production. Subsidy is not given to the farmers, whereas, due to subsidy provision, Indian product is found cheaper in Nepalese market. Nepalese farmers bound to compete with Indian and Chinese fruits, (especially Apple) which are cheaper to Nepalese fruits. Vegetables produces in remote area of the country, and consumption in city area, input supply and output supply increases the
cost of production. Farmers do not know value addition practices for their product; they dispose their product as usual.

### 4.2 Important actors in supply chain

Agro-vets, middleman, wholesaler, and retailers are the important actors in supply chain. Farmers who reside in remote area are unable to get inputs and it is quite difficult to dispose their product in city market by their own. Smallholder farmers they can supply their product only near by their production pockets as in farm gate price, after that collector manage to dispose fruits and vegetables to city markets.

### 4.3 Role of actors in supply chain

Actors (middlemen, contractor) role is very important not only in output disposal, but even in fruits and vegetable production to supply inputs to the farmers. Actors they collect the quantity of market demand of fruits and vegetables and supply as per market need. Most of the farmers they rely on them for their marketing activities. Only the farmers who have enough knowledge about market information and production pockets are nearby cities they dispose their product directly to the city market.

### 5. Recent technology adoption of fruits and vegetables

Farmers who are holding small size of land, and production is found subsistence level are found far from the adoption of recent technology for their production, whereas the commercial type of fruits and vegetable producer farmers are slowly adopting recent technology for reducing post-harvest losses and production cost using harvester and tractor type of machineries and packaging materials.

#### 5.1 Post-harvest

Directorate of Post-harvest Management, under the Department of Agriculture, is responsible for technology dissemination to reduce post-harvest losses. Commercial farmers are adopting new technology for reducing post-harvest losses using recent packaging materials, improved technic for transportation.

#### 5.2 Value addition

Commercial farmers uses value addition practices, like grading, cleaning, packaging and transporting getting higher price in the market. However, smallholders who are unaware about value addition dispose their product in the market and get lower price of the same product. Now there are some projects and institutions are involved to teach the farmers for value addition to get more profit from their products.

#### 5.3 Quality assurance system (food safety)

To assess the quality assurance, Organic certification is provided to the producer farmers of fruits and vegetables, integrated pest management activities launched out through out the country. Food Technology and Quality Control Department is responsible for food safety
control within the country. In addition Plant quarantine offices are also responsible to control pesticide used fruits and vegetables for import and export.

6. Value Chain Analysis of vegetables and fruits

Value chain refers to all activities and services that being a product (or services) from conception to end use in a particular industry from input supply to production processing, wholesale and finally, retail because. It is so called because value is being added to the product or service at each step. A value chain links the steps a product takes from the farmer to the consumer. It includes research and development, input suppliers and finance. The farmer combines these resources with land, labor and capital to produce commodities. In value chain marketing system, farmers are linked to consumers needs, working closely with suppliers and producers to produce the specific good for consumers demand.

6.1 Value Chain Map

The value chain map is presented of two major corridors: i) Eastern corridor (Dhankuta-Dharan-Biratnagar and Siligari), ii) Midwestern corridor (Kapurkot/Dailekh-Nepalgunj/Tulsipur/Kohalpur). The linkages are shown vertically from bottom to top. The left hand block lists the major function of the chain, which includes production, collection, trading, processing, and retailing. During mapping, actors involved in this sector are listed and mapped according to the respective functions. Then the institutions supporting this sector directly or indirectly are listed as enablers. The value chain map provides a graphic representation of off-season vegetables as it moves from production to consumers, passing through different stages and processes.

6.1.1 Value chain Map-Eastern Corridor

Dhankuta is the major production area of vegetables in eastern region. The vegetables produced in this area reach the market mainly through Dhankuta-Dharan-Biratnagar-Siliguri (India) corridor. Around 60 percent of off-season vegetables produced by farmers in Dhankuta are collected by the collection centers. The remaining 40 percent are collected road head traders. Both collection centers and road head traders supply the major part (60 percent and 40 percent respectively) to big traders. Besides selling to big traders, the collection centers also supply directly to the Indian Commission Agent. The big traders give 70 percent of their vegetables to regional wholesalers and 30 percent to the Commission Agent (India). Regional wholesalers also receive directly from road head traders. From the regional wholesalers, more than 85 percent of the vegetables reach the retailers in the major domestic market hubs. The regional wholesalers also supply some quantity (around 15 percent) to the wholesaler of India. The Indian Commission Agents works in 6 to 7 percent commission, and supplies to Indian Wholesalers and Retailers. The detail map of the eastern corridor is presented in Figure 4.
Source: ANSAB, 2011. Value chain/ market analysis of the off-season vegetable sub sector in Nepal. Asian Network for Sustainable Agriculture and Bioresources

Fig.4: Value Chain Map of off-season vegetables in Eastern Region
6.1.2 Value Chain Map—Mid-western Corridor

Surkhet, Dailekh, and Kapurkot are the major off-season vegetables production areas of mid-western Nepal. The vegetables produced in this region reach the markets in Nepalgunj, Kohalpur, and to bordering Indian markets through various marketing channels. Farmers supply their vegetables mainly to road head traders (40 percent) and collection centers (30 percent). Twenty percent of vegetables from farmers are sold in local market ‘Haatbazar’. Some, around 10 percent, are directly purchased by big traders. Roadside traders and collection centers are major supplier for big traders. Big traders in turn sell mostly to regional wholesalers, through whom the vegetables reach to domestic markets directly or through district wholesalers. Around 20 percent of the supply from big traders, 25 to 35 percent of the supply from collection centers, and 10 percent form regional wholesalers are exported to India through the Indian Commission Agent. The detail is presented in the following value chain map of the mid-western corridor, Figure 5.

Source: ANSAB, 2011. Value chain/ market analysis of the off-season vegetable sub sector in Nepal. Asian Network for Sustainable Agriculture and Bioresources

Figure 5: Value Chain Map of off-season vegetables in Mid-western Region
6.2 Jumla apple value chain

Apple is a deciduous fruit and is grown successfully in mid and high mountainous areas from the east to the Far-West of the country. Sub-humid and dry temperate areas in the mountains with elevations ranging from 1800-2800 m.a.s.l. are considered most suitable for high quality apple production. The rain shadow or low rainfall areas are located in western and Mid Western mountainous regions. Some low chilling apple cultivars are being grown at low altitudes, as low as 1200 m.a.s.l.

Apple is one of the key fruits with potential to generate income and employment in the high mountain districts of Western Nepal, especially with road constructions gaining pace in these areas. However, a systematic value chain analysis for apple was not yet carried out till date to diagnose constraints and identify the opportunities.

6.2.1 Activities in value chain map of Jumla Apple

i. **Functions:** Consumption-retail-wholesale-collection, grading, packaging, processing-production-input supply.

ii. **Primary actors:** Final consumers in major towns and Jumla district-apple retailers regional an national markets-Kathmandu based wholesalers Terai based regional wholesalers-district apple traders-Apple farmers-Agro-vet and private apple nursery owners.

iii. **Support organizations enabling environment:** MOAC-AP&MDD-FDD-RDA-MW-JAPC-DADO Jumla-NARC JHRS-KFVM-Fruit business Association-Ingo/projects SNV wv csp EIG-Cm-OCN NHPC

6.2.2 Nursery management and input supply

There are a total of 32 registered apple nurseries. Most registered nursery owners are organized in a “Fruit Nursery Association” since February 2008. However, more than double the numbers of apple nurseries have not been registered and many of them are supported by NGOs and INGOs.

During 2005, the private registered nurseries in Jumla produced a total of 103,000 apple sapling. During 2007 those private nurseries receiving DADO subsidies sold a total of 96,800 apples saplings earned cash income of NRs 1,934,000. They sold 11,000 to Kalikot, 4500 to Dolpa, 6000 to Bajhang, and 6000 to Rolpa and 61,700 in Jumla itself. In 2009, just two nurseries in Talium VDC together produced 60,000 saplings.

Fore several years apple saplings were sold at NRP 2, with the NRP 18 subsidy from DADO, the apple nursery received NRP 20 for their saplings. But when the Surkhet-Jumla Road (Karnali Highway) opened in 2007, still as a seasonal road, this came as a surprise to many and from 2008 onwards people started buying unsubsidized saplings, with prices even going up to NRP 25 per sapling. DADO Jumla continued subsidizing saplings but these saplings were reserved only for the poorest farmers.

Major challenges for the nurseries are related to improving the quality of their saplings:

a) Most nursery owners are not aware which varieties they have a stock: some are early varieties, some late; some are self-pollinating while others need polonaises to
policies them. Nursery owners are not able to advise farmers, nor do most of the latter have much idea about these issues.

b) Currently the nurseries do not have access or possibilities to supply new and improved varieties: they are mostly the same varieties which entered Jumla in the 1970s and 1980s.

c) Nurseries could well be contributing to the spread of diseases, especially when the saplings are produced within existing orchards.

d) Most common rootstock is the edimel and surkilo plants (both wild apples, the latter is without thorns), but some farmers (estimated at 5%) try to save on the edimel seed costs which are collected from the forests and have a price of 5,000-6,000/- per kilo. Use of modern apple varieties as rootstock can lead to root rot.

Other input suppliers

Only few private suppliers are in place for supply of other types of inputs (e.g., Organic pesticides, good quality sprinklers, and other inputs). These agro-vets need to be trained in delivery of organic services as farmers regularly seek their advice. Otherwise, these agro-vets will remain a major opponent to the DDC’s decision of 2007 to declare Jumla an organic district.

In 2009, DADO Jumla provided the contract to Jumla Agricultural Producers’ and Entrepreneurs’ Cooperative (JAPEC) for distributing apple saplings to poor farmers, but this is JAPEC’s only activities related to apple production.

6.2.3 Apple production

Apple production is increasingly becoming popular among Jumla farmers and now apple is being produced in all the VDCs of Jumla.

Varieties

There are about 10 varieties of apples being cultivated in Jumla—mostly the Delicious varieties: Red, Royal, and Golden Delicious—which constitute approximately 70% of the total production. The rest includes Jonathan, Chocolate, Torikulu, and Macintosh varieties.

Cultivation Practices

Most of apple trees have been planted on the slopes with low soil fertility and little irrigation and few of apple trees are grown on fertile and irrigable lowlands. Apple is mostly intercropped with beans and wheat, but also soya beans, potatoes, buckwheat, etc. The average annual cultivation cycle looks as follows:

<table>
<thead>
<tr>
<th>Activities</th>
<th>Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sapling planting</td>
<td>June-July</td>
</tr>
<tr>
<td>Pruning and manure application</td>
<td>Jan-Feb</td>
</tr>
<tr>
<td>Weeding</td>
<td>March-April</td>
</tr>
<tr>
<td>Irrigation</td>
<td>April-June</td>
</tr>
<tr>
<td>Harvesting</td>
<td>Aug-Sept</td>
</tr>
</tbody>
</table>
The present apple orchard management is very poor. One of the reasons is that farmers do not have adequate knowledge, on when or how to efficiently irrigate, fertilize, and prune their apple trees. Many also complain that there are inadequate services of apple exports in Jumla and that a big campaign is needed to promote improved technologies to apple growers.

**Climate**

Two important climatic factors for a good production are sufficient chilling hours in the winter (snowfall) and sufficient rains during the flowering season in April. Because of lack of these two, the 2009 apple production was at least reduced by 50%. As the Indian apple suffered the same problems, this led to high apple prices in August. This also raises questions about the impact of climate change. The expected climate change—less winter rain or snow and more unpredictable starts of the monsoon (starting date) will probably lead to less chilling hours, dryer spring seasons and more pests. This could mean that Jumla would need to import varieties which require less chilling hours, or only start new orchards at higher altitudes. Irrigation will become more important, which is now virtually lacking. Pest management or pest varieties will become increasingly more important. Pest management will not be as easy for organic production as for conventional production.

**Disease and pests**

The common diseases reported are: Stem black, Powdery mildew, Scab, Nectaria twig blight, Alternative twig blight, Peppery bark/pink disease. Similarly, some of the common pests reported are: wooly aphids, San Jose scale, Stem Borer, Root Borer, and Bark Borer.

**Labor**

During peak agricultural seasons, the wage rate for both male and female is around NRP 250-300 per day plus three meals. However, during off-seasons, women tend to get slightly lower wages than males. Now, only large farmers are employing wage laborers, but this is expected to increase once sales increase when the Karnali Highway will become an all-weather road.

**Organic production**

Another Important factor which has limited quality production is that the declaration of Jumla as an organic district was not sufficiently combined with awareness and knowledge on organic-permitted growth stimulants (like Servo oil to be sprayed to increase apple size and shininess), bio-fertilizers, compost making and bio pesticides. Half of the organic matter (dry weight) of Farm Yard Manure is currently pine needles, which increases acidity and lowers nutrient availability, but currently there is little other unused biomass available.

Increased soil fertility is not only good for production but also a requirement for organic certification. Taking Jumla's current low soil fertility levels into account, OCN advised extensive use of cradle pits in orchards which gather moisture and organic matter. In a smaller manner, NARC-Jumla advised to have one compost pit per ropani and to massively grow beans around the apple trees and use the plants as green manure after the bean harvest. Whether organic certified or not, increasing apple quality will requires a large scale, structured campaign to increase quality and quantities of composting.
Organization of producers

Till 2009 apple producers in Jumla were hardly organized and are selling apple independently: therefore, they did not have much bargaining power for better price. They also did not have direct contact with major apple wholesalers in urban markets and depended on apple sales to local traders.

Due to the organic apple certification initiative by the DADO Jumla and High Value Agriculture-Inclusive Business Pilot Project more formal organization of farmers became necessary to receive group certification as this reduces cost compared to certification of each individual farmer: three organic apple producer groups were initiated in 2009 (Kartikswami Organic Group, Malika Organic Agriculture Production Group and Janachetana Organic Group). For the marketing in 2009, these three groups organized an apple management committee which signed a contract with the DCCI-Jumla sub-committee (about seven Jumla apple traders) for supply of organic certified apple.

Then in 2010, with the change in DOA’s subsidy on transport and packaging material, formation of cooperatives became an urgent matter. As per the new directive only cooperatives would be able to receive the subsidy, and not organizations like the DCCI, which received the subsidy in 2009. The above farmers groups largely merged with existing cooperatives which were either inactive or only did saving and credit activities. Another six cooperatives, not active in the apple sub-sector before the new directive, also joined the marketing activities of the three cooperatives and collaborated under the umbrella of the District Cooperative Federation. They did not join in the organic certification activities.

These nine cooperatives represented around 460 active commercial apple producers in 2010 and accounted for about half of total apple export from Jumla. The other half is exported by non-organized farmers. Although no data exists about them, quite likely this part exist out of more farmers, each exporting fewer apples.

6.2.4 Harvesting and post-harvest management

Harvesting

Jumla apple producers do not have much knowledge on the appropriate techniques for proper picking, grading and packaging. Apples are harvested in a most haphazard manner- including shaking the tree and picking from the ground. Without grading they are transported to Jumla airport, in Dokos and bags. The latter is especially a role for women. One of the challenges to improve harvesting is that damage to the apple often only becomes visible after a few days, especially when it arrives at the heat of the Terai, the bruises quickly become visible.

Grading

Grading was done by the traders- usually two grades depending on size alone for export to the Terai till 2008. In 2009 grading (A,B,C,D) was introduced but without price difference. In 2010, this was done by the earlier mentioned nine cooperatives which collaborated under the umbrella of the District Cooperative Federation Jumla. It was agreed to only export A and B grades. Grade A received NRP 30 and 26 per kilo for organic certified and non-certified respectively and grade B received NRP 24 and 22 per kilo for organic certified and non-certified respectively. There are no grading standards for apple in Nepal, and the definition of the different grades is based on mutual understanding between the stakeholders.
As nearly all apples are transported by plane, which is also a challenge because flights get rather unpredictable in the monsoon weather, grading, pricing and packaging all happen close to the Jumla airport.

Sometime Golden Delicious, a late variety, gets packaged separately. The district headquarters traders will use the apples other that grade A,B and C for processing or for the local market. When there are no flights available to transport the apple to Nepalgunj or Surkhet, from where the transport can continue by road, also A and B grades start flooding the local market.

**Packaging**

Till, 2008, traders had not properly prepared themselves by bringing packaging material before the monsoon starts. A lot of losses occurred due to improper packaging: old boxes were used without any wrapping or separation material and a considerable amount got damaged. Often the bruises only started to show after a few days, especially when the apples arrive in the heat of the Terai.

Due to collaborative efforts from DADO Jumla, DDC, DCCI Jumla, World Vision, SNV Nepal, various new developments took place in 2009. A total of 285 farmers were trained in improved harvesting and post-harvest management, investment was made into improved packaging (boxes and foam nets/wrappers). Grading also improved, although price differentiation was initially resisted by the farmers and only took place in 2010. People's vision has widened of what is necessary (and possible) to be competitive in the market. In 2010, even the nine cooperatives managed to organize and pay for packaging material from Nepalgunj, which can be seen as a strong proof of increased local capacities.

**Storage**

Traditionally farmers stored apples inside the house in cool dark rooms. Now some improved zero-energy apple stores (rooms) have been developed, but without proper humidity and temperature control, these stores can only extended the commercial life span of apples with the one or two months.

The road access problems would be greatly minimized if proper storage would exist. Unfortunately the nearest cold storage is in Kohalpur in the Terai. Jumla currently does not have sufficient electricity supply for its current needs, let alone the local micro-hydro power that can manage an energy-consuming cold store. The current zero-energy storage (cellar stores) allow for storage, but still causes losses which often outweigh possible price increases.

Another issue is that the Jumla apple does not have a long keeping quality. Although this needs further research, probably there is due to shortage of certain micro-nutrient in the soil, possibly calcium.

**6.2.5 Trade and marketing of Jumla apples**

Harvesting already starts during the monsoon and makes transport over the Karnali Highway impossible. This makes costly air transport the only option, but the weather makes flight very unpredictable. There is also considerable competition between cargo and passengers, especially before Dashain as many non-Jumlis want to go home for the holidays. If the road
opens early, transport by tractor become possible increasing district headquarters apple prices. For example, in 2008 the prices increased form NRP 10/- to 20/- per kilo but with losses of up to 50% due to the bad road conditions.

The 232 km Karnali Highway opens as barely a track in 2007. This has greatly increased the perceived future perspectives for the Jumla apple sector. But the chances of landslides blocking the road during monsoon will remain large for the years to come.

Those 10% apples which do reach the market outside Jumla largely serve the cheaper market segments in the Terai: poor management, all the way from orchard management to packaging and transport, make these relatively small and often bruised apples less attractive. Nevertheless, in comparison to Chinese and Indian apples, Jumla apples are widely recognized as tasty and crunchy apples in Nepal, but size, color and general condition have a big influence on consumer choices.

The different marketing or trade modalities are currently in operation in Jumla:

a) Large apple producers who bring their produce to Surkhet and Nepalgunj themselves.

b) Growers- especially in Jumla's Sinja belt- who collect from other farmers as well and send the produce to the Terai.

c) District headquarters traders with a storage at the Jumla airport who either i) 'rent' orchard and organize the harvest themselves, or ii) buy at the airport from farmers.

d) For the first time in 2010, nine Jumla cooperatives did joint marketing under the District Cooperative Federation.

The third category took the largest volume in 2009, while the fourth category took the largest volume in 2010, increasing the area of influence of the apple producers (vertical integration). The transport and packaging subsidies provided by the DADO form part of the profits (for transport NRP 7 in 2009 and 75% on transport and on boxes in 2010). As the subsidy is provided on reimbursement basis, it was quite a surprise that the nine cooperatives managed to collect sufficient working capital internally to bridge the gap between actual payment of transport and boxes and the reimbursement later in the form of subsidy. Another significant feat by these cooperative in 2010 was management of air transport, not an easy task seen the competition for air transport and the monsoon weather limiting flights. Due to these flight problems, marketing apple and the coordination between different actors is not easy. Every year a few metric tons of apples lose their marketability while waiting for flights for too long, increasing the costs for the traders or cooperatives.

**Transportation costs**

<table>
<thead>
<tr>
<th>Route- Nepalgunj/ Surkhet</th>
<th>Mode of transport</th>
<th>Transport cost (NRP) per kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jumla- Nepalgunj/ Surkhet</td>
<td>Air</td>
<td>21/- (excluding possible transport subsidies).</td>
</tr>
<tr>
<td>Jumla -Surkhet</td>
<td>Truck/Tractor</td>
<td>4/-</td>
</tr>
<tr>
<td>Nepalgunj/Surkhet-Jumla</td>
<td>Air</td>
<td>82/- (excess luggage) 55/- (cargo separate) 42/- (Charter)</td>
</tr>
<tr>
<td>Surkhet-Jumla</td>
<td>Truck/tractor</td>
<td>8/- to 24/- depending on the volume</td>
</tr>
</tbody>
</table>
After agreeing on a deal with actors in Jumla, wholesale traders form elsewhere collect their apples in Surkhet or Nepalgunj and put their product on night buses to various destinations, where they sell to retailers. Before the market linkage interventions of HVA-IB pilot project, most apples were sold in the Terai, form Narayangarh to the west. With the project larger volumes started reaching Kathmandu.

The year 2009 saw high prices early in the harvest season, which helped the farmers make a good deal with the DCCI-Jumla (NRP 35/kg), but early September the Chinese apples arrived on a large scale after which the apple price in Kathmandu dropped sharply. On the basis of this experience, the above mentioned pilot project argued for a pricing system for Jumla apples based on the general apple market price in Kathmandu, for example agreeing on the apple price in Jumla as a percentage of the general apple market price in Kathmandu and with a certain minimum price also included. But in 2010, the Jumla cooperatives had little interest in such a system: they preferred a fixed price and left the risks (and possible gains) for the wholesaler.

6.2.6 Organic certification

At least 95% of Jumla apples are organic by default, as the marketing opportunities for Jumla apples have been limited and only a few larger farmers are willing and capable to invest into expensive chemicals. The 10% of the total apples which did reach the market outside Jumla was mostly used to serve the cheaper market segment in the Terai: poor management, all the way from orchard management to packaging and transport, made these relatively small and often bruised apples less attractive.

This was rather unfortunate, as usually organic products serve the top-end markets. With this in mind, the HVA-IB pilot project, implemented by SNV Nepal, and DADO Jumla agreed to support organic certification in 2009 and 2010. Later World Vision and other organisations also agreed to contribute.

In 2009 three organic apple producer groups were formed in Mahat, Kartikswami and patmara VDCs respectively: these 207 farmers went through various training and were inspected by Organic Certification Nepal (OCN) in August 2009 and were certified "Organic in Conservation". OCN is a Nepali certification agency which applied the Government of Nepal's Organic Guidelines for this certification. These guidelines were only approved in May 2009, and the certification of Jumla apples was probably its first successful application. Also marketing was supported with posters, banners and "certified organic in conservation" stickers for each apple to create demand and trust among consumers. In a similar manner, in 2010 these farmers organized themselves into three cooperatives, and 200 farmers were certified fully "organic" and another 150 as "organic in conservation", together exporting 38 MT. Another 30 MT was exported by six cooperatives with the same market linkage support from the HVA-IB pilot project. Although not organic certified, these apples where still sold as organic ('truthful labeling'), benefiting from slowly increasing awareness among consumers about Jumla being an organic district.

This certification was one of the reason why the price of organic apple in Jumla increased form NRP 10 in 2008 to NRP 35 per kg in 2009 (ungraded) and was marketed through at least 6-8 supermarkets in Kathmandu. Other reasons for the price increase was caused by the better post harvest management, most tangible the improved packaging. Another important
factor was the general increase in market price due to the reduced production in the Himalayan belt: the price for uncertified, but well packaged apples rose to NRP 25 per kg.

In 2010, the price difference between certified and non-certified organic apples decreased: respectively NRP 30 and 26 for grade A and respectively NRP 26 and 24 for grade B. If this price difference does not increase, this small difference will not justify organic certification from a financial perspective. There appears to be quite some interest for organic apple, but demand and supply are not meeting each other in an effective manner. One reason is that the organic market is not yet well organized in Kathmandu: several places have a few organic products but it remains all very scattered. There are no places where consumers can buy a whole variety of organic products. The other reason is that in 2009 and 2010 the Jumla apples were mainly distributed through a fruit wholesaler which has no expertise and also little interest in organic products. Although there is an organic vegetable wholesaler in Kathmandu, this company did not manage to make a substantial deal with the Jumla cooperatives and latter preferred the offer of the fruit wholesaler: larger volumes, more advance money, etc.

Even though the Ministry of Agriculture and Cooperatives has published its set of guidelines for organic production, Nepal still has no accreditation body which can accredit certifiers as complying with an agreed set of policies and guidelines. Therefore, OCN is not an accredited certifier and its certification remains of a private nature. In other words, the certification of organic apples is based on the trust that OCN is doing its work professionally and there is no accreditation body to guarantee that certain guidelines or standards are met.

Already some lesson has come forward from the 2009 and 2010 certification experience:

- Large scale introduction of use of permitted bio-pesticides and organic compost marking need to be introduced. Especially pest control is become a large concern among the farmers. DADO-Jumla and the Jumla Horticulture Research Farm are doing some experiments, while the HVA-IB pilot project has provided trainings to farmers. Micro Enterprise Development Project might support the initiation of a small bio-pesticide production unit making use of locally available herbs.

- Although there is demand for organic apples in Kathmandu the distribution needs to be better organized to reach out to many consumers. This is related to the fact that is hardly an organized market for organic products in general in Kathmandu. And preferable a wholesaler should be involved which already has experience and networks to serve the fragmented organic market. Without this a sufficient premium price cannot be achieved and the certification will not be financially sustainable.

- As OCN certified the upland fields of the farmers (not the irrigated rice fields where they still found some evidence of [illegal] pesticide use), also other non-irrigated crops can be produced under the present certification, like beans, buckwheat, etc. These extra incomes will increase the financially sustainability of the certification.

6.2.7 Apple processing

Processing of apple is important as a considerable part of the produce will always remain of too low grade to sell for fresh consumption. At the same time, this is even more urgent for Jumla as market access will remain problematic during harvesting time: processed apples
into whatever product can often be better stored and/or have less weight or volume which reduces transportation costs.

Several enterprises—including the largest called RN Organic—have started production of dried apple slice on a commercial scale—both for local consumption and 'export' out of the district to major markets in Nepal. Other products have not seen any commercial up-scaling, except for apple cider production.

The general opinion is that dried apple has the most potential (easy processing, light weight), but they have to compete with the good quality apples coming from Mustang. If these various products are to be promoted on a larger scale, separate value chain analysis of these products would be worthwhile.

6.2.8 Trend of apple production

Apple was introduced in Jumla during 1970s from Himancal Pradesh, India by the Government of Nepal (GoN). In 2011, a total 10767M.

In the past, saplings were distributed by DADO Jumla at NRP 2 per sapling (with a subsidy of NRP 18 per sapling) and are still doing so for the most disadvantaged households. From 2008 onwards farmers bought sapling at the rate of NRP 20 to 30 from private nurseries. The demand was to high that even the production of saplings by private nurseries could not meet the demand of local farmers. Even poor Dalit farmers bought apple saplings at NRP 20 to 25 per sapling from these private nurseries. Every farmer met during the studies' field trips in Jumla mentioned that they were planning to double the number of trees in the next 5 to 7 years.

6.2.9 Income generation

A study shows that with 20 trees per ropani (5476 sq ft) the net annual income opportunity per ropani from apple production and inter-cropping is NRs 57000 when the production is in full swing(with ten-year or older trees). This calculation is on the conservative side, it assumes high labor costs (which are increasing steadily) and apple prices at least NRs 5 below those received in 2010.

6.3 Actors and functions

Farmers

Farmers are the primary and most valued actor in the agriculture value chain. Tow categories of farmers were noticed in production areas: subsistence farmers and commercial farmers. Subsistence farmers generally purchase and organize necessary agro-inputs and sell the produced at local markets (haat bazaar). The local consumption of off-season vegetables is 30 percent of the total production. The rest is sold to outside markets through various levels of traders.

The diverse agro-climate conditions can make growing off-season vegetable crops highly cost effective and competitive, and provide vast opportunities. Unfortunately, these opportunities have not been exploited by the farmers due to the lower price they receive for their produce in the collection centers or markets, as well as bearing the cost of post-harvest losses.
Collectors/traders

Collectors and traders are the key actors in the off-season value chain, responsible for the trading of 70 percent vegetables from production pockets to wholesale markets. Their trading activities include buying and assembling, repacking, sorting, selling to middlemen, transporting, and selling to wholesale markets. Deducting all the costs incurred these activities, including the taxes and transport damage losses; their market margin share comes to about 10 percent.

Big Traders

The traders who collect products in bulk amount from roads or collection centers are the big traders.

Regional Traders

The traders who collect vegetables form collection centers and road heads and supply to wholesalers of other districts are regional traders.

Indian Commission Agents

The actors who purchase product and sell on commission basis to the wholesalers or retailers are the commission agents. The vegetables of the eastern region are traded through the commission agents of Siliguri.

Wholesaler

Wholesalers are mainly involved in buying vegetables from regional traders and supplying them to retailers. They also store products, usually only for a maximum of two days. They generally make an estimated profit margin of NPRs 0.5 to 1 per kg. Their market margin share comes to about 5 percent. They are mainly located in Mandis where there are market hubs with some infrastructure such as office, buildings, open stores, transaction sheds, and shop sheds. These market hubs are usually established with government support and operated by local committee.

Retailers

Retailers’ involvement in the chain includes buying of vegetables, transport to retail shops, grading, displaying, and selling to consumers. Their market share is 15 to 20 percent. Retailers are not organized into a formal organization; they all do their business individually.

6.4 Enablers and Facilitators

Enablers include all chain-specific actors providing regular support services or representing the common interest of the value chain actors. Functions at the enabler level include public research and technology development, agreement on professional standards, promotional services, joint marketing or advocacy, and other support services.

Enablers in production and local processing functions

District Agriculture Development Office (DADO) and their services centers, and research stations of the Nepal Agriculture Research Council (NARC), Horticulture Research Division are working to develop and disseminate different technologies for off-season vegetable
production. Similarly, cooperatives and farmers’ groups are facilitating collective input procurement and in some cases selling of off-season vegetables. Microfinance institutions and cooperatives assist farmers by providing loans during plantation time. Some NGOs provide technical and financial assistance to cooperatives in production and marketing.

**Enablers in trading and export functions**

Business Membership Organizations (BMOs), like the District Chamber of Commerce and Industries (DCCI) and Agro Enterprise Centers (AEC), are supporting business by providing services such as market information and facilitation for market linkages. The Agriculture Information and Communication Center (AICC), Agribusiness Promotion and Marketing Development Directorate (ABPMDD), National Plant Quarantine Program (NPQP), Agribusiness Promotion Program, and the Agri-Commodity Export Promotion Program also facilitate trading activities by providing technology, establishing collection centers, and supporting export-related activity. Similarly, the Trade and Export Promotion Center maintains trade and export-related information.

At a higher level, the Ministry of Agriculture and Cooperatives (MoAC), Department of Agriculture (DoA), Ministry of Commerce and Supplies, Federation of Nepalese Chamber of Commerce and Industries (FNCCI), and Ministry of Commerce facilitate for business through policy lobbying, policy formulation, and bilateral trade agreements. The details on each enablers and facilitators are described below.

6.4.1 Public Actors

**Department of Agriculture:** District Agriculture Development Offices (DADO) operate under the Department of Agriculture of the Ministry of Agriculture and Cooperatives and are functional in all 75 districts of Nepal. DADOs are at the center of all activities related to agriculture in associated districts. In off-season vegetables, DADOs are implementing various activities which are mainly focused at the production level. Group formation, technical advice to growers, technology demonstrations, and training are some of the activities of DADO.

**Nepal Agriculture Research Council (NARC):** At the national level, NARC has the mandate to conduct agricultural research in the country with the goal of raising the population’s economic level. The Horticulture Research Division, Khumaltar, carries out research in off-season vegetable production, disease and pest management, and storage. To date, it has developed the popular tomato variety Srijana, and it also produces breeder’s seed.

**Plant Protection Directorate (PPD):** The PPD is a governmental agency responsible for the program implementation on the Plant Protection Sector and is responsible for different national level programs: the office of Registrar of Pesticides, the National Plant Quarantine Program, and Regional Plant Protection Laboratories. During export of vegetables, the plant quarantine offices work on legal formalities of export.

**Nepal Agriculture Research and Development Fund (NARDF):** NARDF funds various research and development projects of NARC, government extension offices, and different NGOs on competitive grant basis.

Trade and Export Promotion Center (TEPC): The Government of Nepal established TEPC, a national trade promotion organization, in November 2006, with the objective of promoting foreign trade, particularly export trade.
6.4.2 Government Projects

Project for Agriculture Commercialization and Trade (PACT): The development objective of PACT is to improve the competitiveness of smallholder farmers and the agribusiness sector in selected commodity value chain in 25 districts. PACT covers these components: agriculture and rural business development, sanitary and phyto-sanitary facilities, food quality management, and project management, monitoring and evaluation.

Commercial Agriculture Development Project (CADP): CADP began in 2007 with the objective of reducing poverty in 11 districts in the Eastern Development Region (EDR) of Nepal. The project aims to accelerate the process of agricultural commercialization in the eastern development region by building on earlier projects initiatives and responding to the needs of stakeholders by strengthening linkages and ensuring fair benefits to disadvantaged communities and women.

High Value Agriculture Project (HVAP): The HVAP project formally launched in 2011, concentrating its activities in the mid-western and far-western development region. The project primarily focuses on an Inclusive Business (IB) approach, whereby it seeks to mitigate poverty by incorporating lower income communities within the supply chain of larger, more established companies. Off-season vegetable is on of the priority sub sectors of this project.

High Mountain Agribusiness and Livelihood Improvement Project (HIMALI):

6.4.3 Non-governmental Organizations and Projects

AEC/FNCCI: FNCCI created the Agro Enterprise Center (AEC) as an autonomous unit in September 1991. It has its own optimal guidelines and policies, and program approval is given by a separate Board comprising of FNCCI executive members, representative from District Chambers of Commerce and Industry, Commodity Associations, and permanent invitees form various related governmental agencies or who are donors. The mission of this center is to expand and strengthen market-oriented private sector driven agro enterprise in order to increase the value and volume of high-value products sold domestically and internationally.

MEDEP: The Micro-Enterprise Development Programme (MEDEP), started in 1998, is a multi-donor funded poverty reduction initiative implemented by the Government of Nepal, with the technical and financial support of UNDP. The program helps improve the livelihood of the poor and excluded communities by creating income generating opportunities through skill development trainings, and provides support to established small business enterprises specifically in the vegetable sector.

FORWARD: FORWARD is a national NGO established in 1996, committed to helping the rural poor address social disparity and poverty. It has completed various projects on off-season vegetable production and marketing in more than 20 districts of Nepal.

CEAPRED: Since its establishment, CEAPRED has focused on sustainable poverty reduction and enhancement of food security and livelihoods of the poor, and disadvantaged and deprived families, including small and marginal farmers. CEAPRED’s approach to poverty reduction consists of promotion of new and better economic opportunities at the local level, and linking these opportunities to the markets. Some examples of CEAPRED’s
initiatives, which have been widely recognized and referenced, include a commercial off-season vegetable production program launched in eastern Nepal in the early 90s, and a commercial vegetable seed production program currently in operation in several districts of Nepal.

**IDE Nepal:** International Development Enterprise (IDE) is an International non-governmental organization, working in Nepal for two decades. Its mandate is to develop disseminate low-cost irrigation technologies for small holder farmers of Nepal. In vegetable production and marketing, it has completed various projects in different districts of Nepal.

### 6.5 Vertical and Horizontal Linkages

**Vertical Linkages:** Vertical linkages can be attain through cooperation between the different players of firms, and they have the benefits of transferring skills form one player to another, as well as reducing transactions costs. Considering the off-season vegetables value chain, vertical linkages exist between cooperatives and growers, since cooperative distribute the inputs and buy the products of farmers, there was a marketing and planning committee (MPC) in major market centers where there is membership of farmers’ groups and traders. The MPC plan the required inputs and production potential in the catchment area and plan for the output marketing accordingly.

**Horizontal linkages:** This is the relationship among different players operating at the same level of value chain. At the farmers’ level, there are the production groups and cooperatives where members regularly conduct meetings and for input procurement and output marketing, In most of the wholesale markets, traders fix the price of product collectively for a particular day and sell the vegetables accordingly.

### 6.6 Value Chain Governance

Nepal is heavily dependent on India for vegetables, and therefore the vegetables value chains are highly influenced by the supply from India. In most cases, the business relations between the various operational actors are of free market exchange and uncoordinated. The transaction pattern in export market is mainly on commission basis where the commission agents charge 6 to 7 percent as their fee.

Due to lack of a proper market information system and minimal bargaining power, farmers are forced to sell their product at the price offered by traders. Traders usually refer to Indian markets for price fixation. In some cases, there are conflicts among the traders and exporters regarding payment and failure to keep commitment.

### 7. Policy interventions for improving supply chain

The core problem for agribusiness development in Nepal is the lack of effective supply chain linkages among input providers, primary producers, collectors, wholesalers, market retailers and consumers. A functional supply chain means that key stakeholders are aware of their mutual linkages which is a deviation from the generally accepted linear model, make a deliberate effort to improve them, and organize themselves in such a way that they can benefit from such linkages in the network, including other stakeholders.
The analysis of linkages among different stakeholders reveals weak linkages. The paucity of effective farmer organizations, producer associations, trade associations and coordination mechanism among stakeholders is seen as a major obstacle to further commercialization by stakeholders.

In 1995, the GoN in association with John Mellor and Associates formulated a twenty year Agriculture Perspective Plan, 1995-2015(APP). This has been the major guidelines for agriculture development of GoN till now. Since this is considered as agriculture development strategy, on formulated National Agriculture Policy, 2004 and was implemented in November, 2004. Now all agriculture plans, programs and projects are guided mainly by National Agriculture Policy. Till now, following 18 policies have been formulated and these policies are in implementation.

- National Agriculture Policy, 2004
- Agri-business Promotion Policy, 2006
- Agro-biodiversity Policy, 2007
- National Seed Policy, 2000
- National fertilizer Policy, 2002
- Irrigation Policy, 2003
- National tea policy, 2000
- National coffee Policy, 2000
- Dairy Development Policy, 2007
- Agriculture Perspective Plan, 1995-2015

A best practice of supply chain depends on the proper implementation of the above policies. Focusing on smallholder farmer’s situation, development of storage, processing and transportation facilities, linking market development with production, support for smallholder farmers, infrastructure development.

References


Value Chain Analysis and Market Studies on Fruits and Vegetable in Pakistan

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Executive Summary

Market access and value chain analysis of the high value agricultural products of smallholder farmers are the very crucial issues to analyze performance of different actors participating in the supply chain and their role in value addition and suggest policy options. Fruits and vegetables have an important place in the agricultural economy of the Pakistan as it contributes 12% to agricultural GDP. Keeping in view the growth in production of fruits and vegetables as an evident for increasing role of fruits and vegetables in enhancing farmer incomes, alleviating poverty and improving quality of diet, the country study on Value Chain Analysis and Market Study on Fruits and Vegetables in Pakistan is conducted. The study reviews the current status of production, marketing system, market infrastructure post harvest management practices, value addition, quality assurance system and value chain analysis. Best practices are identified based on the value addition and profitability analysis across different supply chains and based on empirical evidences policy intervention for improve income and livelihood of the farmers through fair price and high return are suggested. Beside review of literature and synthesis from secondary information field level information was also collected through mini consultations by a group of social scientists using participatory approaches from all stakeholders across the chain.

In Pakistan area under fruit is 0.85 million hectare and Vegetable 0.39 million hectares, with a production of about 6.9 million tonnes of fruits and 6.2 million tonnes of vegetables (including potato). The important fruits are citrus, mango and guava and apple. Similarly Potato, tomato, radish, turnips are main vegetables grown in Pakistan.

The traditional commission agent oriented market system prevails which did not allow new entry and due to long and complex chain of actors the marketing system is a source of exploitation particularly for growers and consumers. The existing marketing system results in low return to the farmers and high profit margin at marketing level.

The traditional market system with conventional harvesting and post harvest technologies coupled with poor market to farm infrastructure, improper handling and lack of refrigerated transport, poor grading and packing high cost of packaging materials, high transportation cost low level of processing and low export prices of fresh fruits and vegetables, and poor access of farmers to markets information and modern technologies along with limited access to financial resources particularly for small farmers which are the main players in terms of number and contribution to overall agricultural production are the main constraints in the development of the sector.

Three main categories of markets exist; Assembly Markets, Wholesale Markets and Terminal Markets. The market players include farmer, contractor, commission agents, wholesalers, inter-market traders retailers, Processors and exporters. In general market intermediaries dominate the system and there is little direct market participation of the farmers, particularly small farmers.

Wholesale markets are being run by the association of commission agents having office bearers namely President and General Secretary. There is market committee and regulations in the wholesale markets. The products are sold to local shopkeepers and the contractors also purchase the produce to bring to the down country from these markets. Even the consumers may directly purchase from these markets sometimes.
To portray a vivid picture of the actors and their role, a value chain map drawing a visual representation of the chain is presented which depicts the flow of fruit in the market, activities carried out at each stage of the value chain, the structure of actors and the support involved in the value adding process.

Value addition of horticultural commodities requires a strong post harvest support. Some initiatives in this direction include establishment of research centres and cooperative institutes for development, demonstration and transfer of technology to the stakeholders. The various measures adopted include development of infrastructure like farm to market roads, storage facilities, cool supply chain, cargo and shipment convenience, and marketing and export documentation. These steps including Global GAP and HACCP have to some extent helped to improve and maintain quality of horticultural produce. Grades and standards have also been introduced to compete in international market.

Currently growers are not familiar with latest processing techniques that can add value to the products and bring lot of foreign exchange through exports. So there is tremendous scope for introduction of agro food based common facility centers enables to minimize the post harvest losses. Introduction of such facility can increase the income of the growers and as well as exports from the country.

Pakistan does not have adequate packing, grading and cold storage facilities, the produce from Pakistan is often delivered in inferior and inconsistent quality resulting low export prices. Pakistan is far behind with respect to having internationally accredited pesticide residues testing laboratories, although some initiatives, with the help of international organizations (UNIDO) have been taken in recent past. Pakistan has signed many regional and international trade agreements. Pakistan needs to work actively to meet food safety and quality compliance requirements. Setting-up standard food testing and inspection infrastructure, on priority basis, particularly in clusters with exporters is required.

The analysis of the economic viability of fruits and vegetable (mango and tomato) was carried out by calculating costs value chains and assessing their profitability. Comparing the cost by different chains for farmers, it was highest in case of self marketing in the traditional chain called (horizontal coordination) of commission agent in the whole sale market mainly due to the high operational cost. Farmers bear the highest cost around 70% while get share of only 10 % generated throughout the chain. The lowest cost is born by the retailer with highest percentage in the profit.

The second case was also self marketing but directly to processors/exporters called (vertical coordinating). In the vegetable value chain, self marketing in the horizontal and vertical coordination was found with no pre-harvest contract system like fruits. In this case operational cost was less than the whole sale marketing system but production cost was little high than the farmers working with the horizontal chain. In vegetable under horizontal coordination among the post harvest costs, packing cost share was around half of the total cost followed by the transportation cost (15-25%) and commission (10-15%). Under vertical coordination is the transportation cost is the main cost. Among the production inputs, fertilizer (10-18%) pesticide (8-12%), seed (9-13%) land preparation (7-11%) and irrigation (9-11%) were the major cost drivers. The labor cost was one of the important factors in vegetable as compared to fruits and it ranges between 15-25%.

The results depicted higher efficiency, productivity with lower cost of transaction and post harvest management along with more stable prices under the vertical coordination for
farmers both in fruits and vegetables. Furthermore the risk due to price variability could be controlled through vertical coordination by developing a system of supply and demand from farm and market respectively. The formal sector with the development of processing and export sector could provide more competitive market in the fruits and vegetables. Overtime it could be expected that the farmer in general and small holders in particular would be linked through vertical coordination. The resources generated through higher value addition under vertical coordination could built the financial capacity of the farmers through backward linkages. However the underdeveloped system of processing and less opportunities due to lower share in the global trade of fruits and vegetables commodities is hindering back the industry to develop vertical coordination in country.

Main policy interventions suggested for improvement of the value chain of fruits and vegetables include: reorientation of small farmers from subsistence to commercial horticultural farming through development of institutional linkages with farmers, shift from commodity to product through private sector investment, formulating export friendly policy and regulatory framework, enhancing market access and price system through development of demand based and service oriented competitive market environment with regulations for monopoly control at micro level and promotion of efficient and equitable fruits and vegetables value chains to address the question of economic viability of small farmers with respect to competitiveness, inclusiveness, scalability and sustainability to ensure fair prices to farmer and agribusiness to improve the income and livelihood of the chain actors.
1. Introduction

The Agriculture sector continues to be essential component of Pakistan economy. It accounts for 21% of the GDP and generates productive employment opportunities for 45 percent of the country’s labor force and 60 percent of the rural population depends upon this sector for its livelihood. It has a vital role in ensuring food security, generating overall economic growth, reducing poverty and the transforming towards industrialization (Government of Pakistan -GOP, 2012).

Geographically, Pakistan lies between 24°-37°N latitude and 61°-75°E longitude, with arid to semiarid climate. However, the country has enormous environmental diversity in its 796,096-Km2 area, stretching 1600 kilometers north to south and 885 kilometers east to west. Area under cultivation is 21.59 m.ha. of which, only 5.34 m.ha. (i.e., 25 percent) is free from soil limitations and is fit for intensive agriculture (Mian and Mirza, 1993).

Pakistan has two principle crops seasons, namely the "Kharif", the sowing season of which begins in April-June and harvested during October-December; while "Rabi", begins in October-December and harvested in April-May. Rice, sugarcane, cotton, maize, mung, mash, bajra and jowar are “Kharif” crops while wheat, gram, lentil (masoor), tobacco, rapeseed, barley and mustard are "Rabi" crops. Major crops, such as, wheat, rice, cotton and sugarcane account for 90 percent of the value added in the major crops. The value added in major crops accounts for 31 percent of the value added in the agriculture. Thus, four major crops (wheat, rice, cotton, and sugarcane) on average, contribute 28 percent to the value added in overall agriculture and 5.9 percent to GDP. The minor crops account for 10.9 percent of the value added in overall agriculture. Livestock contributes 55.1 percent to agricultural value added – much more than the combined contribution of major and minor crops (41.9%). The share of horticultural crops is 12% of agricultural GDP of Pakistan (GOP, 2011).

Agro-climatic conditions of Pakistan ranging from tropical to temperate allow growing 40 different kinds of vegetables and 21 types of fruits (Raja and Khokhar, 1993). The major fruits grown in Pakistan are mango, apple, banana, and grapes etc. whereas tomato, cabbage, carrot, radish, turnips, and spinach are main vegetables. Horticulture became priority for government in recent years. Total area under fruits 0.85 and vegetable 0.39 million hectares with fruits sharing almost 69 % and vegetables 31% in production. Country produced 6.9 million tones of fruits and 6.2 million tones of vegetable, with fruit sharing in production 53 % and vegetable 47 %. (GOP, 2010).

The government is paying special attention to promote horticulture industry through establishment of Pakistan Horticulture Development and Export Board (PHDEB) which is now transformed to an independent company instead of board. It facilitating the growers and industry to grow and export for better reward through promoting technologies, and developing strategies to create an export oriented environment beside attracting local and foreign investment and developing linkages and networking with relevant local and international R&D institutions. (GOP, 2008).

Pakistan has still experienced a more focus on food crops in term of changes in the area under various crops since the green revolution which was largely in favor of food grains to meet the objective of self sufficiency and country’s food security. Cropping pattern relatively static Horticulture area increased from 4 % to 6 % of total cultivated of Pakistan in last 2 decades. Horticulture sector also offering multiple employment opportunities throughout the
supply chain, particularly in rural areas. Positive growth in production of fruits and vegetables is evident and indicating the increasing role that they play in enhancing farmer incomes, alleviating poverty and improving quality of diet. It is expected that the demand for both fresh and processed fruits and vegetables produce will continue to expand in line with the rise in per capita income, better standards of living and increasing awareness about their health benefits. However, horticulture sector growth and profitability is restrained mainly by the lack of proper post harvest management and transport infrastructure (PHDEB, 2007). Among important issues impacting the fruit and vegetable growth is the low productivity and yield gap between small and large and world level. The country has not yet been able to achieve quality standards and marketing potential due to poor farm management; perishability, cool chain, storage, traditional marketing system resulting in postharvest losses and quality concerns. Lack of cold storage and underdeveloped processing sector results in large price fluctuations. In addition to it there are issues relating to compliance, certification according to international standards and traceability for capturing the international market.

A value chain describes the full range of activities required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers and final disposal after use (Kaplinsky and Morris 2001).

Horticultural crops offer more prospects than other agricultural crops due to their high yield potential and net return per unit area, and being highly labor intensive, create more employment opportunities. In future, the horticulture sector will keep playing this important role due to fact that Pakistan has all the basic natural resources like diverse climatic zones, fertile lands, vast plains, four distinct seasons, and well established irrigation system, which allow production of a range of horticultural crops throughout the year. The country has also got the position, both geographically and strategically to enhance its fresh produce exports to our traditional markets like Middle East, Afghanistan, Iran, and the emerging markets like China, Central Asian Republics along with the highly competitive but lucrative markets of Europe and Far East. Pakistan, itself is a large market for quality fruits and vegetables.

There are different issues and problems of fruits and vegetables at different stages of the value chains in Pakistan, poor management practices at production and post harvest stages, inefficient marketing system, inadequate infrastructure, high post harvest losses, no or little compliance to SPS standards, inadequate flow of information and low technology adoption with small share of processing and export. Keeping in view the scenario the present country study on value chain and marketing of fruits and vegetables is conducted with following objectives.

1.1. Objectives

1. To review the current status of production, marketing system, market infrastructure, present post harvest management practices and value addition in fruits and vegetables.

2. To analyze the existing supply chains, identify the stakeholders, and their role in the supply chain of fruits and vegetables in Pakistan.

3. To highlight the recent technologies on post-harvest, value addition, food safety and development of information management.
4. To assess the quality assurance system including regulatory measures (certification) in fruits and vegetables supply chain and food safety issues that causes hazard for public health and the environment.

5. To analyze farm level production costs, prices, value addition and the performance of important actors of supply chain of high value produces and examine if there is any scope to increase their value added activities.

6. Identify best practices of supply system in the region including

7. To suggest policy intervention for improving supply chain, market access and thereby facilitating fair price to the farmers in order to promote high value produce based agribusiness and improve income and livelihood of the farmers.

2. Methodology

The country report is based on the review of literature, secondary data from different national and international R&D organizations including various issues of Agricultural Statistics of Pakistan, Economic Survey of Pakistan, various reports of PHDEB and PARC along with various research reports and articles. The secondary information was further augmented by field visits and consultation with different stakeholders along the value chains including growers, contractors, commission agents, wholesalers, retailers, processors and exporters of fruits and vegetables from the main growing areas of Pakistan. The value chains of one important fruit i.e., mango and one most demanded vegetable tomato were intensively investigated. The group of social scientists from Social Sciences Research Institute (SSRI), conducted participation focus group discussion following PRA approaches. The report is based on the synthesis of both review of literature, and mini consultation through participatory approaches by following Participatory Rural Appraisal (PRA) and Focus Group Discussions (FGD). The country status report covers the issues as per objectives given above and are discussed in the following section in chronological order.


3.1 Production of Fruits and vegetables in Pakistan

In Pakistan area under fruit and vegetables is about 1.24 million hectare about 6 % of total cultivated area of country. Area under fruit 0.85 million hectare and Vegetable 0.39 million hectares. Production of fruits and vegetables is 13.13 million tones where fruit production is about 6.9 million tones and Vegetables 6.2 million tones.

The major fruits grown in Pakistan are citrus, mango, Guava, apple, and others. However citrus is the leading fruit crop of Pakistan. Share of citrus, mango and Guava in total production is 31 %, 27%, and 7% respectively. Production of different and their share in total fruit production of 2009-10 are presented in Table 1.
Similarly in vegetables the tomato, turnip, radish, spinach, and cauliflower are main vegetables (excluding potato) grown in Pakistan. The share in production are tomato 16%, turnip 9%, Spanish, carrot, and cauliflower are 7% each. Production of different vegetables and their share in total vegetable production of 2009-10 are presented in Table 2.

Table 1: Production of Fresh Fruits and Share of different Fruits in Total Fruit Production in Pakistan, 2009-10 (Production in tonnes)

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<td>7178800</td>
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Table 2: Production of vegetables and Share of different vegetables in Total vegetable Production in Pakistan, 2009-10 (Production in tonnes)

<table>
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<td>234664</td>
<td>213414</td>
<td>7</td>
</tr>
<tr>
<td>Cabbage</td>
<td>74649</td>
<td>75695</td>
<td>71731</td>
<td>71988</td>
<td>69080</td>
<td>2</td>
</tr>
<tr>
<td>Others</td>
<td>1042625</td>
<td>1033523</td>
<td>1006774</td>
<td>998913</td>
<td>1003739</td>
<td>33</td>
</tr>
<tr>
<td>Total Vegetables</td>
<td>3124763</td>
<td>3137973</td>
<td>3136873</td>
<td>3205478</td>
<td>3044858</td>
<td>100</td>
</tr>
</tbody>
</table>

Sustained agricultural growth calls for an efficient marketing system as it affects both producer’s income and consumers’ welfare. The efficiency of agricultural markets depends not only on farm production costs and yields, but also on what happens to the farm products from leaving the farm to reaching the consumers. There are several factors that influence the efficiency of fruit marketing including perishability, seasonality, quality, prices and location of the products beside demand and supply status (Aujla et al., 2007).

The existing marketing system in Pakistan can be distinguished on the basis of market value and the nature of trade activities. Three main categories of markets exist; Assembly Markets, Wholesale Markets and Terminal Markets. The market players include farmer, contractor, commission agents, wholesalers, inter-market traders, retailers, Processors and exporters. In general market intermediaries dominate the system and there is little direct market participation of the farmers, particularly small farmers.

**Assembly Markets** are often situated close to farms, generally in small towns, where farmers and contractor bring major portion of the marketable surplus. Shopkeepers, traders, and retailers participate as buyers in these markets. The price formation process is simply based on direct negotiation between traders and farmers.

**Wholesale Markets** are usually located in a district or a major sub-division town. These markets are the main assembly centers for the fruit surplus of surrounding areas. Wholesale markets have better storage, transport, communication and working conditions than the assembly markets.

**Terminal Markets** are generally situated in large urban centers. The Lahore and Karachi markets are the best examples of this kind of markets in Pakistan.

With a population of 180 million people, Pakistan has large domestic market for fresh produce. However the domestic marketing system of fruit and vegetable is very complex. There are regulated as well as unregulated markets. Under the regulated markets, there are more than 203 markets in Pakistan where as there are more many unregulated markets that are not documented.

The marketing system lacks proper cold storage facilities with no integrated cold chains, thereby has substantial post harvest losses (20-40%) with reduced shelf life and quality of fresh produce. The absence of cold storage facilities in production areas thus force the growers to immediately dispose off the produce once harvested, which often results in glut formation and lower prices. In orchards the pre-harvest contact system is dominated which hampers sustainable fruit productivity because contractors interest lies with the current season production and profit only. In vegetables although mostly self marketing system prevails but still the markets are controlled by the commission agents for price determination and further disposal to terminal markets through their linkages.

Lack of price information system is an obstacle in getting better returns by the growers. The recent introduction of large international supermarket chains, like Makro and Metro in Pakistan, may help improve the returns to growers in domestic market. With the improved income and demonstration effect in addition to the development of modern chain there are
changes in the consumption patterns and shift towards value added products hence developing a good market potential particularly for fruits and vegetables.

At present the market system due to inadequate in size and number of markets, difficult new entry, designed to be commission agent oriented and thus become a source of exploitation particularly for growers and consumers. Old legislations with poor implementation of market regulations and consumer protection acts allow different sort of malpractices. Further more poor cleanliness and in-hygienic conditions prevails in most of the markets.

5. Analysis of the Existing Supply Chains, Identify the Stakeholders, and Their Role in the Supply Chain of Fruits and Vegetables in Pakistan

This section deals with the existing supply chains, identify the stakeholders, and their role in the supply chain of fruits and vegetables in Pakistan. Here we will try to identify the supply chains on which farmers' produces are sold. It also deals with identifying the way by which these commodities reach to the end markets. It also presents the existing systems of supply chains presenting each players and its share across the supply chain. The supply chain system of the other fruits and vegetables is almost along the same pattern as there is no change of market players with the change in the commodity except the change in share in the flow of volume among the players of the supply chain of different fruits and vegetables. In fruits marketing almost similar pattern was found except that majority of the farmers (70% to 90%) go for pre-harvest contract mainly to avoid risks and get advances to fulfill farm and household expenditures. The remaining farmers follow the self marketing in which growers themselves sell their produce after harvesting packing and delivered to local markets through commission agents in wholesale market or few farmer delivered fruits to processors. Although there is a well developed processing and exporter industry in few fruits growing areas of Pakistan yet the supply to the industry is also maintained through contractors and few farmers also supply their produce directly to the processing industry.

5.1. Existing Supply Chains

It describes the routes taken by commodity from producers to consumers. They consist of individuals and firms involved in the process of supply of horticultural commodity from producers to consumers.

5.2. Fruits Supply Chain in Pakistan – A Case of Mango

The supply chain of mango in Pakistan follows one of the following two basic channels as given in Figure 2.1. The details of each of the channel are described briefly.

Channel 1 involves pre-harvest contractors in between growers and Commission agents/exporters or processors, whole sellers etc. It was noted that majority of the farmers sell their orchard as a whole to contractors before harvest. The deal entirely depends on trusting each other and these contractors tend to be regular buyers of certain pockets of production or from certain groups of farmers. The contractors perform transactional functions that involve buying arrangements, harvesting, sorting, grading, packing and
transport of fruits to markets etc. Generally, the contractors make a profit because of their risk-taking functions but sometimes they can also come out at a loss due to market uncertainties. During the discussion with different stakeholders it was observed that 71 percent farmers sell their produce to contractors and get some advance payments (20-25%) at pre-harvest stage.

**Channel 2** is the simplest one, in which growers themselves sell their produce after harvesting packing and delivered to local markets through commission agents. It was found during the consultation with farmers and contractors that 29 percent mango growers sell themselves in the wholesale market.

*Source: Developed by Author based on discussion mango supply chain stakeholders*

*Fig. 5.1: Fruits Supply Chains in Pakistan (Mango)*
5.3. Vegetable Supply Chain in Pakistan – A case of Tomato

Supply channel for vegetable are little bit different and mostly vegetables are sold under self marketing by growers. The growers supply the vegetables on daily basis to the wholesale markets from the main vegetable growing areas. Small scale vegetable production also takes place in other parts by specialized farming of certain farm families. They used to sell in the local market as well as in the wholesale market depending upon the scale of production. Discussion was held with tomato growers and come to the conclusion that 99 percent growers sell their produce in wholesale market through commission agent and 1 percent sellout to processors for tomato products. The processing of other vegetables is even less than tomato except potato.

Source: Developed by Author based on discussion Tomato supply chain stakeholders

Fig. 5.2: Vegetable supply chain in Pakistan (Tomato)
5.4. Stakeholders and their Role in Supply Chains of Fruits and Vegetables

To portray a vivid picture of the actors and their role a value chain mapping drawing a visual representation of the chain is presented in this section. It involves various linkages among the growers, inputs and logistical service providers, transporters, contractors, commission agents, wholesalers, retailers, and exporters. For presenting a true picture is described briefly along with presenting two case studies one on fruit mango and one for vegetable based on the latest information through direct contact with different stakeholders.

5.4.1 Inventory of Market Players of Fruits

The value chain map depicts the flow of fruit in the market, activities carried out at each stage of the value chain, the structure of actors and the support involved in the value adding process (Figure 5.3 and 5.4). This map consists of three elements: functions, operators and promoters. The people or enterprises performing the basic functions of a value chain are operators (also called actors). At one stage in the value chain, they become owners of the (raw, semi-processed or finished) product. Based on this definition, the fruits value chain actors can be grouped by the following functions:

**Production:** Actors whose functions are directly related to basic production fruits (mango) including pre-cultivation, cultivation, harvest, or extractive activities.

**Post harvest handling and processing:** Actors whose functions are directly related to post harvest management of fruits (cleaning, sorting, packaging, etc) or processing of basic goods into value added products.

**Trading:** Actors whose functions are related to buying and selling of the fruits

**VC promoters/supporters:** Value chain promoters/supporters are the associations, networks or organizations that provide support services and represent the common interests of the VC operators. They remain outsiders to the regular business process and restrict themselves to temporarily facilitating a chain upgrading strategy. Typical facilitation tasks include creating awareness, strategy building and co-ordination of support activities. Whereas the services offered by individual actors, organizations, or companies to the value chain, tangible (transport, machinery, storage, among others) or intangible (technical assistance, training, etc.), are known as (PHDEB).
As depicted in the map above, many mango growers in Pakistan act as integrated value chain operators and perform two or more functions. They often arrange farm inputs (chemical fertilizer, FYM, pesticide, etc) manage orchards, harvest the fruits, grade and pack them, and then assemble them and transport them to the wholesale market in case of self marketing.
5.4.1 An inventory of market players for Vegetables

The vegetable supply chain is almost similar in terms of market actors and their role as the stakeholders along the chain perform similar specialized roles for separate vegetables during their production cycle in each season. For understanding the clear picture, value chain mapping of tomato depicting the flow of tomato in the market and activities carried out at each stage of the value chain, the structure of actors and the support involved in the value adding process is presented in Figure 2.6.

Source: Developed by authors based on discussion with stakeholders and literature review

Fig. 5.4: Inventory of Vegetables Market players (Tomato)
5.5. Description of Fruits and Vegetables Chain Actors and their Functions

Fruits and vegetable supply chains are made up of different types of actors and exchange places. Actors are of two types. One refers to the organizers of the market who provided places, regulate the trade and administrate markets for fruits and vegetable circulation and other relates to market traders taking part in the fruits and vegetables circulation from farmers to consumers.

5.5.1. Organizers and managers of the market

Wholesale markets are being run by the association of commission agents having office bearers namely President and General Secretary. There is market committee and regulations in the wholesale markets. The products are sold to local shopkeepers and the contractors also purchase the produce to bring to the down country from these markets. Even the consumers may directly purchase from these markets sometimes (Sharif, 2011).

5.5.2. Primary Actors

Market traders are the main participant of who are directly involved in the business. Six types of market intermediaries are (primary actors – input suppliers, producers, contractors, commission agents, wholesalers, retailers, processor/exporters, and consumers). The brief description of primary actors, their activities, and functions is presented in Table 3.

Table 3: Primary actors, activities, and description

<table>
<thead>
<tr>
<th>Primary Actors</th>
<th>Activities/Functions</th>
<th>Description</th>
<th>Problems/Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Suppliers</td>
<td>Provide agro-inputs and</td>
<td>Input suppliers like seed, fertilizer, weedicide and pesticide are</td>
<td>Poor quality, timely non-availability and expensive inputs are major problems.</td>
</tr>
<tr>
<td></td>
<td>Advisory services</td>
<td>important partners for fruit and vegetable growers because they provide</td>
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<tr>
<td></td>
<td></td>
<td>these inputs for the success of production. This requires them to identify</td>
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<tr>
<td></td>
<td></td>
<td>the most appropriate agro-input products for these crops. Whenever</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>required, these dealers advise the farmers. Commission agents also provide</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>seed and fertilizer to farmers.</td>
<td></td>
</tr>
<tr>
<td>Nursery Developers/Seed</td>
<td>Produce fruit and</td>
<td>Public (limited level) and private sectors involved in the nursery raising</td>
<td>Most of the nurseries of the private sector and nursery grown by farmers are neither</td>
</tr>
<tr>
<td></td>
<td>vegetable seedlings/seed</td>
<td>business. Some growers also involved in the fruit and vegetable nursery</td>
<td>registered nor certified which resultantly lead to poor quality of fruits (mango)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>raising business.</td>
<td>plants resulting low productivity. Likewise poor quality of tomato seed leads to its</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>low quality and low productivity.</td>
</tr>
<tr>
<td>Primary Actors</td>
<td>Activities/Functions</td>
<td>Description</td>
<td>Problems/Constraints</td>
</tr>
<tr>
<td>-----------------</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Producers</td>
<td>Produce and in case of self marketing also harvest, grade, pack, bulk, (wholesale market).</td>
<td>There are two main categories of small and large farmers. Producer lack of information and knowledge for orchard/vegetable cultivation and management. Large farmers in general and small farmers particular are working in bad conditions.</td>
<td>Resultantly farmers face poor quality and low productivity of fruits and vegetables working conditions resulted low labor productivity.</td>
</tr>
<tr>
<td>Contractors</td>
<td>Harvest, bulk, Transport and sell</td>
<td>More than 90 percent contractors buy most of the fruits orchards from the producers before harvesting. Likewise, in some cases village beopari purchased vegetable produce from growers. Labor involved in harvesting of fruits and vegetables are facing poor working condition. Lack of skilled harvesters, collectors, packers and transporters for fruits and vegetables</td>
<td>Growers loose their share in profit resulting low income. Poor working condition of laborer working in harvesting of fruits mango results in low labor productivity. Resulted into high post-harvest losses in case of fruits and vegetables</td>
</tr>
<tr>
<td>Commission Agent</td>
<td>Sell produce on behalf of growers and contractors etc</td>
<td>Almost all the produce of fresh fruits and vegetables reached consumers through Commission Agent. Commission Agent has the pivotal role in the whole marketing system of Pakistan. He finances to growers, contractors beoparies, wholesalers and even retailers in the system. Due to his strong financial and entrepreneurial power, he exploits growers and wholesalers. Presently, the commission agents are charging at least double rate of commission as compared to that provided by law. He also works as trader in this way. He sells the produce of growers to himself. Thus, he arranges fake auctions and damages the interest of growers.</td>
<td>High rate of commission, exploitation of growers and wholesalers, fake auction, damage grower interest.</td>
</tr>
<tr>
<td>Wholesalers</td>
<td>Bulk, Transport, grade,</td>
<td>The wholesalers are based in the main fruit markets in big cities. Wholesalers are bulk brokers. They purchase from auction in bulk, grade it and divide it into small lots, which are purchased by retailers and some times by consumers.</td>
<td>Long chain result in profit distribution which decrease growers share in consumer rupees and high price for consumer.</td>
</tr>
<tr>
<td>Primary Actors</td>
<td>Activities/Functions</td>
<td>Description</td>
<td>Problems/Constraints</td>
</tr>
<tr>
<td>----------------</td>
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<td>-------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Retailers</td>
<td>Grade, Retail,</td>
<td>They are located in the local markets or at the street corners. In the rural areas, they source fruits and vegetables from producers or commission agents. They deal with a limited number of suppliers. In the urban areas, they buy from wholesalers.</td>
<td>Beside the above effects high prices are charged by retailers due to low volume of business and large number of retailers with low investment for infrastructure resulting quality concerns</td>
</tr>
<tr>
<td>Processors</td>
<td>Grade, maturate, process, distribute,</td>
<td>There are 25 processing units for mango and 120 citrus processing units where fruits are being purchased, transported, washed, waxed, graded, packed and exported. Labor involved in harvesting mango facing poor working condition. Limited investment made by processors in new productive technology. Some time supply shortage on product markets. The tomato processing industry is very few in number. Very limited share of fruits and is being processed.</td>
<td>Lack of investment in new productive technology. Lack of skilled labor and recruitment of youth resulted in supply shortages on product markets Low mango, and tomato productivity and their cheap pulp and paste from abroad resulted in low share of processing of these commodities.</td>
</tr>
<tr>
<td>Exporters</td>
<td>Bulk, link,</td>
<td>There are 6 mango exporters in Multan and 20 mango exporters in Karachi. There are 25 citrus exporters in Sargodha and 10 in Karachi. There is 1 alliance of 3 citrus processing enterprises in Sargodha who jointly purchased from growers, processed and exported. Poor product quality and poor packaging are observed. Fresh vegetables are being exported from Peshawar, Lahore and Karachi with no processing except for packaging and grading</td>
<td>Poor product quality and poor packaging resulted in low export prices.</td>
</tr>
</tbody>
</table>

5.5.3. Description of secondary actors involved and their functions

In the fruits and vegetable, there are various categories of supplementary service suppliers and different types of institutional support that define the business environment in Pakistan. The most important are governmental institutions, including: Ministry of National Food Security and Research (NFS&R), Pakistan Agricultural Research Council (PARC), Federal Seed Certification and Registration Department (FSC&RD), Mango Research Institutions Multan, Citrus Research Institute, Sargodha, Local Government, District Councils, University of Agriculture Faisalabad, Pakistan Horticultural Development and Export Board (PHDEB), National Accreditation for Agriculture and Food, Trade Development Authority of Pakistan (TDAP), Small and Medium Enterprises Development Authority (SMEDA),
Trading Corporation of Pakistan (TCP), Ayub Agricultural Research Institute, Faisalabad, Punjab Agriculture Department (Marketing Wing), Agricultural Policy Institute (API) and Department of Plant Protection. These government agencies offer a wide range of support to Fruits and Vegetables chains, including seed multiplication, research activities, private sector support, lobby and advocacy, legislatorial functions, policy development and districts / local level training and extension services. The second category of supportive institutions includes NGOs, Private Sector Horticultural associations and Donor supported programs that offer farm-to-market chain facilitators and integrators (MMA Ltd., 2011). Some of these government institutions and private sector play a crucial role in developing chain capabilities and chain management competencies in Pakistan. The brief description activities and functions of these actors are briefly presented in Table 5.2.

Table 4: Secondary actors, activities and description

<table>
<thead>
<tr>
<th>Secondary Actors</th>
<th>Activities/functions</th>
<th>Description</th>
<th>Problems/Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>R&amp;D institution</td>
<td>Conduct research and development of fruits and vegetables at national and provincial level</td>
<td>There is a horticulture section in almost all of the research establishments located in study areas of Punjab province. Mango, and tomato variety evaluation, agronomic trials, fruits nurseries, vegetable (including potatoes) farming are their major activities. Very limited new high yielding cultivars have been developed despite the fact that there are number of institutions for R&amp;D in the study area. The extension system in the study area remains ineffective, and whatever limited research and development work done is not properly transferred to end-users.</td>
<td>Limited research and development activity on horticultural sub-sector in the study area</td>
</tr>
<tr>
<td>Transportation</td>
<td>Transporting of fruits and vegetables from farm to market</td>
<td>Transportation facilities are available in almost all areas of country</td>
<td>Farm to market road infrastructure is poor</td>
</tr>
<tr>
<td>Market and communication</td>
<td>Information availability and market place</td>
<td>There are regular fruits and vegetable markets in country. These markets are linked with other provinces and terminal market at Karachi. All these markets are very well connected in case of communication.</td>
<td>Commission agents, traders, wholesalers and retailers exploit the horticultural producers and consumers. Due to lack of information for farmers</td>
</tr>
<tr>
<td>Secondary Actors</td>
<td>Activities/functions</td>
<td>Description</td>
<td>Problems/Constraints</td>
</tr>
<tr>
<td>------------------</td>
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<td>---------------------</td>
</tr>
<tr>
<td>Government policy</td>
<td>Efficient and profitable production in horticulture sub-sector</td>
<td>Government of Pakistan has prepared horticulture policy in 2007 with the vision of transformation of country’s horticulture into a vibrant, sustainable, market driven and export based industry. The main objectives are (i) achieve efficient and profitable production and marketing (ii) deliver appropriate quality and safe products in local and export markets (iii) enhance export competitiveness and value added (iv) develop an industry to be profitable for investors and operators.</td>
<td>Poor implementation of government policy for the promotion of horticulture sub-sector</td>
</tr>
</tbody>
</table>

| Regulatory policy | Implementation of regulatory policy | Current policy and regulatory framework for horticulture sub-sector is not functioning properly and creates hurdles in the horticultural development strategy. | Lack of quarantine check posts Limited legal framework of market pesticide Non compliance of WTO pesticide requirement and food safety standards |

6. Recent Technologies on Post-Harvest, Value Addition, Food Safety and Development of Information Management

Some of the constraints to proper postharvest management in developing countries are: inadequate information and skills in harvesting and postharvest handling, lack of appropriate and low-cost infrastructure, high transportation costs, and poor access of farmers to markets information limited access to financial resources discourage from adopting improved postharvest management techniques. There is a need to identify constraints particularly affecting them, develop suitable strategies for overcoming the constraints, and identify areas of regional and sub-regional cooperation to facilitate sharing of information, resources and produce for the benefit of farmers and consumers.

However, more recently attention towards R&D on post harvest and value addition of horticultural products has been increasing. Several organizations are now involved in post harvest and value addition. Value addition of horticultural commodities requires a strong post harvest support. Some initiatives in this direction include establishment of research centres and cooperative institutes for development, demonstration and transfer of technology to the stakeholders. The various measures adopted include development of infrastructure like farm to market roads, storage facilities, cool supply chain, cargo and shipment convenience, and marketing and export documentation. These steps including Global GAP and HACCP have to some extent helped to improve and maintain quality of horticultural produce. Grades and standards have also been introduced to compete in international market. Small farmers are the back-bone of South Asian Agriculture in general and horticulture in particular. In
Pakistan more than 80% farmers are small. In Pakistan fruits and vegetables are marketed traditionally without sorting and grading. Post harvest losses take place due to farmers’ small land holding, non availability of cold chain infrastructure and processing facilities in production catchments. The establishment of modern agro-processing industries requires appropriate and affordable cool storages and processing equipment and methods. GAP is emerging as the basis for a regulatory framework the world over and more so for producing for organized markets of developed countries. GAP requires information management in production and on-farm postharvest handling. This information management includes maintaining auditable records of all inputs and farming and produce handling practices as well as the times at which they were carried out. Without appropriate information management, small holder farmers cannot record the required information and, hence, cannot produce for and participate. There is lack of proper handling and lack of packing and grading facilities, especially in the production areas, to efficiently handle produce and preserve its quality after harvest, grading and packing procedures as per market requirements. High transport cost and Non-availability of refrigerated transport, forcing traders to use non-refrigerated open trucks for domestic market and non-refrigerated containers for export, resulting in reduced shelf life, high postharvest losses, deterioration of produce quality and lower prices in turn. Low yield together with poor quality make our horticultural enterprises less sustainable and uncompetitive, both in local and export markets. The feedback from industry clearly demonstrated that there is lack of technically skilled human resource, including technicians, supervisors and managers, and due to this reason industry is facing problems in operational management and maintenance throughout the supply chain including cold chain. High cost of packaging, processing and low processing recovery limited modern processing industry.

In Pakistan, processing of vegetables and fruits products is a viable and profitable business opportunity that is yet to be fully exploited. Currently growers are not familiar with latest processing techniques that can add value to the products and bring lot of foreign exchange through exports. So there is tremendous scope for introduction of agro food based common facility centers enables to minimize the post harvest losses. Introduction of such facility can increase the income of the growers and as well as exports from the country.

7. Quality Assurance System Including Regulatory Measures (Certification) in Fruits and Vegetables Supply Chain and Food Safety Issues that Causes Hazard for Public Health and the Environment

Fresh produce spoilage due to short shelf life often result in rapid decay and thus in product loss for human consumption. Accordingly, reduction of these losses, particularly if they can be avoided economically, would be of great significance for producers and consumers alike (Din et al, 2011). Safety issues are not only restricted to on-farm practices but also includes post harvest management practices regarding quality and safety concern. In international markets, produce price is determined on the basis of its market grade, which usually is based on its size, colour, and blemish percentage as well as internal quality criteria. Since the country does not have adequate packing, grading and cold storage facilities, the produce from Pakistan is often delivered in inferior and inconsistent quality resulting low export prices.
The supply chain for fresh fruits and vegetables has several links: production, harvesting, post-harvest treatments, packaging, transport and storage, each with its own contamination hazards and, depending on size of operations, of production and of processing systems in use. Safety assurance programs identify these hazards throughout the entire produce production and handling chain. It is hardly possible with the available quality of cold storages and the exporters had to do in transit, which limits export volume and increases cost. Other areas of immediate concern are packaging and traceability. Currently, fruits and vegetables are predominantly packed and exported in wooden crates, which are banned in many of the import markets. Further, traceability of produce is becoming a requirement under new export protocol, and in order to comply, proper packing facilities with electronic bar coding system is necessary.

Pure Food Ordinance 1960 and Pure Food Rules 1965 form the legislative framework of food safety in Pakistan are enforced through health service delivery channels of the provincial government. The Pakistan Standard Institute (PSI) with its Food and Agriculture Division develops standard for foods and food products. The PSI standards are voluntary standards and they indirectly complement the implementation of Pure Food Ordinance, which is mandatory regulatory framework for the entire country. The rules give authority to provincial governments to appoint public analysts for the investigation of quality and safety of food. There is no federal structure of food safety programme in Pakistan. Common food products like edible oils, biscuits, grapes, and bananas are enforced through Pure Food Ordinance 1960. Federal Ministry of Health monitors the quality on import and export of food products. The Agriculture Produce (Grading and Marking) Act 1937 is implemented by the Ministry of Agriculture. Some food products like marine products, oil cake, dry whole chillies, onions, potatoes, citrus fruits, mangoes and eggs are under mandatory certification scheme of national grade standard system.

Postharvest considerations like pre-cooling, hot water treatment, irradiation, ozonation, temperature and humidity control during storage and transportation (cool chain management) significantly affects the quality retention. Prevention of contamination is the most efficient way to ensure food safety and prevent food borne illness. Thus, every effort should be made to protect food from primary sources of contamination. Biological, chemical and physical hazards may therefore vary significantly from one type of production to another.

Pakistan is far behind with respect to having internationally accredited pesticide residues testing laboratories, although some initiatives, with the help of international organizations (UNIDO) have been taken in recent past. Pakistan has signed many regional and international trade agreements (Sanitary and Phytosanitary Agreements, Asia and Pacific Plant Protection Commission – APPPC, Convention on Biological Diversity – CBD, Cartagena Protocol on Biosafety, CODEX Alimentarius, Food and Agriculture Organization – FAO, International Plant Protection Convention – IPPC, International Code of Conduct on the Distribution and Use of Pesticides, Biosafety guidelines, Biosafety Rules, World Trade Organization – WTO, Technical Barriers to Trade – TBT, World Health Organization – WHO, International Standards Organization – ISO, Hazard Analysis and Critical Control Points – HACCP and Good Agricultural Practices – GAP). The obligations of these agreements need to be met, and there is a need of taking necessary steps. MRLs regulations for fresh produce as adopted by EU. Pakistan needs to work actively to meet food safety and quality compliance requirements. Setting-up standard food testing and inspection infrastructure, on priority basis, particularly in clusters with exporters is required.
Encouragement of such facilities to get accreditation from international agencies HACCP and Europe GAP certification should be done on priority basis Integrated Pest Management (IPM) should be promoted.

The overall picture regarding SPS management and the ability to comply with food safety and agricultural health requirements in export markets is one of generally low levels of capacity within both the public and private sectors in Pakistan. Establishment of GAP, GMP, GHP and HACCP programme including SPS measures could be effective tool to cover all aspects of growing, harvesting, packing, transportation, processing, distribution of fresh fruits and vegetables. Assistance from and collaboration between academic institutes, public health authorities, food control agencies, trade organizations and private sector in developing HACCP and GLOBALGAP system for fresh fruits and vegetables industry is necessary for sustainable production and to minimize potential hazards to health due to the contamination as well as to improve the export potential (Din et al, 2011).

8. Farm Level Production Costs, Prices, Value Addition and the Performance of Important Actors of Supply Chain of High Value Produces and Examine if there Is any Scope to Increase their Value added Activities.

An intensive work has been done on cost of production and market margin analysis for different players in different studies for many fruits and vegetables. The important literature on different commodities for different regions includes: on mango for Sindh, Pakistan by Khushk 1997; Siddiqui, 1977,1979; Memon, 1978; Khan, 1980, Khushk and Smith, 1996; Khushk 1997, on Guava produced in Sindh by Khushk et al., 2002, on Apple for Balochistan region by Khair et al. 2002 and Bashir et al. 2001, on Vegetable (tomato, onion, chillies) by Lashari et al., 2003 on Dates for Sindh province by Memon et al. 2003, and nation wide study on fruits an vegetables by Sharif 2011. However instead of presenting the market margin analysis for different fruits and vegetables the value chain analysis at different levels of supply chain for fruits and vegetables is developed based on the current work done by the social sciences team of NARC. The costs and profitability analysis has generated information on the economic viability of fruit and vegetables.

The analysis of the economic viability of fruits and vegetable (mango, and tomato) was carried out by calculating costs value chains and assessing their profitability. This starts from the bifurcation of cost including production, transaction and operational to profitability, value addition at different stages along the chains. Comparing the cost by different chains for farmers, it was highest in case of self marketing in the traditional chain of commission agent in the whole sale market mainly due to the high operational cost. The second case was also self marketing but in the vertical coordinating market directly to the processors/exporters. In this case operational cost was less than the whole sale marketing system but production cost was little high than the farmers working with the horizontal chain. However transaction cost was less due to few actors along the vertical coordination. The third case is the pre-harvest contract system which is main dominated practice at farm level, no operational cost for harvesting and post harvesting practices was involved at farmers’ level. The cost of production was almost similar to farmers doing self marketing while transaction cost was also lowest than the other two chains.
The cost of production was low under horizontal coordination with more operational cost as compared to vertical coordination in vegetables. The transaction cost was also low in vertical coordination resulting in low cost to the vegetable farmers selling their commodity directly to the processors. Looking at the higher per acre income from the vertical coordination between farmers and processor profitability it is necessary to promote this marketing channel an aim of moving the product smoothly from production to marketing through processing and value addition along the value chain that can ensure farmer level profitability.

Based on Discussion in participatory approach and mini consultation with market actors of mango and tomato the cost and value added at different level of the supply chain presented as under:

### 8.1 Profitability and Value Addition at different levels for Fruits (Mango)

Under the horizontal coordination (self marketing to whole sale market) the value addition by each actor and cost associated presented as share of the actor is presented below (Figure 8.1). Farmers bear the highest cost around 70% while get share of only 10 % generated throughout the chain. The lowest cost is born by the retailer with highest percentage in the profit.

**Fig. 8.1 Horizontal Coordination: Fruit Farmer » Commission Agents » Wholesalers » Retailers**

In vertical coordination the farmer sold their fruits directly to exporters/ Processor. As a case of mango selling price at farmer level was 30 per kg (Figure 5.2). Some interesting matters to note are as follows: In this value chain the value-added process occurred at high degree at the exporter 86 % and farmer 14 %. The farmer produced the highest value added as compare to other two chains at a value of Rs.30 per kg. The value added at farmer level was produced from the process of mango production and vertical coordination of farmer to exporter. This chain produced a total value added of Rs.128.70 per kg. During discussion it was found that total volume of this chain is less than one percent. There is dare need to increase the volume of this chain as this chain is more beneficial to the farmer and generate more value-added for them. In other fruits similar pattern of cost and value addition along with share of different stakeholders is prevailing in Pakistan.
In pre harvest system the farmer sold their fruits to the traditional contractor at pre-harvest stage. The selling price was generally stipulated on the basis of price negotiations with the contractor. The mango selling price at farmer level was 14.27 per kg (Figure 5.3). The contractors harvest the fruit sorting, grading, and packing and transport it to the local wholesale market. The expenses incurred by the contractors by doing harvesting, procurement and distribution activities. The mango selling price at the local retail market was Rs.45.40 kg (Figure 8.3). The local market retail bought the mangoes from the wholesale market at Rs.37.95 per kg. In this traditional value chain the value-added process occurred to any large degree at the retailer level followed by contractor, commission agent, wholesale, and farmer. (Figure 8.3). Some interesting matters to note are as follows: The farmer produced the lowest value added in the value chain 9 percent, at a value of Rs.14.27 per kg. This chain produced a total value added of Rs.71.35 per kg.

Fig. 8.3: Pre- Harvest contract Farmer » Contractors » Commission Agents » Wholesalers » Retailers

8.2 Profitability and Value Addition at different levels for Vegetables (Tomato)

The majority of the vegetable farmers used traditional supply chain of selling their vegetables in the fruits and vegetable wholesale markets through commission agents. Very little vertical coordination is found in vegetables mainly for tomato and potato. Therefore case of tomato is analyzed in detail.
In the horizontal coordination which is mainly prevailing in the country farmer sold their vegetables to the traditional wholesale market. In the traditional vegetable value chain the value-added process occurred to any large degree at farmer level followed by retailer level wholesale, and commission. Farmer also bear 87 % cost of the supply chain under consideration. As a case study of the tomato the chain produced a total value added of Rs.13.58 per kg. The share in cost and value addition of each actor is presented in Figure 5.4.

![Horizontal Coordination](image)

Fig. 8.4: Horizontal Coordination Farmer » Commission Agents » Wholesalers » Retailers

In case of vertical coordination the grower harvest vegetable and transport to factory. The expenses incurred by the farmers are production activities, harvesting, however farmers save packing and commission charges. In this chain farmer produced the lower value added but due to less marketing cost, earn more income per acre. In case of tomato this chain produced a total value added of Rs.47.73 per kg, which was the highest value added compared to other value chains. The value-added process occurred to any large degree at the processor level followed by wholesaler, retailer and farmer respectively.

![Vertical Coordination](image)

Fig. 8.5: Vertical Coordination Farmer » Processing factory » Product wholesalers » Retailers

### 8.3 Price Structure and Cost Drivers for Horizontal, Vertical and Pre-harvest Contract System

The price structure of the fruits and vegetables depends not only upon the system of supply chain through which the commodity moves but also a lot of price variability is observed during the production cycle particularly for the vegetables. In case of horizontal coordination in fruits the price depends upon the target market and upon the stage of the season. The price of the commodities varies considerably during the season for the same wholesale market. The price structure, in case of vertical coordination, is more constant with little variation but
are not unexpected as in case of horizontal coordination. Similarly in case of pre-harvest contact system the price of the output (per weight) basis remain almost similar in a production domain. The price determination depends upon the stage of the orchard, amount of advance payment, expected output determined by the condition of the orchard and bargaining between the producers and the contractor. In addition to it the price structure also depend upon the scale of production and business. Hence the price offered to large fruit growers is little high as compared to small farmer of almost similar other conditions and factors. This means that the traditional system of the wet market also favors the large farmers due to more bargaining power and scale of the business.

In case of fruits for which there is some degree of better processing the price fluctuation is less due to more established processing and vertical coordination through selling direct to the processing/export factories even in horizontal value chain. The price structure also depends upon the volume of export and supply orders particularly from the neighbouring countries like Iran and Afghanistan. In case of vertical coordination the price structure remain almost similar with less price fluctuation in the short run. Over the season price variation was observed in early, middle and late season. High price was observed in case of horizontal coordination but less operational/observable cost in case of vertical coordination resulting in higher returns in this case. As for as the pre-harvest contract system is concerned the price structure depends more on the first sale out in a vicinity and the fellow farmers price becomes a reference point. The important factors in fruits considered by the contractors are condition of orchard and the expected fruit bearing/production along with adjustments for the expected risks and advances paid to the farmers.

Little different supply chain arrangements prevailed in the vegetable value chain. Mainly self marketing in the horizontal and vertical coordination was found. The prices were determined by the target market, production stage and each vegetable production cycles of the other regions. The cost drivers are more complex than the price structure of the horticultural commodities for different systems of the supply chain. The production cost is the main element in all commodities under discussion for all the systems. There is little variation in production cost depending upon the scale of business and the characteristics of the farmers. In the production cost the cost of production inputs like fertilizer, pesticides and irrigation water (40-45%) followed by machinery (tractor) involved and the labor cost are the main drivers at production stage for all the commodities under discussion.

In the horizontal coordination in the value chain all post harvesting cost are born by the farmer. Under this system packing cost is the main cost (30-45%) followed by the commission (24-27%) transportation (4-6%). Under the vertical coordination system the labor charges in harvesting, sorting, packing and loading are the main costs as the other cost of packing material and commission are not paid by the farmer.

Main drivers of transaction cost in case of fruits depend upon the system of the product disposal. The information, negotiation and monitoring were the main drivers. However it was highest in case of horizontal coordination in the fruits followed by the vertical coordination. With the advancement in communication technology mainly visiting for negotiation was the main cost. In vegetable under horizontal coordination among the post harvest costs, packing cost share was around half of the total cost followed by the transportation cost (15-25%) and commission (10-15%). Under vertical coordination is the transportation cost is the main cost. Among the production inputs, fertilizer (10-18%) pesticide (8-12%), seed (9-13%) land preparation (7-11%) and irrigation (9-11%) were the
major cost drivers. The labor cost was one of the important factors in vegetable as compared to fruits and it ranges between 15-25%.

9. Identify Best Practices of Supply System in Supply Chain

To determine the best practices in terms of economic viability based on the profitability and returns to the farmers along with share in total value addition the analysis of the of cost and value addition for different supply chain system of fruits and vegetables under different supply value chains was conducted as described in section 5.

9.1. Effects of Vertical Coordination on Transaction Cost and Farm Profitability of Smallholders in Horticultural Value Chain

Overall positive effect of vertical coordination on farm profitability was observed for the two commodities under consideration (mango as a case for fruits and tomato as a case for vegetables) through lower transaction cost and observable post harvesting cost along with little higher productivity as compared to the horizontal coordination. When compared with all the three systems in fruits and two in vegetables the net benefits were found higher to the farmers vertically coordinated with the processing/export market. The increase profitability with better production was resulting with little higher production cost for quality product for the processors in vertical coordination. Quality production also require better management which ultimately is translated into better productivity. The transaction cost was also lower in this case as compared to horizontal coordination due to smaller chain of intermediaries. However the transaction cost was little bit higher in vertical coordination than the pre-harvest contract system. At present there are some issues of inclusiveness as reported by the small farmers that some preferential treatments were given to the large farmers and contractors due to large quantity of the produce as compared to small farmers in terms of prices offered and payments procedures. Hence there is need to develop a collective system of marketing for increasing bargaining power of the small farmers. The results for mango under different systems are presented in Table 5.

<table>
<thead>
<tr>
<th>Market</th>
<th>Gross Income (Rs/Ha)</th>
<th>cost (Rs./Ha)</th>
<th>Profit (Rs/Ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Horizontal Coordination</td>
<td>273214</td>
<td>140323</td>
<td>132890</td>
</tr>
<tr>
<td>Vertical Coordination</td>
<td>314237</td>
<td>125381</td>
<td>188857</td>
</tr>
<tr>
<td>Pre-harvest sale</td>
<td>140833</td>
<td>77128</td>
<td>63706</td>
</tr>
</tbody>
</table>

9.2. Identification of Stronger Forms of Integration that could Sustainable Improve Wellbeing of Smallholder Farmers in Horticultural Value Chains

The results depicted higher efficiency, productivity with lower cost of transaction and post harvest management along with more stable prices under the vertical coordination for farmers both in fruits and vegetables. Furthermore the risk due to price variability could be controlled through vertical coordination by developing a system of supply and demand from farm and market respectively. The formal sector with the development of processing and export sector could provide more competitive market in the fruits and vegetables. Overtime it
could be expected that the farmer in general and small holders in particular would be linked through vertical coordination. Furthermore the smallholders are leader in the fruits and vegetable production cycle and the demands could not be met without taking them into the loop. Above all there is higher value addition in the vertical coordination when farmers are direct linked with the processing/export industry. The resources generated through higher value addition could built the financial capacity of the farmers through backward linkages. This would increase the system efficiency and productivity increasing employment and income of the small farmers. Similarly the purpose of higher productivity for achieving the self sufficiency and surplus for foreign exchange earning is also achievable under vertical coordination as yield was reported high, reported in the section of profitability. The vertical coordination also develop competition for the other systems resulting in higher prices for the farmers. Keeping in view the above discussion and the results presented in this chapter it could be concluded that developing vertical coordination could sustainably improve the wellbeing of the smallholders in horticultural value chains. However the underdeveloped system of processing and less opportunities due to lower share in the global trade of fruits and vegetables commodities is hindering back the industry to develop vertical coordination in country.

10. Policy Interventions

Based on the above discussion and empirical evidences there is need to improve the value chain system of fruits and vegetables at each stage of the chain right from the input supply for quality and efficient production, distribution, processing and consumption. The improved market system improvement through developing a competitive markets may ensure producer and consumer welfare. Following policy interventions are suggested to enhance the participation of farmers in vertical coordination and development of the improved supply chain.

10.1. Promotion of commercial horticultural farming

In Pakistan the farming is small farm based as majority of the framers fall in the small farm category of less than 2 Ha resulting in small quantities of marketable surpluses. It is need of the time to make their small farmers viable for staying in high value agriculture business by transforming them from subsistence agriculture to sustainable commercial horticultural farms through specialized production.

10.2. Development of institutional linkages with farmers

Research and development efforts need to be directly farmer oriented through participatory research and development efforts. This would help in developing base for technology base development of the sector through: a) Introduction of GAP to bring the horticultural production in the area at par with WTO compliance; b) the production methods need to be changed to make it in line with both domestic and international market demands in order to achieve best prices of the farmers’ produce; c) facilitating faster adoption of high efficiency irrigation systems for sustainable natural resource conservation and it is now a vital input for growing high value agricultural commodities; d) it is suggested to integrate farmers with processors, value addition sectors and exporters in order to accrue maximum returns.
10.3. **Shift from commodity to product through private sector investment**

Keeping in view the role of private sector in the international system there is need that the public sector should facilitate the private sector lead investment and development of the markets and processing sector for export of fruits and vegetables through commodity to product development. For coping the WTO requirement and SPS measurements, there is need to encourage the public private partnership and private sector investment.

10.4. **Export friendly policy and regulatory framework**

Federal government should formulate export friendly policy to capture a due share in the international export so that demand driven development in the sector is possible. The sub-tears of the government like provincial and district governments should be responsible for managing extension activities, local marketing systems, monitoring of inputs and coordinating with line departments and governments.

10.5. **Market access and price system**

In addition to the above policy interventions there is need to develop demand based and service oriented competitive market environment with regulations for monopoly control at micro level. This would enhance market access and free entry for more players in the system. Fair price objective oriented system should be promoted at all levels through: a) promotion of environmentally safe production practices and packing material; b) facilitate stakeholders involved in horticulture business in getting credit from banks, other institutions on easy terms and conditions and as quickly as possible; c) establishment and development of modern wholesale markets, cold storage facilities, grading facilities in the production areas; and d) availability of technical expertise to the private sector for the preparation of feasibility of any business related activities of horticulture sector.

10.6. **Efficient and equitable fruits and vegetables value chains**

Value chains for fruits and vegetables are different from food grains. These are highly perishable commodities and there are issues of food safety both for domestic and international markets. There is a need to envision a complete agri-food system. Agricultural processors and retailers are scaling up very fast while farmers continue to be small and fragmented. The question of economic viability of small farmers arises which is answered by developing vertical coordination (domestically and globally) through efficient and equitable fruits and vegetables value chains development with respect to competitiveness, inclusiveness, scalability and sustainability to ensure fair prices to farmer and agribusiness to improve the income and livelihood of the chain actors.
11. References


GOP (Government of Pakistan) 2008 “Guidelines for Horticulture Financing” State Bank of Pakistan Agricultural Credit Department. www.sbp.org.pk

GOP(Government of Pakistan), 2009-10 “Agricultural Statistics of Pakistan” Ministry of Food, Agriculture & Livestock, Economic Wing, Islamabad

GOP(Government of Pakistan), 2009-10 “Fruits Vegetables and Condiments Statistics of Pakistan” Ministry of Food, Agriculture & Livestock, Economic Wing, Islamabad

GOP(Government of Pakistan), 2011-12 “Pakistan Economic Survey, 2011-12, Economic Adviser’s Wing, Finance Division, Islamabad


PHDEB, 2007. “Pre-feasibility study, establishment of cold chain system under, national trade corridor improvement project volume-I horticulture industry


Value Chain Analysis and Market Studies on Fruits and Vegetable in Sri Lanka

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Executive Summary

Fruits and vegetables processing, trading and marketing require some vital support of integrated value chain management system. Due to its perishable nature and more consistent application of quality standards, the organizations involved in business of these horticultural commodities have to face enormous quality problems. Therefore, this study basically aimed to analyze the emergence of new value chains i.e. supermarkets, marketing through co-operative societies, marketing of high value crops, which are created vegetable value chains different from existing traditional value chains and if so, to examine whether such alternative value chains are comparatively more efficient and effective. Fruit supply chain was considered separately. Value chains were selected purposively and the actors involved in a given value chain was chosen using the snowball sampling technique. The second purpose of this research study was to collect information regarding current processing practices and quality attributes applied. For this purpose, exploratory and qualitative information collected from large scale as well as small scale processors. Third and fourth objectives were to highlight recent post-harvest technologies developed and review cost of production of vegetables and fruits. Evidence suggests that the supermarkets are competing to adopt a range of management strategies to offer quality products, a wider choice, reduced wastage, greater value for money and shorter, but more effective value chains. Similarly, value chain on high value crops is more efficient and effective due to practice of buy back system which pays high price for crops, presence of quality consciousness low post harvest losses and many appealing factors. Farmers being risk averters they would not face risk at all within this channel. Further, the study reveals that marketing via fruit supplier is the most efficient and effective fruit supply chain. The emergence of more dynamic marketing channels that is more capable of satisfying both consumer and producer needs are of vital. Considering whole fruit and vegetable market system the most effective and efficient system is introduction of contract farming and forward–purchase mechanisms at the producer level.
1. Background

Vegetable sector

The vegetable sector occupies a prominent place in the Sri Lankan economy, which has a contribution of 20% to the agricultural GDP (Department of Census and Statistics, 2011). Main vegetables grown in Sri Lanka are classified into two main categories such as upcountry vegetables and low country vegetables. The upcountry vegetables are leeks, beans, cabbage, beetroot, carrot, cauliflower, lettuce etc., which are mainly cultivated in hilly areas located in the central part of the country. The low country vegetables are brinjal, ladies finger, bitter gourd, snake gourd, long bean, leafy vegetables, luffa, drumstick, capsicum, etc., which are mostly cultivated in low and paddy fields of low country areas. Entire local demand for the vegetables is met through local production. Only negligible share of vegetables has been imported to meet the special demand of tourist hotels. The cultivation extent was 81,993 ha (2010) under both types of vegetables of which 63 % of the area occupied under low country vegetables while 37 % of the total area was under up country vegetables. Total annual production in 2010 was 810,869 mt (@9.8 mt/ha). Contribution of low country vegetables to total production is around 53% while share of up country vegetables is around 47%. However, the productivity of low country vis-à-vis up country vegetables has no apparent difference where it was 10.4 mt/ha and 9.6 mt/ha respectively. Entire local demand for the vegetables is met through local production.

In terms of supply, the bulk of the fresh fruit and vegetables produced in the country are grown in the drier parts of Sri Lanka, which accounts for two-thirds of the country’s physical land area. This area typically produces “lowland”, hot climate fruits and vegetables. Because of its seasonal rainfall, fresh fruit and vegetable production in the dry zone is highly seasonal. On the other hand, in the wet zone, due to a more reliable rainfall intensity and distribution, a wider range of fruit and vegetables are cultivated on a year round basis. The central hills of the country, with their milder climatic conditions, produce temperate vegetables, typically known as “upland” vegetables, throughout the year (Abeysekara et. al.)

The vegetable sub-sector of Sri Lanka which provides livelihood to a large proportion of country’s poor has much potential to contribute to increase the level of national income, export revenue, generate new employment opportunities, increase farm income and enhance the nutrition and health of the people (Ceylon Chambers of commerce, 2011). Approximately 300,000 farm families depend on either directly or indirectly on vegetables for their livelihood.

Sri Lanka’s per capita consumption of vegetables remains below the required average daily intake. For example the recommended daily intake of vegetables is at least 200 g (WHO estimate), but an average Sri Lankan consumes only about 140 g per day (Department of Census and Statistics, 2010).

Fruit sector

Sri Lanka has 40 tropical, sub tropical and temperate fruit cultivars. At present average extent under fruit crops is 132,191 ha (Socio Economics and Planning Centre, 2011) of which 40%, 20% and 8% are under banana, mango and lime cultivation respectively. Total annual production of fruits in Sri Lanka is 604,725 mt. Most of this production is consumed locally and only about 2 percent is exported. Fresh fruit exports are mainly limited to banana,
pineapples, papaw, cashew nuts and mango. The export income from banana in 2010 is Rs. 213 millions which is the second most important fruit crop after cashew nuts. Export values of pineapple and papaw are Rs. 117 millions and Rs. 83 millions respectively. The commercial cultivation is reported only for few numbers of fruits such as banana, pineapple, papaw, passion fruit, cashew, lime and rambutan (*Nephelium lappaceum*). In the mean time those fruits arrive to the market from home gardens as well. Other fruit varieties such as mango, wood apple, guava, pomegranate, avocado, etc. are supplied mainly from home gardens. The demand for local fruits is met mainly through local production. However the local demands for certain fruits such as apples, oranges, grapes and dates are met through imports. High prices, lack of suitable commercial cultivars, availability of quality planting materials, seasonality of production, quantity and quality, high cost of air freight and poor marketing efficiency are the major concerns of the fruit sector.

According to Medical Research Institute (MRI) of Sri Lanka the daily per capita requirement of fruits for a balanced diet should be 30-40 g (edible portion), which is approximately equivalent to 25-40 kg fresh fruit per head per year. Recent statistics reveals that the per capita consumption of fruits per head per year is equal to 28 kg (Department of Census and Statistics, 2010).

**Constraints in marketing**

Agricultural marketing is a complex process comprises with series of services and functions involved in moving a product or commodity. In the process of movement of product from point of its production to final consumption various marketing functions are involved. One major constraint for vegetable marketing is high price fluctuations due to supply variations in off peak and peak harvesting periods.

Second most apparent problem is the pre-harvest practices and post harvest practices along the supply chains of fresh fruits and vegetables in Sri Lanka. This can be evident from the elaborating on the export market of Sri Lanka for fruits and vegetables. The quantity and value of the vegetables exported remained negligible (less than 3 percent) as compared to other main agricultural commodities. Export of fresh vegetables and fresh fruits remained at very low level. Banana was prominent among fresh fruit exports while gherkin preserved in vinegar/acetic acid and chilled cucumber are major processed types of vegetables in export. Moreover, both the export quantity and value of vegetables and fruits fluctuated over years.

The vegetable loss is estimated about 30 percent to 40 percent in the tropical countries (Desai and Salunkhe, 1996). This figure is debatable, which arrived from past literature however, a recent study conducted reveals that the post-harvest loss of up-country vegetables varies from 15 percent (Beans) to 27 percent (Leeks) of selected vegetables. The post-harvest loss of cabbage, tomato, carrot and beet-root is 25%, 24%, 22% and 21% respectively (Karunagoda et. al., 2011).

The seasonal nature of production and lack of infrastructure facilities and marketing facilities have significant effect on the extent of post-harvest losses of vegetables. Apparently techniques use in packing of vegetables is not suitable. Laws are enforced making compulsory the usage of plastic, wood or hard board crates for transport of vegetables and fruits under the statement of 10 (I) (b) (II) in the Consumer Affairs Act No 09 of 2003. However, the act was not able to function practically and the bulk of vegetables are still
transported using traditional methods. The market structure were not arranged accordingly, i.e. when farmers transport their products to Dedicated Economic Centers (DECs) by using their own plastic crates either they have to unload the vegetables from the crates and the wholesaler who buys the products have to repack into crates otherwise farmers are not receive their crates back. Even farmers receive their crates they have to incur transport cost to take them back. The law may be more fruitful if this method is practiced for the segmented markets where consumers are willing to pay higher price for high quality vegetables and fruits initially.

The establishment of regional wholesale markets known as DECs modified the marketing of vegetables. Currently, considerable volumes of vegetables are bought to regional wholesale markets which directly supply commodities to consuming areas. Involvement of people in various activities such as harvesting, sorting, grading, transportation and sale is apparent. The marketing channel consists of producers, collectors, transporters, wholesale and retail traders; exporters and consumers.

On the other hand market inefficiencies occurred due to the intermediary involvement throughout the supply chains and those are elaborated in the section on results and discussion.

2. Objectives

1. To review the current status of production, marketing system, market infrastructure, present post harvest management practices and value addition in fruits and vegetables.
2. To analyze the existing supply chains, identify the stakeholders, and their role in the supply chain of fruits and vegetables in Sri Lanka.
3. To highlight the recent technologies on post-harvest, value addition, food safety and development of information management.
4. To assess the quality assurance system including regulatory measures (certification) in fruits and vegetables supply chain and food safety issues that causes hazard for public health and the environment.
5. To analyze farm level production costs, prices, value addition and the performance of important actors of supply chain of high value produces and examine if there is any scope to increase their value added activities.
6. Identify best practices of supply system in Sri Lanka
7. To suggest policy intervention for improving supply chain, market access and thereby facilitating fair price to the farmers in order to promote high value produce based agribusiness and improve income and livelihood of the farmers.

3. Justification

In Sri Lanka fruit and vegetable sector is typically characterized by seasonality and subject to higher price fluctuations end up with price risks for producers and high price uncertainty for the consumers. Conventional fruit and vegetable chains comprises of multilayered and long marketing channels hence the role players are lack of quality conscious result poor quality at the retail end (Abeysekara et. al.,).
The post harvest losses of vegetable in Sri Lanka also has greatly hindered the overall growth of the vegetable industry in Sri Lanka adding considerable losses not only to the farmers but also to other actors of the vegetable value chain who share the risk created primarily by the highly perishable nature of vegetables. During the peak supply season, the fresh fruit and vegetable supply system typically records wastage of around 30 to 40 percent (HARTI, 2005). As a means of breaking away through dependence on the traditional export and prevailing wastage during glut periods, emphasis should be on preservation and processing technologies of fruits.

In Sri Lanka, vegetables and fruits are highly seasonal. Therefore, the price, supply and demand normally fluctuates throughout the year. Apart from that all the people involved above have an effect on the quality, price and demand of fruits and vegetables. They participate in order to obtain a better market value because even if they harvest a very high quality produce, after harvesting, the quality and the quantity of these fresh products decrease every day due to poor post-harvest practices and inadequate packaging. This requires sorting and removal of spoiled and badly damaged fruits and vegetables. This widens the price gap between the grower and the consumer.

After 33 years of civil war, Sri Lanka expands economically and consumers demand more, better and healthy food, a varied and substantial impact awaits for vegetable production and consumption, as well as the underlying fresh fruit market. The technological innovations cannot only boost both vegetable and fruit production and consumption in the country but the lessons learnt in managing the actors and role players can be incorporated in policy options to better off both the consumers and producers using win -win options.

### 4. Methodology

Analysis of “supply chain” is relatively similar to the analysis of “value chain”. The “value chain” describes the full range of activities which are required to bring a product or services from conception through the different phases of production delivery to final consumes and final disposal after use (Kaplinsky, 2000).

In order to understand the overall context of the vegetable and fruit sector in Sri Lanka, secondary data on extent, production, per capita consumption, requirement, prices, post harvest indices and recently developed technology on post harvest were obtained. Further, some relevant literature were collected regarding the supply chain, market studies which of them were published research, undergraduate studies and available on World Wide Web.

With the intention of guiding towards the exact directions of the study sector experts were interviewed specially on fruit sector vis-à-vis recent post harvest techniques and value addition etc. Information on the actors/role players in supply chains of fruit and vegetable supply chains were obtained from primary data using a semi structured questionnaire and observations. Five types of marketing channels were considered in the study.

1. Traditional marketing channel
2. Supermarket channel
3. Marketing via cooperative society
4. Marketing channel on high value crops (buy back system)
5. Supply chain of fruits considered separately.
Sri Lanka has two major traditional fruit and vegetable supply chains so-called “Colombo Manning Market” in the Colombo district which is the capital city in Sri Lanka and the other is the “Dambulla Dedicated Economic Centre (DDEC)” in Matale district. For this research the second supply chain in Dambulla was considered in order to analyze traditional market chain system. In order to assess new emergent for instance supermarkets; supermarket with larger number of outlets considered. For further elaboration on supermarket structure a recent study conducted by Perera, M. et. al., on “Analysis of vegetable supply chains of supermarkets in Sri Lanka” was used. Another new emergent marketing system via co-operative society was considered together with marketing channel on high value crops.

4.1 Sampling procedure

Fruit and vegetable supply chains to be analyzed were purposively selected. Actors involved in the supply chains were chosen to represent farmers, collectors, wholesalers, retailers, commission agents etc. Selection of actors in the supply chain was done using the “snowball sampling” method. Snowball sampling was used because it was considerably difficult to identify members of the desired population.

The steps involved in this technique are as follows.

1. Make a contact with one or two members in the population
2. Ask these members to identify some other members. Make contact with these new members.
3. Ask these new members to identify some more members and so on…..
   This process is continued until we obtain the required number of members into the sample.

Procedure adopted

1. Identified fruit/vegetable markets were visited and information about fruit/vegetable supply chains was obtained.
2. The structure of the fruit/vegetable supply chains were designed
3. A sample of actors involved in the supply chain was obtained using the “snowball technique”
4. Data analysis

4.2 Data analysis

With collected data structure of the supply chains were developed. The role play of each actor was identified. Following attributes which relates to efficiency and effectiveness of vegetable and fruit supply chain considered in selecting most viable supply chain.

i. Higher price paid to farmers
ii. Buy vegetables/fruits from small scale farmers
iii. Use of contracts (Formal/verbal) so, that the farmers are assured of a market
iv. Quality consciousness along the chain
v. Post harvest losses along the chain

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1 There are 12 Dedicated Economic Centers (DECs) in Sri Lanka. The setting up of Dedicated Economic Centers was started in 1998, as means of implementing marketing development strategy to provide marketing facilities for producers in the rural areas. Coordination and supervision of operation of all DECs are done by Ministry of Co-operative and Internal Trade.
vi. Number of intermediaries involved
vii. Nature and number of handling
viii. Efficient transport route taken, method of transport
ix. Flow of information along the chain
x. Use of upgrading activities
xi. Reasonable and affordable price paid by consumers
xii. High quality, safe products at the end of the chain
xiii. Less wastage and better keeping quality

5. Results and Discussion

5.1 Vegetable/fruit supply chain

5.1.1 Traditional supply chain

The traditional supply chain that go through the DDEC; The amount that passes through the Dambulla wholesale market is higher than the amount which passes through any other wholesale market. Approximate vegetable lorries reached to the DDEC per day range from 18 to 20 million mt (700-800 lorries per day) and 100 lorries of fruits.

Fig. 1: Traditional vegetable/fruit supply chain

Farmers-DDEC

This interface has very good relation over period based on the trustworthiness. The DDEC has around 150 boutiques consist of commission agents and most of the farmers go to
particular commission agent. Vegetables/fruits arrive in to the DDEC in two ways. Either farmer harvests their produce brings either by own or hired lorry and take them. This specially happens by the farmers live surrounding to Dambulla area for low country vegetables. Farmers who live far away from this area specially farmers in hill country transport their produce (up country vegetables) by transport agents/collectors to Dambulla. In the former routine, the farmer come with their produce unload at the commission agents shop wait until wholesalers arrival. Wholesaler and farmer come to a compromise in front of the commission agent with both parties concession the shop keeper weigh the produce keep his commission per kilogram and load the produce to wholesalers lorries. Farmers receive spot cash and the commission agent receives his commission. Packaging material usually for all vegetable types are poly sacks except for tomato it is wooden boxes.

Table 1: Commission agents’ commission

<table>
<thead>
<tr>
<th>If the price of the crop range between (per kg)</th>
<th>Commission per kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rs. 10</td>
<td>50 cents</td>
</tr>
<tr>
<td>Rs. 10-29</td>
<td>Rs. 1</td>
</tr>
<tr>
<td>Rs. 30-59</td>
<td>Rs. 2</td>
</tr>
<tr>
<td>Rs. 60-99</td>
<td>Rs. 3</td>
</tr>
<tr>
<td>Rs. 100</td>
<td>Rs. 5</td>
</tr>
</tbody>
</table>

Due to lack of quality consciousness and accountability, transporting agents overload the sacks of vegetables. This practice will eventually lead much of the vegetables being wasted as post-harvest losses at retailer's level.

Unlike vegetables, unloaded fruits at the commission agent sorts based on the size, ripeness/maturity and repack. Major fruit types that move through Dambulla supply chain are banana, papaw, mango, water melon, butter fruit and pineapple. In farmer transportation bunches of banana are covers with dried banana leaves while papaw, water melon, butter fruit and pineapple are transported as it is uncovered, mango are transported in cardboard cartons.

In the latter way mentioned hill country farmer sells their produce to collectors happens usually in Nuwara-Eliya district. Collectors directly go to farmer fields and state their price to farmers if farmers willing to sell, the collector harvest the crop and loads into their lorries for transportation. On the other way farmers come to road side with their harvest and the transport agents/collectors bargain with them and transport them either to Dambulla or Colombo.

**Major obstacles faced by the farmer-DDEC interface**

Neither quality signals nor price information are move to the farmer. In case of vegetable, sorting, grading practices are not done instead the wholesalers check the quality randomly. The major difficulty face by the farmers is sometime they have to wait the whole day till they receive a fair price. Since the majority of lorry loads arrives to the Dambulla market in the afternoon onwards and then they receives comparatively a low price. There is no appropriate solution for this as the long distance for transportation, specially up country vegetable lorries arrives in this time. Up country vegetable farmers are facing another problem as the collector does harvesting. Mostly they harvest only the amount that has reach to the proper maturity level and leave the remaining at the field.
Wholesaler-Retailer interface
Retailer pays farm-gate price and commission of the wholesaler and he keeps 20% to 50% margin. Retailers don’t have regular buyers and usually they grade and sort vegetables; i.e. removes outer leaves of cabbage, carrot by washing and removing remaining parts of leaves to obtain a good appearance, removal of leaves or part of leaves in leeks due to drying and yellowing, removal of pest damage beans etc. Post harvest losses at retailer level estimated in a recent study conducted by Karunagoda et al., in 2011 and accordingly the losses are mentioned in the parenthesis i.e. cabbage (59%), tomato (52%), beans (43%), carrot (41%), leeks (40%) and beet (37%).

5.1.2 Supermarket Channel
The analyzed supermarket channel comprise of large number of outlets all around Sri Lanka. The regional collecting centers convey the orders given by supermarket outlets to farmers and vegetable collectors. Workers at the regional vegetable collecting centers check and then buy the products with required quality and the reset are returned.

The supermarket does not adhere to quality standards stipulated by formal certificates. Instead they mostly concern quality parameters related to physical attributes like size, colour, texture, free of pest and diseases etc (Perera, M. et al., 2004). In comparison to the traditional supply chain price paid to farmers is higher in supermarket supply chain. In traditional supply chain price is just a matter of weight and they never get premium price for quality. In contrast quality signals are passed down to farmers/collectors in supermarket supply chain as they obtain price for the quality product. Farmers are present at the regional vegetable collecting centers there by higher transparency exists. On the other hand in Colombo wholesale market (Colombo manning market) has low transparency with absence of farmers the commission agents taken unjustifiable advantage (Rupasena, et al., 2001).
Major advantage of the supermarket channel is both price signals and quality signals (quality consciousness and accountability) are passed down to farmers and they get spot cash. However, situation is rather different for the case in up country vegetables as mentioned in traditional supply chain mostly the collector transport the vegetables/fruits to the regional collecting centre at Nuwara-Eliya. In this situation higher price offered by the supermarket retains with the collector and neither price signals nor quality signals are passed to the farmers. This problem exists due to the accessibility to the regional collecting centers is confined only by the farmers live surrounding areas. Further, supermarkets do not offer either formal or verbal contracts/orders to farmers or collectors instead farmers get order from the day prior to harvesting by the regional collecting centers.

Post harvest losses are negligible along the vegetable supply chain of the supermarket which is around 1 to 3 percent (Hettige and Senanayake, 1992; Rupasena et. al., 2001).

5.1.3 Marketing via cooperative society

It is a statutory body registered before the Commissioner of the Cooperative Development under the Cooperative Societies Act No. 05 of 1972 of the parliament. This is established with the aim of ensuring to buy farmers vegetables and offering them a better price other than apparent in traditional market. They have around 100 registered farmers and 55 of them are actively participating for the process. Farmer harvests their crop under the supervision of the field officers of the society. The orders receives by the supermarkets/hotels/exporters to the society distribute among the farmers and the farmers are paid after around one weeks time. Farmers receive a higher price than that of the traditional marketing channel which is around Rs. 5 to Rs.10 per kg. However, farmers are not bound to sell their produce to the society. If farmers do not have transportation facility the society transports vegetables by their own vehicles. The society has their own pack house the borrowed vegetables and high value crops are categorized and packed according to the quality parameters. Basically in the pack house they wash air dry and cut top edges of leaks, carrots and grade according to the size and repack. Slightly damaged and low in quality sell in to wholesale or retail market to a lower price.
Quality signals are passed down to the farmers. Transportation from farmers field to pack house and from pack house are done over night in order to avoid loss of quality happen in day time transportation. They use plastic crates in transporting vegetables to their buyers.

5.1.4 Marketing channel on high value crops (buy back system)

Protected Agriculture Entrepreneurs' Association was established in 1997 under the companies act no 17 of 1982 NA 1253. It promotes controlled environmental agriculture and offers a buy back system for farmers. There exists quality assurance, branding, packaging and storage of high value crops. They provide inputs such as fertilizer, agro chemicals, nets: insect proof nets/shade nets for very reasonable price other than market price and later deduct from their payments for the supply. This is an interest free facility. Moreover, they provide technical expertise, extension service and training programmes etc as per the farmer requirement. They deal with mainly with vegetable crops includes bell pepper, cucumber, broccoli, cauliflower, sweet corn, tomato, iceberg lettuce and cherry tomato etc.

![Fig. 4: Supply chain of high value crops](image-url)

Apparent feature in this supply chain is that the Association develops a cropping plan and the targets are distributed among the registered farmers. So there is formal contract agreement with farmer which states that they would purchase the set quantity for a pre-agreed price. Farmers being risk averters are willing to adopt this kind of production process. The farmers may not incur a loss as they are ensured to purchase the whole via this buy back system. Filed supervisors inspect the fields around once a week. While harvesting also they do inspections.

The Association receives orders from supermarkets, hotels and exporters. In case of supermarkets they transport vegetables to the pack house at Colombo then the pack house
distribute among the supermarket outlets. The Association has 2 freezer trucks for transportation. With any delay occurs to transport they have a cold room to store crops. Thus, the quality consciousness is prevalent throughout the supply chain. In their pack house they grade crops based physical characteristics and do packaging for some crops i.e. sweet corn, cherry tomato and transport in plastic crates only. Farmers are paid around one week's time. However, the Association receives their payments a bit delay mostly it takes 1 to 3 months occasionally the export agents evade payments.

5.2 Supply chain of fruits

![Supply chain of fruits](image)

**Fig. 5: Supply chain of fruits**

**Fruit collector**

Fruit collector collects the whole bulk from farmer and his labours' do harvesting. He has know how on grading, packaging thus well-informed with quality signals. Meanwhile he has built up rapport with the farmers over long period based on the trustworthiness. Packaging
type changes based on the fruit. Papaws are wrapped in papers and packed into cardboard boxes, bunches of banana covered with dried banana leaves and pineapple arrange in the lorry in an organized manner. Most of the large scale fruit collectors are lorry owners so they are not met with transport problem. Large scale fruit collectors transport fruit to the commission agents at the DEC's where as small scale collectors to middlemen at the village level market.

**Middlemen in the village level markets**

This is special markets prevailing in Sri Lanka not a retail kind but all middlemen and sellers gather in a spacious place with their fruits, vegetables, handmade food items, confectionery items and sometimes clothing materials for a one or two days per week in a village. Middlemen in the village level markets are usually obtaining fruits from small scale farmers. The middlemen pay the farmer the same price prevailing in the traditional supply chain or lower than that by using their bargaining power. Farmers take their own products into market by hired lorry, cart or their own tractor. Sometimes few farmers get together in transporting products. There exists a huge competition between the middlemen this system.

**Wholesaler**

Wholesaler-farmer interface is a sustainable interface which has a very strong relationship where most of the wholesalers have permanent suppliers. Wholesalers have their own lorry to transport the fruits and labours to handle the fruits carefully. The fruits are transported to all areas of the county. They collect fruits form different areas of the country due to seasonal availability. Their labours know about the areas and the time of harvesting. Purchasing managers of hotels and restaurants purchases fruits form the wholesalers as they possess larger stocks.

**Commission agent**

Fruit collectors bring their fruits to the commission agent. He grades them and supplies to supermarkets, hotels, hospitals and camps, retailer and directly to consumers. He keeps 10 % commission for the products he buys from fruit collectors and middlemen at village level. The interface of wholesaler-commission agent exists when there is a large stock at the wholesaler and at that situation the wholesaler brings excess fruits to the commission agent in his own vehicle. The interface of commission-agent retailer exists on geographical reasons and concentrated in surrounding areas of economic centers.

**Fruit supplier**

Fruit supplier directly buy fruits from small scale and well large scale farmers and capable of paying a higher price as he supply moves to supermarkets, hotels and restaurants where quality consciousness is high. The transparency in the transaction between the buyer and the farmer is high as he grades fruits at farm-gate. Fruit supplier is well established person and he has own transport facilities and skilled labours for harvesting, loading and unloading. Post harvest losses are comparatively low. Another attractive reason of this channel is fruit supplier provides credits to farmers based on their trustworthiness. Fruit supplier-farmer interface is based on the economic reasons.
Supermarket

The supermarket which has the largest number of outlets in Sri Lanka was considered for this supply chain. This supermarket is the only one in Sri Lanka which directly buys fruits and vegetables form the farmer. It has regional collecting centers. From the collecting centre fruits and vegetables are brought to the CPU. This is same type of supermarket considered in analysis supermarket supply chain under 4.2. Therefore, supermarket-famer interface has the exact context that already mention under the section. As the farmers are unable to meet the demand of the quality fruits they fill the rest of the gap by wholesalers and commission agents. The quality protects while storing and transporting as they strictly adopt the post-harvesting techniques.

Retailer

Retailer-farer interface prevail in between a village based farmer and village retailer. The transaction bulk is very low. When only the farmer has a small quantity of fruits he sells them to the retailer and the price receives buy the farmer is not reasonable because of the bargaining power of the retailer. Some retailers are roadside retailers where as some of them have their own fruits carts and walking along the lanes to directly sell fruits to consumers.

Consumer

Consumers usually buy fruits from retailers on the other hand consumers having high purchasing power go to supermarkets. They sometimes buy directly from the wholesalers and the price is higher than the wholesale price. Consumer-famer and consumer-commission agent interfaces exist due to geographical reasons.

5.3 Recent technologies on post-harvest

The relevant post-harvest technologies for fruits and vegetables developed by the Department of Agriculture and Institute of Post Harvest Technology in Sri Lanka are as follows.

i. Maturity indices
ii. Harvesting techniques
iii. Pack house operations (Sorting, grading, packing)
iv. Ripening techniques
v. Package for exports
vi. Post harvest disease control methods

5.3.1 Maturity indices and harvesting techniques of vegetables

Bitter Guard

− When the cultivation is 65 – 75 days aged, first harvest is picked.
− Well grown pods which are suitable for consumption are harvested 14 days after the flowering.
− Following the first harvesting, it can be done 10 – 14 times by 4 days interval.

Capsicum

− First harvest is taken 75 days after planting.
− Harvesting can be done by 7 days or 5 days interval. Pods can be harvested 7 – 10 times.
− Harvesting is carried under dry conditions avoiding rainy conditions.

**Winged Bean**
− Harvesting is started 90 – 110 days after planting.
− Since first harvesting, 40 – 45 days harvest can be taken.
− Immature fleshy pods should be plucked by 3 – 4 days intervals.

**Cabbage**
− Harvesting time varies according to the variety.
− Normally it is between 90 – 110 days.
− If the fruit is matured too much, it can be cracked.
− After removing damaged, pest attacked and diseased fruits and grading the fruits, they should be packed in a suitable package and sent to the market quickly.

**Beans**
− Harvesting is done after 45 days and after 60 days for bush beans and beans respectively.
− For consumption plucking should be done before pods get matured.
− By picking them by 4 days interval, the quality and the quantity of the harvest can be improved.
− Harvesting should be done without damaging the pods.
− For transportation, pods should be packed in well ventilated packages.

**Carrot**
− After 3 – 3 ½ months harvest can be taken.
− Harvested roots should be washed thoroughly, before send to the market.
− Post harvest losses can be minimized by sending them to market in bundles or in plastic crates carefully.

**Pumpkin**
− Harvesting is done when there is a starchy wax on the surface of the fruit.
− Well matured fruits can be stored 6 – 8 months in a dry place.
− Leeks:
− Harvesting is done after 4 – 4 ½ months after planting.
− After grading the harvest according to the size of plants, they should be sent to the market in well ventilated gunny bags.

**Tomato**
− 3 – 3 ½ months after planting, harvesting is done.
− Plucking is done when the green colour of the fruit starts turn yellow.
Okra
- The harvest is taken 50 -55 days after planting. 100 days is also possible.
- Immature pods should be picked.
- When arranging the harvest damaged pods should be removed.
- By using a sharp knife for picking them, the damage to the tree can be minimized.

Cucumber
- When the fruit gets yellow colour, it should be separated from the stalk using a knife.
- For salads, they should be harvested in the immature stage.

Potato
- When 80% of leaves turned yellow, harvesting is done.
- If a potato is touched with a pressure the peel is not removed, then potato is matured and suitable for harvesting.
- Damaged and diseased potatoes should be removed.

5.3.2 Maturity indices, harvesting techniques, packaging of fruits

Grapes
- Time of harvesting varies according to the variety.
- Israel blue: 3 – 3 ½ months after pruning
- Cardinal variety: 2 ½ - 3 months after pruning
- It is very important to restrict water supply in the ripening stage.
- Water supply should be stopped when the colour of grapes begins to change.
- Harvesting should be done when the whole bunch is ripened. After plucking, fruits will not ripe.
- Naturally generated ash contained on the fruits should not be removed.
- Harvesting is done in the morning.
- Damaged fruits in bunches should be removed before they are sent to the market.
- Graded bunches should be transported in boxes carefully.

Banana
- The time of harvesting varies according to the variety.
- Matured bunch of banana should be plucked in dry conditions avoiding rain.
- Two persons should be involved to cut a bunch of banana. When one person applies a cut on the banana stem, the other person should hold it using his shoulder.
- By keeping the bunch horizontally on dried banana leaves touching the ground can be avoided.
- To avoid mechanical damages to bunches, cushions can be applied to the bottom and sides of the lorry.
- By using polythene layers or Styrofoam layers between layers of banana bunches, rubbing them each other can be avoided.
- Transportation should be done using a well ventilated lorry.
− Developing temperature inside the lorry can be minimized by transporting them in the morning or at night,
− Bunches should be unloaded carefully.
− To maintain the external appearance they should be ripened quickly.

Mango
− Identification of the matured stage which is suitable to harvest is very important.
− For variety ‘Villard’, stage of fruit attaining pink colour near to red colour is decided as the matured stage.
− For other varieties one or more of below characteristics can be used to decide matured stage.
  • Elevated nature of the area around the stalk.
  • Losing the glossy nature of the peel.
  • Reduction of latex dropping, when the fruit is detached from stalk.
  • Matured fruits are sunken in water or submerged floated.
  • Fleshy fruit turns to yellow or orange colour.
  • Well developed fiber in the flesh of fruit.
− To minimize the damage caused by latex, harvesting should be done at the time of latex dropping is less i.e. 10.00 a.m. to 3.00 p.m.
− Developed picker should be used to harvest fruits.
− By detaching the fruit in the upper part of the stalk the amount of latex dropping can be minimized.
− By removing the stalk while holding the fruit down, the damage to fruit caused by contacting latex can be minimized.
− Fruits that are discoloured, having scars due to pest and mechanical damages, abnormal shaped and too small should be removed.
− Grading fruits as small, medium and large will result high price and minimized damage while transportation.
− By dipping fruits 3-5 minutes in hot water at 52 °C, anthracnose and decaying of point of stalk can be minimized.
− Hot water treatment (adding 1 ml of Ethereal per one litre of hot water) will help fruits maintain its good colour in ripening.
− Wooden boxes that can be kept one on another are suitable as packages.
− It is better to apply a cover on the bottom and sides of boxes and packing the fruits using their flat sides.
− For exportation fruits should be packed in one layer in cardboard boxes.
− Packed boxes should be transported carefully in well ventilated lorry.
− While transportation direct contact of sunlight and rain should be avoided.

Papaw
− For harvesting, 10% yellowing and 20 -25% yellowing are suitable for the fruits to be transported to distant markets and markets adjoining the cultivation respectively.
− Unless handpicked it is better to use a developed picker to minimize mechanical damages.
− At least 30% yellow colour of the peel should be gained to pick ‘Red Lady’ and ‘Rathna’ varieties.
− To minimize discolouration, picked fruits should be kept downward to avoid contacting latex on the outer cover.
− By washing the fruits latex and dirt can be removed.
− Fruits that are discoloured, having scars due to pest and mechanical damages, abnormal shaped, too small and too large should be removed.
− Grading fruits as small, medium and large will result high price and minimized damage while transportation.
− Wooden boxes and plastic baskets that can be kept one on another are suitable as packages.
− Damage caused by rubbing the fruits each other can be almost minimized by covering each fruit using paper.
− Covered fruits should be packed in one layer while keeping the stalk downward.

Avocado
− Picking is suitable in the morning after dew gets disappeared.
− It is possible to pick the fruit with the stalk by using a knife or a pair of scissors.
− By using a developed picker fruits can be picked with the stalk as well and mechanical damages can be minimized.
− By collecting Fruits of tall trees to a basket and sending down carefully, fruits without mechanical damages can be obtained.
− Leaving the end of the stalk on the fruit, excess part should be removed.
− Fruits that are discoloured, having scars due to pest and mechanical damages, abnormal shaped, too small and too large should be removed.
− If the fruits are not of one variety, they should be graded according to the size.
− This will result easy packing and high price for fruits.
− Wooden boxes and plastic baskets are suitable as packages.
− Exceeding 3 layers is not appropriate.
− It is better to apply a cover on the bottom and sides of boxes to minimize abrasion on fruits.
− Packed boxes should be transported carefully in well ventilated lorry.
− While transportation direct contact of sunlight and rain should be avoided.

Citrus
− After harvesting fruits will not ripe. Therefore they should be plucked after attaining maturity.
− Harvesting of un matured fruits will result fruits with low taste.
− One or more of below characteristics can be used to decide mature stage.
  • Enlarging the fruit
  • Dark green colour turns to light green colour.
  • Tenderness of the fruit
  • Increasing the amount of juice and attaining bright colour
− To minimize generating brown scars on the peel, harvesting should be done in the period of 10.00 a.m. to 3.00 p.m.
- Harvesting should be done with the stalk of fruit.
- Stalks of picked fruits should be cut short.
- Remaining several leaves on the stalk is not suitable.
- Fruits that are discolored, having scars due to pest and mechanical damages, abnormal shaped, too small and too large should be removed.
- Grading fruits as small, medium and large will result high price and minimized damage while transportation.
- Wooden boxes that can be kept one on another are suitable as packages.
- It is better to apply a cover on the bottom and sides of boxes and packing the fruits using their flat sides.
- Packed boxes should be transported carefully in well ventilated lorry.
- While transportation direct contact of sunlight and rain should be avoided.

5.3.3 Ripening Techniques

Ripening of fruits using chemicals has been a problem for Sri Lankan consumers in the recent past due to use of Calcium Carbide. The fruit sellers and vendors have abused calcium carbide to make fruits get ripe faster. The indiscriminate use leads to contaminate fruits with arsenic. This is directly affecting to the human health. Usage of Calcium Carbide for ripening of fruits was banned by the amended Food Control Act in 1993.

Current recommendation is for the ripening process is use of ethylene gas at an accurate rate. Dosage: One milliliter of sodium hydroxide or calcium hydroxide dissolved in one liter of water. One milliliter of ethereal should be added to this solution. The fruits should be ripened only by exposing them to the ethylene gas that emanates from that solution kept in a room. The time period of exposure should be 24 hours.

Ethereal could only be used to ripen fully grown banana, papaya, avocado, pears and mango. It has prohibited the use of chemical on fruits like orange, lime, mangosteen and wood apple.

5.3.4 Post harvest disease control in fruits

Mango

i. Anthracnose disease
   - Causal organism: *Colletotrichum gloeosporioides*

Control
   - Appropriate pruning in order to get better sunlight in to the canopy
   - Application of recommended fungicide before flower initiation and fruits at smaller age.
     - **Fungicide**
     - **Amount that dissolve in 10 l of water**
       - Mancozeb 80% WP 20g
       - Maneb 80 % WP 20g
       - Carbendazim 50% WP/Wb 7g
     - Dip harvested fruits in 52°C water up to 3-5 minutes.

ii. Stem end rot
   - Causal organism: *Botryodiplodia theobromae*
Control
- Appropriate pruning in order to get better sunlight in to the canopy
- Application of Mancozeb after flower initiation and before maturity of fruits.
- Harvest with proper maturity
- Application of recommended fungicide as per anthracnose disease.

**Banana**

i. Anthracnose disease  
   - Causal organism: *Colletotrichum musae*

Control  
- Maintain field sanitation  
- Minimize fruit injuries

ii. Crown rot disease  
   - Causal organism: *Colletotrichum musae, Fusarium spp, Botryodiplodia theobromae*

Control  
- Change water use for washing bunches frequently  
- Dilute 1 g of Bavistin fungicide in to water and coat the cut edge of the bunch.

**Papaw**

i. Anthracnose disease  
   - Causal organism: *Colletotrichum gloeosporioides*

Control  
- Field sanitation  
- Use fungicide as mentioned in control of anthracnose of mango

**Avocado**

i. Stem end rot  
   - Causal organism: *Laseodiplodia theobromae*

Control  
- Avoid removal of stem end while harvesting  
- Chemical control is not applicable

ii. Anthracnose disease  
   - Causal organism: *Colletotrichum gloeosporioides*

Control  
- Appropriate pruning in order to get better sunlight in to the canopy  
- Use fungicide as mentioned in control of anthracnose of mango before flower initiation and after fruit formation.
Citrus fruits

i. Stem end rot
   - Causal organism: *Penicillin*

Control
   - Avoid mechanical damages
   - Chemical control is not applicable

5.4 Value addition

As a means of breaking away from dependence on the traditional exports and prevailing wastage during glut periods, emphasis should be on preservation and processing technology of fruits.

The impact of the local fruit processing industry to the economy is significant while for vegetable it is negligible. Gherkin has contributed as the main part of the total processed vegetable exports which is around 8,000 mt in 2009 (Sri Lanka Customs, 2005-2009). Gherkin preserved by vinegar/acetic acid, chilled tomato and chilled cucumber are major processed types of vegetables used in export purposes (Appendix 1). Fresh and dried banana, dried lemon, prepared/preserved/dried pineapple, grape fruit juices, mixture of juices, dried mangoes are the forms of processed fruits use in exports. However, less than 3 percent of total production of fruits and vegetables undergo sort of fresh export and processed products.

Table 2: Processing possibilities of fruits

<table>
<thead>
<tr>
<th>Fruit type</th>
<th>Height of season</th>
<th>Processing Possibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Avocado</td>
<td>February - July</td>
<td>Spread</td>
</tr>
<tr>
<td>(<em>Persea Americana</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Anona</td>
<td>May – July</td>
<td>Frozen, Juice, Jam, Butter</td>
</tr>
<tr>
<td>(<em>Anona reticulata</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cashew</td>
<td>July - September</td>
<td>Wine</td>
</tr>
<tr>
<td>(<em>Anacadium Oxidentale</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Lime</td>
<td>September - November</td>
<td>Juice, Candied, Marmalade</td>
</tr>
<tr>
<td>(<em>Citrus aurantitolia</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mango</td>
<td>May – June</td>
<td>Juice, Jam, Preserve chutney, Marmalade</td>
</tr>
<tr>
<td>(<em>Maugitera indica</em>)</td>
<td></td>
<td>Candied in syrup</td>
</tr>
<tr>
<td>6. Papaya</td>
<td>December</td>
<td>Frozen, Pickle, Jam candied, Jelly, Marmalade, Preserve, Candied in syrup</td>
</tr>
<tr>
<td>(<em>Carica papaya</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Passion fruit</td>
<td>All year round 3 month cycle</td>
<td>Jelly, Frozen, Canned Juice</td>
</tr>
<tr>
<td>(<em>Passiflora foetida</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Pineapple</td>
<td>May – July</td>
<td>Preserve, Jam</td>
</tr>
<tr>
<td>(<em>Anana comosus</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Rambutan</td>
<td>August - October</td>
<td>Frozen, Jam, Crackers</td>
</tr>
<tr>
<td>(<em>Nephelium lappoem</em>)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Banana</td>
<td>All year round</td>
<td>Candied, Jam, Crackers</td>
</tr>
<tr>
<td>(<em>Musa sapiertu</em>)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministry of Agriculture and Food, 1982.
Box 1: Commercial methods of preservation

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canning</td>
<td>Fruit canning has been inexistence in Sri Lanka from more than four decades. Main item which was canned are plastic or metal cans are used. Mango, Passion fruit, Pineapple, Wood Apple, Papaya, Durian (Durio Spp.), Anoda (Annona muricata), Lime, Amberella (Spondias dulcis), Guava (Psidium guajava), Laulu (Pouteria campechiana), ripen jackfruit (Artocarpus heterophyllus)</td>
</tr>
<tr>
<td>Freezing</td>
<td>More suits for perishable food stuffs, freezing preserves natural colour, flavour, volatile components &amp; vitamin better than canning or dehydration.</td>
</tr>
<tr>
<td>Dehydration</td>
<td>This techniques has been practiced, even in pre-historic eras by our ancestors. The underline theory is reduction of moisture content. So that microbial activities are prevented.</td>
</tr>
<tr>
<td>Jelly</td>
<td>One of the most popular fruit by product. In Jelly manufactories it is important to obtain desirable colour flavour consistency clarity.</td>
</tr>
<tr>
<td>Jams &amp; Preserves</td>
<td>Whole or large pieces of fruit are used. Those are products which are made by looking fruits with sugar to a suitable amount with or without water.</td>
</tr>
<tr>
<td>Candied fruits</td>
<td>Old method of pre fruits Dehydration of fruit by osmotic pressure of the sugar solution is the theory behind.</td>
</tr>
<tr>
<td>Pickled fruits</td>
<td>Include large number of varieties depending on the type of ingredients used for processing.</td>
</tr>
<tr>
<td>Chutney</td>
<td>These shall be prepared from sound ripe raw or preserved fruits or a mix of fruits with salt spices &amp; various other ingredients.</td>
</tr>
<tr>
<td>Marmalade</td>
<td>Made mainly from citrus fruits alone or in combination with other fruits. It contains fruit particles &amp; peels suspended in Jelled fruit Juice.</td>
</tr>
<tr>
<td>Fruit butters</td>
<td>Made by mixing fruit pulp with sugar</td>
</tr>
<tr>
<td>Ready to drink fruit beverages</td>
<td>This fruit juice is considerably altered in composition.</td>
</tr>
<tr>
<td>Concentrated fruit</td>
<td>Water is reduced physical means from single strength fruit juice consultation</td>
</tr>
</tbody>
</table>

According to Dissanayake (1996) processors rely on two to three products in the production line on the sample collected by small, medium and large fruit processors in Sri Lanka. On his sample 25% of the processors solely depend on one product but it was found that they have a regular market for that particular product. The list of value added products under fruit processing industry in Sri Lanka according to the order from the highest preparation to lowest preparation is jam, cordial, sauce, chutney, dehydrated fruits, pickles, preserves and marmalade respectively. First four products in the order occupy more than 50% of production out of all sort of processing products.

Large scale processors only follow SLSI and other standards as they mostly deal with export market. Small and medium scale processors are reluctant to follow standards as they cannot compete with the large scale operators. Dehydrated fruits, cashew, canned fruits and concentrated fruit juices have high potential in export market. Accordingly, processors view more and new marketing channels and incentives are needed to promote international trade.
5.5 Food safety

5.5.1 Present legislation of food

Food laws regulated to protect consumer as well as genuine manufactures from unscrupulous traders. Specific legislation enacted in Sri Lanka on prevention of contamination of food was enacted in 1949 with the name of food & drugs Act. This has been replaced by the food Act No. 26 of 1980 with regulations given in food Act\(^2\) being cited as food regulations. But amendments were done in several occasions.

SLSI\(^3\) is an officially recognized certification body as it represents the Government of Sri Lanka.

Food safety assurance is one arena where SLSI provides certification services to the industry and commerce. They are conduction following systems certification which relates to food safety.

i. GMP Certification System

SLSI operates a GMP Certification Scheme to the food industry and services based on the Sri Lanka Standard on Code of practice for general principles of food hygiene (SLS 143). In case where a Sri Lanka Standard on code of practice for the industry or service concerned is available, that specific standard is also considered for granting certification in addition to SLS 143. Regular post certification inspections will be arranged by the SLSI to assess the effectiveness of GM practices.

ii. Hazard Analysis and Critical Control Point (HACCP) for food safety assurance

A certificate holder develops and maintains its food safety assurance programme based on the internationally accepted principles of ISO 22000 and SLS 1266. Having obtained HACCP certificate from the SLSI implies that chemical, physical and biological hazards encountered during production or processing of the food item, as applicable to the scope of certification are controlled to make the food safe for human consumption. Followings are some of the food and agriculture related industries that concern in HACCP system.

Industry sectors:
- Agriculture and farming
- Food production, processing and packaging concerns
- Food warehouse, storage, transport and distribution
- Food retailers, including major supermarkets
- Organic food industry
- Food preparation and processing

SLSI has obtained accreditation status from RvA which is the most renowned accreditation body in Netherlands for HACCP Certification Scheme as per SLS 1266:2005 and Food Safety Management System as per ISO 22000:2005 and also from Sri Lanka Accreditation Board.

\(^2\) FOOD ACT; an act to regulate and control the manufacture, importation, sale and distribution of food, to establish a food advisory committee, to repeal the food and drugs act (chapter 216) and to provide for matters connected therewith or incidental thereto.

\(^3\) http://www.slsi.lk/
SLSI Operates the HACCP scheme with competent and fully trained auditors. All the auditors are well qualified in auditing and having masters in Food Science and Microbiology.

iii. **ISO 14001- Environmental Management Systems (EMS) - Certification scheme**

EMS certification is a voluntary certification scheme of SLSI which supports the industry to comply with the requirements of the ISO 14001 standard and to demonstrate company's commitment to environmental protection. Under the accredited scope sectors Food products, beverages and tobaccos are included.

Other legislations which are applicable to the domestic trading and processing food are;

i. The Penal Code (1983) Amendment act, no. 16 of 2006- Law which prohibits the adulteration or sale of noxious articles of food and drink (code no's 265 and 266)

ii. The Consumer Protection Act (1979)\(^4\) which regulates food to be manufactures and sold not below specification standards.

iii. Food Control Act (1950): An act to make provision for the regulation and control of the distribution, transport and supply of food.

Apart from these Food Advisory Committee and International Standards (FAO/WHO standards) exists. The importer and exporter of food must be aware of the rules and regulations which are prevailing in different part of the world.

### 5.6 Cost of production and farm-gate prices

#### 5.6.1 Cost of production of vegetables

Cost of cultivation surveys are conducting by the Socio economics and Planning Centre of the Department of Agriculture season-wise in each year for major food crops. Cost of cultivation available for upcountry vegetables such as cabbage, carrot, tomato capsicum and pole bean under irrigated condition. Most of the farmers use hybrid varieties and the unit cost of production and per hectare cost is depicted in the Figure 6 and 7 respectively.

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\(^4\) An act to make provision for the regulation of internal trade; for the protection of the consumer; for the establishment of fair trade practices; for the amendment of the national prices commission law, no. 42 of 1975; for the repeal of the licensing of traders act, no. 62 of 1961; and for matters connected therewith or incidental thereto.
Net return is highest for capsicum and tomato in contrast with the cost of production (Fig. 7).

Cost of cultivation was estimated under the major components of labour, machinery and material. Vegetable production is a labour intensive activity and the share of labour cost of total cost ranges from 43% for pole bean to 65% for brinjal (Figure 8).

5.6.2 Cost of production of fruits

The Crop Enterprise Budget conducted by the Department of Agriculture includes benefit cost analysis of commercial cultivation of fruit crops adopting recommended technology. The latest economic information such as input quantities, costs, returns, benefit cost ratios and net present values have been estimated in this study. The B/C ratios are presented in the
Table 3. The highest B/C ratio occupies by dragon fruit. Yet, the dragon fruit supply to the local market is limited, and commands a high price of around Rs. 400 per kilogram. There is a demand for the fruit from hotels and internationally renowned for its therapeutic and nutritional value.

Table 3: Benefit/Cost ratios of fruit cultivation

<table>
<thead>
<tr>
<th>Type of fruit</th>
<th>Benefit/Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orange (Variety: Bibile Sweet)</td>
<td>3.59</td>
</tr>
<tr>
<td>Lime</td>
<td>2.25</td>
</tr>
<tr>
<td>Passion fruit</td>
<td>1.92</td>
</tr>
<tr>
<td>Pineapple</td>
<td>4.4</td>
</tr>
<tr>
<td>Papaya (Variety: Red lady)</td>
<td>1.3</td>
</tr>
<tr>
<td>Cashew</td>
<td>1.9</td>
</tr>
<tr>
<td>Pomegranate</td>
<td>6.6</td>
</tr>
<tr>
<td>Dragon fruit</td>
<td>16.74</td>
</tr>
<tr>
<td>Rambutan</td>
<td>5.9</td>
</tr>
<tr>
<td>Banana (Variety-Kolikuttu)</td>
<td>2.5</td>
</tr>
<tr>
<td>Banana (Variety-Ambul)</td>
<td>1.27</td>
</tr>
<tr>
<td>Banana (Variety-Ambon)</td>
<td>3.59</td>
</tr>
<tr>
<td>Banana (Variety-Seeeni)</td>
<td>1.34</td>
</tr>
<tr>
<td>Pears</td>
<td>5.98</td>
</tr>
<tr>
<td>Durain</td>
<td>5.3</td>
</tr>
</tbody>
</table>


5.6.3 Farm-gate prices of vegetables

Following paragraph describes vegetable movement/supply in to the market and price determination in Sri Lanka.

Because of the biological cycles of crops and weather conditions, vegetable production is seasonal and their market value is determined by supply and demand. At harvest, supply is at its peak and prices are low, as market supply weakens prices start to climb, reaching a peak when supply is lowest. Accordingly vegetable supply move in to the market in the months of March, April, May and in the months of September, October in the latter period of the year (Figures 9 and 10). During this glut periods there exists an apparent drop in either prices of producer, wholesale or retail. Withstand of rainy weather again discourage wholesalers to buy vegetables as it is of low quality and low durability of the vegetables, exposed to rain at harvesting. Another apparent issue of the excess supply of vegetables in the market is the tendency of cultivating crops which were received higher prices in the previous season.
Farmers have to sell produce at low prices and sometime to discharge them when there is excess supply. In the case of fruits such monthly variation is not apparent instead seasonal variation is observable.

6. **Conclusion**

**Traditional marketing channel**

This supply chain has several inefficiencies such as lack of quality consciousness, inadequate flow of information along the chain, poor small scale farmers have to comply with the commission agents as well the wholesaler who have the decision making power. However, the status of the traditional market channel through DECs is hardly changed accordance to its established nature over the period.
Supermarket channel

The supermarket channel with the largest number of outlets has given rise to an efficient and effective supply chain where the supermarket buys directly from the farmer and sells directly to the consumer, quality signals are passed throughout the supply chain, farmers offer with comparatively better price for high quality produce, minimum number of intermediaries are involved. Yet, benefits received by the farmers vary depending upon the conditions prevalent in the locality, they are not able to sell their total production, at the same time, the quantity moving along the supermarket supply chain is negligible in contrast with the quantity moving along the traditional supply chains.

Marketing via cooperative society

This system seems to be an emerging supply chain where farmers are ensured with buying their produce. Nevertheless, this is not very popular in all over in Sri Lanka.

Marketing channel on high value crops (buy back system)

This is an efficient and effective supply chain in contrast with the all other vegetable supply chains considered. Yet, this system is in practice only for high value crops. Farmers being risk averters they would not face risk at all in this channel.

Supply chain of fruits

Most efficient and effective supply chain of fruits is
Farmer-fruit supplier  - Retailer
- Supermarket/hotels and restaurant
- Consumer

Higher price offered to farmers, trustworthiness of buying fruits, quality consciousness, transparency in transactions, informal credit accessibility, easiness in transportation, low number of intermediaries are the major reasons for the effective and efficiency of this supply chain.

The emergence of more dynamic marketing channels that is more capable of satisfying both consumer and producer needs are of vital. Considering whole fruit and vegetable market system the most effective and efficient system is introduction of contract farming and forward-purchase mechanisms at the producer level. With the increase of number of outlets belonging to supermarket they would acquire economies of scale in order to acquire their own vegetable/fruit supply chain in order to satisfy both parties i.e. consumers and producers. This sort of system would enable to improvement of product quality while remaining very low post harvest losses.

A fair and equitable distribution of benefits for all potential participants calls for a better understanding of the economic and social dynamics of the changing supply chains. In order to maintain social benefits at higher levels policy makers are expected to develop suitable strategies while maintaining economic growth. Some of the key areas that can be addressed by the policy makers are as follows.

i. Adequate investment on research and development: Development of fruit and vegetable varieties considering the factors such as yield, pest resistance, consumer
acceptance, competent in terms of qualities required in export market and many other favorable characters.

ii. Development of techniques to make continuous production in order to overcome seasonality. In order to create new avenues of export market where Sri Lanka is lacking currently the barrier on off-season production have to overcome. Either use of high tech facility to ensure continuous supply or development of cold storage facility especially for fruits would be effective. It must be highlighted the fact that Sri Lanka has exposure to this cold stores concept in long ago and that past experiences were utter failures as most of the vegetables can be stored few days (2-3 days) even within a cold store. Thus, emphasis should be placed on vegetables and fruit types that can be store more duration and in order to achieve success through cold storage whole supply chain should be a re-arranged as a cold chain.

iii. Improve extension services to provide information to farmers so that they are fully aware of the opportunities as well as the most efficient techniques of production, crop establishment and management, transportation and storage.

iv. Awareness programmes on reduction of cost of production and post-harvest losses; High cost of production prevails due to cost of planting material, labour and improper use of chemicals. There exist a greater demand for organic vegetables recently which ensure better price for producer and healthy food for consumer. Adequate post-harvest techniques are developed by the Department of Agriculture, Industrial Technology Institute, and Institute of Post-Harvest Technology in Sri Lanka. The challenge is to make farmer aware on the developed techniques and provide them hands on experience.

v. Provide infrastructure facilities or public utilities to enhance efficiency specially in wholesale markets and retail markets

vi. Provide an enabling environment for small farmers to group together so that they can avail some of the economies of scale that larger farmers have when dealing with agents of the supermarkets and fruit processors.

vii. Awareness on quality control measures
Quality controls and food safety measures are strictly enforced in penetrating in to export markets. The acquisition of ISO, HACCP and other standards is expensive for local exporters of raw and processed fruits and vegetables. In order to increase the ability of the enterprises to penetrate industrialized markets availability proper awareness programmes has become vital.

viii. Promotion of testing and certification facility
This is not generally practice in usual supply chains instead use for exporting commodities only. However, most of these services are not available within Sri Lanka. Therefore the exporters depend on more expensive foreign sources for these services. The present laboratories and testing facilities are inadequate for this process still Sri Lanka Standards Institution, which is the government body dealing with quality standards and control aspect provide the facility. Thus, it is essential to develop standard laboratory facility.
7. References


## Appendix 1: Processed fruits and vegetable exports in Sri Lanka

<table>
<thead>
<tr>
<th>Fruits &amp; vegetable</th>
<th>2005 Qty (mt)</th>
<th>2005 Value (000' Rs.)</th>
<th>2006 Qty (mt)</th>
<th>2006 Value (000' Rs.)</th>
<th>2007 Qty (mt)</th>
<th>2007 Value (000' Rs.)</th>
<th>2008 Qty (mt)</th>
<th>2008 Value (000' Rs.)</th>
<th>2009 Qty (mt)</th>
<th>2009 Value (000' Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fruits</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana Fresh &amp; dried</td>
<td>31.46</td>
<td>937</td>
<td>46.58</td>
<td>15,534</td>
<td>48.88</td>
<td>14,835</td>
<td>25.51</td>
<td>12,509</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pineapple dried</td>
<td>434</td>
<td>67,715</td>
<td>251</td>
<td>104,823</td>
<td>216</td>
<td>114,448</td>
<td>334</td>
<td>220,484</td>
<td>84</td>
<td>55,072</td>
</tr>
<tr>
<td>Avocado dried</td>
<td>0.13</td>
<td>23</td>
<td>0.06</td>
<td>8</td>
<td>2.83</td>
<td>251</td>
<td>0.30</td>
<td>93</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Guavas dried</td>
<td>21.06</td>
<td>6,148</td>
<td>3.41</td>
<td>398</td>
<td>7.74</td>
<td>6,542</td>
<td>0.55</td>
<td>569</td>
<td>0.12</td>
<td>18</td>
</tr>
<tr>
<td>Mangoes dried</td>
<td>1.61</td>
<td>1,109</td>
<td>11.25</td>
<td>8,041</td>
<td>48.83</td>
<td>41,548</td>
<td>14.54</td>
<td>14,037</td>
<td>15.73</td>
<td>12,858</td>
</tr>
<tr>
<td>Mungoteen dried</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.05</td>
<td>6</td>
</tr>
<tr>
<td>Oranges dried</td>
<td>16.33</td>
<td>2,129</td>
<td>3.57</td>
<td>257</td>
<td>12.37</td>
<td>22,511</td>
<td>11.60</td>
<td>2,186</td>
<td>0.01</td>
<td>14</td>
</tr>
<tr>
<td>Mandarins dried</td>
<td>0.12</td>
<td>5</td>
<td>0.39</td>
<td>28</td>
<td>0.48</td>
<td>82</td>
<td>-</td>
<td>-</td>
<td>11.85</td>
<td>3,414</td>
</tr>
<tr>
<td>Grape fruits dried</td>
<td>0.03</td>
<td>23</td>
<td>0.14</td>
<td>31</td>
<td>0.06</td>
<td>47</td>
<td>9.24</td>
<td>1,584</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lemons dried</td>
<td>312</td>
<td>59,636</td>
<td>347</td>
<td>52,863</td>
<td>393</td>
<td>72,389</td>
<td>672</td>
<td>100,917</td>
<td>557</td>
<td>133,998</td>
</tr>
<tr>
<td>Grape dried</td>
<td>2.28</td>
<td>259</td>
<td>0.12</td>
<td>82</td>
<td>0.60</td>
<td>579</td>
<td>0.20</td>
<td>23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pineapple prepared/preserved</td>
<td>103</td>
<td>1,018</td>
<td>159</td>
<td>36,797</td>
<td>134</td>
<td>40,430</td>
<td>459</td>
<td>111,995</td>
<td>394</td>
<td>97,181</td>
</tr>
<tr>
<td>Avocado prepared/preserved</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>27.67</td>
<td>6,671</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mangoes prepared/preserved</td>
<td>5.35</td>
<td>1,196</td>
<td></td>
<td></td>
<td>26.06</td>
<td>9,972</td>
<td>18.96</td>
<td>6,042</td>
<td>27.68</td>
<td>6,027</td>
</tr>
<tr>
<td>Other fruits prepared/preserved</td>
<td>52.84</td>
<td>10,702</td>
<td></td>
<td></td>
<td>163.74</td>
<td>33,254</td>
<td>116.78</td>
<td>36,951</td>
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<td></td>
</tr>
<tr>
<td>Oranges juice</td>
<td>0.00</td>
<td>64</td>
<td>2.62</td>
<td>958</td>
<td>20.16</td>
<td>5,811</td>
<td>1.84</td>
<td>738</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other juice</td>
<td>4.88</td>
<td>1,113</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passion juices</td>
<td>25.02</td>
<td>5,935</td>
<td>18.07</td>
<td>4,404</td>
<td>21.14</td>
<td>8,745</td>
<td>22.03</td>
<td>8,155</td>
<td>3.22</td>
<td>976</td>
</tr>
<tr>
<td>Other juice</td>
<td>227</td>
<td>27,100</td>
<td></td>
<td></td>
<td>277</td>
<td>39,931</td>
<td>163</td>
<td>33,525</td>
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<tr>
<td>Grapes Fruit juices</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6.54</td>
<td>398</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pineapple juices</td>
<td>4.14</td>
<td>615</td>
<td>2.36</td>
<td>314</td>
<td>1.15</td>
<td>174</td>
<td>8.35</td>
<td>1,554</td>
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<tr>
<td>Tomato juice</td>
<td>0.12</td>
<td>71</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Mixture of juices</td>
<td>206</td>
<td>112,937</td>
<td></td>
<td></td>
<td>183</td>
<td>45,200</td>
<td>148</td>
<td>69,237</td>
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<td></td>
</tr>
<tr>
<td>Processed fruits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.63</td>
<td>715</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruits &amp; vegetable</td>
<td>Qty (mt)</td>
<td>Value (000' Rs.)</td>
<td>Qty (mt)</td>
<td>Value (000' Rs.)</td>
<td>Qty (mt)</td>
<td>Value (000' Rs.)</td>
<td>Qty (mt)</td>
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</tr>
<tr>
<td>Vegetable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber preserved by vinegar/acetic acid</td>
<td>0.40</td>
<td>377</td>
<td>0.14</td>
<td>21</td>
<td>38.39</td>
<td>2,645</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gherkins preserved by vinegar/acetic acid</td>
<td>5,407</td>
<td>531,529</td>
<td>5,710</td>
<td>568,920</td>
<td>5,725</td>
<td>612,806</td>
<td>8,363</td>
<td>836,323</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomato fresh or chilled</td>
<td>2.33</td>
<td>210</td>
<td>9.72</td>
<td>1,078</td>
<td>16.95</td>
<td>2,251</td>
<td>10.19</td>
<td>1,280</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber fresh or chilled</td>
<td>1.20</td>
<td>68</td>
<td>2.71</td>
<td>326</td>
<td>1.17</td>
<td>216</td>
<td>6.79</td>
<td>1,673</td>
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</tr>
<tr>
<td>Gherkins fresh or chilled</td>
<td>5,198</td>
<td>384,098</td>
<td>0.04</td>
<td>14</td>
<td>10.50</td>
<td>4,739</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beans cooked</td>
<td>-</td>
<td>-</td>
<td>0.54</td>
<td>35</td>
<td>7.47</td>
<td>366</td>
<td>0.67</td>
<td>1,112</td>
<td>0.80</td>
<td>88</td>
</tr>
<tr>
<td>Total processed fruits</td>
<td>1,410</td>
<td>296,853</td>
<td>869</td>
<td>217,558</td>
<td>931</td>
<td>338,707</td>
<td>2,221</td>
<td>601,488</td>
<td>1,556</td>
<td>463,363</td>
</tr>
<tr>
<td>Total processed vegetables</td>
<td>5,200</td>
<td>384,166</td>
<td>5,413</td>
<td>532,491</td>
<td>5,739</td>
<td>575,318</td>
<td>5,749</td>
<td>617,863</td>
<td>8,412</td>
<td>840,336</td>
</tr>
</tbody>
</table>

*Source: Sri Lanka Customs, 2005-2009.*
Regional Consultation Meeting on “Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

Dates: 13-14 August 2012  
Venue: In-service Training Institute, Gannoruwa, Sri Lanka

Jointly organized by SAARC Agriculture Centre (SAC), Dhaka, Bangladesh & Department of Agriculture, Peradeniya, Sri Lanka

**Day-1: 13 August, 2012 (Monday)**

<table>
<thead>
<tr>
<th>Time (Hrs)</th>
<th>INAUGRAL SESSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>08.30-9.00</td>
<td>Registration</td>
</tr>
<tr>
<td>9.00</td>
<td>National anthem</td>
</tr>
<tr>
<td>9.05</td>
<td>Lighting of Oil Lamp</td>
</tr>
<tr>
<td>9.10</td>
<td>Welcome address by Mr. K.G. Sriyapala, Director General, Department of Agriculture, Peradeniya, Sri Lanka</td>
</tr>
<tr>
<td>9.20</td>
<td>Brief Introduction about SAARC Agriculture Centre by Nasrin Akter, SAC, Bangladesh</td>
</tr>
<tr>
<td>9.30</td>
<td>Remarks by Dr. Hemal Fonseka, GB Member of SAC for Sri Lanka</td>
</tr>
<tr>
<td>9.50</td>
<td>Remarks by the Mr. V. Krishnamoorthy, DG, SAARC Division, Ministry of External Affairs</td>
</tr>
<tr>
<td>10.00</td>
<td>Remarks by the Secretary, Ministry of Agriculture, Mr. W. Sakalasooriya</td>
</tr>
<tr>
<td>10.20</td>
<td>Keynote Address –Ms. Janaki Kuruppu, Advisor to the President on food Security</td>
</tr>
<tr>
<td>10.30</td>
<td>Vote of thanks</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time (Hrs)</th>
<th>TECHNICAL SESSION I</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.45-11.00</td>
<td>Refreshment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time</th>
<th>Chairperson</th>
<th>Rapporteurs</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.00-13.30</td>
<td>Dr. Ms. Manel Dassanayake, Deputy Director General</td>
<td>JMPN Anuradha and P. Malathy</td>
</tr>
<tr>
<td>11.00</td>
<td>Ms. Nasrin Aktar- Objectives and Guidelines</td>
<td></td>
</tr>
<tr>
<td>11.15</td>
<td>Dr. P. G. Chengappa, National Professor of ICAR Karnataka, India</td>
<td></td>
</tr>
<tr>
<td>11.35</td>
<td>Dr. M. Saleh Ahmed, Postharvest Management Expert, Hortex Foundation, Bangladesh</td>
<td></td>
</tr>
<tr>
<td>11.50</td>
<td>Ms. Pema Yuden, DAMC, Ministry of Agriculture and Forests, Thimphu, Bhutan</td>
<td></td>
</tr>
<tr>
<td>12.10</td>
<td>Dr. Bishnu Datta Awasthi, Deputy Director General Department of Agriculture, Hariharbhawan, Lalitpur, Nepal</td>
<td></td>
</tr>
<tr>
<td>12.30</td>
<td>Mr. Waqar Akhtar, Scientific Officer, Social Sciences Research Institute, NARC, Islamabad, Pakistan</td>
<td></td>
</tr>
<tr>
<td>12.50</td>
<td>Ms. V.D. Nirusha Ayoni, Socio Economics and Planning Centre, Department of Agriculture, Peradeniya, Sri Lanka</td>
<td></td>
</tr>
<tr>
<td>13.10</td>
<td>Discussion on the papers presented and Chairman’s Remarks</td>
<td></td>
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</tbody>
</table>

13.30-14.30 Lunch
### TECHNICAL SESSION II

<table>
<thead>
<tr>
<th>Time</th>
<th>Speaker/Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.30</td>
<td><strong>Chairman</strong>: Mr. KB Wahundeniya, Director, HORDI</td>
</tr>
<tr>
<td>14.30</td>
<td>Present Status, Issues and Future Trends in Fruit and Vegetable Handling, Distribution and Marketing in Sri Lanka <strong>Prof. Nimal Dharmasena</strong> Dept. of Agric. Engineering, Fac. of Agriculture, University of Peradeniya</td>
</tr>
<tr>
<td>14.50</td>
<td>A comparative study on Value Chains of Bangladesh and Sri Lanka by <strong>Mr. JMPN Anuradha</strong>, Lecturer, Dept. of Agric. Extension, Fac. of Agriculture, University of Peradeniya</td>
</tr>
<tr>
<td>15.10</td>
<td>THE TRIPPLE DELIGHT&quot;- The Cargills Model Produce Supply Chain <strong>Mr.Haridas Fernando</strong>, Cargills</td>
</tr>
<tr>
<td>15.30</td>
<td>Value chain of Pineapple and Banana in Sri Lanka by <strong>Ms. Chitra Haturusinghe</strong>, Research Fellow, HARTI</td>
</tr>
<tr>
<td>16.10</td>
<td>Discussion on the papers presented and Remarks by the Chairperson</td>
</tr>
<tr>
<td>16.30</td>
<td><strong>Tea</strong></td>
</tr>
<tr>
<td>16.45-19.00</td>
<td><strong>Free time</strong></td>
</tr>
<tr>
<td>19.00</td>
<td><strong>Workshop Dinner</strong></td>
</tr>
</tbody>
</table>

**Day-2: August 14, 2012 (Tuesday)**

<table>
<thead>
<tr>
<th>Time</th>
<th>Thematic Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>09.00-10.00</td>
<td><strong>Chairman</strong>: Prof. Buddhi Marambe&lt;br&gt;<strong>Co-Chairman</strong>: Dr. Hemal Fonseka&lt;br&gt;<strong>Rapporteurs</strong>: Ms. Nasrin Akter, Mr. JMPN Anurdha, P. Malthy</td>
</tr>
<tr>
<td>09.00</td>
<td>Introduction of Group Work by the Chairman</td>
</tr>
<tr>
<td>09.10-09.30</td>
<td><strong>Group 1</strong>: Research Issues&lt;br&gt;<strong>Group 2</strong>: Extension and Development issues&lt;br&gt;<strong>Group 3</strong>: Policy Issues</td>
</tr>
<tr>
<td>09.50-10.00</td>
<td><strong>Tea</strong></td>
</tr>
<tr>
<td>10.00-11.00</td>
<td><strong>Presentation and discussion on Thematic Group Reports</strong>&lt;br&gt;<strong>Chairman</strong>: Prof. Buddhi Marambe&lt;br&gt;<strong>Co-Chairman</strong>: Dr. Hemal Fonseka&lt;br&gt;<strong>Rapporteurs</strong>: Ms. Nasrin Akter, Mr. JMPN Anurdha, P. Malthy</td>
</tr>
<tr>
<td>10.00</td>
<td><strong>Group -1 (15 minutes for presentation and 15 minutes for discussion)</strong></td>
</tr>
<tr>
<td>10.15</td>
<td><strong>Group -2 (15 minutes for presentation and 15 minutes for discussion)</strong></td>
</tr>
<tr>
<td>10.30</td>
<td><strong>Group -3 (15 minutes for presentation and 15 minutes for discussion)</strong></td>
</tr>
<tr>
<td>11.00</td>
<td>Remarks by the Co-Chairman and Chairman</td>
</tr>
</tbody>
</table>

### CONCLUDING SESSION

<table>
<thead>
<tr>
<th>Time</th>
<th><strong>Chief Guest</strong>: Director General of agriculture&lt;br&gt;<strong>Chairman</strong>: Dr. Hemal Fonseka</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.30-12.00</td>
<td><strong>Presentation of draft Workshop Recommendations by Ms. Nasrin Aktar</strong></td>
</tr>
<tr>
<td>11.45</td>
<td>Remarks by the Chairman</td>
</tr>
<tr>
<td>12.00</td>
<td>Remarks by the Chief Guest</td>
</tr>
<tr>
<td>12.20</td>
<td>Distribution of Certificates and Memento</td>
</tr>
<tr>
<td>12.40</td>
<td>Vote of Thanks by Ms. Nasrin Aktar</td>
</tr>
<tr>
<td>13.00-14.00</td>
<td><strong>Lunch</strong></td>
</tr>
</tbody>
</table>

A field excursion at Nuwaraeliya/ Bandarawela in hill country with lunch and dinner
Regional Consultation Meeting on Value Chain Analysis and Market Studies on Fruits and Vegetables in SAARC Countries
13-14 August 2012, In-Service Training Institute, Gannoruwa, Peradeniya, Sri Lanka

Jointly Organized by SAARC Agriculture Centre (SAC), Bangladesh & Department of Agriculture, Sri Lanka
Value Chain Analysis and Market Studies on Fruits and Vegetable in SAARC Member Countries

Regional Consultation Meeting on
Value Chain Analysis and Market Studies on Fruits and Vegetables in SAARC Countries

Date: 28-29 August 2009
Venue: The WWF Office, New Delhi