Study on the Roles and Opportunities for Private Sector in Agro-food Processing Industry of Bangladesh

For
Agri-Business for Trade Competitiveness (ATC-P) branded as Katalyst

Submitted by
Innovision Consulting Private Limited
Research | Technical Assistance | Project Management

20 October 2016

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Research | Technical Assistance | Project Management

KATALYST

In partnership with

Implemented by
swisscontact

Funded by
UKaid
Swiss Agency for Development and Cooperation SDC
DANIDA

Acknowledgement

We thank Katalyst for commissioning the work to us and for extending the support to design, manage and deliver this study.

We express our gratitude to Mr. G B Banjara, Head of Sectors, for his guidance on the objectives and scope of the study and for providing valuable feedback on the draft findings from the field.

Ms. Mehjabin Ahmed, Manager, Sector Portfolio Division, Katalyst, led the study team from the front by providing inputs on the requirements of Katalyst and the feedback on the sector selection process. We acknowledge her contribution.

We specially thank Mr. Istiaque Chowdhury from the vegetables sector team and Ms. Mashiat Chowdhury from the capitalization team for their contribution to the review of the report and for their coordination and management support.

We sincerely acknowledge the contribution from the respondents which include the agro processors, farmers, traders, officials from the government agencies and experts working for the development of the agro-processing subsectors in Bangladesh for providing us valuable information and data during our field assessments.

Foreword

The Agro Processing sector in Bangladesh is currently valued at USD 2.2 Billion. Between the fiscal years 2004-2005 and 2010-2011, it has grown annually at an average rate of 7.7%. With the rapidly growing current middle class population of over 30 million, the food processing sector in Bangladesh is expected to grow in the future.

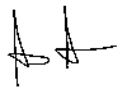
Despite the growth trends, the contribution of the food manufacturing or food processing industry in Bangladesh has remained mostly static at around 2% of the GDP since 2004-2005. This indicates that the growth achieved in agro-food processing is only at par with the economic growth of Bangladesh and the sector has further potential.

Agri-business for Trade Competitiveness Project (ATC-P), known as Katalyst, is a market development project that aims to contribute to increased income for poor men and women in rural areas, thereby contributing to sustainable poverty reduction in Bangladesh. Katalyst has been working in Bangladesh since 2003 and currently is on its Phase 3, which commenced in March 2014. The project is working in maize, vegetable, farmed fish, information channels, women's economic empowerment and local agribusiness networks sectors, and an overarching capitalisation theme. The project has so far reached out to over 3.5 million farmers and small enterprises, and increased their income by USD 430 million.

Katalyst is co-funded by the Swiss Agency for Development and Cooperation (SDC), the UK Government, and the Danish International Development Agency (Danida) and implemented by Swisscontact under the Ministry of Commerce, Bangladesh.

Katalyst commissioned the study on "The roles and opportunities for private sector in agro-processing industry of Bangladesh" to identify the growth potential of agro-food processing industry in Bangladesh. The study began by identifying prospective sub-sectors to analyze their specific and overarching constraints and opportunities. After thorough screening process, Tilapia and Pangus (aquatic fish), Mango and Tomato (fruits and vegetables), Chili and Turmeric (spices), Potato, Mung (Pulses), Maize (grain processing), and Mustard (oil seed) were selected as sectors of future growth in agro-processing.

We would like to express sincere thanks to Mr. Rubaiyath Sarwar and Mr. Johny Maung of Innovision Consulting Private Limited, Dhaka, Bangladesh for carrying out the study. We would also like to express our sincere appreciation to all of the respondents involved during the study for their time and providing valuable information. Finally, we would also like to acknowledge the efforts of our staff who contributed to this study by incorporating the knowledge they gained from their work at Katalyst.



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Executive Summary

The agro processing sector in Bangladesh currently stands at USD 2.2 billion and grew on average 7.7% per annum between fiscal years 2004-05 and 2010-11. The beverage industry more than doubled during the same period to US $29 million, showing an average growth rate exceeding 8 % per annum. According to Bangladesh Agro Processor's Association (BAPA), export of agro-processed products from Bangladesh increased from USD 60 million in 2010-2011 to USD 224 million in 2014-2015. With the growing middle class population of over 30 million, the food processing sector is expected to grow positively in the coming years. Despite, the positive growth trends, the contribution of the food manufacturing or food processing industry in Bangladesh has remained mostly static at around 2% of the GDP since 2004-2005. This indicates that the growth achieved in agro-food processing is not at par with the economic growth of Bangladesh and the sector is currently under-performing.

Katalsyt, one of the leading market development programs in Bangladesh, wanted to investigate the scope for growth of agro-food processing industry in Bangladesh and define the interventions that could facilitate the growth by addressing the key barriers for growth and competitiveness. The study began with identifying prospective subsectors to analyze and understand the subsector-specific & overarching constraints and opportunities. After a rigorous selection process: Tilapia and Pangus (aquatic fish), Mango and Tomato (fruits and vegetables), chili and turmeric (spices), Potato, Mung (Pulses), Maize (grain processing), and mustard (oil seed) were selected and analyzed.

Analysis of the overall value chain of agro processing and the shortlisted crops utilized in processing revealed a number of findings. Firstly a lot of progress has been made on increasing the production of the selected crops. Almost all of the crops show increasing annual growth trend of around 5-10% with Maize achieving the highest at around 37% during 2013-14. The introduction of high yielding varieties and improvement in cultivation process facilitated the increased production however the productivity is yet to reach the highest potential. Secondly the utilization of crops in agro processing is still very low compared to total production. For majority of the crops except Maize, Mustard and turmeric, only 2-5% of the total production is utilized in processing and the rest is consumed fresh. Thus there is good scope to improve the utilization of existing production in agro processing.

There are several agro processors such as Pran, Akij, Square, Ahmed, ACI, BD Foods and Bombay Sweets in Bangladesh with Pran being the largest. According to Bangladesh Agro Processors Association (BAPA), there are around 250 processors however the list in not exhaustive as there are other processors who are not members of the association. These processors produce a range of items and sell their products both nationally and internationally. Export destinations are primarily countries with large Bengali diaspora; penetration in new markets has been low. The processors are mostly engaged in processing of food products for which there is a proven market; import trends and the significance of the local informal processing are used as indicators to test the market potential. This is observable in the growth in local manufacturing of real potato chips (Following

growth in import of Lays chips from India) and growth in snack food items (muri, chira etc.) for which there has been a strong local informal processing market.

These processors mainly procure from the Northern districts of Bangladesh and the factories are mostly situated in this region. Although the production of crops have been increasing in other parts of the country (for instance, Mung is being cultivated on a large scale in Patuakhali), the processors are not interested to set up procurement centers in these regions as it involves significant resource mobilization and limited infrastructure (primarily road network). The region can experience growth in agro processing after the completion of the Padma bridge and the power plants (Rampal). The processors mainly procure through agents/suppliers who procure these products from all over Bangladesh. The processors are very loosely connected to the farmers and previous attempts of introducing contract farming (in case of potato) have not been very successful as the farmers do not trust the processors. Thus the procurement channel is characterized by seasonal and opportunistic procurement (processors procure only when there is surplus production and the price of the crops is at lowest) made through agents and traders.

The agro processors receive support service from Bangladeshi manufacturers who produce various ingredients, machinery and packaging material. Some of the ingredients used in agro processing such as certain food colours, flavours and preservatives like sodium benzonate are imported as these are not produced locally. High end sophisticated machineries such as vacuum fryer are also imported as only light machinery are produced in Bangladesh. However the most pressing issue for the agro processors is perhaps the food safety issue. The presence of lead in the turmeric powder and pesticides and formalin in mango juice has reduced consumer confidence in some products and the processors have seen decline in sales of these products nationally. The application of food safety laws is still weak and monitoring of quality assurance by different government agencies is not organized and effective.

The agro processing industry is not predominantly pro-poor as significant investment is needed to establish a processing plant (Virgo Fish invested around USD 12.5 million for establishment of fish processing plant in Mymensingh) however it has indirect impact on the poor. Growth in the agro processing does not lead to growth in the engagement of the poor in the production since majority of the crops that are being processed mostly engage medium and large farmers (with the exception of mung, turmeric, chili and mustard). At the off farm level, significant numbers of women are involved at the supplier/agent level where they participate in cleaning, sorting and grading of crops (for instance, the agents/suppliers of mango store, ripen, grade and clean the mango before supplying to the processors by employing 10-15 female workers). Males are engaged as day laborers at farms (involvement in fish production operation like feeding, harvesting, washing, icing, packaging, transportation) and workers at factories. As the agro processing sector grows, the engagement of poor and women at various level of the value chain will also increase.

Analysis of the agro processing sector and the relevant crops revealed a number of opportunities. There is growing export market for a number of products such as spices, juice and snacks (export volume of spices increased by 3.9% as per EPB 2013-14, volume of juice exported increased 34%

according to BAPA 2015, 700% increase in volume of snacks exported in 2013-14 according to BAPA). There is also a deficit in demand and supply for some crops such as tomato, maize and potato (500 MT of sauce imported in 2014, BBS 2014 and the current production of maize is not enough to meet demand). Untapped market opportunities have been observed in the case of Mustard, Fish and Maize (only 8% of the mustard goes through formal processing, new fish processing plants have been established and the usage of maize starch in textile and pharmaceutical is very low).

All major business conglomerates in Bangladesh have invested in agro-processing and are expanding their operations and their investment is well spread across inter-related markets (agro-machineries and equipment, inputs, post-harvest infrastructure). There is increasing interest in FDI on agro-processing in Bangladesh as Poland and Japan (Sumitomo corporation) want to invest in food processing. Agro processing has been identified as one of the thrust sectors by the government and several policies such as Industrial Policy 2016, Seventh five year plan and Agriculture Policy 2013 target the agro processing sector. The government also provides tax holidays and cash incentives (20% cash incentive for export of agro processed products) for agro processors. The revenue earned from export of agro products and volume exported both have increased in recent years and non-traditional markets such as Nepal and India have been explored. There is significant engagement of donor-funded projects (B-SEP Project – ILO, GAFSP – IFC, USAID-AVC Project- DAI) focusing on Institutional Capacity development, Standard and Certification, Skill Development, Developing and strengthening local service provider networks, Leveraging private sector investments to commercialize and scale agricultural technologies and Research.

To realize such opportunities, a number of challenges need to be addressed. Inadequate Gas supply and restrictions on commercial gas lines is restricting new investment. Procurement is primarily dependent on middle men and agents which leads to wastage during transportation and increase in price of raw material as there are several actors involved in the supply chain. High market demand for the table crop disincentives the farmers to produce process varieties and often the production does not meet the specific requirements by the processors (the usage of pesticides and insecticides does not comply with Good Agriculture Practice which is essential for export market penetration). Inappropriate packaging and lack of cold storage facilities result in high post-harvest losses (post-harvest losses in fruits and vegetables are around 23-45%). Food safety in Bangladesh is a multi-sectoral responsibility however the administrative enforcement mechanism of Bangladesh is not organized.

There are inadequate training programs and facilities as the existing skills development programmes focus on training SMEs on small scale cottage based processing but not on quality control, food safety issue, supply chain management, productivity management for the large scale private sector agro processors. The lack of coordination among research institutions and processors means that innovations on new products by Bangladesh Agriculture Research Institute and Bangladesh Council of Scientific and Industrial Research are not being scaled up by private sector. Although the government has identified the agro processing sector as a thrust sector; there is no set action plan to achieve different objectives stated under various polices (Industrial Policy 2016 sets out different objectives however it does not provide any directives or timeline on realization of these objectives). In some cases, policies are not favorable (NBR has halved the Customs Duty (CD) (from 10% to 5%)

on import of starch in order to support the local textiles and paper industry however it makes the locally produced starch costlier).

To realize the opportunities and address the challenges prevailing in the agro processing sector a number of interventions need to be undertaken. The establishment of agro processing zone in the Northern region of Bangladesh through public private partnership can foster the uptake of agriculture produce from the region. Promotion of industrial varieties of crops can ensure a sustainable supply of raw materials for the processors. Establishment of fair trade system by offering better trading conditions to, and securing the rights of, marginalized producers and workers can influence the processors to source directly from the producers. Fostering widespread usage of improved packaging and low cost cold storage systems can reduce the post-harvest loss. Introduction of new products such as vacuum fried chips and fostering utilization of new raw materials for innovative products such as jackfruit for making chips can open up new markets. Facilitating proper implementation of food standards and certification such as GMP, GAP and HACCAP and consumer confidence building activities can strengthen the existing market. Finally a detailed action plan which sets out specific objectives, road maps and timelines need to be developed to foster growth in the agro processing sector.

Acronyms

AESA	Agricultural Extension Support Activity
AIN	Agro- Inputs Project
APBPC	Agro Processing Business Promotion Council
ATC-P	Agri-business for Trade Competitiveness Project
AVC	Agricultural Value Chains
BABBMA	Bangladesh Auto Biscuit Bread Manufacturers Association
BAPA	Bangladesh Agro Processor's Association
BARI	Bangladesh Agriculture Research Institute
BBS	Bangladesh Bureau of Statistics
BCAS	Bangladesh Centre for Advanced Studies
BFFEA	Bangladesh Frozen Foods Exporters Association
BFVAPEA	Bangladesh Fruits, Vegetables and allied products exporters association
	Bangladesh Krishi Bank
BKB	Bangladesh Maize Products Ltd.
BMPL	Business Membership Organizations
BMO	The Breast-Milk Substitutes (Regulation of Marketing) Ordinance
BMSO	Board of Investment
BOI	Business Promotion Council
BPC	British Retail Consortium
BRC	Bangladesh Standards and Testing Institution Ordinance
BSTIO	Bangladesh Standards and Testing Institution
BSTI	Bangladesh Skills for Employment and Productivity Project
B-SEP	Consumers' Association of Bangladesh
CAB	Competency Based Training & Assessment
CBT&A	Cold Chain Bangladesh Alliance
CCBA	Centre of Excellence Agro Food Skills Foundation
CEAFS	Consortium of International Agricultural Research Centers
CGIAR	International Maize and Wheat Improvement Center
CIMMYT	Chloropropham
CIP	Competitiveness and Innovation Programme
CIPC	Control of Essential Commodities Act
CECA	Chittagong Hill Tracts
CHT	Carboxy Methyl Cellulose
CMC	Cantonments Pure Food Act
CPFA	Cereal Systems Initiative for South Asia
CSISA	Department of Agriculture Extension
DAE	Development Alternatives Inc.
DAI	Danish International Development Agency
DANIDA	Dhaka City Corporation
DCC	Dhaka Chamber of Commerce and Industry
DCCI	Everything But Arms
EBA	Export Promotion Bureau
EPB	European Union
EU	Food (Special Courts) Act
FA	Food and Agriculture Organization
FAO	Fish and Fish Products (Inspection and Control), Ordinance Focus Group
FFPO	Discussion

FGD	Food Safety Management System
FSMS	Fiscal Year
FY	Global Agriculture and Food Security Program
GAFSP	Good Agricultural Practices
GAP	Gross Domestic Product
GDP	Government of Bangladesh
GoB	Good Manufacturing Practices
GMP	Generalized System of Preferences
GMP	Hazard Analysis and Critical Control Point
HACCP	Information and Communication Technology
ICT	International Development Association
IDA	Iodine Deficiency Disorders Prevention Act
IDDPA	International Electrotechnical Commission
IEC	International Fund for Agricultural Development
IFAD	International Finance Corporation
IFC	International Food Policy Research Institute
IFPRI	International Labor Organization
ILO	Integrated Pest Management
IPM	International Rice Research Institute
IRRI	Industry Skills Council
ISC	International Organization for Standardization
ISO	International Trade Center
ITC	Japan International Co-operation Agency
JICA	Kingdom of Saudi Arabia
KSA	Metric Ton
MT	Ministry of Commerce
MoC	Ministry of Industry
MoI	National Agricultural Research System
NARS	National Agricultural Technology Program
NATP	National Food Safety Advisory Council
NFSAC	Non-Government Organization
NGO	National Training and Vocational Qualifications Framework
NTVQF	Polyethylene terephthalate
PET	Pure Food Ordinance
PFO	Pesticide Ordinance
PO	Public Private Donor Partnership
PPDP	Public private partnership
PPP	Rajshahi Krishi Unnayan Bank
RAKUB	Ready Made Garments
RMG	Research & Development
R&D	Retailer Training Program
RTP	Sustaining Competitive and Responsible Enterprises
SCORE	Swiss Agency for Development Cooperation
SDC	Small Enterprise Credit Program
SECP	Small and Medium Enterprise
SME	Special Powers Act
SPA	Sanitary and phytosanitary
SPS	Terms of Reference
ToR	Training of Trainers
TOT	United Arab Emirates
UAE	United Kingdom

UK	United States of America Dollars
USD	Technical and Vocational Training Education Reform Project
TVET	

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1. Introduction

1.1 Background

A report by Hussain et. al (2013) states that with economic growth of 8 percent per annum, the USD 2.2 billion food processing sector in Bangladesh grew on average 7.7% per annum between fiscal years 2004-05 and 2010-11. The report argues that the demand for processed food arises primarily from the growing middle class population of over 30 million. The beverage industry more than doubled during the same period to US $29 million, showing an average growth rate exceeding 8 % per annum. According to Bangladesh Agro Processor's Association (BAPA), export of agro-processed products from Bangladesh increased from USD 60 million in 2010-2011 to USD 224 million in 2014-2015. Despite, the positive growth trends, the contribution of the food manufacturing or food processing industry in Bangladesh has remained mostly static at around 2% of the GDP since 2004-2005 (Table 1). This indicates that the growth achieved in agro-food processing is not at par with the economic growth of Bangladesh. There is therefore a need to investigate the scope for growth of agro-food processing industry in Bangladesh and define the interventions that could facilitate the growth by addressing the key barriers for growth and competitiveness.

Table 1: Bangladesh Food Industries in Gross Domestic Product (in USD million)

Fiscal Year(July/June)	**2004-05**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**
Food Manufacturing	1,248	1,328	1,517	1,825	1,867	2,094	2,223
Contribution to GDP by Food Manufacturing, in percent	2.07	2.14	2.22	2.29	2.09	2.09	2.01

Source: Calculated from data in the Statistical Yearbook of Bangladesh, 2011

The Agri-business for Trade Competitiveness Project (ATC-P), branded as Katalyst is a market development project operating under the umbrella of the Ministry of Commerce, Government of Bangladesh. The project, funded by the UKAid Department for International Development (DfID), Swiss Agency for Development Cooperation (SDC) and the Danish International Development Agency (DANIDA in the third phase (2012-2017) aims to contribute to increasing the income of poor men and women in rural areas by facilitating changes in services, inputs and product markets, which in turn increases the competitiveness of farmers and small enterprises. The third phase of the project is being implemented with the goal to consolidate and deepen the achievements of the project from its first two phases.

Since its inception in 2002, Katalyst has intervened extensively in improving supply of quality inputs, packaging and transportation system and knowledge on production and post-harvest processing

practices for the farmers and for the actors in the backward and forward linkages in several key agricultural sectors in Bangladesh. The sectors that Katalyst has intervened in include maize, fisheries and vegetable. Impact data suggests that the project's interventions have contributed to increasing production volume and quality of the produce in these sectors resulting in increase in income for the farmers and the poor households engaged in the value chain in these sectors. The promising results on production and productivity provides an impetus to investigate the prospect for processing since it can diversify the demand, reduce price fluctuation and increase the income generated for the poor by increasing the value of the core produce. Set on this background and given that the project is expected to phase out in mid-2017, this study on agro-processing subsector in Bangladesh was commissioned to inform the project management and the donors of the Katalyst project how the agro-processing sector in Bangladesh is performing, what are the prospects for growth, how the private sector enterprises could build on these prospects and what are the challenges that have to be overcome to achieve the prospective growth.

Innovision Consulting is an international consulting firm based in Dhaka, Bangladesh and London, United Kingdom. The firm specializes in undertaking formative investigation in agriculture, health and industrial markets. Innovision was contracted by Katalyst to undertake the research and provide strategic recommendations that could guide future interventions in the agro-processing sector in Bangladesh. This report presents the research findings.

1.2 Objectives of the Study

Katalyst identifies dual objectives for the study. First the project wants to investigate whether the agro-food processing industry offers prospects to the private sector and whether that prospect could be translated to an opportunity for income generation for the people involved in agricultural sector. If so, the project then wants to define the role of the private sector and formulate recommendations for the project's donors for future engagement for inclusive growth of the industry. The broad objectives of the study are:

1. To determine the contribution of agro-food processing industry in Bangladesh in poverty alleviation (for instance, employment and income generation for the poor and for the women in the poor households)
2. To determine the prospect for growth (or market opportunities) for private sector agro food processors in selected crop specific segments (vegetable, fish and maize and 2 other crops as found relevant)
3. To define the scope for donor intervention to support the private sector agro food processors to avail the market opportunities such that the investment from the private sector leads to poverty alleviation opportunities as presented by the growth prospect of the agro-food processing industry in Bangladesh

Specifically, the study is conducted to review the following aspects of the agro-processing industry:

- The agro-food processing value chain in Bangladesh

- The key players in the agro-food processing value chain and their functions in the value chain
- The agro-food processing support industry
- The agro-food processing raw materials supply chain
- The engagement of the poor and the women in the agro-food processing value chain and the raw materials supply chain and the future prospect for employment and income generation for the poor
- The quality assurance systems and its application
- The business membership organizations in the agro-food processing subsector in Bangladesh, their capacity and services
- The government's policy and regulations to support the agro-food processing industry in Bangladesh
- The engagement of different multilateral and bi-lateral donor agencies in supporting the growth and competitiveness of the agro-food processing subsectors in Bangladesh

1.3 Methodology

The investigation followed both primary and secondary approaches. The study was undertaken in four stages- inception, literature review, primary investigation and dissemination. Innovision started with holding a kick-off workshop with the relevant staffs from Katalyst to get a better understanding of the assignment where the key research questions, methodology, timeline and work plan were approved. Following the kick off meeting, literature review was carried out to get a better understanding of the agro processing sector in Bangladesh and to understand what information are already available. Based on the secondary literature review, the primary investigation was carried and the findings and recommendations were shared with different stakeholders.

1.3.1 Inception

A kick off workshop was held with the participation of Innovision and Katalyst staffs. The objectives, scopes and methodologies of the assignment were discussed and the methodology was finalized. The key agenda in the inception meeting was to review the research questions and research methodology, establish a time line and work plan and distribution & approval of roles and responsibilities. Annex 1 provides a summary of the discussion in the inception workshop.

1.3.2 Literature Review

The first part of the study began with the review of relevant secondary literature. Both published and unpublished literatures were reviewed from different sources. Main sources of documents include:

- Documents found on the internet pertaining to the work of different development projects and organizations, donors, research and educational institutions, alongside government

agencies. Information from some agro-processors' websites and repositories was also incorporated
- Documents obtained via consultation with USAID funded Agriculture Value Chain Project and Katalyst (Katalyst's Comprehensive Sector Strategy papers, Sector Study reports, and End Market Analysis from the USAID funded Agricultural Value Chains Project.)

Documents which were reviewed included previous studies and research on the specific sub-sectors, particularly shedding light on agro-food processing subsectors in Bangladesh. The particulars of the documents consulted are detailed in the bibliography.

1.3.3 Consultative Workshop

Next, a consultative workshop was organized where industry stakeholders including agro-processors, key personnel from related development organizations and projects, as well as sector experts shared knowledge and information on the agro processing industry. The workshop was conducted with the following objectives:

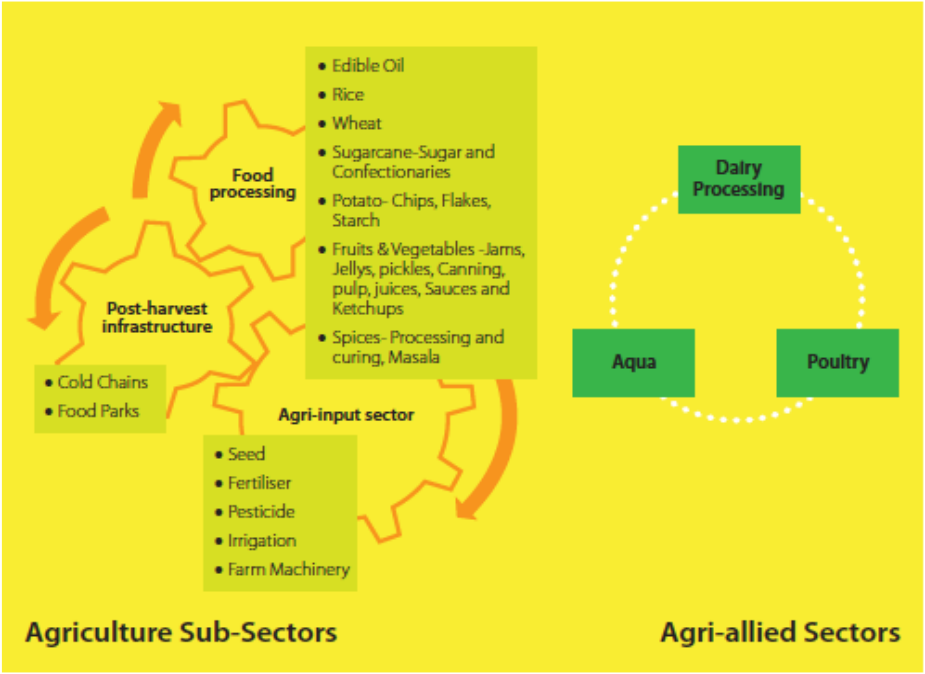
- Collect information that could guide selection of two additional subsectors (apart from vegetable, fisheries and maize) for investigation
- Identification of respondents through stakeholder mapping exercise that would be used to guide the primary field investigation

The list of participants in the consultative workshop is provided in Annex 3.

1.3.4 Sector Selection Exercise

The consultants reviewed the findings from the literature and consultative workshop to determine the additional subsectors that were to be investigated in this study.

Figure 1: Bangladesh Agricultural Subsectors and Agri-Allied Sectors (Source: Board of Investment)



The Board of Investment (BoI) Bangladesh segregates the agricultural sector in Bangladesh into agricultural subsectors and agri-allied sectors. The agricultural subsectors include –food processing, post-harvest infrastructure and agri input sectors. The agri-allied sectors are aquaculture, poultry and dairy processing (figure 1). Agri-allied sectors, post-harvest infrastructure and agri-input sectors were excluded from the scope of this study and the study focused on the food processing subsectors. From the food processing subsectors, we selected mustard under edible oil, tomato and mango under fruits and vegetable, pangus and tilapia under fish food processing, chili and turmeric under spices. Further to that we selected mung beans under pulses even though pulses is not identified as a major crop under food processing by the BoI. The selection of these crops were guided by the following considerations (i) Positive growth trends in production (ii) increase in growth in processing, (iii) strong current and prospective local market demand for the processed product, (iv) strong current and potential export market demand for the processed product. Annex 2 provides the details of the sector selection exercise.

1.3.4 Primary Investigation

The tools and questionnaires for the primary investigation were developed after careful analysis of the findings from the literature review and the consultation workshop. We investigated the status of agro processing related to- maize, Tilapia and Pangusius (under fisheries), Mango, Tomato and Potato (under fruits and vegetable), chili and turmeric (under spices), mung beans and mustard (under pulses and oil seeds). For the facilitation of accurate and prompt data collection, five sets of questionnaire guides were developed respectively for (i) agro-processors, (ii) farmers (iii) key informants (iv) traders and (v) retailers. The questionnaires are attached in Annex-4. Apart from individual interviews, we also held Focus Group Discussions (FGDs) with farmers in the field.

Table 2: Number of respondents

Agro Processors	Farmer	Key Informant	Trader	Retailer
9	72	14	21	31

The field investigation was carried out in Rajshahi, Natore, Chapainawabganj, Thakurgaon, Dinajpur, Mymensingh, Jessore and Dhaka districts in Bangladesh. These districts were identified as the major production and procurement hub for the processors involved in processing of the selected crops. The major production areas for each crop were selected from Bangladesh Bureau of Statistics (BBS) data and the procurement hubs were identified through interviews with major agro processors. The qualitative and quantitative data collected from the field were analysed and triangulated to determine conclusions with regards to the key research objectives and research questions.

1.3.6 Validation Workshop

The findings and conclusions were presented to representatives of agro processors, donors, government agencies, research organizations and development agencies in a validation workshop organized in Dhaka. The list of participants is attached in Annex -5. This report reflects the suggestions and comments of the participants in the validation workshop.

2. Production and Market Trends of Selected Processed Crops

2.1 Fruit and Vegetable Processing

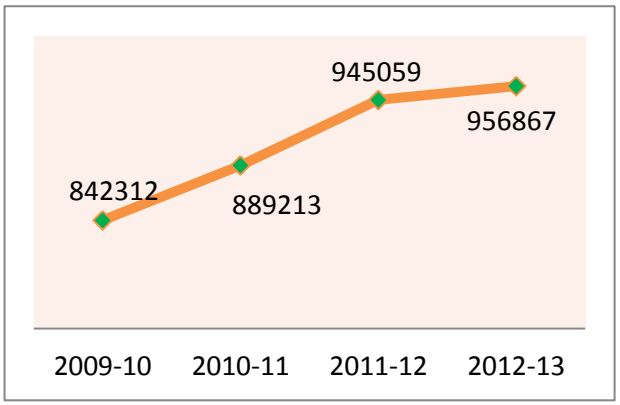
2.1.1 Mango processing

Background: Bangladesh is the 8th largest producer of mango in the world (Ahmed 2015) with a production of almost 1 million MT and constitutes the highest production with almost 20% of the total fruit production (BBS 2012). The production of mango in Bangladesh is steadily increasing with an annual growth rate of around 6% as reported by Bangladesh Bureau of Statistics (BBS). Traditionally, these mango orchards were owned by landlords controlling large expanses of land however; as suggested from field investigation, poor households are also being increasingly involved in micro-level orchard management. The ease of maintenance of mango orchards and increasing demand of fruit have attracted farmers to establish small and medium orchards. The favorable soil and climatic condition in many parts of the country coupled with the introduction of high yielding varieties (BARI Varieties) by Bangladesh Agriculture Research Institute (BARI) have led to the increase of mango cultivation.

Table 3: Mango Production in Bangladesh

Period	Total Production (Metric Tons)	Annual Growth Rate %
2009-2010	842,000	
2010-2011	889,000	5.6
2011-2012	945,000	6.3
2012-2013	956,000	1.2
2013-2014	992,000	3.7
Cumulative average growth rate		**3%**

Figure 2: Growth in Mango Production



Major Varieties: The various types of mangoes being cultivated in Bangladesh are: Himsagar, Fozli, Lengra, Guti and different BARI varieties. BARI has released 10 varieties with different yield and characteristics. There are also numerous local varieties which are cultivated all over Bangladesh. However only Guti and Sahwina variety are used in processing as the consumer demand for these mangoes is low and the processors can procure these varieties relatively cheaply.

Production and Procurement Hubs: The main mango growing regions are around Rajshahi, Chapainawabganj, Nawabganj, and Dinajpur. The production from this region stood at 250,000 MT alone in 2016 (The independent 9 August 2016). Mango cultivation is steadily increasing in other parts of the country also and in these regions the different BARI varieties have become popular because of their high yield and early maturity compared to sapling from seed. The major procurement hubs for mango are: Chapai Nawabganj, Dinajpur, Natore and Pabna.

Major processed products: The major processed products of mango are mango juice, mango drink, bar, pickle and pulp. Whereas mango juice, bar and pickle are final consumer products, the mango pulp is used to make mango juice or drink. The main difference between mango juice and drink is the percentage of pulp in the final product with juice having the higher concentration. There are some canned mango being produced in Bangladesh, however the quantity is very low. From the field investigation it is estimated that only 6% of the total mango production is used for processing. 84% (50,000 MT) of the processed mango is used to make Mango Juice and the rest 16% (10,000 MT) is used in Pickle & Bar.

Figure 3: Major Production and Procurement Hub

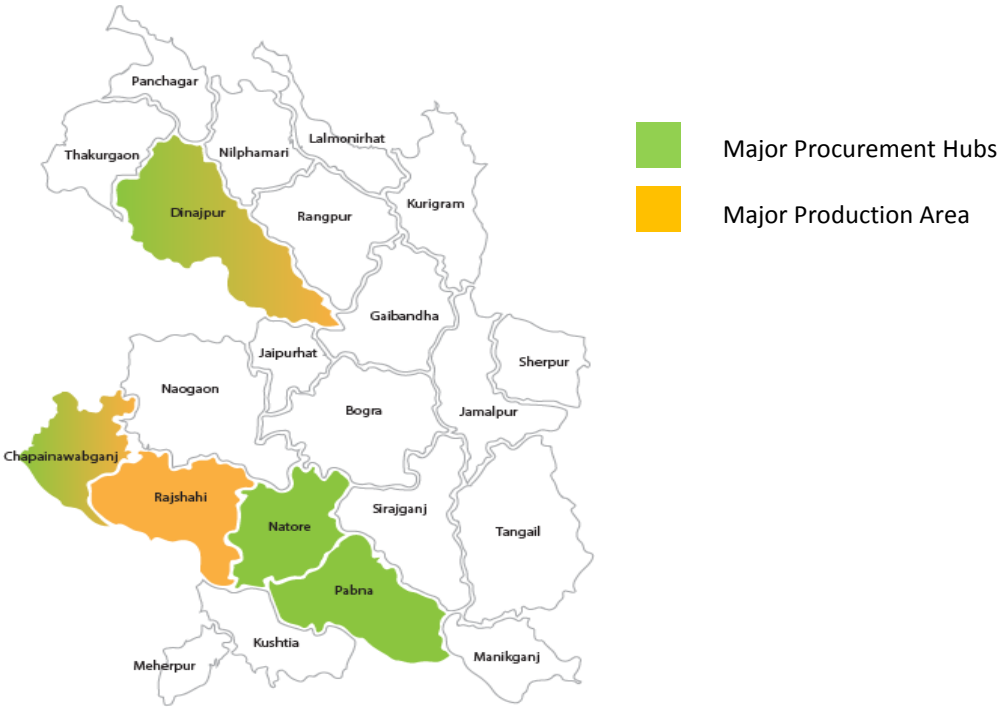


Chart 1: Consumption of Mango in Bangladesh

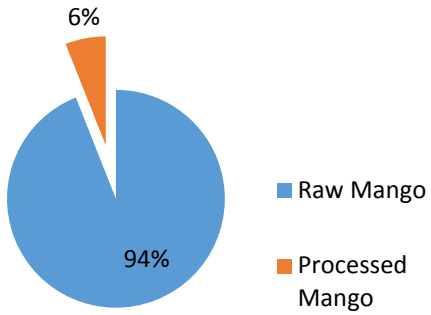
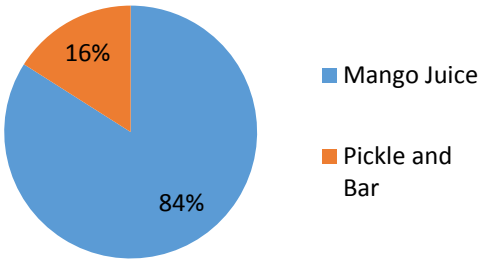


Chart 2: Utilization of Mango in processing



Major processors:

Pran Foods Ltd and Akij Food and Beverage Ltd. produce different mango products in Bangladesh. Pran started its operation in 1981 as a processors fruit and vegetable in Bangladesh. Pran produces different products using mango such as juice, drinks, bar, pickle and chutney. Akij only produces mango juice, pickle and bar. The rest of the market is occupied by imported drinks such as Tropicana, Masafi, Fontana, Shezan etc. These are imported by importers such as Mawla Traders, RS traders. Most of these importers are based in Gulshan area of Dhaka.

Market Size: Data on national market of mango processed products is not very much available from available literature or any other sources. According to AVC 2013, the national market of mango processed products stood at USD 15.6 million with the market of mango pulp at USD 15.1 million. Pran reported that they have procured 30,000 MT of ripe mango for making juice and 7,000 MT of green mango to make mango pickle and chutney from farmers. Akij reported that they procured 3,500 MT of ripe mango for making juice and 300 MT for mango bar, 700 MT of green mango for pickle and green mango juice. It is estimated from key informant interview that Pran dominates the mango processed market with 65% share with Akij having around 20% of market share.

The export value of mango processed products stood at USD 12.3 million and the volume was 16,000 MT (BAPA 2015). Of the different products, Mango drinks and juice together generated almost 91% of the revenue followed by mango pickle with an 8% share of the total revenue. In terms of volume exported, mango juice and drinks account for 97% and mango pickle only 2% of the total revenue.

Chart 3: Share of Mango Products in Export

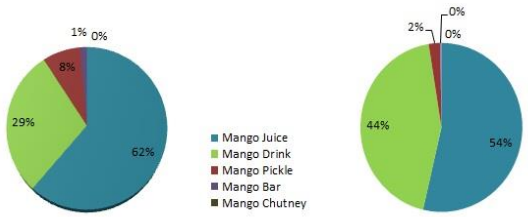
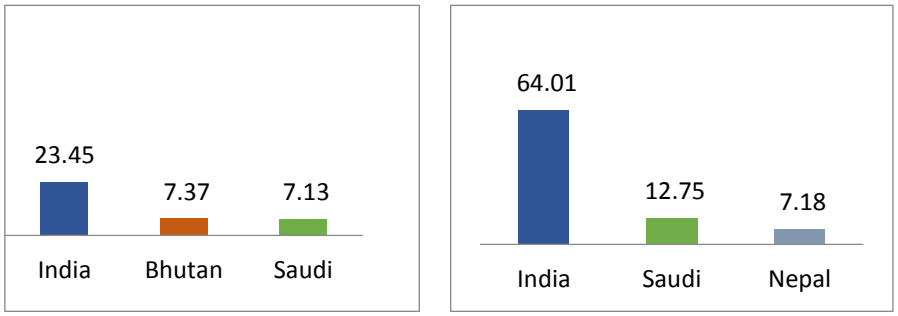


Table 4: Export of Different Mango Products

Products	Total	
	US$	**KG**
Mango Juice	7,500,000	8,785,000
Mango Drink	3,604,000	7,174,000
Mango Pickle	972,000	377,000
Mango Bar	166,000	33,000
Mango Chutney	3,000	1,500
Total	**12,300,000**	**16,370,000**

The major destinations (in terms of volume) for mango drink are: India (23%), Bhutan (7.4%) and Saudi Arabia (7.1%) and United Arab Emirates (19%) and Angola (13%). for mango juice: Malaysia (21%)

Figure 4: Major Export Destination of Mango Drink



Volume wise

Revenue wise

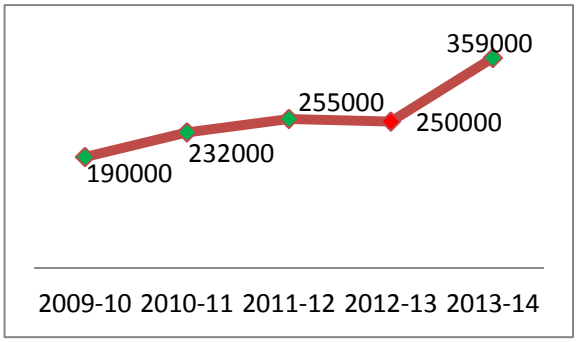
2.1.2 Tomato Processing

Background: Being the third largest producer of tomato in South Asia, Bangladesh promises immense potential for the poor in further expansion of the tomato value chain. In fiscal year 2013-2014, the tomato production amounted to 360,000 tons, with a per acre yield of 5,454 KG, one of the highest for any winter or summer season vegetable in the country (BBS Agricultural Statistics Yearbook, 2014). According to the Agricultural Value Chains Project (AVC), between 2005 and 2012, tomato production increased at an average rate of approximately 11 percent per annum – highest in South Asia. BBS reported that in 2013-14 the annual growth rate was at 43.4% with a cumulative growth rate of 14% over the period 2009-2014. Traditionally, tomatoes were seasonal vegetables, which could only be cultivated during winter. With the introduction of new seed and improved technology, tomatoes are also produced in summer.

Table 5: Tomato Production in Bangladesh

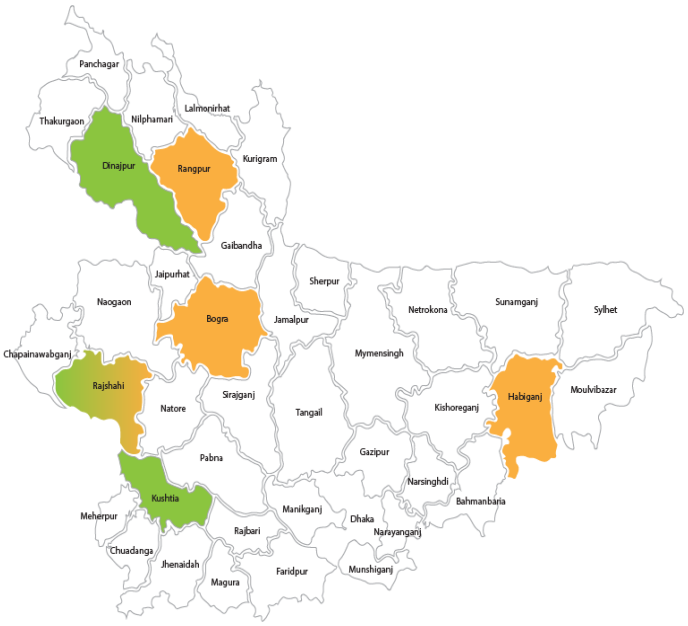
Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	190,000	
2010-2011	232,000	22.2
2011-2012	255,000	9.9
2012-2013	250,000	-1.7
2013-2014	359,000	43.4
Cumulative Average Growth Rate		14%

Figure 5: Growth in Tomato Production



Major Varieties, Production and procurement Hubs: Currently, 17 tomato varieties have been released by Bangladesh Agricultural Research Institute (BARI), all of which are table varieties. On the other hand, hybrid tomatoes, popularly known as "Shurokkha" and "484", which originate from India, are more appropriate for processing purposes as they have higher flesh content.

Figure 6: Major Production and Procurement Hub



Major Production and Procurement Hubs: According to DAE, hybrid tomato was cultivated on around 15,000 hectares of land in the Barind tract comprising 25 upazilas of Rajshahi, Naogaon and Chapainawabgonj districts. These new high yield varieties present an opportunity for marginalized, poor farmers to become self-reliant, often taking the role of a second cash crop of the region (One World South Asia, 2012). Major production hubs for tomato within the country include Rajshahi, Bogra, Rangpur and Hobiganj. Processors procure tomato from Dianjpur, Kustia and Rajshahi.

Why are the production and procurement hubs different?

The establishment of processing plants was initiated in the Northern region of Bangladesh as this region traditionally produced various crops used in processing. Abundant supply of raw material coupled with other factors such as improved road connectivity and electricity supply helped in establishment of processing plants of different companies such as Pran and Akij. These companies found it easier to procure the crops locally and established an agent/supplier network. These suppliers also have their own network of arotdars who are spread across the country. These suppliers/agents procure the crops from different parts of the country and supply to the agro processors. Large agro processors find it easier to procure through the agent/supplier network and do not want to establish procurement hubs in other regions of the country as it will require significant resource mobilization.

Major Processed products: Only 5% of the total tomato production is utilized in processing. The major processed product of tomato is tomato sauce and ketchup/sauce. A small amount of tomato is also used as the base for chili sauce. Almost 100% (4,500 MT) of the tomato is utilized in making tomato sauce/ketchup.

Chart 4: Consumption of Tomato in Bangladesh

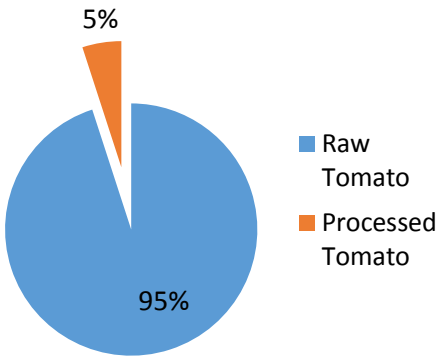
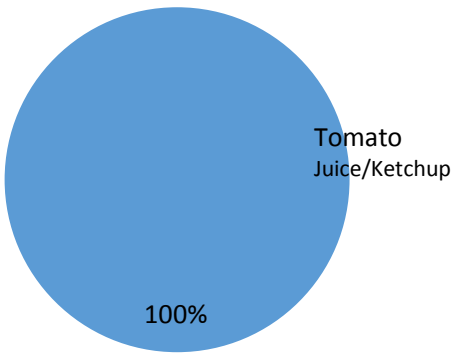


Chart 5: Utilization of Tomato in processing



Major Processors: Two of the largest processors are Pran Foods Ltd. and Ahmed Food Products (Pvt.) Ltd. PRAN started its operation in 1981 as a processor of fruit and vegetable in Bangladesh. Tomato is used as an ingredient for a variety of tomato sauce and ketchup, including Tomato Ketchup, Hot Tomato Sauce, Premium Tomato Sauce and also as a base ingredient for Red Chili Sauce. Ahmed Food Products, which is one of the oldest operators in food manufacturing industry in Bangladesh, use tomato in making Tomato Ketchup, Tomato Sauce and Hot Tomato Sauce. Other local manufacturers include Square (Ruchi), Sajeeb and BD. Imported brands including Best's, Life, Heinz among others are also widely available in the market. These products are brought into the market by importers such as Mawla Traders, Juliet Traders, etc. most of whom are situated in Gulshan, Dhaka.

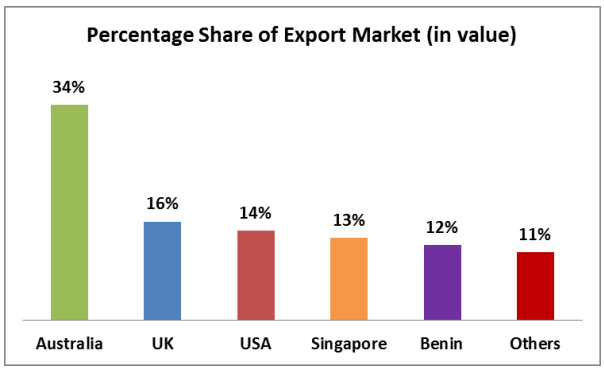
Market Size: According to AVC (2014), total market value of fresh and processed tomatoes is approximately 156 million USD- out of this processed tomatoes constitute approximately 5 percent. With total production of 360,000 tons in 2014, the volume of processed tomato in Bangladesh would approximately amount to 18,000 tons. If we take into account the market value of tomatoes estimated by AVC, the processed tomato can be valuated at USD 8 million. Pran utilizes around 3,500 tons of tomato annually, while Ahmed makes use of 800 tons. The estimated market shares of Pran, gathered from key informant interviews, is around 40%, and that of Ahmed is around 20%, of the overall tomato based processed food market.

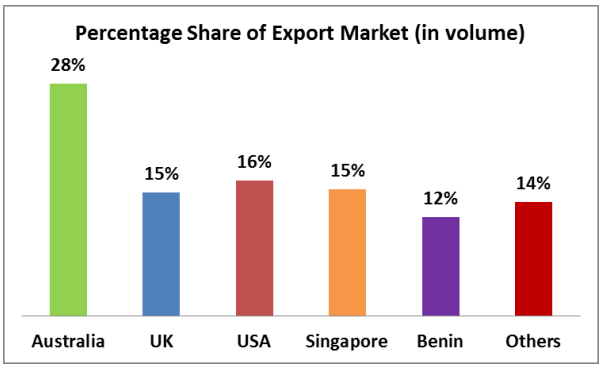
The export potential of tomato products is still not fully realized. According to BAPA, in fiscal year 2014-15, a total of 6 MTs of sauce were exported, which fetched around USD 14,500 which is very low compared to the overall market size of USD 8 million. The largest export destination for tomato sauce from Bangladesh is Australia, having brought USD 5,000 (34.2%) worth of sauce in 2014-15. Other export destinations include UK (USD 2,000; 15.7%), USA (USD 2,000; 14.2%), Singapore (USD 1,900; 13%) and Benin (USD 1,700; 12%).

Table 6: Major Export Destination of Tomato Sauce

Countries	Total	
	US$	KG
Australia	5,000	1,800
UK	2,000	900
USA	2,000	1,000
Singapore	1,900	1,000
Benin	1,700	700
Others	1,600	900

Figure 7: Major Export Destination of Tomato Sauce





2.2 Spices Processing

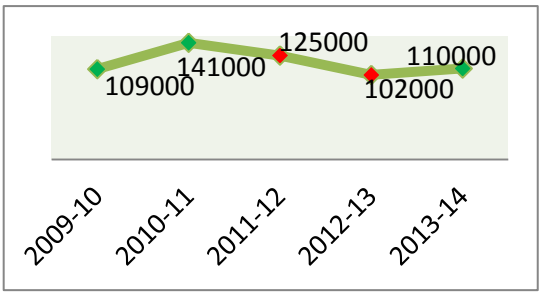
2.2.1 Chili

Background: Bangladesh is the 10th largest producer of Chili in the world (FAO, 2013), having produced around a 110,000 tons of chili in 2013-2014 (BBS, 2014) with an annual growth rate in production of chili recorded at 7.8%. With per acre benefit cost ratio as high as 2.32, chili farming is gradually becoming popular among farmers across the country. Particularly, in the monsoon season, when prices of chili skyrocket to BDT 150-200 per kg, demand outnumbers supply dimensions. Despite the positive trends outlined, chili farmers are not able to realize high yield from farming chili as many farmers still use local varieties which are low yielding and they are not following modern cultivation methods.

Table 7: Chili Production in Bangladesh

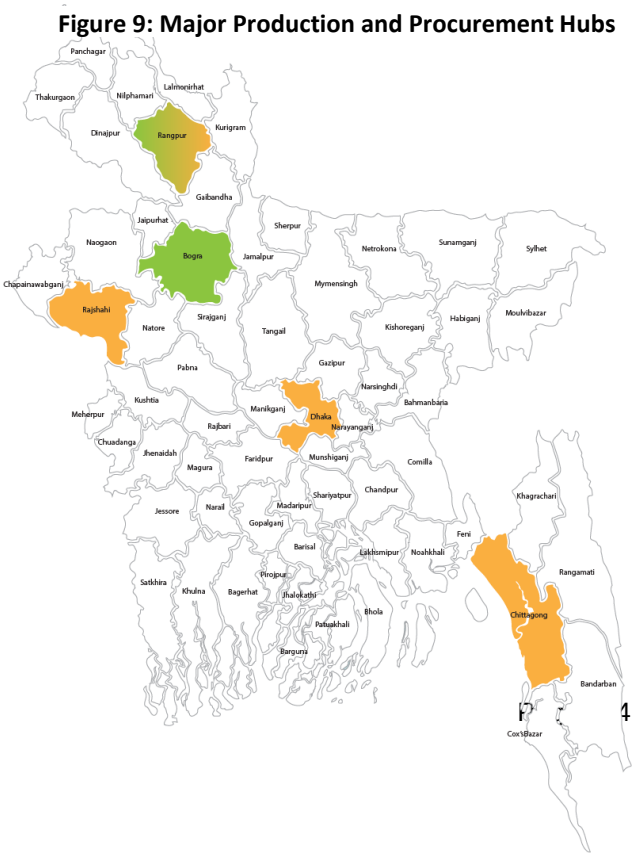
Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	109,000	
2010-2011	141,000	29
2011-2012	125,000	-10
2012-2013	102,000	-18
2013-2014	110,000	7.7

Figure 8: Growth in Chili Production



Major Varieties, Production and procurement Hubs: The Bangladesh Agricultural Research Institute (BARI) has developed 3 varieties of chili. These varieties are high yielding and can be cultivated in both winter and summer. There are many local varieties such as Bombai and varieties of private seed companies such as sonic and premium of Lal Teer Seed Ltd.

Figure 9: Major Production and Procurement Hubs



Production and Procurement Hubs:

Chili is mainly cultivated in areas around Dhaka, Chittagong, Rajshahi and Rangpur. The main variety of Chili used in processing is known commonly as “Bogra’r Morich”- a

variety common to Bogra and surrounding Char areas. Nearly 50% of the demand for chili by agro-processors in the country is met by this variety, making Bogra the hub for chili sourcing by processors. BARI is working to introduce a number of chili varieties to be used in processing. The major procurement hubs of chili are Bogra and Rangpur.

Major Processed Products: In Bangladesh, only 12% of the total production of chili is utilized in processing. Chili is used in manufacturing powder spices, sauce and as chili powder, to be used as additive in other food products. While green chili is used in some amounts to make sauce and mixed spices, majority of the dry chili powder, sauce/ketchup and the additive form is made from red chili. Currently 95% (13,000 MT) of the chili is used to make chili powder and the rest 5% (500 MT) is used as additives in Sauce and other snacks.

Chart 6: Consumption of Chili in Bangladesh

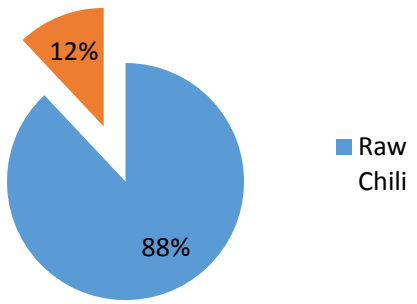
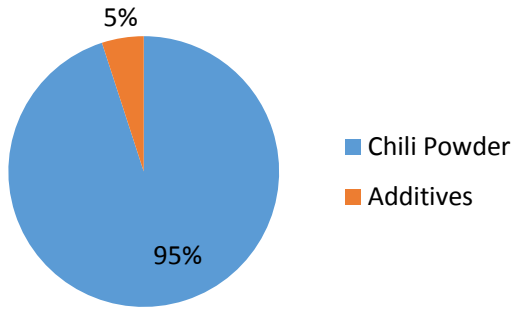


Chart 7: Utilization of Chili in processing



Major Processors: Major processors of chili include Pran Foods Ltd, Square Food and Beverages Ltd., Ahmed Food Products (pvt.) ltd. and ACI. Pran uses chili to produce green chili sauce, red chili sauce, thai chili sauce, hot tomato sauce, chili powder, mixed spices, chili and other varieties of pickles and chutneys. Pran also uses chili powder as additive in snacks and food items including chanachur, potato crackers, fried nuts, fried peas, fried lentils etc. Square is the market leader in powder spices category in Bangladesh. Square produces Radhuni brand of chili powder, Ruchi red chili sauce, along with using chili in various other kinds of spices/mixed spices, snacks such as fried pulses, chanachur, jhuribajha and pickles and chutney. ACI's main chili based product is Pure brand of chili powder, along with some usage in chanachur and mixed spices. Ahmed, one of the pioneers of the food manufacturing in Bangladesh, use chili to produce chili sauce, green chili sauce, sweet chili sauce, hot tomato sauce, chili pickle and mixed pickle. Danish, Fresh, Dekko and BD are some of the other local brands available locally. It can be seen that there are many competitors in the local market for chili powder and this has led to market saturation. Agro processors reported that the increased competition has significantly lowered the profit margin at the local market and they are trying to explore export destinations. In the spices market, presence of foreign brands does not pose a significant threat to the local products, with brands such as Shaan, Haiko, National occupying the mixed and specialized spices shelf space. The sauce/ketchup market sees the presence of foreign

brands like Best's, Maggi and Life, among others. These are imported by importers such as Mawla Traders, RS traders, mostly based off Gulshan in Dhaka.

Market Size: In the national market, Square leads the packed chili powder segment, followed by Pran, ACI and BD. In the chili sauce segment, the market is dominated by Pran, followed by Ahmed and Square. In its various operations, Pran makes use of around 3,500 tons of chili annually, while Ahmed uses 1,000 tons. From our primary investigation, we can estimate the market distribution to be- Square: 45%, Pran: 27%, BD: 12%, Ahmed: 10%, ACI: 4-5% and the rest distributed among others.

From the information provided by agro-processors, it was found out that the major export destinations for chili powder include countries like USA, UK, Australia, Saud Arabia, UAE, Malaysia. Most of the demand, if not all, is derived from expatriate Bangladeshis living in these countries. However, specific quantifiable data regarding export for chili based products was not available in either primary or secondary sources of information.

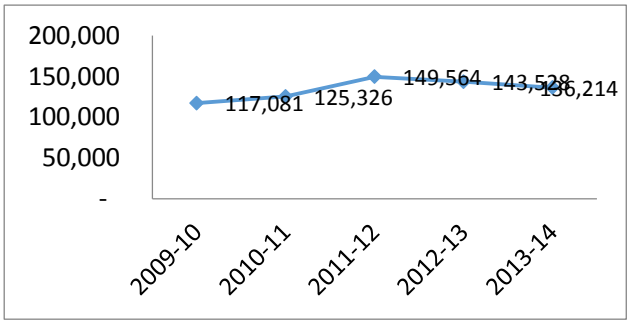
2.2.2 Turmeric

Background: Catering for around 3% of the world's total demand for turmeric (APEDA), Bangladesh is a major producer and consumer of turmeric. Turmeric and turmeric powder are essential spices elemental to Bangladesh cuisine. According to the Bangladesh Bureau of Statistics, the production of turmeric in 2013-14 amounted to 136,000 tons, with a negative growth rate of 5% and a cumulative growth rate of 3% over the eperiod of 2009-2013. However this situation has changed recenlty, ccoupled with government support such as subsidy on different inputs, growing demand and market price and favorable conditions in some of the districts of the country, turmeric farming is gaining popularity among farmers, appended with the demand from processors.

Table 8: Turmeric Production in Bangladesh

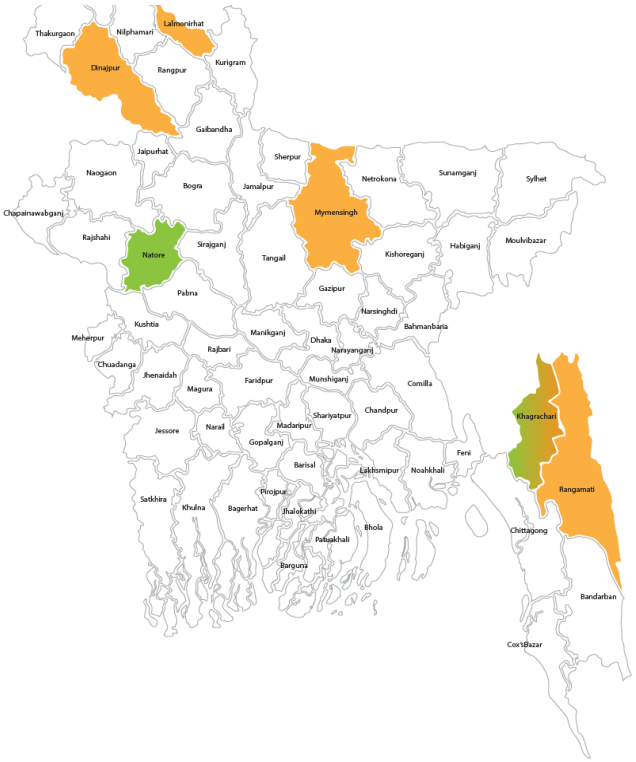
Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	117,000	
2010-2011	125,000	7
2011-2012	149,000	19
2012-2013	143,000	-4
2013-2014	136,000	-5
Cumulative Average Growth Rate		3%

Figure 10: Growth in Turmeric Production



Major Varieties, Production and procurement Hubs: In Bangladesh, predominantly two local varieties of turmeric are cultivated- Simla and Sinduri. BARI has released 5 varieties of turmeric with different characteristics. However majority of the producers cultivate various local varieties and they retain the seeds themselves.

Figure 11: Major Production and Procurement Hubs



Production and Procurement Hubs: Major hubs for turmeric include Chittagong Hill Tracts, especially Khagrachari, Rangamati, greater Mymensingh, Dinajpur and Lalmonirhat. The processors procure turmeric from Natore and Khagrachari. The turmeric of Natore and Khagrachari have different characteristics and is preferred by different consumers. The turmeric of Natore has higher oil content and the turmeric of Khagrachari has higher color pigments. Companies such as Pran favor the turmeric from Khagrachari as it releases more color when cooked.

Major Processed Products: Turmeric is processed to make turmeric powder, which is one of the core ingredients needed for preparation of any Bangladeshi meal. Earlier, consumers used to depend on manually crushed or diced turmeric, which they prepared themselves or at local mills. However, there has been a shift to packaged turmeric powder as the consumer find it more convenient. Aside from use in turmeric powder, turmeric is also used in making mixed spices. All the turmeric produced in Bangladesh is consumed through processing. 93% (125,000 MT) of the total production is utilized in informal processing while the rest 7% (10,000 MT) is utilized in formal processing.

Major Processors: Pran Foods Ltd., Square Food and Beverages Ltd., BD Foods and ACI are the major processors of turmeric. Allo of them is involved in manufacturing turmeric powder, sold in packets and jars. There is small presence of foreign brands in this market arena, with brands like Shaan, Haiko, National providing some competition at high-end super stores and departmental stores. These are imported and released into the market by importers such as Mawla Traders, RS Traders, Juliet Traders.

Market Size: Square, with its Radhuni brand of turmeric powder is the market leader with 42% of the market share. It is followed by Pran at 29%, BD at 14%, ACI at 8% and others at 7%.

The popularity of turmeric is transgressing the boundaries of the country, originating mainly from expatriate Bangladeshis, while slowly making its place in ethnic cuisines of countries in Africa and UK among others. From the information provided by agro-processors, it was found out that the major

export destinations for turmeric powder include countries like USA, UK, Saudi Arabia, Qatar, Oman, Egypt. Most of the demand, if not all, is derived from expatriate Bangladeshis living in these countries. However, specific quantifiable data regarding export for turmeric based products were not available either from primary or secondary sources of information.

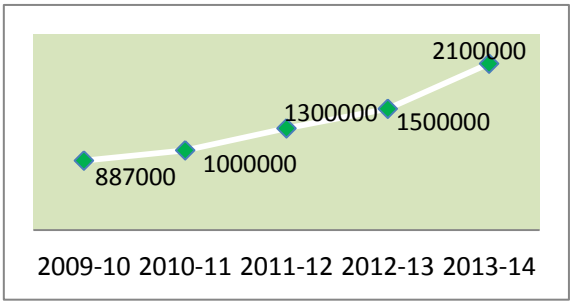
2.3 Maize Processing

Background*:* Maize is an important cereal crop in Bangladesh, ranking third only to rice and wheat in terms of cultivated area and second to rice in terms of production. Maize productivity in Bangladesh is the highest in South Asia (7 MT/ha). In 2013-2014, maize production in Bangladesh was 2,123,000 tons, recording a growth rate of 37% p.a. and a cumulative average growth rate of 19% over the period of 2009-2013 (BBS, 2014). Majority of the maize (90%) grown in Bangladesh is used in poultry feed industry, which is expected to grow at a rate of 20% per year. Thus it is expected that with the growth of poultry sector, the demand for maize will also increase. Current production cannot satisfy the demand for maize in the feed industry as the poultry feed industry to some extent depends on imported maize. According to a study by Katalyst (2015), maize has at least double the yield potential of rice and wheat and thus provides greater returns for lower production costs. Contrary to rice and wheat, maize requires less irrigation, bringing down fuel, electricity and other amenity costs for farmers. Due to all these factors, maize farming is seeing an increasing trend in Bangladesh, especially in the northern regions of the country.

Table 9: Maize Production in Bangladesh

Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	887,000	
2010-2011	1,000,000	14
2011-2012	1,300,000	27
2012-2013	1,500,000	19
2013-2014	2,100,000	37
Cumulative Average Growth Rate		19%

Figure 12: Growth in Maize Production

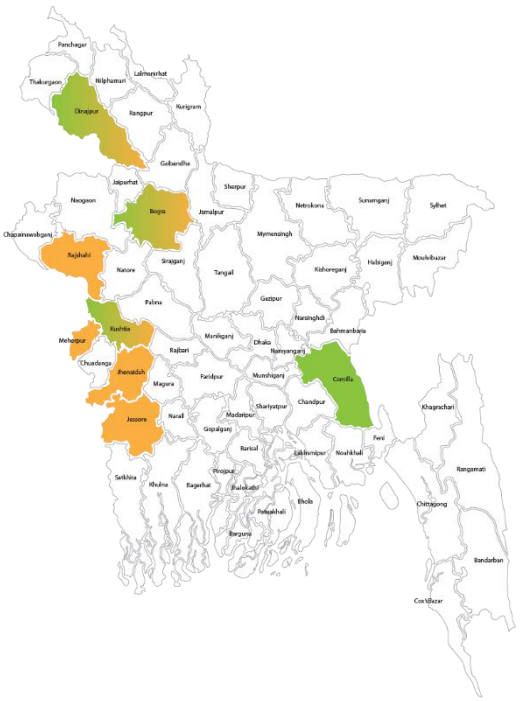


Major Varieties: The different BARI varieties available in the market are: BARI Hybrid Bhutta 1 (released in 2001), BARI Hybrid Bhutta 3 (released in 2002) and the QPM variety BARI Hybrid Bhutta 5 (released in 2004). Other varieties introduced in recent years are BARI Hybrid Bhutta 6 and BARI Hybrid Bhutta 7 and BHM8, BHM9 and BHM10, which were released in 2008. Many of the BARI developed varieties are processing varieties, which are characterized by low moisture content (as

low as 30-35%), Popular imported varieties include Pacific varieties and Uttoron marketed by BRAC, NK-40 marketed by Syngenta, 900M and 900M gold marketed by Krishi Banijya Pratishthan, C1837 and C1921 marketed by United Seed Store (Innovision, 2011).

Production and Procurement Hubs: Maize is grown in the North in Bogra, Dinajpur, Kushtia and Rajshahi and in the South in Jessore, Meherpur, Jhenaidah belt. Usually, processors tend to source maize from Bogra, Dinajpur, Kushtia and Comilla. The major procurement areas for maize are: Dinajpur and Rangpur

Figure 13: Major Production and Procurement Hubs



Major Processed Products: The major products of maize are: animal feed, industrial starch, flour and popcorn and chips. Almost 98-99% of the locally produced starch is utilized in processing. Although the key product that maize is processed into is animal feed, this study will only consider the market for maize starch, popcorn and chips. Maize starch is of two types-modified and native- which can be further processed into other types of products including liquid glucose, dextrose monohydrate. Maize is also processed into chips by a few local companies, and popcorn by small scale companies and traders. Around 90% (2 million MT) of maize is utilized in the animal feed industry while 6% (106,150 MT) is used by flour mills and the rest 5% is utilized in industrial starch and popcorn industry. Even though the majority of the starch is utilized in the animal feed, Bangladesh still imports a significant amount of maize to be used in feed formulation.

Chart 8: Consumption of Maize in Bangladesh

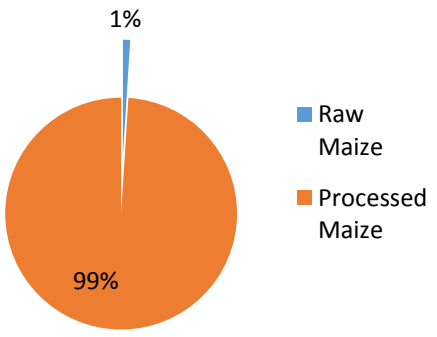
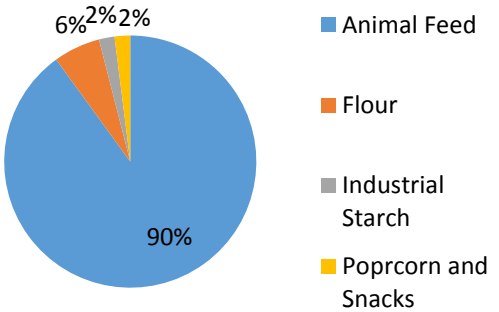


Chart 9: Utilization of Maize in processing



Major Processors: In the maize starch manufacturing industry, the major players are MAAR Ltd., Bangladesh Maize Products Ltd. (BMPL) and Varosha Group. In the chips segment, the market has only a few players who manufacture chips from corn. The undisputed market leader here is Akij Food and Beverages Ltd., with their popular snack, Cheese Puffs. There has been a recent entry in this market, with the introduction of New Zealand Dairy's Detos. In the case of popcorn, there is no established industry or major processor involved in processing corn into popcorn. It is mostly sold by street vendors throughout the big cities, and are available in stores from local small scale producers. Imported varieties of starch include brands such as Apple, which come from mainly China and India- however there is a market discrepancy here, as many importers are involved in illicit trading i.e. undervaluing invoice, rampant erroneous declaration and wrongful utilization of import subsidies. Some importers are also based in Old Dhaka, particularly Moulavibazar and Chawk Bazar. In the chips market, imported brands include Doritos and Cheetos. These are imported by importers such as Mawla Traders, RS traders, mostly based off Gulshan in Dhaka.

Market Size: In the starch industry, the largest manufacturer is Varosha, who cater to around 50% of the market demand. MAAR supplies around 30% more, and the rest is taken up by BMPL and other small manufacturers. However, they face steep competition from tapioca based starch manufacturers, and unbounded import of foreign starch by unscrupulous companies and businesses, who do so under the provision of bonded warehouse facility, of importing raw materials tax-free, and then inject it into the local market. From the investigation, it was identified that MAAR Ltd. has a production of 6,000-ton p.a. So, the total market size for starch can be estimated to be around 20,000 tons. With the market price being around BDT 42/KG, the market can be estimated to be around BDT 800 million. In the snacks industry, the market leader for corn-based chips is Akij Food and Beverage Ltd. with their Cheese Puffs, dominating with almost 85% share of this niche market. Detos holds a share of 10%, with imports taking up the rest. Since there is no presence of a formal popcorn industry or an established manufacturer in Bangladesh, the market size could not be estimated. However, given the recent influx of popcorn traders who are available throughout the major cities, with popcorn becoming the highest selling street snack in Dhaka, along with presence in many brick-and-mortar stores, it is safe to assume that the popcorn industry is one of the most potent areas for investment currently.

Export data for maize based products could not be retrieved during investigation. However, from the accounts of the Key Informant Interviews, it can be inferred that most of the maize-based products, including starch, snacks which are produced domestically are also consumed by local customer base.

2.4 Pulses Processing (Mung)

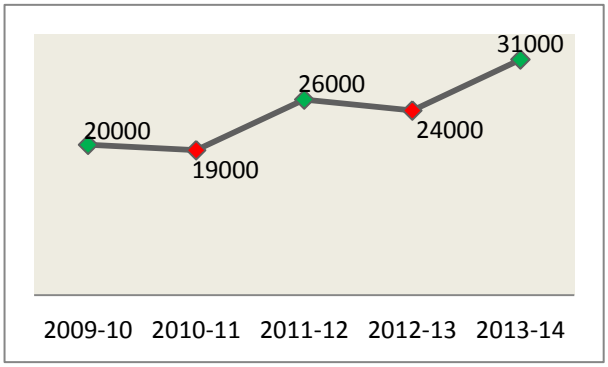
Background: Food grains are the single largest food group in the agriculture of Bangladesh. Constituting of staple food including rice, wheat and corn, the total production of food grains amounted to 36.06 million tons in 2014-2015 (Ministry of Food 2015). Since the food grain family consists of a fairly large array of crops, the study will focus on mung. In 2013-2014, the production of

mung stood at 31,000 MT and the production growth rate was 28% with an average cumulative growth rate of 9%(BBS, 2014).

Table 10: Mung Production in Bangladesh

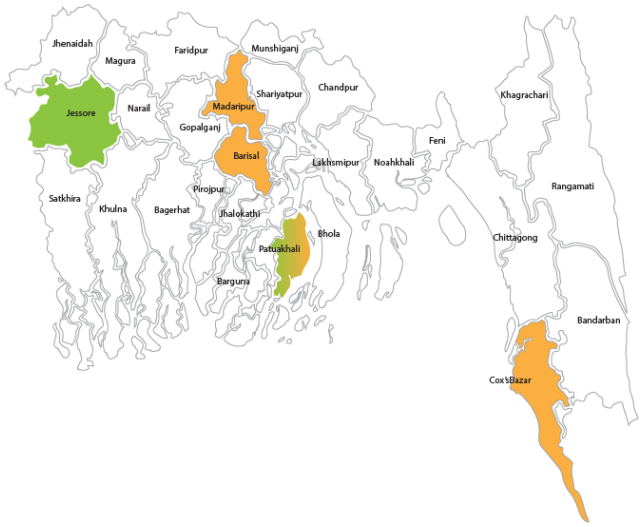
Period	**Total Production (Metric Tons)**	Annual Growth Rate (%)
2009-2010	20,000	
2010-2011	19,000	-4
2011-2012	26,000	35
2012-2013	24,000	-5
2013-2014	31,000	28
Cumulative Average Growth Rate		9%

Figure 14 Growth in Mung Production



Major Varieties: Major varieties of mung include BARI-3,4 and 5.

Figure 15: Major Production and Procurement Hubs



Production and Procurement Hubs: The areas where these crops are most prominent are Patuakhali, Barisal, Madaripur, Noakhali, and Cox's Bazar for mung bean and the major procurement hubs are Jessore and Patuakhali.

Major Processed Products: The major products in Bangladesh made from processing food grains are chanachur and fried dal (dal bhaja). Chanachur is a spicy snack that made of besan, fried in double refined oil and tossed with peanuts, mung, black gram and other ingredients in a blend of eclectic spices. On the other hand, fried dal is made from frying mungbeans. The utilization of pulses in the production of different products could not be assessed.

Major Processors: For chanachur, major processors include Bombay Sweets, Pran, Square (Ruchi), BD, Danish and ACI. Bombay Sweets is the pioneer in this industry, with the Bombay Sweets brand of chanachur becoming a household name since its introduction in the 1950's. Recently, Pran, one of the largest conglomerates of the country and Square, another leading conglomerate, have been gaining popularity, both home and abroad, by introducing new falvors of chanachur. For fried dal, the major processors include Pran, Square, ACI and BD.

Market Size: While the size of the national market for chanachur and fried dal could not be estimated from the field investigations, market share estimation by producer was established. For Chanachur, the market leader is Square with their brand Ruchi, catering to 38% of the total demand. It is followed by Bombay Sweets (30%), Pran (22%), and the rest evenly split between BD, ACI and Danish. In the fried dal market, the leader is Pran, with 42% market share, followed by Square (37%), BD (8%), ACI (6%) and other brands.

According to BAPA (2015), in 2014-2015, Bangladesh exported a total of 6,000 MTs of Chanachur, worth USD 12 million. The export of fried dal was estimated, in the same period, to be 480 MT, valued at USD 850,000.

Chart 10: Share of Mung Products in Export

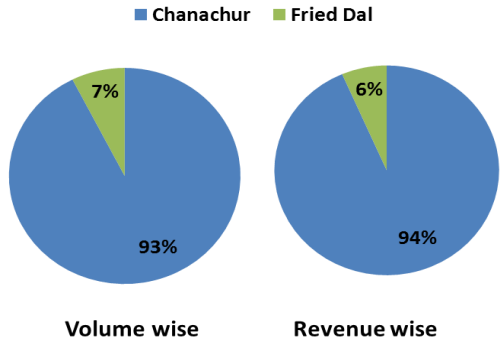


Table 11: Export of Different Mung Products

Products	Total	
	US$	KG
Chanachur	12,000,000	6,000,000
Fried Dal	850,000	480,000
Total	**13,000,000**	**6,500,000**

For chanachur, the biggest export destinations, in terms of value include KSA, who purchased chanachur in 2014-2015 worth USD 4.5 million (38%), followed by UAE at USD 3 million (25%) and Malaysia, with USD 1million (10%). In terms of volume, the take comes down to KSA with 2,000,000 kg (32%), UAE with 1,100,000 kg (19%) and Malaysia with 600,000 kg (10%).

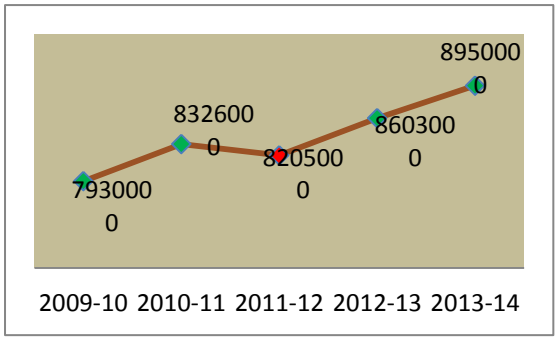
2.5 Potato Processing

Background: Bangladesh is the eighth largest potato producer in the world and has a favorable climate for Potato production (JICA 2015). The production of potato is Bangladesh is around 8.9 Million MT and the production increased at a rate of 4% per annum and a cumulative average growth rate of 2% over the period of 2009-2013 (BBS 2014). In Bangladesh, a hectare of land has the capacity to produce 15 MTs of potatoes, which is four times the productivity of rice. The production of potato is increasing, but excess production sometimes creates havoc due to a glut in the market (excess production of 1.5-3 million tons in 2013, according to a local daily, The Financial Express {2015}). As the people in Bangladesh are generally rice-consumers, in most cases the excess production goes to waste. Thus processing can be viable option for utilization of the excess production.

Table 12: Potato Production in Bangladesh

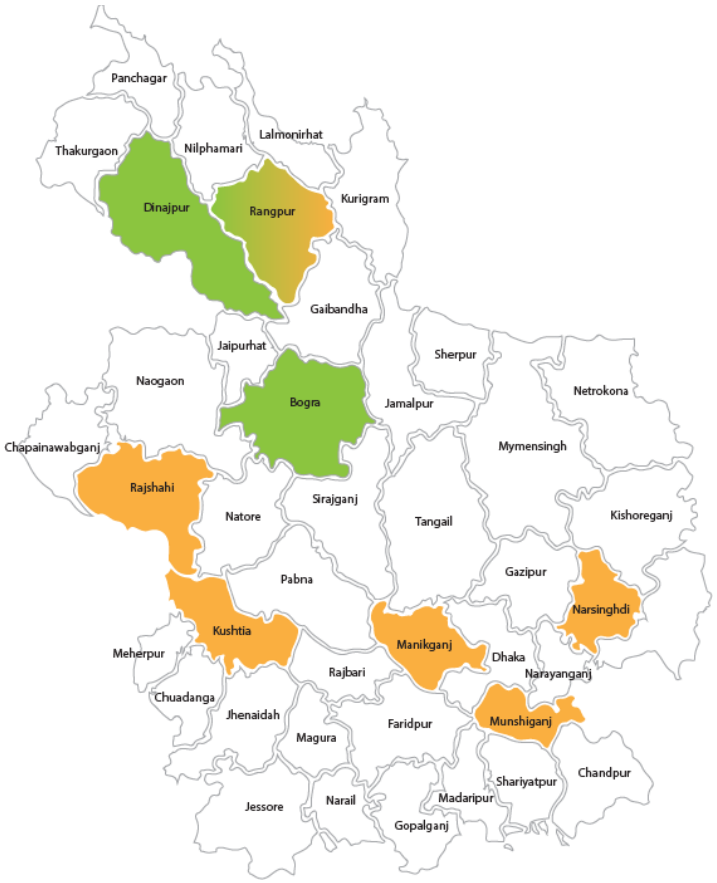
Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	7,930,000	
2010-2011	8,326,000	4
2011-2012	8,205,000	-1.5
2012-2013	8,603,000	5
2013-2014	8,950,000	4
Cumulative Average Growth Rate		2%

Figure 16: Growth in Potato Production



Major Varieties: There are about 27 local varieties of potatoes cultivated in different parts of the country. Among them, the most popular varieties include SheelBilatee, LalSheel, LalPakri and Do Hajari (BRAC, 2013). BARI released around 40 High yield potato varieties in the country, disseminating them across the farmers on the field. However, these were not well received as they were did not fit the palette of consumers, who were more used to the table varieties of potato. However, as agro processors are now gradually and successfully facilitating farming of such varieties by paying good prices, entering contract farming agreements, and injecting the processing varieties into the mainstream consumer markets, so as to align customer preferences towards these varieties. Processing varieties, which are more suited for making chips, starch, flakes because of high dry matter content (19-22%) include Diamond, Courage, Lady Rosetta among others.

Figure 17: Major Production and Procurement Hubs



Production and Procurement Hubs: Rangpur, Rajshahi, Munshiganj, Manikgnaj, Narshingdi and Kushtia are the country's biggest potato producers. (BOI, 2016). The major procurement hubs are: Dinajpur, Rangpur and Bogra.

Major Processed Products: In the processed food industry, potato is mainly used in the production of snacks which include potato chips and ready-to-eat frozen singara. Potato is also used to produce potato flakes and potato starch, which has uses in the food processing industry, along with textile and pharmaceuticals. Only 2% of the current production is used for processing (JICA 2014). Currently 60% (110,000 MT) of the processed potato are utilized in making Chips and Crackers, 24% (42,000 MT) is utilized in flakes industry and the rest 16% (25,000 MT) is used in Starch industry.

Chart 11: Consumption of Potato in Bangladesh

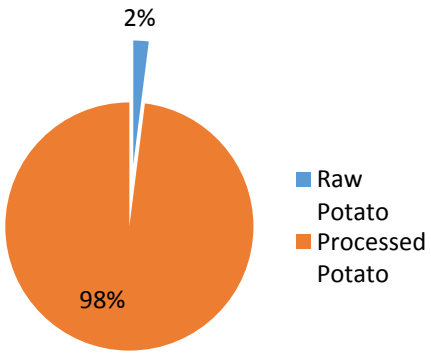
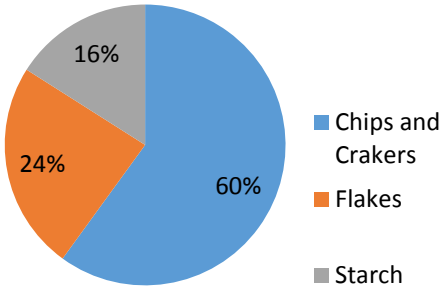


Chart 12: Utilization of Potato in Processing



Major Processors: The potato processors can be segmented depending on the kinds of products they manufacture. For potato chips, major producers include Bombay Sweets, Pran, Quasem Food Products who make real potato chips, and potato chips made from starch.

Major producers of starch and potato flakes include Patwary Potato Flakes, Flamingo Agro Tech, Bikrampur Potato Flakes and Rahman Chemicals. Other products such as shingara are made by Golden Harvest, Lamisa, Kazi and some other local companies.

Popular imported potato chips include Lays, Pringles, Kurkure. Importers of these items like Mawla Traders, Juliet Traders are mostly situated in Gulshan, Dhaka. On the other hand, potato starch importers include the food processing, textile and pharmaceutical companies.

Market Size: According to BBS data, in 2013, Bangladesh produced a total of 9 million MTs of potatoes. Now, according to JICA, if 2% of the total production is used in processing, then it would amount to 172,000 MTs. From the field investigation, the market share for potato chips was observed to be distributed as- Bombay Sweets 51%, Pran 21%, Quasem Foods 13% and the rest distributed among other brands. For making flakes, majority of the market share is held by Patwary Potato flakes, who has the capacity to produce 7,200 MTs of potato flakes per annum. In starch production, the market is dominated by Rahman, who cater to 40% of the demand. In the frozen singara segment, the market is evenly distributed between local brands such as Lamisa, Kazi and Golden Harvest, along with substantial presence from non-brand frozen singaras made by local manufacturers.

Approximately 3,200 MTs of potato based products were exported in 2014-15, worth USD 5 million (BAPA 2015). Of this, potato crackers, which accounted for half the volume, 1500 MTs, alone fetched USD 3 million, which outlines the profitability and hence the prospect of exporting this particular type of potato based processed product.

Chart 13: Share of Potato Products in Export Market

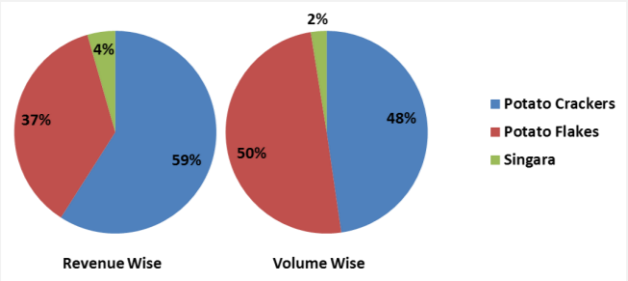


Table 13: Export of Different Potato Products

Products	Total	
	US$	**KG**
Potato Crackers	3,000,000	1,500,000
Potato Flakes	1,850,000	1,600,000
Singara	226,000	80,000
Total	**5,076,000**	**3,180,000**

The major destinations, both in terms of revenue and volume, for potato flakes are India (36%), Lebanon (21%) and Japan (8%). For potato crackers, major export destinations include India (34%), Nepal (19%) and Bhutan (14%). Major export destinations for singara are USA and UK (equal shares of 40% combined to 80%), followed by Australia (12.6%).

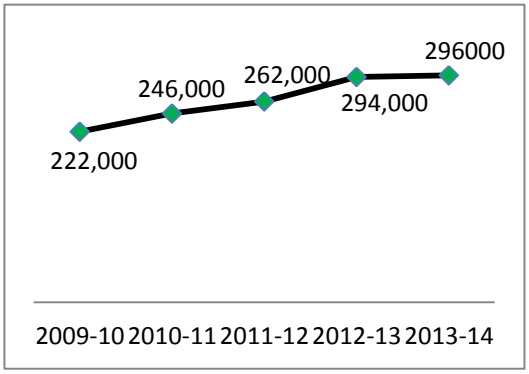
2.6 Mustard Processing

Background: Mustard is one of the most important oil seed crops in Bangladesh. Together with RaiSharisha (*Rape*), it accounts for about 35 % of total oilseed production in the country. In 2013-2014, the production of mustard stood at 296,402 MT with a production growth trend 0.7% (BBS 2014). Mustard grows during Rabi season (October-February) usually under rain-fed climate, and requires low input. Hence, it is a highly lucrative crop for marginalized, low income farmers. On the demand side, mustard oil is a very popular product in the context of Bangladesh. It has manifold uses, including for skin care, hair care and medical usage, also used for farming (manure) and feeding cattle with oil cake. One very important use of mustard oil, throughout the country and most frequently in rural Bangladesh, is the use of mustard oil for cooking purposes. Be it for cooking chicken, fish, vegetable curries, rice dishes, or preparing snacks such as jhalmuri, or even with fruits, mustard oil has a cemented place in the diet of the people of this country.

Figure 18: Growth in Mustard Production

Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	222,000	
2010-2011	246,000	11
2011-2012	262,000	6
2012-2013	294,000	12
2013-2014	296,000	0.7
Cumulative Average Growth Rate		6%

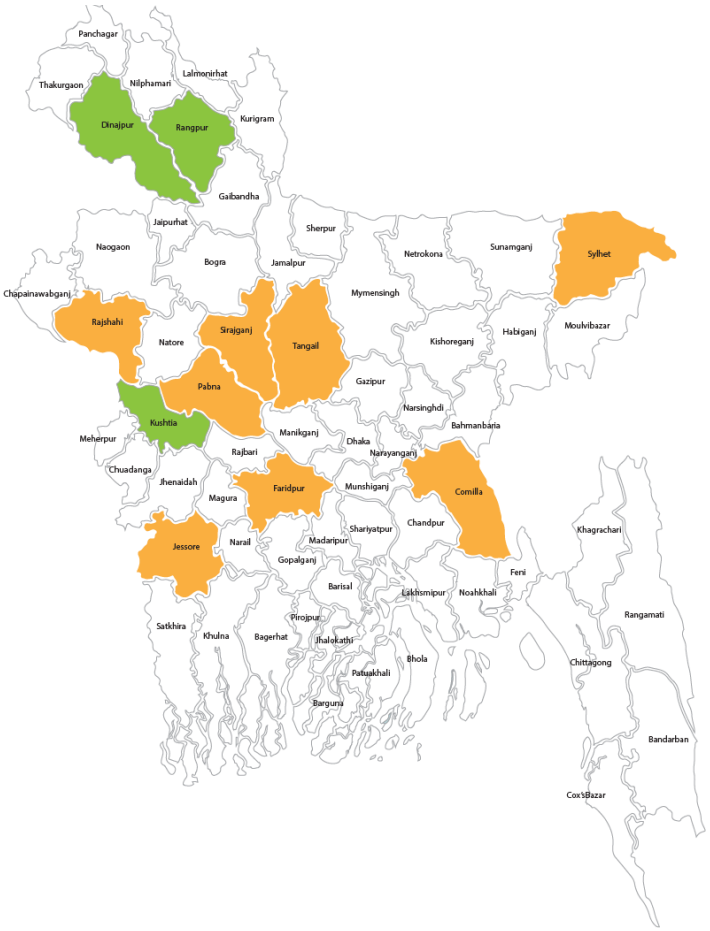
Table 14: Mustard Production in Bangladesh



Varieties, Production and Procurement Hubs: Popular varieties of mustard in the country include BARI-9, BARI-12 and Tori-7, a local indigenous variety. Among these varieties, BARI 9 has the highest yield per acre (892 kg/ha), higher gross return (BDT 21882/ha) and gross margin (BDT14936/ha). Other high yield varieties, recently developed by Bangladesh Institute of Nuclear Agriculture (BINA) include MM-2-16-98. MM- 34-7, MM-38-6-98, MM-49-3-98 and Binasarisha-4 (Pandit and Khurram, 2007).

Major Production and Procurement Hubs: Mustard is grown all over the country, while major production hubs include Tangail, Jessore, Comilla, Sylhet, Faridpur, Sirajganj, Pabna and Rajshahi. The major procurement hubs are: Dinajpur, Rangpur and Kustia.

Figure 19: Major Production and Procurement Hubs



Major Processed Products: The main product that mustard is processed into is mustard oil. Mustard oil is used as primary cooking oil in households across the country, alongside preservation of pickles, another very popular delicacy in Bangladesh. Almost 98% of the mustard production is utilized in processing while the rest in consumed fresh. According to field investigation, Informal 92% (271,000 MT) of total mustard production is utilized in informal processing while the rest 8% (24,000 MT) is used in formal processing.

Chart 14: Consumption of Mustard in Bangladesh

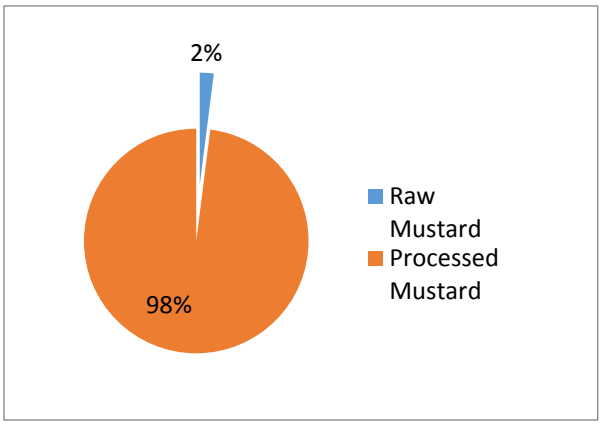
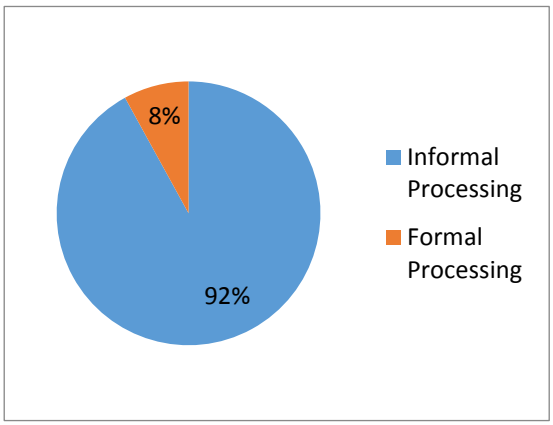


Chart 15: Utilization of Mustard in Processing



Major Processors: Many agro-processors of the country, including Pran, ACI and Square produce mustard oil. While Pran sells the oil under their brand, ACI sells it under their brand Pure, while Square sells it as Radhuni. Meghna Group, another large conglomerate of the country, also produces the Fresh brand of mustard oil. Perhaps the most prominent brand of mustard oil in the country is Suresh mustard oil, which is one of the pioneers in the field of commercially manufacturing mustard oil.

Market Size: There is increasing demand for mustard oil in the local market. In 2013, whereas the production of mustard oil in the country was 74,188 MTs, import alone was 56,000 MTs (BOI, 2014). The market leader for mustard oil is currently Suresh, with around 41% market share. It is followed by Square (26%), Pran (21%), ACI (8%) and others. However, Square's Radhuni is quickly gaining market share.

In 2014-2015, Bangladesh exported a total of 3,169 MTs of mustard based products, which include mustard oil and kashundi, a condiment which has mustard as a key ingredient. In total, the value of exports was USD 6 million (BAPA 2015). Both in terms of export volume and value, mustard oil held almost the entire consignment (99% and 99.3% respectively).

Chart 16: Share of Mustard Products in Export Market

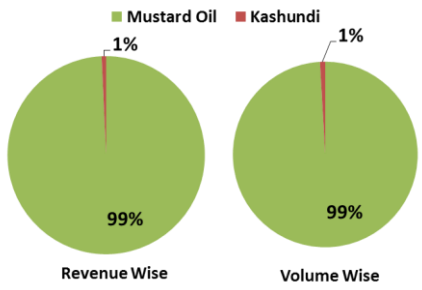


Table 15: Export of Different Mustard Products

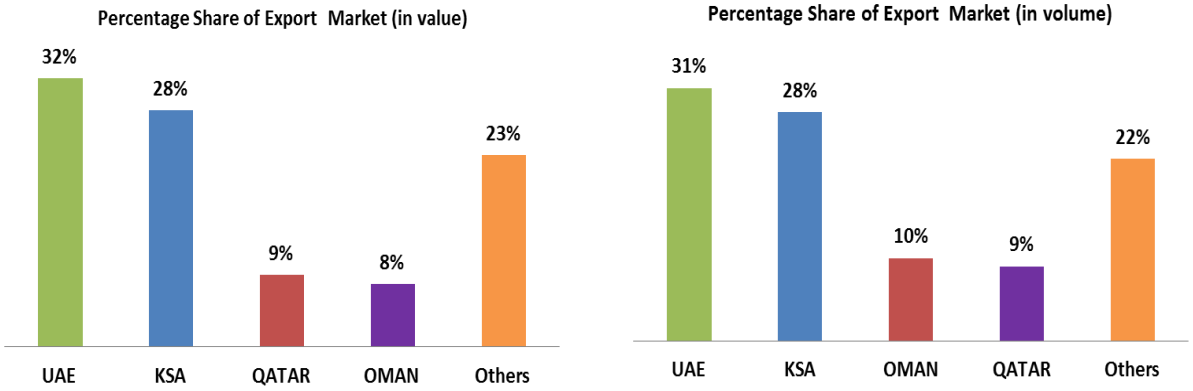
Products	Total	
	US$	**KG**
Mustard Oil	6,500,000	3,100,000
Kashundi	48,000	30,000
Total	**6,600,000**	**3,130,000**

For Mustard oil, the largest export destinations in terms of value are UAE at USD 2 million (32%), KSA at USD 1.9 million (28%), Qatar at USD 567,000 (9%) and Oman at USD 494,000 (8%). When volume is taken into account, UAE leads at 960,000 kg (31%), followed by KSA at 868,000 kg (28%), Oman at 307,000 kg (10%) and Qatar at 295,000 kg (9%).

Table 16: Major Export Destination of Mustard Oil

Countries	Total	
	US$	KG
UAE	2,100,000	960,000
KSA	1,800,000	868,000
Qatar	567,000	295,000
Oman	493,000	307,000
USA	257,000	98,000
Malaysia	204,000	112,000
Kuwait	197,000	100,000
Singapore	186,000	75,000
Bahrain	165,000	96,000
UK	133,000	57,000
Others	380,000	169,000
Total	**6,482,000**	**3,137,000**

Figure 20: Major Export Destination of Mustard Oil



2.7 Aquatic Fish Processing

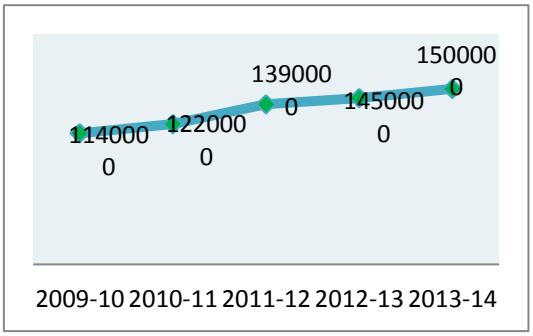
Background: Fish is one of the primary sources of protein in Bangladesh. In 2013-2014, pond fish production in Bangladesh amounted to 2 million MT (BBS 2014). In 2015, Bangladesh was ranked as the 4th largest aquaculture producing country in the world by FAO. According to the Household Income and Expenditure Survey 2010, the average fish intake per person increased in Bangladesh from 42.2 g/day in 2005 to 49.5 g/day in 2010; the DoF estimates that this needs to increase to 70 g/person/day by 2020, which will require an additional 1.2 million MT of fish production annually. The fisheries sector provides 60% of animal protein supply, provides employment to about 18 million people directly and indirectly, and generates 1.4 million women employment (Husain, 2014). The

Katalyst Fisheries Comprehensive Sector Study done in 2015 reports that here has been a rapid increase in recent years in the usage of fish for both food and non-food purposes.

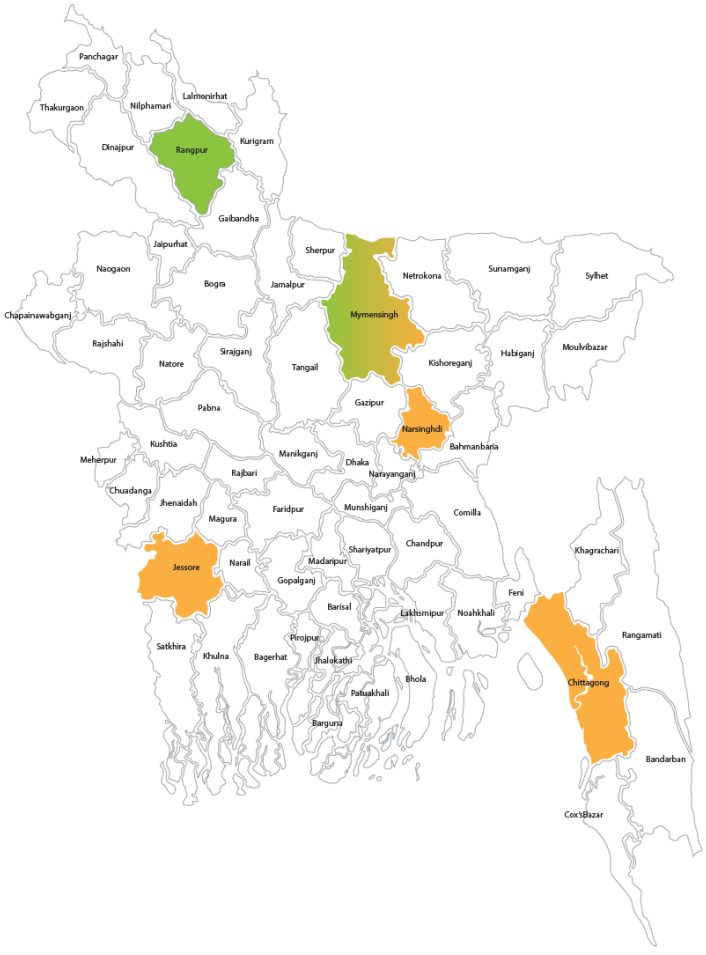
Table 17: Pond Fish Production in Bangladesh

Period	Total Production (Metric Tons)	Annual Growth Rate (%)
2009-2010	1,140,000	
2010-2011	1,220,000	7
2011-2012	1,390,000	14
2012-2013	1,450,000	4
2013-2014	1,500,000	6
Cumulative Average Growth Rate		6%

Figure 21: Growth in Fish Production



Major Varieties: this study will focus on high-yield varieties of tilapia and pangus. These species have high flesh content and less amount of bones which are suitable for processing. High-yield varieties provide farmers with a more reliable cash flow and higher income, reducing their vulnerability to sudden shock. Sector experts predict that these high value species will experience per annum growth of 10-12 per cent over the next few years. Locally, the domestic market for Pangus and Tilapia is not saturated and shows the potential for growth, fuelled by population growth and sustained national economic growth.



Production and Procurement Hubs Major fish producing hubs are Jessore, Mymensingh and Narsingdi, with most processors having established plants in Chittagong and Mymensingh. The major procurement hubs are Mymensingh and Bogra.

Major Processed Products: In the context of Bangladesh, fish is used to produce fish fillets and fish balls. Of them, fish fillets are more in demand, both home and abroad. While there are no specific processing varieties for these two species of fish, for export, white-flesh variety of pangus is more

preferable, as this variety has a higher flesh to bone ratio, making it more appropriate for making fillets. A very insignificant amount of fish is being processed currently, 90% utilized in making Fish Fillet and the rest is sued in making fish ball and finger.

Chart 17: Consumption of Fish in Bangladesh

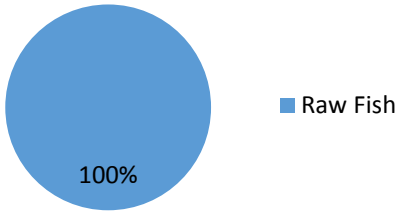
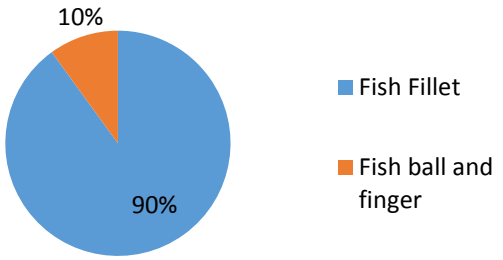


Chart 18: Utilization of Fish in Processing



Major Processors: Some of the major fish processors of the country include Bengal Meat, BD Seafoods Ltd., Golden Harvest, Gemini Seafoods and Virgo Seafood. Of them, the most prominent is Bengal Meat. They started their journey in 2006, beginning with selling quality meat and poultry, but soon entered the processed fish market as their customers wanted fish fillets and other products. They are currently producing different snacks such as fish ball and fish burger. Virgo is the newest of the processors who have established a processing plant in Mymensingh with a capacity of 30 MT/day. They are trying to capture European market however finding it difficult to compete with countries such as Vietnam as their products are cheaper than that of Bangladesh. Golden harvest used to produce different snacks using fish however they have stopped production as the consumer demand is very low.

Market Size: In the national market, the lion's share is held by Bengal Meat. Bengal Meat operates from their own outlets, which are strategically located across major shopping destinations of the city including Gulshan, Banani, Dhanmondi, Uttara, Mirpur and Wari. They also sell their products through super shops including Agora, Unimart, Shwapno etc. Other fish processors including Golden Harvest, Gemini Seafoods also sell their products through super store chains. Of the products sold, the most popular locally is the Bengal Lemon Pepper, which accounts for around 30% of all processed fish products sold. Other product variants sold include the smoked and frozen fillets.

Data pertaining to export of processed fish could not be obtained from the field investigation. However, the total value of fish exports in fiscal year 2013-2014 was USD 52 million (BFFEA, 2015). Two of the major export destinations for processed fish export include China and KSA, with the two countries importing a total of approximately USD 54 million in 2013-2014. Countries in Europe including Belgium, UK, Netherlands, Germany, and the United States are among other top destinations.

3. Overview of the agro processing value chain

The value chain of agro processing encompasses the range of activities from procurement till the product reaches the consumers. The major components of the value chain are raw material procurement, processing and marketing.

3.1 Raw material procurement

3.1.1 Review of the procurement channel

The raw material requirement for agro processing can be divided into two broad categories: primary input and secondary inputs. The primary inputs are the agriculture crops that are used to make the final product such as mango for mango juice, tomato for tomato sauce and Mustard for mustard oil. The secondary inputs are the different ingredients used in the processing of the primary input such as additives, color, sugar, starch and preservatives. The procurement channels for these inputs are different for the processors. As the focus of the assessment is the processing of primary ingredients, the report will assess the primary input procurement channels and identify the value addition and roles of different actors in the value chain in this chapter. The secondary inputs will be discussed in subsequent chapters. From the field investigation, it was revealed that there are three major channels for procurement which are detailed below.

Channel 1 (Farmer-Faria-Arotdar/Wholesalers-Agent-Processor)

In channel 1, the processors employ agents who supply the required crop to the processors. These agents procure the crop from arotdars who in turn buy the crops from the farias who again buy the crops form the farmers. Majority of the large processors such as Pran, Akij and Ahmed use this channel for procuring majority of the raw materials.

Table 18: Raw Materials Procured Using Channel 1

Crops	Major Procurement Area	Remarks
Chili & Turmeric	Northern districts such as Bogra (Chili) and Khagrachari and Natore (Turmeric)	Chilli and Turmeric are procured through this channel. The turmeric from Khagrachari has more intense color which is desired by large processors such as Pran
Mango	Chapainawabganj and Rajshahi	The procurement period for Ashwina and Guti mangoes is approximately one month each
Tomato	Chapainawabganj and Bogra	The procurement period for tomato is approximately one month
Potato	Northern Districts	NIL
Mustard	All areas	As the cultivation of mustard is gaining popularity especially in char areas, the procurement area has also increased
Pulses	Northern and Southern districts	Large processors procure through this channel. As the cultivation of pulses has increased considerably in chars in the Southern districts such as Patuakhali, agents are increasingly buying for this region.
Maize		Large processors procure through this channel

Channel 2 (Farmer-Faria-Arotdar/Wholesalers-processor)

In channel 2, the processors do not employ any agent; rather they procure directly from arotdars. These arotdars can be in Dhaka or in regional markets. These arotdars buy from farias or farmers and sell to the processors. Often these arotdars do not have any formal contract with the processors rather they are ordinary wholesalers. This channel is mainly used by the smaller agro processors who can easily source their crops in desired quantity (usually much smaller than the large processors) from these local markets.

Table 19: Raw Materials Procured Using Channel 2

Crops	Major Procurement Area	Remarks
Chili & Turmeric	Northern districts such as Bogra (Chili) and Khagrachari and Natore (Turmeric)	Smaller processors procure through this channel
Tilapia and Pangus	Greater mymensingh region	The amount procured is very low as fish processing has not become mainstream yet
Mustard	All areas	Smaller processors procure through this channel
Pulses	Northern and Southern districts	Smaller processors procure through this channel
Maize		Smaller processors procure through this channel

Channel 3 (Farmer-Processors)

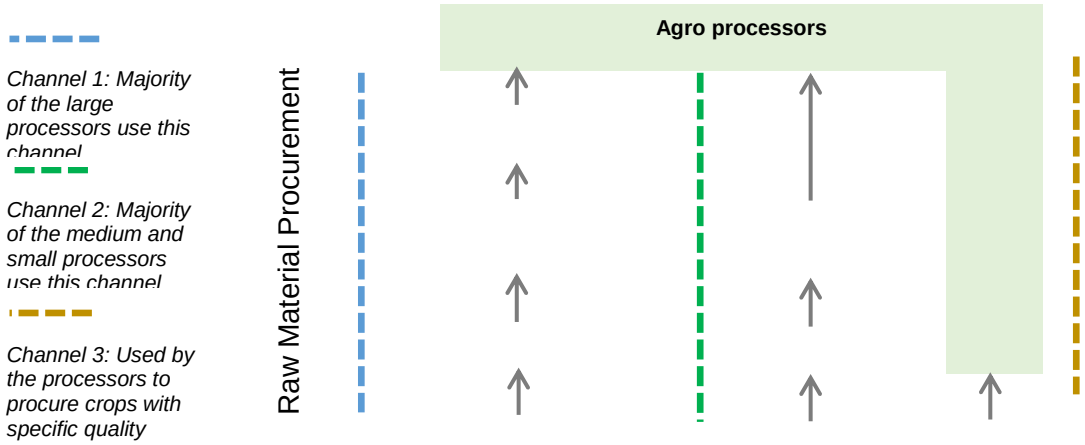
In this channel, the processor procures the ingredients directly from farmers. The processors employ contract farming under which the processors supply different inputs to the farmers and have a buy back agreement with the farmers. The processors specify the quality that is to be maintained by the farmers and buy back the produce at a pre-determined rate. Usually this contract farming is employed when the processors want crops with specific quality such industrial variety potatoes with a specific dry matter content or crops which are not usually produced by the farmer such as cassava.

Table 20: Raw Materials Procured Using Channel 3

Crops	Major Procurement Area	Remarks
Potato	Northern districts such as Bogra (Chili) and Khagrachari and Natore (Turmeric)	This channel has been developed through the efforts of development programs such as Katalyst. However, the processors did not respect the buy back guarantee when the market became volatile which resulted in the farmers losing faith in the system.

The different procurement channels are illustrated below:

Figure 22: Different Channels Raw Materials Procurement



3.1.2 Procurement Actors and their functions

Agents: Agents are basically traders who are employed by the processors to supply the required ingredients to the processors. Majority of the large agro processors employ these agents to procure majority of their ingredients. Pran has around 80-100 agents for individual crops they procure. The agents receive schedule (work order) from the processors which specifies the quality and the quantity of the ingredients that need to be supplied to the processors. The price for the ingredients is floating meaning they are changed by the processors every 4-5 days depending on the prevailing market rate. After receiving the schedule, the agents source the ingredients from arotdars. Depending on the crop, these arotdars can be local, regional or national. The agents perform some primary sorting, cleaning and grading after receiving the ingredient from the arotdars.

Table 11: Functions of Agents in Processing

Crops	Functions
Chili & Turmeric	Perform some primary processing such as drying and cleaning if required
Mango	Agents buy the unripe mangoes and ripen the mangoes. This ripening process involves significant women involvement as it takes two-three days to ripen the mangoes. After ripening, the mangoes are sorted to select the mangoes with the required quality by the processors.
Tomato	Perform some primary processing such as sorting and grading as processors take tomatoes of a certain size (ideal weight should be 30gms)
Potato	No specific function
Mustard	Perform cleaning and drying if required
Pulses	No specific function
Maize	Perform cleaning and drying if required

Arotdars/Wholesalers: Arotdars are traders who have a physical infrastructure or arot where they procure different crops from farias. These arotdars are usually located in large markets where they buy the crops from the farmers. The agents have an informal relationship with these arotdars. After getting the schedule from the processors, the agents contact these arotdars with the required quantity and quality of the processors. The arotdars decide whether they can supply the required crops at the given price and then supply accordingly. In most cases the arotdars buy the crops from

farias, however some of the large farmers sell directly to the arotdars also. This happens mainly for large farmers or for perishable products such as tomato. The arotdars perform some basic processing such as sorting, grading and drying.

For some crops such as maize, pulses and spices, the wholesalers are also millers. The millers buy the produce from farias or farmers and perform significant processing at their level. These millers have large semi-industrial processing plants and they perform a variety of processing such as drying, shelling, grinding, sorting, cleaning and storing. After performing necessary processing, the millers sell to the local market or supply the product to the processors.

Table 22: Functions of Arotdars/Wholesalers in Processing

Crops	Function
Chili & Turmeric	Perform some primary processing such as drying and cleaning if required
Mango	No specific function
Tomato	No specific function
Potato	Store the potatoes in cold storage
Tilapia & Pangus	No specific function
Mustard	Significant primary processing such as drying, husking, cleaning and grading. Significant women involvement
Pulses	
Maize	

Farias: Farias are smaller traders who do not have any physical establishment. These farias buy directly from farmers and sell to arotdars. They sometimes buy products from the farmers when there is abundant supply and then sell the crops at a premium during low supply. The farias perform some basic processing such as sorting, grading and drying.

Table 23: Functions of Farias in Processing

Crops	Function
Chili & Turmeric	Perform some primary processing such as drying and cleaning if required
Mango	No specific function
Tomato	No specific function
Potato	No specific function
Tilapia & Pangus	No specific function
Mustard	Drying and cleaning if required
Pulses	
Maize	

Farmers: The farmers can be divided into three categories: small, medium and large farmers according to their cultivable land area. These farmers generally do not have any direct linkage with the processors except in the case of contract farming. The farmers are distributed throughout the country however there are geographical concentration based on crop such as there are large number of potato farmers in the Northern region of the country. These farmers generally sell their produce to the processors when they find it profitable to sell to these processors. The processors do not procure the crops year round; rather they buy when there is abundant supply meaning the price is lowest. As the supply of the crops are at their highest, often there is practically no demand for the crops at the local market and the farmers do not have any other means to sell the produce. The

farmers perform the first set of primary processing meaning cleaning, frying, sorting and packaging of the crops.

Table 24: Functions of Farmers in Processing

Crops	Functions
Chili & Turmeric	Cleaning and drying (Chili) Cleaning, boiling and drying (turmeric)
Mango	Cleaning
Tomato	Ripening of tomato as the farmers harvest unripe tomato to ensure better color and quality Use of ripening agent which is harmful for human health
Potato	Washing and drying
Tilapia and Pangus	Washing
Mustard	Cleaning and drying
Pulses	Cleaning and drying
Maize	Deshelling, cleaning and drying Deshelling is mainly done by women

3.2 Processing

As explained in earlier chapter, the processing of agriculture crops can be divided into primary and secondary processing.

3.2.1 Primary Processing

Primary processing involves drying, shelling/threshing, cleaning, grading and packaging of the agricultural products in their basic form. Fresh cut vegetables, fish-fillet, frozen meat are examples of primary processed products. The processors performing primary processing do not have heavy investment in machinery, rather they have basic facility for cleaning and freezing. The use of secondary ingredients is almost non-existent in primary processing. All of the vegetable and fruits exported undergo primary processing. After receiving the primary ingredients, the crops are sorted, graded and cleaned. If needed, the product is either hot water treated or frozen, packaged and distributed through the distribution channel.

Table 25: Primary Processing of Agricultural Products

Crops	Product	Process
Mango	Fresh mango	Washing, degumming, hot water treatment
Tomato	Fresh tomato	Cleaning, washing
Potato	Fresh potato	Washing and drying

3.2.2 Secondary Processing

Secondary Processing involves the conversion of agricultural products into value added products like juice, concentrates, pickles, jams and squashes. Through secondary processing, the crops are transformed into the final products through different means such as pureeing, cooking, grinding,

frying and baking. The use of secondary ingredients is very prominent in secondary processing. The secondary processing actually involves two sets of processing, intermediate and final processing. Intermediate processing is used to convert the crops to intermediate product which are then used to produce the final product. After receiving the primary ingredients, the ingredient is first sorted, graded, washed and cleaned depending on the ingredient. The first stage of quality control happens here when the ingredients which do not meet quality standards are rejected. If needed the product is than peeled, de-seeded, sliced, diced, pulped and pureed. This intermediate product than goes through a final processing where the intermediate product is further processed by different methods such as cooking, baking, grinding, frying or any other means. Majority of the secondary ingredients are used in this stage of processing. After the finished product is produced, it is packaged in different containers such as PET bottle and cans and distributed through the marketing channel.

Figure 23: Processing of Agricultural Products

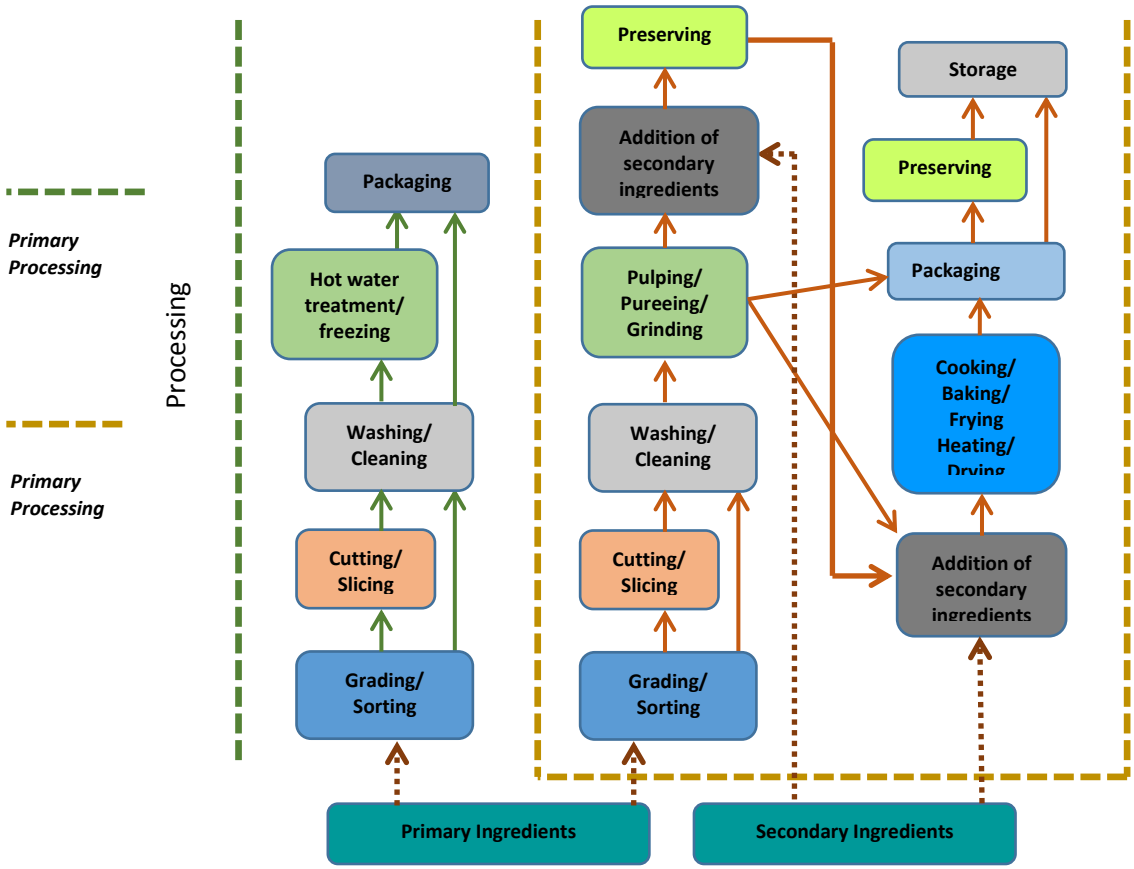


Table 26: Secondary Processing of Agricultural Products

Crops	Product	Process
Chili & Turmeric	Chili Powder	The procured chili and turmeric are first graded and sorted. If the dry matter content is not high enough, then both the crops are further dried. After achieving the right dry matter content, the crops are grinded to produce powder and packed in plastic bag or bottles.
Mango	Mango Juice	The processors first sort, grade the mangoes and unsuitable mangoes are

		removed. Then the mangoes are washed, peeled and deseeded and made into pulps. Different ingredients and additives are then incorporated to the pulp to make fruit juice.
Tomato	Tomato Sauce	The tomato is first graded and sorter, then washed. After washing, it is than pulped and skin and seeds are removed and made into a paste. This paste is than reserved to be used in the manufacturing of ketchup and sauce. Different additives and ingredients are mixed with the paste to make tomato sauce and ketchup.
Potato	Potato chips	The procured potatoes are first graded and then washed. It is than peeled, sliced and washed again. The sliced potatoes are then cooked or baked and mixed with other ingredients to produce potato chips.
Tilapia and Pangus	Fish fillet	The procured fish is first graded and sorted then washed. The side flesh of the fish is removed and any bones in these slices are removed. Than washed again, frozen and packed.
Mustard	Mustard oil	The procured mustard is first dried if the dry matter content is not satisfactory. Then the mustard is cleaned and pressed to make mustard oil.
Pulses	Chanachur	The procured pulses are first cleaned. Processors only buy the fine grained mung and blackgram for preparing chanachur. These products are then cooked and mixed with other ingredients to make chanachur.
Maize	Feed and starch	The procured maize is first dried if the dry matter content is not satisfactory. It is than cleaned and thrashed. It is than mixed with other ingredients such as animal protein and other additives and cooked to produce the animal feed.

3.3 Marketing

The marketing of primary processed products is done through two channels. The first channel is for the export market and the second channel is for the domestic market.

3.3.1 Marketing: Export

For exporting their products, the processors utilize a simple channel which includes the processor directly exporting to the importer. The importer than distributes the product through their distribution channel which include wholesalers and retailers. Some of the large processors such as Pran have their own international distribution system through which they market their products internationally. Majority of the smaller processors do not have such distribution system and simply export their products through importers.

3.3.2 Marketing: Domestic

The marketing system in domestic market is more complex. The processors usually have two distribution channels: own and through dealers.

Channel A: (Own distribution)

The processors usually supply to the large retailers and institutional buyers themselves but this channel is not predominant. Large processors do not usually follow this channel rather smaller

processors follow this channel as they find it easier to do it themselves and it is more profitable as they do not have to pay any discount to distributors. If the processor has a retail outlet such as Fish Harbour of ACI or shops of Bengal Meat (selling some fish processed products), they supply the products themselves to these outlets.

Channel B (Dealer Based)

Through this channel, the processors select distributor who sell the product to wholesalers and retailers. These distributors are large traders who have their own distribution system. They receive the product at a discounted rate from the processors and use their distribution system to supply to the wholesalers and retailers. The wholesalers are usually large shops in large market who supply the product to retailers and also sell to final consumers. The retail shops are small grocery shops, large super shops such as Shwanpo, Meena Bazar and Agora or institutional buyers such as hotel, restaurants.

Figure 24: Marketing System of Primary Processed Product

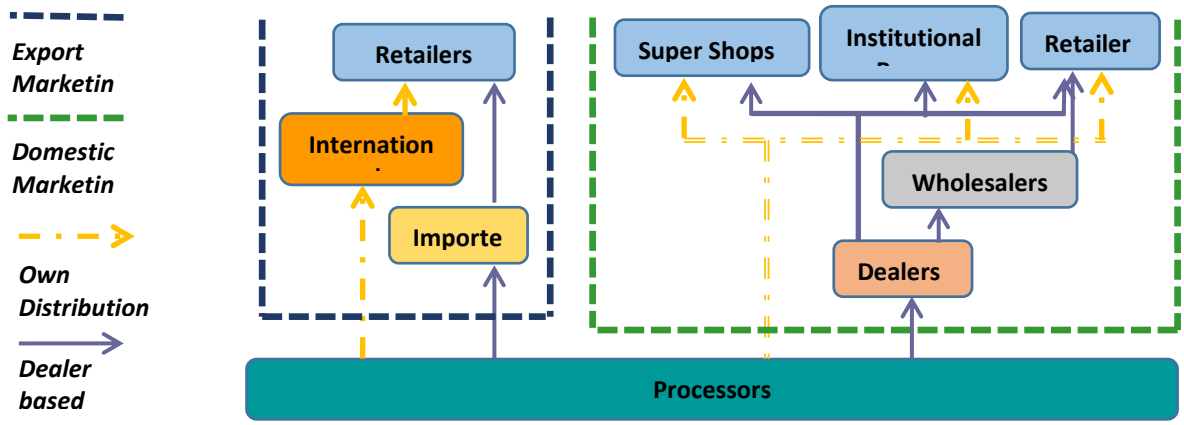


Table 27: Marketing System of the Processed Products

Product	Export Market Product		Domestic Market	
	Own Distribution	Through Importer	Own Distribution	Dealer network
Chili Powder	√		√	√
Mango Juice	√	√		√
Tomato Sauce	√	√		√
Potato chips	√	√		√
Fish fillet			√	
Mustard oil	√	√	√	√
Chanachur	√	√	√	√
Feed and starch			√	√

4. Analysis of the Key Support Services for Agro-Food Processing

The agro processing industry connects various markets that are directly and indirectly involved in the production, transformation and provision of agro-processed product. The operations of these markets include primary production of commodities: the unprocessed food, supply of input for production of the transformed products, value adding activities for transformation of agricultural commodities by processing, preparation, packaging and distribution, the marketing and retailing of commodities and the provision of services such as education, finance, investment and technical advice.

The interconnected market systems pertaining to the agro-processing industry is explained in detail below:

4.1 Input Market

The function of agro-processing industry is to process simple agricultural raw materials while also transforming highly sophisticated industrial inputs that are often the result of considerable investments in research, technology and innovation. Corresponding to this growing complexity of inputs is an increasing range of transformation processes, characterized by physical and chemical alteration and aimed at improving the marketability of raw materials according to the final end use.

The raw materials used by agro-industry are generally characterized by the seasonal nature and the variability of their production as well as by their perishability. These aspects put particular demands both on the organization of agro-industrial activities and on the agricultural base producing the inputs, thereby adding to the need for a close integration of raw material production and processing. The quality of these raw materials are highly influenced by such factors as the choice of seed; the application of fertilizers; the control of weeds, pests and diseases; and sorting and cleaning. Processors are interested not only in obtaining uniformity in the quality of their raw material supplies, but in some cases their needs are quite specific. Particular varieties of some crops (for example, of tomatoes, apples and pears for canning) have long been grown for processing, but the need for such varieties is increasing as food technology develops more advanced processes. Often there are specific requirements for such factors as shape, size, texture, colour, flavour, odour, acidity, viscosity, maturity, specific gravity, soluble solids, total solids and vitamin content

A variety of ingredients are used in agro processing. These range from sugar to spices. According to an economic policy paper crafted by Dhaka Chamber of Commerce and Industry (DCCI) in 2000, the Bangladesh Sugar and Food Industries Corporation manufacture refined sugar of pharmaceutical grade. However, the quality of sugar they produce for the local market is nor suitable for use in processing exportable products. Rahman Chemeical Ltd. produces starch, glucose, dextrose and

liquid glucose and fructose syrup. Liquid glucose and fructose syrup are used in fruit juice preparation and in canning and preservation. The DCCI report articulates that there are a few agencies importing these chemicals from the UK and Germany. Trans World Services imports certain food colours and flavours from the UK. Chemicals like citric acid, pectin, CMC (Carboxy Methyl Cellulose), preservatives like sodium benzonate and NA/K metabisulfite are all imported. Some of these are imported from China, Japan, Sweden and other countries. The quality of these chemicals varies and it is very difficult to use them for production of quality food products for export.

4.2 Processing and packaging Market

A wide range of packaging materials are used in the processing and packaging market operations (DCCI 2000). Glass jars and bottles are made from local glass works as glass container is expensive to transport long distances because of heavy weight, high bulk and fragility. Plastic pots and bottles are now increasingly becoming popular as it lowers production and distribution cost. Pots can be heat sealed with a foil lid and with a snap on plastic lid. For dried products and some other kinds of products, different types of plastic films are being increasingly used. Packaging and storage of fruits are often done in an improvised manner. Only highly perishable items are packed, mostly in bamboo crates. No refrigerated transport is used. Hardly any post-harvest treatment is resorted to except in the case of bananas and mangoes, where some artificial ripening is done.

Processors import sanitary cans from Thailand, returnable bottles from India and crown caps from Sri Lanka. These materials cannot be produced at home. Some of the bottles can be produced locally however larger sizes bottles need to be imported from India. The glass bottles and jars with pilfer proof and metal caps are locally made. Pran has installed a tetrapack plant for processing mango and orange juice and extruder with processing unit for production of chips. Processing procedure can be different for the two types of products: processed products and semi processed products. The canned foods and dehydrated products are the processed products. The existing can-making plant is situated at Chittagong, set up by BSFIC. The products can be promoted in the export market presenting them in attractive packages. Such packages can be made locally from imported food-grade polystyrene and plastic materials. Moreover, the design and dies for making trays can be made locally.

Glass jar is generally local made and JMH glass manufacturing company is the leader is manufacturing and supplying the glass jar. Lug cap for jam jelly bottles is imported mainly from India to cater to the local demand. The establishment of lug cap and tin can making facility is highly capital intensive and the local demand is not enough to justify the investment.

The semi processed products include certain fruits and vegetables that we import in bulk in a semi-preserved form and they are to be processed into a finished product in the importing countries. This requires less cargo space than processed products in finished form in retail packs. Importing countries reprocess the products according to the tastes of their consumer. Again, the exporting countries do not have to set up full-fledged processing plants. Preservation of green vegetables like

gherkins, green jack-fruits, green mangoes is possible by preserving the prepared pulp in bulk quantity in brine. Fruits can be semi-preserved in sugar syrup with metabisulphite (S02). These semi-preserved products are packed in food grade polythene bags, put in plastic drums and sealed according to the specification of the importing countries. Another type of product is concentrated fruit juice, which can be exported in aseptically sealed flexible packages. The importing countries dilute and process it in different forms according to local tastes. The Multiple Juice Concentration Plant at Chittagong has prospects of exporting concentrated pineapple juice, provided the cost of production is competitive in the international market.

4.3 Equipment Market

Major manufacturing and exporter countries of agro processing equipment are Germany, Italy, Netherlands, Denmark, US, Japan and Australia. The food processing equipment industry can be grouped as follows: Processing machinery and equipment, packaging machinery and equipment and Utilities (include all other machinery and equipment used to clean/ purify air, water etc.). The Fruit and Vegetable processing equipment are Trimmers, Stemmers, Huskers, Juice extractors, Peelers, shelling machines, Pulpers, Separators, Graders, Continuous blanchers/ cooker, Coolers/ sterilizer system, dehydrating equipment, washing machines and Shredding / grounding / chopping machines. For the fish and sea food sector there are Filtering machine, scaling machine, shelling machine and Grounding machine. Liquid nitrogen tunnel freezers, Blast freezers, IQF systems, Compressors, condensers/ evaporators, Refrigerator milk cooling tanks Food preparation, processing and control equipment, Heat exchange process system, Cookers, Microwave ovens are some refrigeration/quick freeze equipment. Royal International, Ahmed Agro Agency, Orion Associates, Ashraf Bin Asad Enterprise (Pvt) Ltd and Sumaiya Corporation. (Go4worldbusiness-List of Bangladeshi Buyers) import and sell this equipment. The light machinery such as drier and sorter can be locally produced however the heavy and sophisticated machinery such as liquid nitrogen tunnel freezers and juice extractors needs to be imported. If a processor wants to introduce a new product such as vacuum fried chips, he needs to import the vacuum fryer as these machineries re not locally produced.

4.4 Finance and Investment Market

Alauddin (2014) in an academic research paper identifies the banking system acts as a major contributor for the development of this agro processing sector. Different banks undertook special scheme to intensify financial support for establishment and expansion of agro-based industries such as Special loan facilities to set up an agri-business venture. The government also supports establishment of agro-based industries by providing equity finance and other funds to banks and financial institutions to disburse to the entrepreneurs. Since October 2008, participation in agricultural and rural credit programme to provide credit to farmers and farms on a variety of sectors such as fishery and livestock.

The government has plans to establish 4 agro-product processing centers to facilitate the commercialization and knowledge sharing of agricultural technology. Rajshahi Krishi Unnayan Bank (RAKUB) has introduced a special credit program titled "RAKUB-Small Enterprise Credit Program

(SECP)". The project aims at promotion of entrepreneurship in agro-based small enterprises and non-farm activities in Northwest region of Bangladesh. Maximum credit limit for a single enterprise has been fixed at BDT 0.5 million. One of their target programs is related to Agro-industry & Agri-Business.

Alauddin (2014) also denotes that Bangladesh Krishi Bank (BKB) finances the following seven priority sectors, namely: Crop, Fisheries, Live Stock, Farm and Irrigation Equipment, Agro based Industrial Project, S M E, Continuous Loan (Working Capital and Cash Credit), Micro Credit (Small Loan). The agro processing sector has been declared as a "Thrust Sector" by the government and therefore receives preferential treatment like income tax exemption, tax return, cheaper air transport, low interest rates and export assistance. 12.5% cash incentives to export of frozen shrimp and fish and 20% cash incentives to export of agro processed products is given.

4.5 Technology

The technology in the food processing technology has not yet been fully modernized. The food processing technologies in the country at present are limited to the preparation of traditional products, e.g. pickles, achar, mango leather, salad and brined products, jam, jelly, etc. The existing food processing industries should affect their own improvement by taking advantage of emerging technologies and making more efficient use of existing technologies which are adapted to local conditions. According to BARI, processors do not take up the new technologies developed by the institute. On the other hand, processors commented that the technologies developed by BARI are not suitable for commercialization and needs to be aligned with the market situation and demand of the processors.

4.6 Food Safety

There are at present 16 laws to regulate safe food delivery to the consumers. These laws are: 1. Penal Code, 1860 ('PC 1860'), 2. Control of Essential Commodities Act, 1956 ('CECA 1956'), 3.Food (Special Courts) Act, 1956 ('FA 1956'), 4.Pure Food Ordinance, 1959 ('PFO 1959'), 5.Cantonments Pure Food Act, 1966 ('CPFA 1966'), 6.Pesticide Ordinance, 1971 ('PO 1971'), 7.Special Powers Act, 1974 ('SPA 1974'), 8.Fish and Fish Products (Inspection and Control), Ordinance, 1983 ('FFPO 1983'), 9.The Breast-Milk Substitutes (Regulation of Marketing) Ordinance, 1984 ('BMSO 1984'), 10. Bangladesh Standards and Testing Institution Ordinance 1985 ('BSTIO 1985'), 11. Iodine Deficiency Disorders Prevention Act 1989 ('IDDPA 1989'), 12.VoktaOdhikarSongrokkhonAin, 2009 [Consumers Rights Protection Act 2009], 13. StanioSarkar (City Corporation) Ain, 2009 [Local Government (City Corporation) Act 2009] , 14. StanioSarkar (Paurashava) Ain, 2009 [Local Government (Paurashava) Act, 2009] 15. Mobile Court Ain, 2009 [Mobile Court Act, 2009] and Food Safety Act, 2013.

Table 28: Food Safety Laws of Bangladesh

Laws	Description
The Penal Code, 1860	▪ Imprisonment up to six months term or fine extending to one thousand taka are stated punishment for the act of adulteration of food or drink and selling something that is unfit for food or drink.
The Control Of Essential Commodities Act, 1956	▪ The act provide for power so that the government can control the production, treatment, keeping, storage, movement, transport, supply, distribution, disposal, acquisition, use or consumption of, and trade and commerce in, certain commodities.
The Food (Special Courts) Act, 1956	▪ Offences related to foodstuffs shall be tried and punished by Special Magistrates under speedy trial ▪ Any person commits such offences shall face imprisonment extending to three years or fine or both of them as punishment.
Pure Food Ordinance, 1959 ('PFO 1959')	**Repealed by Food Safety Act, 2013**
Cantonments Pure Food Act, 1966 ('CPFA 1966')	▪ The Act is designed to prevent the adulteration of food in cantonment. Under the act any direct or indirect involvement in preparing, manufacturing, selling of any adulterated food that is unwholesome, injurious to health or unfit for human consumption, and any involvement in import and export of such food item are strictly prohibited. ▪ The stated rules provided for the mode of manufacture, processing or preparation, packaging, labeling, consignment, delivery and the standard of quality or fill of containers are to be followed. ▪ This act gives power to the health office to prohibit the supply of certain food items by giving notice to the person in charge of supply and to make that person take remedial measures specified in the notice.
Pesticide Ordinance, 1971 ('PO 1971')	▪ This is an ordinance designed to regulate the import, manufacture, formulation, sale, distribution and use of pesticides. ▪ To import, manufacture, formulate, sell, hold for sale advertise any brand of a pesticides one must apply to the government for the registration in the stated manner. The government has the power to prohibit the further import of certain pesticide into Bangladesh by placing notification in the official Gazette, if the imported pesticide is found to be adulterated, misleadingly tagged, labeled or named, or if its sale in any way contravenes any of the provisions of this Ordinance. Under this act it is a punishable offence to falsely represent a pesticide for sale that is not of the nature, substance or quality which it is represented to be by the brand or mark on the package containing it.
Special Powers Act, 1974 ('SPA 1974')	▪ SPA 1974 provides for special measures for the prevention of certain prejudicial activities and allows more speedy trial with effective punishment for certain grave offences and for matters connected therewith. Section 25 under the law states the measures to be taken for adulteration of, or sale of adulterated food, drink, drugs or cosmetics. According to the law, one can get punishment of death or imprisonment for life, or rigorous imprisonment for term up to fourteen year with fine for their involvement in adulteration or in the procedure of sale of such noxious food or drink.
Fish and Fish Products (Inspection and Control), Ordinance, 1983 ('FFPO 1983')	▪ This ordinance is intended for the inspection and quality control of fish. To ensure the quality of fish and fish products for export and of the containers thereof the government can impose rules prescribing grades, quality and standard of fish and fish products, regulation of catching, handling and marketing of fish or fish products. The processing, storing, grading, packaging, marking, transporting and inspection of fish and fish products need to be followed by the government provided rule. The

	registration of fish processing and fish packing plant and provision of license will take place under their surveillance. Under the ordinance there are certain prescribed standards that need to be conformed in case of packaging, exporting and handling fish processing.
The Breast-Milk Substitutes (Regulation of Marketing) Ordinance, 1984 ('BMSO 1984')	**Repealed by The Breast-Milk Substitutes, Baby Food, Commercially produced additional baby food and tools to use them (Regulation of Marketing) Ordinance, 2013**
Bangladesh Standards and Testing Institution Ordinance 1985 ('BSTIO 1985')	▪ This is an ordinance that is outlined for the establishment of the Bangladesh Standards and Testing Institution (BSTI) for standardization, testing, metrology, quality control, grading and marking of goods. Under the act the institution is responsible for the set-up of Bangladesh Standards of quality and dimension including the preparation and promotion of the general adoption of standards on national and international basis relating to materials, commodities, structures, practices and operations. The act describes all other functions the institution needs to perform. Only the institution can grant the license as they arrange the facilities for examining, testing and inspection of commodities and issue the certificates according to test report. Any violation of following the procedure is considered as a punishable offense.
Iodine Deficiency Disorders Prevention Act 1989 ('IDDPA 1989')	▪ The law was enacted for universal salt iodization and banned non-iodized salt from market, aimed at virtual elimination of IDD from the country with the establishment of a 'Salt Committee' and a 'Salt Lab'.
Vokta Odhikar Songrokkhon Ain, 2009 [Consumers Rights Protection Act 2009]	▪ The act is enacted to make provisions for the protection of the rights of the consumers, prevention of anti-consumer right practices and for matters connected therewith. The act defines who the consumers are and what 'anti-consumer right practice' means. The National Consumers' Right Protection Council carries out different functions to fulfill the purpose of this act. These include formulation of policy on the protection of consumer rights, making necessary regulations, advising and cooperating with the Government in protecting and promoting the rights and conduct research on consumer rights.
Local Government (City Corporation) Act 2009	▪ The act designed for the consolidation of the current laws and ordinances relating to the City Corporation. In the sections relating to food and drink it is stated that the corporation can ban processing of certain food and drink in a certain place not licensed by the corporation and have control over the time and system of transportation of food item. According to this act corporation is responsible for the establishment and maintenance of the common market for food and beverage. Moreover, the sale of food and beverage by person infected by contagious diseases and deception by supplying low and different quality food product are listed as punishable offences.
Local Government (Municipality) Act, 2009	▪ This act was issued for the composition of new ordinance by abrogating any current declaration regarding municipality. The section 'Food and Beverages' says that a municipality may by-laws prohibit the manufacture, sale or the import of any specified article of food or drink in any place not licensed by them and within the municipality they may regulate the time and manner of transport of any specified food or drink. Again, the offences under the ordinance include the sale of articles of food or drink by a person suffering from any disease and selling food or drink to any purchaser which is not of the nature, substance or quality demanded by such purchaser
Mobile Court Act, 2009	▪ In order to maintain law and order and to perform the crime prevention activities more effectively with skill the Mobile Court Act, 2009 is

	enacted for the administration of Mobile Court. The act is expedient and necessary to operate the Mobile Court where the executive magistrate can penalize for some offences considered immediately on the spot by imposing his/her limited power. The Executive Magistrates of Bangladesh are empowered to conduct Mobile Court for ensuring social justice by focusing on various social problems which include food adulteration.
Food Safety Act, 2013	▪ Food Safety Act, 2013 provides for the coordination among the programs related to the manufacturing, importing, processing, storing, supplying, marketing and sale of food products to ensure the right to safe food with the appropriate practice of scientific method. Bangladesh Pure Food Authority has been established to fulfill the purpose of this act. Emphasize has been given to the facts that: restrictions related to the food safety management , responsibilities of food brokers, food analysis and testing, food inspection, offences and punishments, food court, charges and trial and administrative investigations and penalties.

There is overlapping of laws for criminalizing some particular offences. This multiplicity of laws creates confusion in the mind of manufacturers, processors, retailers or even to the enforcement authorities to realize which law deals with particular food safety issue. Moreover, there is no effective coordination among these regulatory authorities dealing with food safety. Several authorities carry out anti-adulteration drives in Bangladesh. Some drives are conducted by the ministry of commerce (MoC), some are done by the ministry of industry (MoI), and a few are operated by the city corporations (under the ministry of local government).

Food safety in Bangladesh is a multi-sectoral responsibility however the administrative enforcement mechanism of Bangladesh is not organized. There are no clear inspection strategies with the coordination of different authorities and there is no clear method of detecting non-compliance with the regulations. The roles and responsibilities of the concerned ministries and agencies are unclear and do not cover the whole food chain from farm-to-table. The overall coordination body for food safety and food control at the national level is the National Food Safety Advisory Council (NFSAC) however its role has been somewhat limited in ensuring food safety and control. There are a few food laboratories under various government, autonomous and international organizations in Bangladesh (Bangladesh Standard and Testing Institution (BSTI) and International Centre for Diarrhoeal Disease Research, Bangladesh (ICCDR,B) each a food testing lab). However, very few of those are operating down to the regional and district level. It is observed that only a few of the laboratories are well equipped and well maintained. They have shortages of maintenance budget, inadequate technological resources, human resource and, above all, lack of coordination in procedures/methods of testing.

5. Enabling Environment for Agro-Food Investment

5.1 Standards and Certification

BSTI Certification: BSTI is responsible for the Standardization, Certification Marks and Monitoring quality control of food items. Inspectors (Field Officers) check trade license, label and quality of food by collecting samples. The BSTI product certification scheme is a third party scheme based on ISO Type 5. It consists of determining conformity of a product with a Bangladesh standard through product sampling and initial testing and assessment of the factory quality management system. The product quality is continuously monitored through surveillance of the factory's quality management system and testing of samples from the factory and open markets. Product certification system of BSTI has been up gradated in accordance with the international standard ISO/IEC Guide 65 (General requirements for bodies operating product certification system) with a view to achieving the satisfaction of local consumers as well as to promoting export. BSTI has 13 standards related to different food products and inspects raw materials, manufacturing process, packing and marking, laboratory and inspection procedure, hygienic and environmental condition at factory premises in case of food processing plant, testing facilities available as per Bangladesh Standard, storage facilities and testing personnel before approving the certification.

HACCP Certification: Hazard Analysis and Critical Control Point (HACCP), a system which identifies, evaluates, and controls hazards that are significant for food safety and quality. Most food industry prepares HACCP plan*, a* document in accordance with the principles of HACCP to ensure control of hazards which are significant for food safety in the food chain. These controls can be put in place through prerequisite program (GAP/GMP) and hazard analysis and critical control point (HACCP) system. The GAP lays the foundation for designing HACCP and its smooth functioning in the overall framework of food safety and product quality management. HACCP is a team-based logical step-by-step approach to the food growing and processing environment, and analyzing the range of hazards that may enter food at any step of the chain from manufacturing to consumption. This process has been implemented in several food industries of the country such as PRAN and has been monitored and certified by international accreditation experts.

ISO 9001 certification: International Standard Organization (ISO) certification is suitable for all sizes and types of organizations and is well established around the world as an invaluable Quality Management System standard. It is suitable for organizations in all industry sectors and will help to improve management processes to compete locally and/or globally. The process encompasses the entire organization and requires senior management buy-in, it is not just a function of the Quality Department. To achieve **ISO 9001 certification** an organization needs to demonstrate that it can meet the regulatory requirements and apply the system effectively.

Sanitary and phytosanitary (SPS) measures: Plant Protection Wing of the Department of Agricultural extension(DAE) is responsible for the Plant Quarantine Section which runs the plant quarantine services in Bangladesh. Plant Quarantine rules and regulations include laws, decrees, regulations, requirements, and procedures that governments apply to protect human, animal, or plant life or

health from risks arising from the entry or spread of plant- or animal-borne pests or diseases, or from additives, contaminants, toxins, or disease-causing organisms in foods, beverages, or feedstuffs. SPS certification is required to meet the quarantine requirement for importing and exporting plant products. DAE, Ministry of Agriculture also issues import and export permits and phytosanitary certificates for importing and exporting plants and plant products.

GAP: Good Agricultural Practices (GAP) codes, standards and regulations have been developed by the food industry and producers' organizations but also governments and NGOs, aiming to codify agricultural practices at farm level for a range of commodities. Their purpose varies from fulfillment of trade and government regulatory requirements in particular with regard to food safety and quality, to more specific requirements of niche markets. The objective of GAP codes, standards and regulations include, to a varying degree:

- Ensuring safety and quality of produce in the food chain
- Capturing new market advantages by modifying supply chain governance
- Improving natural resources use, workers' health and working conditions, and/or
- Creating new market opportunities for farmers and exporters in developing countries.

According FAO, Good Agricultural Practices are "practices that address environmental, economic and social sustainability for on-farm processes, and result in safe and quality food and non-food agricultural products" (FAO COAG 2003 GAP paper) for the consumer. Bangladesh is outlining its Bangla GAP in accordance with Global GAP standards.

GMP: Good manufacturing practices (GMP) are the practices required in order to conform to the guidelines recommended by agencies that control authorization and licensing for manufacture and sale of food, drug products, and active pharmaceutical products. These guidelines provide minimum requirements that a pharmaceutical or a food product manufacturer must meet to assure that the products are of high quality and do not pose any risk to the consumer or public. Good manufacturing practices, along with good agricultural practices, good laboratory practices and good clinical practices, are overseen by regulatory agencies in the United States, Canada, Europe, China, and other countries.

BRC: BRC Global Standards is a leading safety and quality certification program, used by certificated suppliers in 123 countries, with certification issued through a worldwide network of accredited certification bodies. The Standards guarantee the standardization of quality, safety and operational criteria and ensure that manufacturers fulfill their legal obligations and provide protection for the end consumer. BRC Global Standards are now often a fundamental requirement of leading retailers in UK and EU.

HALAL: The HALAL certification is especially important for marketing of products for Muslim consumers. The certification is given by a variety of organizations such as SGS, HALAL Bangladesh, HALAL Malaysia and HALAL UK. The HALAL certificate ensures that no ingredient identified as HARAM (not permitted to be consumed under Islam) is used in the making of a certain product.

There are other regional certification standards for product quality assessment e.g. Europe GAP, which specify regional standards for marketing of products.

5.2 Government Policies

The government of Bangladesh has identified agro processing as one of the thrust sectors and has given priority to the development of processed food industries. Among the many policies proposed by Government related to food processing: The Industrial Policy, the Agricultural Policy and the Seventh Five Year Plan are specifically significant for the growth of the agro processing sector in Bangladesh.

5.2.1 Industrial Policy 2016

The main objective of the recently announced Industrial Policy 2016 is to promote industrialization through the coordination of government and private organization in order to achieve employment opportunities and industrial growth. The policy mainly focuses on acceleration of industrial growth, creation of entrepreneurs, development of SME industry, establishment and diversification of export oriented industrial product, production increase, quality development and capability building in marketing of industrial product. Agriculture and food processing industry has been announced as high priority sector as these sectors can create large-scale employment through quick expansion and earn substantial amounts of export revenue. To foster the growth of the agro processing sector, the following activities are planned under the industrial policy:

Table 28: Industrial Policies 2016 for Processing Industry

Category	Activity Plan
Production	▪ Administer GAP certificate and establish strong value chain.
Processing	▪ Introduce and implement special program on harvesting, grading, transportation and packaging process of produced products ▪ Assist the entrepreneurs in establishing commercial agro-based industries ▪ Give support to the local industries on innovation development and transfer of technology ▪ Connect the local technical institute with the national machinery manufacturing industries.
Marketing	▪ Identify the potential markets of the product for export and undertake marketing efforts ▪ Institutional capacity building in negotiation for commercial agreement.
Quality and Standard	▪ Formulation of standards for safe products ▪ Take effective steps to implement food safety management system (FSMS) ISO 22000:2005 ▪ Arrange workshop regularly in the national level to develop quality assurance ▪ Set methods for long-term preservation of processed food items with the help of physical and chemical agents.

5.2.2 Agricultural Policy 2013

The Agricultural policy of 2013 mainly aims to create employment opportunities by diversifying agricultural activities, to ensure food security and to improve the standard of living of rural people

with increase productivity of agricultural products. The policy acknowledges the need for expansion of agro processing to reduce the wastage and increase the income of the farmers. The policy identifies inadequate technology for quality production to meet the demand of export market, poor storing and processing practice of agricultural products and weak transportation system of agricultural products as constraints in achieving a strong processing industry. The following activities are planned under the policy to support the development of the agro-processing sector:

Table 29: Agricultural Policies 2013 for Processing Industry

Category	Activity Plan
Production	▪ Provide support to produce high value crop in order to increase export of agricultural product and the income level of farmers ▪ Encourage "Good Agricultural Practices" (GAP).
Processing	▪ Encourage the development agro-processing industry ▪ Develop the value chain of agro-processing industry ▪ Provide special incentive to agro-processing industry
Marketing	▪ Strengthen quarantine services to meet the requirement of export and import market ▪ Encourage export of agricultural product to the mainstream market as well as to the Bangladeshi community dominated market ▪ Take necessary steps for diversification of agricultural products and to search prospective market for them ▪ Develop E-infrastructure to promote export market.
Quality and Standard	▪ Develop Sanitary and Phytosanitary measures.

5.2.3 Seventh Five Year Plan (FY 2015-FY 2020)

The seventh five-year plan aims to empower people with more employment and skill development opportunities, supply credit for SME development, and introduce ways to make people more productive. Along with growth, the plan will emphasize social protection, urban transition and a sustainable development pathway resilient to disaster and climate change. Under the plan, priority will be given to the application of GAP for safe food production, farm mechanization, post-harvest management, agro-processing and market development. The Five Year Plan sets some targets and proposed activities to achieve growth in the agro processing sector which is detailed below:

Table 20: Five Year Plan for Processing Industry

Targets	Activities
Post-harvest technology development	▪ Assessing post-harvest loss of different crops ▪ Development of improved post-harvest management ▪ Development of agro processing as income generation activities
Post-harvest monitoring	▪ Increasing transport facilities ▪ Collection of seed samples ▪ Seed test for purity, moisture and Germination
Providing access to marketing formation	▪ Improvement of marketing information collection and dissemination system ▪ Improvement of ICT infrastructures
Market access facilitation to farmers, producers and entrepreneurs	▪ Formation of farmers marketing Groups ▪ Training and motivational tours for farmers group ▪ Promotional activities

	▪ Strengthening of market management system ▪ Development market linkage
Support to agro-processors And agri-business entrepreneurs and Support to group marketing	▪ Development of agribusiness entrepreneurs ▪ Provide credit support ▪ Development of value chain linkage ▪ Promoting agro-processing ▪ Establishment of processing infrastructure
Improvement of marketing extension services and value addition	▪ Support transfer and use of modern post-harvest technologies ▪ Development of post-harvest skill and knowledge ▪ Development of Quality and Safety Certification System
Safe food production	▪ Safe food production and protect environment through minimizing hazardous chemical (pesticides) uses.
Promotion of high value crop	▪ Development of technologies for the production of high value horticulture crops, spices, aromatic and fine grain rice.

5.3 Business Membership Organizations (BMOs)

Bangladesh Agro Processors Association (BAPA)

BAPA is the leading business membership organization of the agro processors in Bangladesh. There are currently 235 members of BAPA. The primary objective of BAPA is to bring together and represent processors of all types of agricultural products and supporting industries which include field crops, horticultural items, mushrooms, fruits and vegetables, dairy & poultry, fisheries & other agricultural items. BAPA has undertaken activities on developing action plans, motivational and skill development programs, quality improvement and innovation with preservation techniques. BAPA is also involved with many national level government and non-government organizations on promoting agro-processing. However, BAPA has failed to utilize its full potential due lack of skilled human resource, weak product promotion system, inability to ensure quality products and lack of business model.

Bangladesh Frozen Food Exporters Association (BFFEA)

Bangladesh Frozen Foods Exporters Association (BFFEA) is the only trade body for the fish processing plants in Bangladesh. The association has been working to promote and protect the interest of frozen food processors, packers and exporters in the country who are engaged in fish processing and exporting. It also acts as a link between the trade bodies and the different government and private agencies. The association is pursuing foreign buyers, business association and the chamber of commerce and industries to develop export marketing of frozen foods. BFFEA has also advises the government in relevant policy, quality control, packaging, marketing and developing the fishery industries of the country. However, limited knowledge on niche export markets, weak marketing effort and lack of a business plan constrains the effectiveness of the association.

Bangladesh Auto Biscuit Bread Manufacturers Association (BABBMA)

BABBMA mainly looks after the policy and advocacy along with the issues like skill development, quality assurance, product development and welfare of employees for the related sectors. Their main objectives are: to improve productivity and profitability of industries in agro-food sectors, to promote apprenticeship and CBT&A to develop skills of poor and disadvantage people, to facilitate joint venture establishment and policy advocacy for agro-food sector. BABBMA has introduced apprenticeships for Bakers, Food Technicians and Packaging Technicians. They are provided with industry driven training research, course curriculum and learning material development along with capacity development through international accreditation, certification, Public private partnership (PPP) and Public Private Donor Partnership (PPDP). However, the association lacks financial strength and resource for R&D in order to develop international standard products.

Bangladesh Fruits, Vegetables and allied products exporters association (BFVAPEA)

BFVAPEA is a business membership organization of exporters dealing with of fresh vegetables, fruits, betel leaf and other products. Currently it has more than 350 members and the association is working as a service provider to producers, exporters of Bangladesh and importers of global market by ensuring quality of export crops and under taking developmental and promotional activities for export promotion and diversification. It also supports export diversification by promoting new products, export market linkages and facilitating product improvement.

5.4 Government Agencies

Export Promotion Bureau

The Export Promotion Bureau (EPB) of Bangladesh is the leading government authority for export market promotion with specific departments for trade promotion, commodity development, information and policy. EPB undertakes such activities through its different wings such as fair and display division, commodities development division, policy and planning division. The Fair and Display Division fosters participation of different processors and exporter in various international trade fairs and also organizes Bangladesh single country trade fairs to provide direct marketing support to the exporters of the country. The Commodities Development Division works closely with the private sector and advises the exporters on the quality of the products, its marketing and adaptation. The policy and planning division provides advocacy support and the information division publishes and distributes different brochures and leaflets. However, EPB does not undertake any market research to understand the export market and thus fails in identification and segmentation of niche market where Bangladeshi products can be introduced.

Business Promotion Council

Business Promotion Council (BPC) promotes export diversification by focusing on the growth of potential industrial sectors of Bangladesh economy. The Ministry of Commerce has selected six potential sectors including fisheries and frozen fish and agro processed and horticultural products, to give special attention through BPC. The main objective of BPC is to enable these six sectors to grow in such a way so that they can be competitive successfully in the export market. Their activities primarily include capacity building among industries, market intelligence support, market research and protection of private sector interest in the relevant sectors. The council responsible agro processing sector is the Agro Processing Business Promotion Council (APBPC). APBPC provides knowledge & technology dissemination and policy advocacy to the government on issues related to agro processing. However, lack of own trainers and under equipped lab facilities undermine the capability of the council to promote agro processing.

Department of Agriculture Extension (DAE)

Department of Agriculture (DAE) provides and promotes eco-friendly, safe, climate resilient, sustainable agricultural practices to ensure food security as well as commercial agriculture with a view to accelerating socio-economic development of the country. DAE provides location specific, demand responsive and integrated extension services to all categories farmer in accessing and utilizing better know how to increase sustainable and profitable crop production. The different wings of DAE: crop wing, horticulture wing, plant protection wing, plant quarantine wing, training wing, planning, project, implementation and ITC wing provide extension services to the farmers. DAE promotes Good Agriculture Practices, administers plant quarantine rules and regulations and issues import and export permits and phytosanitary certificates for importing and exporting of plants and plant products. However, there are no specific standards for GAP and monitoring& application of quarantine rules is not always up to the standard.

6. Development Projects focused on Agro Processing in Bangladesh

6.1 Bangladesh Skills for Employment and Productivity (B-SEP) Project – ILO

The Bangladesh Skills for Employment and Productivity (B-SEP) Project is an initiative of the Government of Bangladesh (GoB) funded by the Government of Canada and executed by the International Labor Organization with support from the GoB. ILO is partnering with various government ministries, line agencies, associations and private organizations for this project. Incepted on 27th March, 2013, the five-year project is expected to run till 31st March 2018. The project aims to accelerate the current efforts being undertaken by other organizations, donors and government to make skills in Bangladesh nationally recognized, accessible to all, higher quality and directly linked to jobs. The B-SEP project is focusing on five industry sectors, among which is the agro-food processing sector. The project works through four interrelated components:

- Institutional capacity development: Supporting the National Skills Development Council to implement the National Skills Development Policy
- Standard, training, assessment, and certification: Expanding the availability of new NTVQF programmes and supporting the adoption of new quality assurance guidelines among TVET institutions.
- Industry skills development: Increase engagement of industry in the skills system by establishing and supporting five new Industry Skills Councils, expanding the scope and nature of workplace learning and productivity enhancement programmes and expanding apprenticeship programmes in both the formal and informal sectors.
- Equitable access to skills: Increase access to skills and jobs for disadvantaged groups through the development and delivery of technical, supervisory and entrepreneurial skills for women and people with disabilities as well as supporting employment in green jobs.

Under this project, a number of initiatives have already been taken directed at the skills and capacity development of the agro-processing sector, which include:

- Introduction of the ILO productivity improvement tool SCORE (Sustaining Competitive and Responsible Enterprises) which assists mall and medium enterprises to becoming more sustainable through being greener, more productive and providing decent jobs. The programme is particularly relevant to enterprises that face internal problems common to many small and medium sized enterprises in Bangladesh; quality control, productivity management, pollution and waste management, workplace health and safety and human resources management.
- A workshop in 2014 to present the findings of a study focusing on the priority occupations for the future growth of the agro food processing, furniture, ceramics and pharmaceutical sectors.

The study analysed the internal strengths and weaknesses of the four priority growth sectors, the external opportunities and threats the sectors are facing and presented a detailed strategic plan focusing on which occupation are the most important to raise the skills and improve the productivity of the workforce.

- ILO is working with Government of Bangladesh to introduce green entrepreneurship in the agro-food processing sector. ILO's focus is on greening supply chains, as well as the creation and employment of green entrepreneurs in the agro food sector. ILO plans to work with partners for introducing environment friendly solid waste management and organic fertilizer, assessing the prospects for greening other business processes and creating green jobs.

Previously, under their **Technical and Vocational Training Education (TVET) Reform Project**, funded by the EC and implemented with the support of Government of Bangladesh, ILO established two industrial entities, Industry Skills Council (ISC) and Centre of Excellence Agro Food Skills Foundation (CEAFS). The Industry Skills Council (ISC) helps to strengthen linkages between the agro-food processing industry and the national training system by bringing together the major enterprises and industry bodies within the sector to discuss skill development issues affecting their sector. CEAFS is an initiative by the ISC as one-point resource and service centre in developing, supporting and strengthening the skills development system of Agro Food Processing Sector.

By exposing the various actors of the agro-processing sector including the associations such as BAPA, BABBMA, BFFEA etc., agro-food processors and workers to training and skill development, the ILO projects are taking a fundamental step in bridging the skill gap that is present throughout the agro-processing sector, not only helping improve overall productivity and efficiency in the system, but also streamlining processes to enter the global supply chain.

6.2 Global Agriculture and Food Security Program (GAFSP) – IFC

Under this program, the International Finance Corporation (IFC) invests across the entire food supply chain from farm inputs to logistics and storage, to processing and financing- for agricultural sectors which have perceived high risk, and are thus not targeted by other investors. The core issue is to address market failures by providing affordable funding with less demanding terms. This allows IFC to invest in early stage or riskier projects that hold high potential for development impact and financial sustainability. IFC partners with companies who include farmers as part of their overall value chain, providing access to markets, financing and storage, and increasing production and incomes. This program also helps to raise capacity building with IFC's advisory services, providing on-the-ground training and advice for businesses and farmers in improving farmer productivity, strengthening standards, reducing risks and mitigating climate change effects. The program is funded by Australia, Canada, Japan, Netherlands, UK, and US.

IFC sanctioned USD 15 million to PRAN Group, a Bangladeshi agribusiness firm, to expand its production capacity, create new rural jobs, and integrate small farmers into retail supply chains. The 5-year loan, the term for which began at 2012 and runs till 2017, is to be used to expand the production capacity of its subsidiary company Natore Agro in response to an increase in the demand

for packaged food products both in local and international markets, supporting PRAN Group's strategic investment plan in six food categories, such as snacks, confectionery, juice, beverage, culinary products, dairy and premium rice. The project is expected to create over 1,200 new jobs in rural areas, positively impacting the livelihood of farmers and their communities; it will source fruits, vegetables and other inputs directly from small farmers, the funding helps to ensure that farmers have a consistent demand and fair pricing for their produce; PRAN's extended distribution network will enable the company to reach under-served, impoverished communities to provide them with affordable, essential food products of high quality.

Since majority of this investment will be driving forward the growth and market integration of the snacks, confectionary, juice and culinary product segments of Pran, which are interlinked with all of the subsectors of the study (except fish), this investment is in line with our aim of improving the market linkages and spearheading growth of the private sector in certain facets of the agro-processing industry of Bangladesh. However, to achieve large scale impact in agro-processing sector, integrated interventions on support functions such as infrastructure and core functions such as supply chain development, quality control etc. is essential.

6.3 Cereal Systems Initiative for South Asia (CSISA) – CGIAR

The USAID-funded Cereal Systems Initiative for South Asia in Bangladesh (CSISA-BD) project is a five-year initiative implemented through collaboration between three CGIAR member centers, the International Rice Research Institute (IRRI), International Maize and Wheat Improvement Center (CIMMYT) and WorldFish. Running for an eleven-year period between 2009 and 2020, the project aims to increase household income, food security and livelihoods in impoverished and agriculturally-dependent regions of Bangladesh. Another objective is to build capacity of researchers, extension workers, farmers and others by enabling rapid dissemination and adoption of improved agricultural technologies and varieties. Its major activities are:

- Promoting innovative technologies
- Developing and strengthening local service provider networks
- Leveraging private sector investments to commercialize and scale agricultural technologies
- Research and public sector engagement

The project aims to extend direct research and extension services to 60,000 farmers indirect benefits to 300,000 farmers; deliver rapid and sustainable increases in agricultural production; ensure expansion of agriculture extension “hub” systems that enable interaction by local change agents‘ including researchers, Department of Agriculture Extension agents, farmers, producer associations, NGOs, the private sector, local government leaders and agro-entrepreneurs; develop more efficient rice-wheat, fisheries and maize production systems adopting new seed technologies; apply innovative information delivery mechanisms, including robust decision support tools developed to better integrate producer information, market prices, weather and risk; participatory evaluation of new technology and management practices.

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To achieve this, CIMMYT and WorldFish have organized trainings, on the job learning and provided coaching on different activities of improved technology. The project also focuses on increasing women's participation in agriculture to reduce the gender gap and enable women and men farmers to innovate and adopt improved technologies and varieties. Some of the achievements of the project in both the maize and fisheries sectors of Bangladesh include increased on-farm productivity, adoption of improved maize and fish varieties and agricultural management practices, raised awareness among farmers of new varieties and management practices, increased availability of improved agricultural technology to farmers, enhanced research and development capacity, increased use of agricultural services, private sector provision of agricultural machinery and enhanced participation of women in food security activities.

Encompassing two of our sub-sectors, namely fish and maize, this project works with a number of important factors cross-cutting with our study. First, it ensures availability of improved, high yield varieties at farmers'/producers end, including educating farmers on, and disseminating high yield and improved varieties of fish and maize and agricultural management practices, disseminating improved production technology, enhancing overall research and development capacity, which was identified as another key constraint to growth of the agro-processing sector in our study, increasing private sector participation and participation of women in the value chain.

6.4 USAID-Agricultural Value Chains (AVC) Project- DAI

The Agricultural Value Chains (AVC), a five-year project which began in 2013 and is expected to end in 2018, is funded by USAID under its Feed the Future initiative to improve the food security scenario in Bangladesh by strengthening agricultural value chains. AVC aims to achieve broad-based economic growth and enhance long-term food security in 20 districts of the Southern Delta of Bangladesh by applying a market systems approach. This will result in increased access to and availability of diverse and nutritious fruits, vegetables, and pulses in local, regional, and national markets and will contribute significantly to improving food security in the targeted area. They work with the Agro- Inputs Project (AIN), the Agricultural Extension Support Activity (AESA), the WorldFish AIN Project, the Cold Chain Bangladesh Alliance (CCBA), the USAID Horticulture Project (with CIP), IFPRI, Shouhardo II, Spring, and Shika. They also work with private sector enterprises such as Bomba Sweets & Co. Ltd., a leading consumer food producing company in Bangladesh that manufactures potato, corn and cereal based food products.

AVC divided the crops that it works with into two value chains- food and non-food. In the food value chain, AVC works with crops that are nutritious, and/or high income generating, while being agronomically and culturally feasible in the Southern Delta. This includes fruits, vegetables, spices, pulses, etc. The specific crops that AVC works with include mango, tomato, groundnuts, potato, pulses, bitter gourd, cucumber, eggplant, pointed gourd and pumpkin. AVC works with farmers through providing training in production technologies for producing high-yielding, safe crops following safe production and post-harvest practices, along with cross-cutting issues such as gender, nutrition, access to finance and environment. They also promote and organize dialogues, workshops and establish linkages in international markets.

The AVC project works with multiple sub-sectors which are common with the sectors chosen for our study, including mango, tomato, potato and pulses. Through the AVC project, farmers are receiving training on production of high-yield varieties, and in some instances, processing varieties of crops, with a total of 200,000 individuals already having received training in their food value chain sector. This will immensely help strengthen the supply side for the growth of the agro-processing sector of Bangladesh. In addition, AVC also works to create strong market linkages between farmers and actors in their upward and downward supply chain, including input suppliers, farias/traders, and support service providers including DAE officials. AVC also works to create linkages between their beneficiaries and the agro-processors, which ensure an influx of quality raw materials, translating into high quality processed products. AVC also works with international market linkages, leveraging which, agro-processors can cash in on export opportunities in the growing international market base.

6.5 National Agricultural Technology Program - Phase II Project

After successful implementation of Phase I, the National Agriculture Technology Program Project Phase II project was launched in 16th April 2016, expected to operate for five and a half years till 30th September 2021. The overall objective of NATP-I was to increase income and reduce extreme poverty and hunger by improving agricultural productivity and the performance of the national agricultural technology system. Although the objectives were achieved by increasing efficiency and effectiveness of the agricultural research and extension systems, there is room for more work. A key lesson learned from the implementation of NATP-1 is the need to look beyond productivity increase and focus equally on facilitating market linkages to ensure sustainability of farmer groups and in particular of producer organizations. Smallholders in Bangladesh are generally poorly integrated into post-harvest agricultural value chains, resulting in a large between the commodity value received by farmers and the ultimate retail value of these products (raw or transformed). Principal contributory factors to the limited price pass-through include, among other things: inordinately lengthy chains with multiple links/intermediaries, logistical challenges; poor linkages among chain participants and high information asymmetry; postharvest deterioration. The sector also suffers from food safety concerns that limit markets.

The objective of the second phase of the NATP for Bangladesh is to increase the agricultural productivity of smallholder farms and improve smallholder farmers' access to markets in selected districts. There are five components to the project, the first component being enhancing agricultural technology generation. This will help improve the performance of the national agricultural research system (NARS) through the support to agricultural technologies development and strengthen agricultural research institutions. The second component is to increase farm yields, diversify agricultural production, and improve market linkages for smallholder farmers. The third component is to support fisheries development by promoting an integrated approach to achieve productivity, quality and output increases through technology transfer, as well as a better access to market opportunities for fish farmers. The fourth component is the supporting livestock development by promoting an integrated approach to achieve productivity, quality and output increases through

enhanced technology transfer, service delivery, as well as a better access for livestock farmers to markets. Finally, the fifth component is the project management, which will: (i) ensure that the project is carried out in line with the provisions in the official project documents, in particular all fiduciary and governance aspects; (ii) establish liaison mechanisms between the World Bank and the project, as well as between the project and the GoB, and (iii) coordinate the implementation of selected overarching project activities with the support of external technical assistance.

While the project budget is USD 214 million, IDA, IFAD and USAID will come up with USD 176.06 million in project assistance while the remaining balance will come from the state exchequer. Over 28,40,000 farmer's families would be benefitted after the implementation of the project in 270 upazillas under 57 districts by September 2021. The Ministry of Agriculture, Government of Bangladesh will act as the main implementing agency.

The NATP Phase II project will work to improve on-farm productivity, which will ensure abundance of quality raw materials for the agro-processors of the country. The improvement of the NARS will bolster research bodies to develop new and improved, high-yield processing varieties, a dearth of which currently haunts many of the otherwise potential market sectors in agro-processing. The project will also work to develop the fisheries sector, improving productivity, quality and output increases, alongside improving market linkage, allowing fish processors to seamlessly get high quality materials for processing.

6.6 Sustainable production and consumption of tomato and mango processed products- SNV Bangladesh and SWITCH-Asia

The four-year project, beginning in January 2016 and ending in December 2019, seeks to contribute to greater consumer confidence in domestically produced processed horticultural products-namely mangoes and tomatoes, reduced food safety incidences in the domestically processed mangoes and tomatoes, and inclusive business development in the fruit and vegetable processing industry. At the end of the four-year project at least 50% of the domestically processed tomato and mango products marketed and consumed in Bangladesh will be certified safe. The key objectives of the project include:

- Enhance consumer awareness of safe food and increase access to safe tomato and mango processed products
- Develop traceable, safe and sustainable supply chains for tomato and mango products in the country
- Establish an industry standard and a certification body for tomato and mango processing

The project is being funded by the EU, with a budget of €1,999,811 (EU Contribution: 90%). The project is being implemented by SNV Bangladesh in partnership with the SWITCH-Asia Programme.

Other partners include Consumers Association of Bangladesh (CAB) and CEAFS. The expected outcomes from the project will be-

- Supply chain traceability and certification systems for safe and sustainable tomato and mango processed products will be developed and adopted
- Certified tomato and mango processed products (puree, ketchup, juice etc.) will account for minimum 50% of the (retail) market in Bangladesh
- At least six food processing companies will adhere to the sector standard
- CEAFS will develop the capacity to introduce and implement certification of tomato and mango processed products
- Consumers' trust in the products safety will increase by 50%

This project is very closely linked with the objective of the study, as it deals with potato and tomato based products, namely juice and ketchup, which have been identified as high potential products in our study. The development of the supply chains will ensure top-grade raw materials reach the agro-processors to work with. This project will help ensure industry-wide adoption of standard and certifications, ensuring quality products at the consumers' end, alongside boosting consumer confidence in the products, hence increasing domestic demand for these products.

6.7 BAPA-European Union SME Competitiveness Grant Scheme

In the year 2013, the Ministry of Industries (MoI) and European Union (EU) in collaboration with the Bangladesh Agro Processors' Association (BAPA) undertook a five-year project to develop the sector's contribution to the economy by improved performance home and abroad, culminating into the BAPA-European Union SME Competitiveness Grant Scheme. The BAPA-European Union SME Competitiveness Grant Scheme consists of two projects. These are:(a) The Road to Sustainable agro small and medium enterprise (SME) development in target clusters of Bangladesh through Ability and Technical Skills and (b) Strengthening the capacity of Bangladesh Agro-Processors' Association (BAPA) to enhance competitiveness' of its member SMEs involved in Agro-Processing

The overall objective of the scheme is to achieve economic growth, increase employment and alleviate poverty through sustainable agro SME development in four target clusters. The BAPA-EU SME Competitiveness Grant Scheme aims to create 200 new small entrepreneurs, another 60 from Technical Vocational Education and Training (TVET) students, generating 5000 jobs in such new SMEs, with women or tribal or physically challenged persons sharing 50 per cent of the jobs. The SME Competitiveness Grant Scheme envisions four results:

- entrepreneurship development which will lead to business growth, increased sales, new jobs and increased business opportunities in the agro processing sector
- the apprenticeship programme which bridges the skills gap and boosts productivity of the members of agro food processing clusters and businesses

- generate innovative business ideas, including value addition and enhanced capacity to explore international markets
- sustainable mechanism for delivering entrepreneurship training for agro processing sector.

BAPA has already involved a total of 1,400 persons in the apprenticeship program, where the target set was 2,000. Of the targeted 200 small entrepreneurs, BAPA has already contributed to the development of 215. Under Training of Trainers (TOT) program, BAPA has already trained 30 trainers who are now able to help current or upcoming agro-entrepreneurs. BAPA has also trained 30 industry managers and supervisors with a view to developing their management skill as they can contribute to boosting production of their individual factories.

Under this program, the agro-processing sector of Bangladesh will see an influx of skilled personnel, both as founders of new agro-processing ventures and as skilled workforce who will drive productivity and growth of the sector. New business ideas will be generated, opening up new avenues in agro-processing, with novel and diversified product lines to capture international export markets. Coupled together, the existing skill gap and dearth of product innovations in the agro-processing sector of Bangladesh will be mitigated.

7. Pro-Poor Prospect

7.1 Income generation from on-farm activities

From field investigation; it has been observed that majority of the short-listed crops are capital intensive meaning that production of these crops require high investment. As a result, poor farmers generally do not cultivate these crops. However, the crops which do not require high capital investment such as mustard and mangoes can be cultivated with small capital investment. Mustard can be cultivated in chars with low capital investment and poor farmers usually cultivate mustard in these chars. The mango varieties used for processing i.e. guti and ashwina does not require high maintenance and small orchards can be established in homesteads. Turmeric, cultivated in Khagrachari is almost entirely cultivated by poor farmers as the cultivation method is not capital intensive. However, this is not true in other areas of the country as the farmers practice more modern methods of cultivation which is both labor and capital intensive.

Table 31: Income Generation from On-farm Activities

Crops	Poor farmer engagement	Prospect for poor farmer engagement
Chili & Turmeric	Meidum (Chili) High (turmeric)	Engagement of the poor farmers in the chars High for turmeric especially in Chittagong Hill Tracts
Mango	Moderate	Moderate as poor farmers can establish micro orchards of guti and ashwina in their homestead Chili and turmeric can be cultivated in the mango orchards as inter-crop.
Tomato	Low	Low as tomato cultivation is capital intensive
Potato	Low	Low as potato cultivation is capital intensive
Tilapia and Pangus	Low	Low as tilapia ad pangus cultivation is capital intensive
Mustard	Moderate	Moderate; mustard production can be increased in chars
Pulses	Low	Moderate as pulse production can be increased in chars
Maize	Low	Low as maize cultivation is capital intensive

7.2 Employment from off-farm activities

The engagement of women and poor are moderate in agro processing. Women are engaged as workers in different factories. Women are also engaged in post-harvest management such as leaning, washing and drying. Laborers are engaged in crop production and harvesting, transport and factories. The crop specific engagement of women and laborers are detailed below:

Table 32: Employment from Off-farm Activities

Commodities	Female engagement	Male engagement
Chili & Turmeric	Engagement in sorting, drying of chili Engagement in sorting, cleaning, boiling and drying for turmeric Engagement in turmeric production in CHT	Crop diverse cultivation management operations, field transportation, and also post-harvest management activities
Mango	Engagement in sorting, grading, de-	Mango orchard management, harvesting,

	latexing, hot water treatment, ripening of mangoes at agents' level	transportation and also post-harvest management activities, Significant engagement at mango orchard management especially, in spraying pesticides, and packaging of mangoes
Tomato	Engagement in post-harvest management	Crop production, transportation and
Potato	Engagement in potato storing at farmer household	Crop production, transportation and
Tilapia and Pangus	None	Fish production operation like fish feeding, watching/guarding fish catching, washing, icing, packaging, transportation
Mustard	Engagement in threshing, winnowing, cleaning and drying	Crop production, threshing, winnowing transportation
Pulses	Engagement in threshing, winnowing, cleaning and drying at farmer level	Crop production, threshing, winnowing, transportation and
Maize	Engagement in deshelling with hand tools, cleaning and drying	Crop production, mechanical deshelling, transportation and

7.3 Income from Non-Farm Activities

There are income-generating opportunities in non-farm activities as factory laborers and as small scale entrepreneurs (women and poor). As the agro processing industry is growing, the number of factories is also increasing which are employing a good number of women and poor as factory workers. A significant scope for non-farm employment generation lies in the formation of groups to take up small scale processing. Rural poor and women can form groups and pool together their resources to establish a small scale processing facility to produce animal feed, chips and mango chutney.

Table 33: Employment from Non-Farm Activities

Commodities	**Female engagement**	**Male engagement**
A. Employment in factories		
All the selected agricultural commodities	Employed as factory worker or other occupation	Employed as factory worker or other occupation
Mango	Engagement in sorting, grading, de-latexing, hot water treatment, ripening of mangoes at agents' level	Mango orchard management, harvesting, transportation and also post-harvest management activities, Significant engagement at mango orchard management especially, in spraying pesticides, and packaging of mangoes
B. Self-Employment in own factories as individual or group forming as a social business		
Mango	Salt stock Preparation	Salt stock Preparation

Chili and Turmeric	Turmeric boiling, Chili and turmeric solar drying	Turmeric boiling, Chili and turmeric solar drying
Potato	Potato chips preparation	Potato chips preparation
Tilapia and Pangus	Small scale feed mill (group forming)	Small scale feed mill (group forming)
Mustard	Kashundi preparation (group forming)	-
Pulses	Chanachur, Jhuri Bhaja, Beson preparation (group forming)	Chanachur, Jhuri Bhaja, Beson preparation (group forming)
Maize	Small scale feed mill (group forming)	Small scale feed mill (group forming)

8. Summary of Opportunities and Challenges

8.1 Crop Specific Opportunities

Analysis of the crop specific value chain revealed a number of crop specific opportunities. For example, for mango juice, processors identified export market diversification as the demand for mango juice is increasing the export destinations. For maize, the use of maize starch in the textile and pharmaceuticals industry is still very low. For fish, the establishment of new processing plants provides opportunities to tap into the export market. The crop specific opportunities are detailed below:

Table 34: Crop Specific Opportunities

Crops	Opportunities
Turmeric	Increasing export market (volume of spices increased by 4% as per EPB 2013-14) Processors focusing on export market as local market has become saturated
Chili	
Tomato	Deficit in current demand and supply for tomato for tomato sauce (500 MT of sauce imported in 2014, BBS 2014) Increasing demand of tomato sauce in the growing fast-food industry
Mango	Increasing export market (Volume of juice exported increased 34% according to BAPA 2015) Local processors identified mango juice which can be pushed in the export market
Potato	Deficit in current demand and supply for potato starch (EU Inspired 2013) High demand for convenient snacks (chips, french fry and crackers) Prospect for making potato powder
Pulses (Mung)	Increasing export market for snacks (700% increase in volume of snacks exported in 2013-14 according to BAPA)
Mustard	Informal Processing of Mustard Oil 92% (271,000 MT) and formal Processing of Mustard Oil 8% (24,000 MT)
Fish	Establishment of fish processing plants through government incentives
Maize	Deficit in current demand and supply for maize for animal feed; Growth of the animal feed industry in Bangladesh Untapped opportunities for industrial starch (locally produced maize accounts for only 9.5% of the total demand for maize for starch production) Growth in demand for maize for food processing

8.2 Overarching Opportunities

Local Economic Growth

Bangladesh is enjoying a 7.05% economic growth per annum (WB 2016) and the size of the middle class population is projected at 30 million. According to BCG 2014, the middle class population will grow at 10.5% per annum. This increasing middle class population provides a great opportunity for the growth of the agro processing industries as the demand for agro processed food rises with the

increase of the middle class population. The proliferation of departmental stores and establishment of new outlets such as ACI fish harbor justifies the increasing opportunity in the agro processing industry.

Untapped export market

The existing major export destinations are the middle-eastern countries where there is a large Bengali diaspora. These destinations provided the entry points to the export market and still are lucrative market as the number of people working abroad in increasing. However, there are other markets such as US and the European market which has not yet been penetrated. These markets are high value markets and can be targeted with the right products and ensuring quality standards.

Government support

The government has identified agro processing as one of the thrust sectors and has developed specific guidelines and policies for promoting the growth of the sectors. These policies and guidelines detail out the tasks and activities of different government organizations for the promotion of agro processing industry. The government has also provision for establishing mega food parks, special credit schemes and tax holidays and cash incentives (20%). However, the realization for these policies has been slow and needs a detailed action plan to achieve the desired outcomes. The different government agencies also need to coordinate among themselves to achieve a unified outcome.

New Product Development

The existing product range of major agro processors are still limited in the sense that only products which are already familiar to the consumers are being introduced. There are opportunities for increasing the product range by utilizing different crops which are produced abundantly in Bangladesh. One such example can be jackfruit. It is the third most produced fruit in Bangladesh and no major product in made using jackfruit. According to EU (2013), different products that can be made from jackfruit are: Pickle/Chutney, Canned jackfruit, Fruit leather, Jam, Candy/Toffee/biscuit, Beverage and chips. Thailand is already procuring different products from jackfruit. As with the case of jackfruit, there are other crops (bananas, pineapple) that can be used to make new products.

Private Sector Investment

The private sector has invested significantly in the agro processing sector. All major business conglomerates in Bangladesh have invested in agro-processing and are expanding their operations. Private sector investment is well spread across inter-related markets (agro-machineries and equipment, inputs, post-harvest infrastructure). There is increasing interest in FDI on agro-processing in Bangladesh as Poland wants to invest in food processing (Samakal 2016) and Sumitomo corporation from Japan is reportedly investigating prospect for investment in agro-

processing The recent major investment has been in the fish processing sector with companies such as Virgo Fish and Agro Process investing around USD 18 million to establish a fish processing plant in Mymensingh.

Donor Investment

There has been significant involvement of the donors and development organization in fostering the agro processing industry in Bangladesh. Some of the projects currently being implemented in Bangladesh are: B-SEP Project – ILO, GAFSP – IFC, USAID-AVC Project- DAI, Sustainable production and consumption of tomato and mango processed products- SNV Bangladesh and SWITCH-Asia, BAPA-European Union SME Competitiveness Grant Scheme). Major areas of interventions: Institutional Capacity development, Standard and Certification, Skill Development, Developing and strengthening local service provider networks, leveraging private sector investments to commercialize and scale agricultural technologies and Research and public sector engagement. These projects provide a significant opportunity to foster growth in the agro processing industry of Bangladesh.

8.3 Overarching Challenges

Infrastructure

To develop the agro processing sector, strong infrastructure such as power and road connectivity is essential. However, the power generation in Bangladesh is inconsistent and erratic and road connectivity still needs improvement. The natural gas supply in Bangladesh is decreasing and the government does not provide any industrial gas connection. The availability of space in air cargo is limited and the container handling at Chittagong sea port can be improved. In the field investigation, farmers in the Northern region of Bangladesh reported that if there was a processing plant in the vicinity of their production area, they could easily supply to the plant. However, the establishment of processing plants is not feasible as the government does not provide gas connection to new industries and generating own power will not be cost effective.

Procurement

The raw material procurement process in Bangladesh is still in the rudimentary stage. Processors rely mainly on agents and arotdars to procure their raw materials. The processors only procure the raw materials when there is abundant supply and the price of the raw materials is cheapest. Though supplying to the processors opens up a new market for the farmers, the benefits of agro processing does not directly reach the farmers. Contract farming, through which the farmers can directly benefit from processing, has not yet been popular in Bangladesh as the processors are not committed to the system and they tend to exploit the farmers through the system. Erratic and irregular demand from processors lead to mistrust amongst the farmers and the high market

demand for the table crop disincentives the farmers to produce industrial varieties. Often production not meeting the specific requirements by the processors (Processors seek industrial varieties of potatoes with higher dry matter content and larger tubers (100 gram) are sought by French fry producers).

The productivity of different crops in Bangladesh is still below world standards. In recent years, the productivity has increased significantly with the introduction of different improved varieties of crops and the improvement of cultivation practices. However, the productivity can be further increased if the production methods are improved and more farmers use high yielding varieties. In Vietnam, the productivity of Pangasius is around 400-500 MT/Hectare whereas in Bangladesh it is only 40-60 MT/Hectare (Katalyst 2013). This is possible as the feed in Vietnam is of better quality and the cultivation method is more modern than that of Bangladesh. Such low productivity means that the production can be increased many folds which can ensure a sustained supply of raw material for processing.

Quality standards

To enter the world market especially the European and US market, Good Agriculture Practice (GAP), HACCP and other standards need to be strictly maintained. However, the current agriculture practice in Bangladesh does not conform to GAP. The rampant use of pesticides and insecticides during production, use of ripening agents and use of formaldehyde make the crops unsuitable for human consumption. Food safety has been a key concern in Bangladesh and the government has taken steps to curb food adulteration. However as explained earlier, food safety in Bangladesh is a multi-sectoral responsibility however the administrative enforcement mechanism of Bangladesh is not organized. The processors often do not want to comply to the standards which further aggravates the situation.

Packaging and Storage

Inappropriate packaging and storage results in high post-harvest losses in Bangladesh. According to the Daily Star (2013), post-harvest losses in Jackfruit (32%), banana (30%), tomato (28%) and cabbage (24%). According to Kitinoja and Kader, 2015, post-harvest losses in fruits and vegetables are around 23-45%. Such losses are mainly due to the usage of inapposite packing material being used to store and transport the perishable crops. There are also inadequate storage facilities. For potato, the cold storage capacity of the country is 4.5 million MT, which is just 50 per cent of the total production (The financial Express 2016).

Consumer perception about quality

The persistent concern about food safety has tainted the consumer perception about the quality of products. There have been reports of mango juice being produced from expired pulps, unhygienic

and unsanitary condition at processing facilities and the use of harmful ingredients (lead in turmeric powder) in the production of different product has impacted consumer perception about quality of products. Pran reported that; because of the consumer perception about the low quality of mango juice, their domestic market of mango juices is shrinking. Such negative attitude of consumers towards Bangladeshi products is a major barrier in expanding the agro processing sector in Bangladesh.

Skill Development

There are inadequate training programs and facilities in Bangladesh. There are some training programs as BABBMA has introduced apprenticeships for Bakers, Food Technicians and Packaging Technicians, BAPA has conducted Apprenticeship programme for skills development and Centre of Excellence Agro Food Skills Foundation (CEFAS) provides workplace skill development. BITAC, SME foundation and BSCIC also provide skill development. However, the existing skills development programs focus on training SMEs on small scale cottage based processing and there is lack of training to industrial processors on quality control, food safety issue, supply chain management, productivity management.

R& D

There is a lack of coordination among research institutions and processors. As explained earlier, the processors are not very keen to take up the technology developed by research organizations such as BARI as they find it not commercially suitable. BARI, on the other hand commented that the processors do not communicate with them about suitable technology. As such, BARI, BCSIR innovations are not being scaled up by private sector. The private sector investment on R&D is insignificant, most of the agro processors do not want to take risk on introducing new products in the market rather they are satisfied with introducing competing products of existing products.

Policy Environment

The government has identified the agro processing sector as one of the thrust sectors and developed various policies and laws to foster the growth of the agro processing industry. However, there is no set action plan to achieve different objectives stated under various polices. For example, Industrial Policy: 2016 sets out different objectives however it does not provide any directives or timeline on realization of these objectives. In some cases, policies are not favorable. Recently NBR has halved the Customs Duty (CD) (from 10% to 5%) on import of starch in order to support the local textiles and paper industry however it makes the locally produced starch costlier (The financial Express 2015).

8.4 Relevance of Katalyst Interventions to the Major Crops for Agro-Processing

8.4.1 Aquatic Fish (Tilapia and Pangus)

Background: Katalyst focuses in cultured fisheries or farmed-based fisheries as this has the highest poverty reduction and growth potential. In the 1st phase of Katalyst (2003-2008), it intervened in regional markets, focusing on various inputs and cultivation practices associated with commercial fish farming. By 2009, in phase 2 (2008-2013) Katalyst shifted its general strategy from region specific interventions to more geographically spread interventions within the country. A comprehensive study of fisheries sector of Bangladesh commissioned by Katalyst, conducted by Bangladesh Centre for Advanced Studies(BCAS) in 2009, revealed that certain species like tilapia, pangus (Pungasius), koi (Anabas testudineus) and freshwater prawn (Macrobrachium Rosenbergi), can be promoted for commercial culture by engaging market players. However, market constraints such as weak linkage between farmers, hatcheries and input companies, low supply of quality inputs, limited information on effective farming techniques were barriers to improving the productivity and profitability of these small farmers. Katalyst also facilitated linkage activities for different stakeholders i.e. government, private agro processors, hatchery owner to Thailand, Vietnam and World Seafood Expo to understand the export market better and commissioned a study on the export potential of fish processed product of Bangladesh. From these activities, it became evident that to enter the export market, the quality of the fingerling of Pangasius and Tilapia needed improvement to increase the amount of flesh that can be extracted from the fish and also to achieve the white flesh of Pangus which is desired by different buyers.

Key Interventions and their relevance to agro processing

Facilitating private hatcheries in sourcing quality brood stock: Katalyst linked the major national hatcheries to source of quality brood from Vietnam, Thailand, and Philippines, built capacity of hatcheries to better manage their infrastructure and quality of brood. It significantly reduced the mortality rate of fingerlings at culture ponds and in turn resulted in higher profit for farmers. This improved brood stock and the resulting fingerling has direct relation with agro-processing especially in capturing the export market as the flesh content is higher for Tilapia and Pangus and the flesh of Pangus is white which is required for capturing the export market.

Facilitating feed companies in improving the feed quality: Katalyst has facilitated private feed companies in improving the feed quality. Katalyst worked to improve the feed formulation, machinery up gradation, lab testing facility at the factory level. These interventions have improved the feed quality which has a direct relation to ensuring good aquaculture practice which is a pre requisite for export.

Improving post-harvest packaging: Katalyst has undertaken interventions with a few private sector procurement companies in promoting quality fish packaging and in establishing safe procurement

channels in compliance with the safety standards, certification and traceability. Katalyst promoted the use of plastic crates and other packaging materiel to improve the storage of fish and also reduce post-harvest loss. Such improved post-harvest packaging and traceability is essential to ensure GAP.

Utilization of fish waste (offal) and fish fillet processing:

Katalyst through its partner BPC is currently working to use the fish waste for feed and other by-products.

Promotion of safe fish farming:

Katalyst has partnered with various input companies (Eskayef Bangladesh, ACI and Meridian) to promote safe fish farming in Bangladesh. Through the partnership, Katalyst has facilitated training on safe fish cultivation which is a prerequisite for export. Framers wer trained on good aqua culture practices, usage of safe input and post-harvest management. Through this intervention ACI and Meridian is directly procuring the fish from the farmers at market price and they buy the total produce of the farmers. Katalyst has also worked on improving the traceability of the companies which are a pre-requisite for export and maintaining quality.

Facilitation of introduction of new outlets:

Katalyst has partnered with ACI and Meridian to introduce 2 new outlets in Dhaka and Chittagong. These outlets perform some primary processing such as cleaning, sorting and grading. ACI has procured an Arot at Karwan Bazzar and grades the fish at the arot. Only the best quality fish is selected to be sold at their outlets. Meridian is also following the same practice. Both of the companies are also supplying to institutional buyers such as hotel, restaurants and government offices.

Facilitation of HACCAP certification for ACI, VIRGO and Meridian:

Katalyst is also working with ACI and Meridian to facilitate HACCAP certification for both of these companies. VIRGO has already received the HACCAP certification and they are now trying to procure BRG Global Standards which is necessary to export products to the European market.

8.4.2 Maize Processing

Background: Maize cultivation in Bangladesh started to become popular with the rise in poultry rearing. Maize production increased manifolds however, the potential of the maize sector, especially outside of the main production areas in the north, remains unfulfilled, and innovation in the north of Bangladesh has not spread organically to other regions. Despite the increasing demand, Bangladesh is still not self –sufficient in maize, importing 556,000 MT of maize in 2014-15 (ITC). Katalyst intervened in the sector back in 2004 when the sector met more than 70% of its demand through international imports. After 10 years of involvement in the sector, Katalyst acknowledges a promising development in the sector's competitiveness since the sector can rely heavily on local production of maize and only have to procure 30% of maize through international imports. Katalyst's intervention in 2014 was based on a diagnostic process that sought to understand not just the

superficial manifestations of market performance, but the underlying cause of this underperformance. Katalyst focused on four supporting functions: information, behavior, inputs and linkages, with associated impact on behavioral norms. In 2006, after a few years of experience of maize promotion activities, and commencement of retailer training programmes (RTP) in partnership with Syngenta, Katalyst identified contract farming as a market based solution. Partnering with Doyel Agro, Katalyst piloted a contract farming model and working with other seed companies, extended the model to char and other areas of Bangladesh.

Key Interventions and their relevance to agro processing

Promoting contract farming in the char and other areas: Katalyst linked the local and national feed mills with the farmers to promote contract farming. This helped the farmers in having an ensured market for their produce and the feed mills also could plan their procurements accordingly. Such contract farming especially in the char areas increased the production as these lands were not under maize cultivation before Katalyst's intervention. This increased production and linkage with feed mills were instrumental in promoting the use of local maize by the feed mills rather than depending on the imported maize. The farmers were also taught about proper post-harvest management to ensure the farmers could maintain good quality of their produce.

Promoting summer and winter maize: Katalyst also partnered with private seed companies to promote summer and winter maize varieties. Before the intervention, majority of the maize grown in Bangladesh was winter variety and through the intervention, the total maize production increased as a result of the increased production period. The promotion of winter maize in greater North (Phase 1 & 2) and other promising areas such as Mymensingh, Faridpur, Barisal (Phase 3) resulted into both horizontal and vertical expansion of maize production.

8.4.3 Potato Processing

Background: Katalyst started its work in potato sector by working with exporters to establish backward/forward market linkage. As the main aim during the 1st phase was to develop the export market, Katalyst facilitated exposure visits, participation in fairs. During the 2nd phase, Potato was recognized as a sector. Katalyst focused in this phase on potato seed, with the goal of ensuring export variety and processing variety of potatoes available in the market Katayst worked with its partners in seed multiplication and marketing. Interventions on potato were on two strategic areas: interventions related to the potato value chain in general and interventions related specifically to potato processing.

Key Interventions and their relevance to agro processing

Improving access to and use of quality inputs: Katalyst concentrated on improving farmers' access to quality seed of industrial varieties Katalyst partnered with seed companies to import breeder seeds

of courage and Lady Rousetta which are industrial varieties suitable for processing. The seed association, as a leverage point to ensure scale-up, was also to promote these varieties. These interventions helped in improving access to industrial varieties of potato which are necessary for processing.

Promoting cultivation of industrial varieties: Katalyst also promoted the cultivation of industrial potatoes by encouraging contract farming. Katalyst partnered with agro processors to facilitate the contract farming process. With the contract farming in place, the production of industrial varieties of potato has increased significantly.

Improving post-harvest management: Post-harvest management is especially important for potato as it is a highly perishable product and if the quality is not maintained the produce will not be sourced by the processors. Katalyst facilitated the training of cold storage personnel on improved storage methods and also promoted local cold storage methods. Interventions on use of CIPC technology (spraying chloropropham in the stores), which is used as a sprout suppressant to keep the cold stored potato suitable for the production of crisps and flakes and the use of leno mesh bags has also improved the quality of raw materials to the degree sought by the processing companies.

8.4.4 Vegetable (Tomato)

Background*:* Vegetable is one of the sectors that Katalyst intervened in since 2004. Farmers can earn considerably more from vegetable farming than from cultivating traditional crops such as rice and wheat. Over the last two decades, the productivity of Bangladesh's vegetable sector has increased significantly. The key intervention areas under vegetable cultivation were: promoting quality seeds, introducing smaller packets of seed, promoting balanced fertilization, IPM promotion and post-harvest management. These interventions were cross-cutting i.e. the impacts were distributed along the different vegetables that Katalyst worked on. Piloting and promoting summer tomatoes, introducing improved baskets for post-harvest transportation of tomato, seed improvement program encompassing the overall vegetable sector also helped further the improvement in grade of tomatoes. During its 3rd phase, Katalyst focused on promoting vegetable cultivation in hard to reach areas such as chars.

Key Interventions and their relevance to agro processing

Promoting Integrated Pest Management (IPM): Katalyst has promoted IPM at the farmer level which has resulted in decreased use of pesticides. Tomato is one of the crops where farmers use high dosages of pesticides to repel pest attack. However, the high concentration of pesticides and insecticide often remains in the final produce as farmers do not obey good pesticide management. However, with the intervention of Katalyst on IPM the usage of pesticide has been reduced significantly and the tomatoes are suitable for human consumption and processing.

Improved Post-Harvest Management: Katalyst has promoted improved post-harvest management at the farmer and trader level. This intervention is especially significant for tomato as the produce is highly perishable. Improved post-harvest management such as use of plastic crates has significantly reduces wastage at both farmer and processor level.

Facilitating forward market linkages: Katalyst has linked farmers with different institutional buyers such as ACI and Direct fresh. These companies procure tomatoes from the farmers and perform some primary processing such as grading, sorting and cleaning. Katalyst facilitated Direct Fresh to acquire a warehouse in Gabtoli which serves as a landing station for all the vegetables and goes through sorting, cleaning and grading before being supplied to customers.

Facilitating improved packaging for export of vegetables:

Katalyst partnered with Bengal Plastics to introduce plastic crates designed for farmers to transport their produce with the minimum of damage. Around 400 value chain officials were informed about the benefits of using plastic crates at farm level for long distance transportation. More than 2,500 crates were sold during the pilot phase (up to May 2011). Encouraged by this success, in March 2012 Bengal Plastics launched two new types of plastic crates for fish and vegetable. Through this intervention, Katalyst helped in achieving improved packaging which is a pre-requisite for export. Pran, RFL and local plastic manufacturers

Ensuring GAP of vegetable farming through contract farming:

Katalyst has partnered with Business Promotion Council and Bangladesh Frozen Food Exporters Association to ensure GAP of vegetables to promote export of the vegetables. Bangladesh imposed a self-ban on the export of vegetables as there was pesticide residue found in some shipments to the European Union. Katalyst in partnership with BPC and BFFEA provided training to contract farmers to produce safe vegetable by following GAP. Already a significant amount of vegetables such as yard long bean has been exported through the intervention.

Promoting alternative low cost Storage facility (solar powered storage facility):

Katalyst is also promoting alternative low cost storage facilities through partnership with Green housing and energy limited. Under the partnership Katalyst is promoting solar powered cold storage system which will support the cold chain system in case of power outage. One such facility has already been established in Bogra, where the farmers can keep their vegetables for up to 1 week. The rationale behind the intervention is that when the supply of a certain type of vegetable increases, the price falls. If the farmers can keep their vegetables for even two or three days, they are not forced to sell their produce at a lower price.

Facilitation for HACCAP certification for Direct Fresh:

Katalyst is working with Direct Fresh to acquire HACCAP certification. Katalyst is working with SGS Bangladesh and providing technical assistance to Direct Fresh to acquire the HACCAP certification.

9. Areas for Interventions and Roles of the Private Sector, the Public Sector and the Aid Agencies

9.1 Establishment of Agro processing zone

The establishment of an agro processing zone can significantly boost the agro processing zone. This agro processing zone can be established in the Northern region of the country as majority of the agriculture crops are being produced in this region. Setting up an agro processing zone will foster the uptake of agriculture produce from the areas and reduce the transport cost of raw material which currently needs to be transported to Dhaka. The government can provide incentives such as tax holiday and power supply to promote the agro processing zone. The government can also follow public-private partnership to develop the agro processing zone where the government provides the land and basic infrastructure such as power and other utility and the private sector builds the necessary infrastructure. Development partners can finance the establishment of the agro processing by providing loans.

9.2 New product innovation

New product innovations are critical in fostering the agro processing industry. The current markets for the many products have reached maturity stage and are starting to decline. The dal fry of Pran has reached maturity stage and the company is experiencing declining sales. The chili market has been saturated and companies are now experiencing major competition in the market. To overcome these dynamics, the processors need to invest in new product development. Organizations such as Agro Products Business Promotion Council (APBPC) and Bangladesh Agriculture Research Council conduct research on new product development however the uptake of these technologies have been slow by the processors. Development organizations can promote these technologies to the processors and share the cost of introducing these products in the market together with the government to reduce the risk associated with introducing new products. The agro processors can also introduce improved packaging to make the product more appealing to the consumers.

9.3 Strengthening existing market

The existing domestic market of the agro processing in Bangladesh needs to be strengthened. The consumer perception about the quality of the products in Bangladesh is very low because of adulteration. This conception about the low quality of the products is affecting the domestic market as processors are finding it difficult to capture the domestic market and they are now targeting the export market. However, without strengthening the domestic market, the agro processing sector cannot develop. To do so, the government needs to increase the confidence in the agro processing sector. The government in partnership with development partners can take up confidence building activities to regain consumer confidence. The government can strengthen the monitoring and

implementation of food standards and involve the public in driving the implementation of the standards. The development partners together with the private sector can take up promotional activities to educate the consumers about the different quality standards and how the processors comply with these standards.

9.4 Varietal Improvement

Varietal improvement is paramount to ensure a sustainable supply of raw materials to processors. The existing varieties being cultivated in Bangladesh are not industrial varieties i.e. the varieties do not have the required characteristics which are suitable for processing. The government along with the private sector actors can promote the different industrial varieties. The government with private sector seed companies can establish demonstration plots and promote these varieties. However only promoting these varieties cannot ensure the taking up of these varieties, there needs to be a pull from the processors to procure crop of these varieties from the farmers. This can only happen when the agro processing sector is growing and the processors need the varieties to ensure quality products.

Promoting Fair Trade

To promote the growth of the agro processing industry, establishment of fair trade system should be facilitated. Fair trade is a system through which marginalized producers and workers are offered better trading conditions and their rights are secured. Through the system both the processors and the producers gain as both the parties receive better prices for their products. This will also help in targeting new markets which want the processors to ensure fair trade. As environmental concerns among consumers is increasing, fair trade can ensure the production of the products were environmental friendly and sustainable.

Fostering usage of improved packaging

Promotion of improved packaging of products can facilitate the growth of the agro processing sectors. Improved packaging at the farmers and intermediaries level can reduce crop wastage. Though there have been some improvements in packaging through initiatives such as Katalyst's improved packaging interventions, however the scale of uptake of the farmers is still low. The processors can also benefit from improving their packaging. HeliCap of Tetra makes it easier for consumers to enjoy the products as instead of opening a cap and then removing a foil seal or pull-tab, these two steps are combined into one convenient twist of the cap. With the screw-cap design, it is also easy to reseal and refrigerate any remaining product. Such packaging has been introduced by the agro processors and usage of the technology can give the agro processors a competitive advantage.

Introducing low-cost cold storage system for fruit and vegetables

A cold chain from farm gate to processing unit is required to maintain quality and reduce postharvest loss of the fresh produces. The existing capacity of the cold storage units in Bangladesh is not sufficient and new cold storage establishment requires high investment and operational costs. There are alternative low cost cold chain management techniques such as CoolBot technology,

evaporative cooling systems and ice packaging system which can be introduced especially for fruits and vegetables.

Improved quality control and inspection

It is necessary to ensure effective control in food safety and quality aspects especially on GMP and HACCP and their concerned SOPs and ISO, control of Sanitary and Phyto-sanitary System and traceability. Such improved quality control and inspection will not only improve the quality of the agro processed products but will also help to regain consumer confidence in the locally produced agro processed products.

Skill development

Skill development especially on industrial productivity improvement, food safety control and supply chain management for the Food Processing and Quality Control Personnel is an absolute requirement if the industry is to grow. There is a knowledge gap on business planning especially for the small scale processors which can be addressed through proper training programmes. Other areas which need improvement are productivity, proper production management, assessment of market demand & supply, processing, product packaging and packaging machinery, new technology & how to operate machinery, maintaining food quality, manufacturing operation, product buying & quality, grading and marketing, market management, product development, export marketing & transaction, business development, food quality & strategy, latest development of food technology. Appropriate programmes on capacity building are needed in the area of food hygiene and safety through establishing GAP in crop production, GMP, GHP and HACCP and their SOPs at the factory levels.

Establishment of business incubation facility

Business incubation is a unique and highly flexible combination of business development processes, infrastructure and human resources designed to nurture new and small businesses by helping them to survive and grow. Business incubation provide SMEs and start-ups with the nurturing environment needed to develop and grow their businesses, offering everything from virtual support, rent-a-desk through to state of the art laboratories and everything in between. They provide direct access to hands on intensive business support, access to finance and experts and to other entrepreneurs and suppliers to really make businesses and entrepreneurs to grow. The goal of incubators is to increase the chance that a start-up will succeed, and shorten the time and reduce the cost of establishing and growing its business. A pilot plant can be established to provide hands on training to the industrial personnel.

Developing an action plan for promoting growth in the agro processing sector

Policy initiatives are required in assuring the infrastructural facilities like gas and power supply in the agro-processing enterprises, making easier and cost effectiveness in awarding BSTI certification especially, for the micro and small scale enterprises, creating separate food industry policy, reforming Industrial policy in some cases such as the import of similar products and higher level

imposing of Value Addition Tax to those products and simultaneously reducing the VAT on the agro processed products being produced in the country and essentially inclusion of food technologists in food processing industries. The government should develop an action plan which will outline the key objectives, sets out specific objectives, identifies road maps and timelines to develop the agro processing sector. The action plan also needs to provide a framework on how the different government bodies need to collaborate to foster growth of the agro processing industry of Bangladesh.

The role of different actors in the development of the agro processing sector is detailed below:

Table 35: Roles of Different Actors in the Development of Agro-Processing Sector

Areas of Intervention	**Roles of Different Actors**		
	Government	Processors	Development Assistance
Establishment of agro processing zone	Provide land and other basic infrastructure Promote PPP for the establishment of agro processing zone	Participate in PPP	Provide technical support by ensuring technology transfer Provide financial assistance (soft loans)
Varietal Improvement	Promote industrial varieties through demonstration plots	Utilize the industrial varieties to develop new products and strengthened the market for existing products	Facilitate the government in promoting the industrial varieties
Promoting fair trade system	The system can be initiated by marketing agencies like Department of Agricultural Marketing (DAM) and Hortex Foundation.	The processors should build up close supplier relationship with the traders/supplier and the marginalized growers under this system.	Providing Technical assistance and aid in establishing such system.
Improved quality control and inspection	Strengthening regular and proper monitoring of the status of controlling food safety and quality	Appropriately follow the SOPs for the relevant quality control systems	Technical assistance in Skill development/ capacity building and institutional strengthening in relation to facility development
Fostering usage of improved packaging	Support the manufacturing and adoption of improved packaging	Facilitate the adoption by demanding specific packaging	Promote improved packaging
Introducing low-cost cold storage system for fruit and vegetables	Providing land and subsidy in establishment of Low-cost Cold Chain Infrastructure for Fruits and Vegetables especially at assembly market/commodity collection centers and CoolBot Refrigerated Van for transporting to Processing Industry	Cost sharing in establishment of Low-cost Cold Chain Infrastructure for Fruits and Vegetables especially at assembly market/commodity collection centers and CoolBot Refrigerated Van for transporting to Processing Industry	Technical assistance and cost sharing in establishing of Low-cost Cold Chain Infrastructure for Fruits and Vegetables

Skill development	Strengthening quality control certification agencies including BSTI and capacity building of their relevant personnel, Increasing allotment of training fund for APBPC	Providing opportunities of training for their production and quality personnel	Technical assistance and providing aid for organizing training on Processing and Quality Control aspects
New product innovation	Conduct research on new product development Promote the developed technologies to the processors.	Need to invest in R&D to develop new products to replace mature products	Promote the technologies to processors Share cost of introduction of new products
Strengthen existing markets	Take up confidence building activities together with development partners Strengthen the monitoring and implementation of food standards and involve the public in driving the implementation of the standards.	Educate consumers about quality standards Ensure quality standards are being followed	Work with the private sector to take up promotional activities to educate the consumers about the different quality standards and how the processors comply with these standards.
Developing an action plan for promoting growth in the agro processing sector	Reform the policies	Find out the causes and justification for reforming the policies and persuade the relevant authorities	Technical assistance in conducting policy dialogues with the concerned persons /organization and drafting the reformation
Establishment of business incubation facility	The system can be initiated by Concerned research institutes like BARI, BCSIR or relevant universities	The entrepreneurs should participate to take graduation for this system to learn all aspects food industrial business.	Providing aid for establishing business incubator and technical assistance in operating the system.

It is to be noted that no single intervention can induce growth of the agro processing sector; rather a holistic approach needs to be utilized. Also no single actor i.e. public, private or development organizations can stimulate any sustainable growth singlehandedly. Only working in the backward linkage and deducing that the increased production would foster agro processing and vice versa is a common fallacy. As the different chains are interlinked, working on only forward or backward linkage will only result in an artificial thrust to the sector which will not be sustained. Inducing growth in the forward linkage i.e. increasing the market of different products will not automatically benefit the farmers and the poor engaged in the overall value chain. Only by having a holistic and synergetic approach which fosters growth in both the forward and backward linkage will result in sustainable growth of the agro processing industry.

Annex

1. Summary of Inception Workshop

Reasons for investing in Agro processing sector (from groups):

1. Cheap labor- Although Bangladesh has very small landmass, the abundant cheap labor is a great source of competitive advantage
2. Market opportunity- New untapped markets both in home and abroad
3. Raw material availability- Very high supply of raw materials. According to Mr. Abdul Maleque Khan, Senior Manager, R&D at Akij Food & Beverage Ltd., 40% raw materials in the agricultural sector suffer from between light to heavy damage due to lack of processing facilities
4. Low cost of raw materials- Raw material production cost, both in terms of time and money, is relatively low in the country. According to Mr. Abdul Maleque Khan, Senior Manager, R&D at Akij Food & Beverage Ltd., potato harvesting in the UK takes 6 months, whereas in Bangladesh, it takes about 3 months.
5. Prospect for value addition- Bangladesh is rich in agricultural produce, most of which is consumed in its raw form, with little processing or value addition. This absence of value addition could be converted into profit margins through processing, which would add value for consumer's home and abroad, as well as the processors

Overall reasons to invest:

1. Institutional buyers such as offices, hospitals, universities, etc. are growing in number, thus bolstering demand
2. Locally available and cheap raw materials
3. Available technology
4. Secondary processing/ preservation yields better results
5. Tax shelter: low tax in agribusiness sector
6. Untapped market opportunity

Why processing is important (non-business)

1. Processing is needed to break seasonality. Earlier, many products, especially fruits and vegetables could only be made available by growing them in certain seasons. As a result, there was price fluctuation in the market, creating instability. Through the advent of processing, the cycle of seasonality has been broken, with produce being made available year round.
2. Raw product market has become saturated.

Pro-poor and women involvement in Agro processing: According to Dr. Anisur Rahman, in Natore, earlier, only 600 hectares land was used to grow mung beans. After Pran entered the area, now, 11,000 hectares are used for growing mung beans, with many women and poor villagers involved in harvesting mung bean pots.

Prospect in fruits-

Discussants mentioned potential of fruit processed products from Citrus, Pineapple, Banana and Mango initially. Further discussion highlighted that only production of mango juice has growth potential considering both domestic and international demand.

Last year, in Bangladesh, according to Mr. Abdul Maleque Khan, Senior Manager, R&D at Akij Food & Beverage Ltd., 687-ton mango exported, which is expected to steadily grow to 1500 tons.

Production of mango is 1,000,000 tonnes, however 65% is Amropali variety, which can't be processed- according to Bani Amin. However, for pineapple, the same sort is used for eating and processing.

According to Mr. MahatabUddin, COO of Pran Agro Business Ltd, Pran produced 80,000 MT of Ashwina and guti mango, and have plans to expand to export mango pulp.

For fruit drinks, local market demand is falling as the concept among consumers is that they consist of no real fruit. However, the international market demand for juice/drink is increasing by 20%.

There were 2 pineapple processing plants in Madhupur, said by one participant. Others mentioned that one has been closed down- name Bangla Dutch. The other is still operational. They make juice.

Amzan Khan Chowdhury took initiative to promote pineapple juice in Bangladesh 15 years ago, but it did not work out.

Prospect in vegetables- Ready to cook okra, carrot, raddish, yard long bean, pumpkin (which can also be used for making chips)

Combination of fresh-cut vegetables processed and packed together, or vegetables that have similar value chain in nature

Vegetable processing can be promoted through the facilitation of cottage industry.

Sub-sectors:

Mango

- High market prospect given export potential for juice/drink. Pakistan mango, India mango is banned in many countries, due to compliance issues with the extensive and sensitive processing chain
- High pro-poor involvement through labor intensive value chain in post-harvest handling. Baneshwar, Kansat, Rangpur, Dinajpur are large mango hubs
- Support industry: Many processors available in the market, in post-harvest, there is room for work through import and establishment of ripening chambers for various large processors.
- Policy/regulatory support: Packaging center and labs are being established by the government.
- Number of Under construction heat treatment plant: Solidaridad 3
  From private sector 4
- BARI developed hot water treatment (it does not count as a secondary processing)

Tomato

- **Supply side:** Participants mentioned need for mulching. Also disparity among supply and demand side exists. Industrials want hard/thick skin tomato, good for production. However, these have low shelf-life, and are low yield, so except contract farmers, traditional farmers do not want to be involved with this type of production.

- **Demand side:** For Pran, according to Mr. MahatabUddin, COO of Pran Agro Business Ltd, tomato is used mainly in Ketchup. Demand is 60% local, 40% for foreign export.

- High opportunity for pro-poor involvement, especially in production. According to Bani Amin, a study conducted by AVC discovered that for processed tomato, growth rate in pro-poor involvement is 30%, while for fresh tomato, it is 11%.

- From the support function end- access to finance, transport, packaging, are all major issues that need to be addressed.

- Policy/regulatory support: Bank loans are available at low interest rates, along with tax subsidy and cash incentives. Cargo fare is also low for export

Potato

- **Demand**: According to Mr. Animesh Saha, GM Operations, Pran produces the 'Courage' variety of potato, which is industrial grade with starch content of around 25%, through

contract farming. Yield is around 4,000 MT. This is also done by Bombay sweets. Potato is mainly in demand for producing chips- for both local and international market. Potato is also needed for starch and making french fries.

- **Supply:** Courage is needed for processing. Pran has, according to Mr. MahatabUddin, COO of Pran Agro Business Ltd, already injected 'Courage' as a table potato in the Bangladeshi market, so that customers would slowly get used to consumption of this variety. This would prompt farmers, or rather, deter them from deciding not to harvest this variety, thus aiding the supply side of the processing industry.

- **Support:** According to Dr. AnisurRahman, Chlorpropham (or CIPC) is isopropyl-N-(3-chlorophenyl) carbamate, and is widely used as a sprout suppressing agrochemical to store potatoes. This is much needed to increase shelf life of potatoes. Cold chain establishment is also necessary, as in normal transport, sugar is produced within the potato.

- **Policy/regulatory support:** Potato starch export needs to be incentivized- used in chips, glucose, fructose (pharmaceuticals) and in the textile sector.
- **Pro-poor involvement:** Huge involvement of poor in industrial grade potato farming in Bogra, Munshiganj, Rangpur and Thakurgaon

Maize

(Information obtained from Mr. Syed AktharHasanUddin (Ellis), MD, Maar Ltd.)

In the 1990s, tapioca farming started in Thailand. Govt. incentivized use of this starch, and export. Now, even our industries such as textile and pharmaceuticals are dependent on this.

Modified starch, a major input in textile and pharmaceuticals, both big industries of Bangladesh, is produced locally. Modified starch is produced from native starch through addendum of certain chemicals. However, despite local production, the import of modified starch is tax free.

Government has plans to increase production of maize from 2.5 to 5 million MT. But, the market will fail if demand is not subsequently increased. In Bangladesh, square has biggest denim manufacturing plant in South Asia. However, in most cases, although Square has good understanding with local starch manufacturers such as Maar Ltd, they are being dictated by customer on ingredients, e.g., recently, a Turkish customer for Denim specifically asked to source starch from Turkey.

According to Mr. Bani Amin for AVC, 25% of maize usage is for adding to wheat flour. According to a 2008 study by Katalyst, 4,000,000 MT wheat flour was made in Bangladesh.

Back then, the market for popcorn was small, at only 500 MT. Now, popcorn is a huge market for maize. Last year, import of maize was 70,000 tonnes from Brazil.

In the starch industry, according to Mr. Syed Akthar Hasan Uddin Ellis, MD of Maar Ltd., starch demand in the 2008 study was overrated. The actual demand for starch is only 100,000 MT. Particularly for one single company to operate profitably, 100,000 MT demand is required.

However, for farmers, Maize has high potential, fetching three times more price than paddy. To support this industry, particularly on the starch front, govt. needs to tone down cassava and potato production.

The maize industry is predominantly supplying to the feed industry, for which, one needs yellow maize. White maize, which is only used in flour industry, or for human consumption, is not as popular among farmers, thus narrowing its market opportunity.

To give an example of the size of the demand of starch by feed industry the discussant mentioned Nourish Feed, one single feed company, which uses 43,000 MT of maize per month.

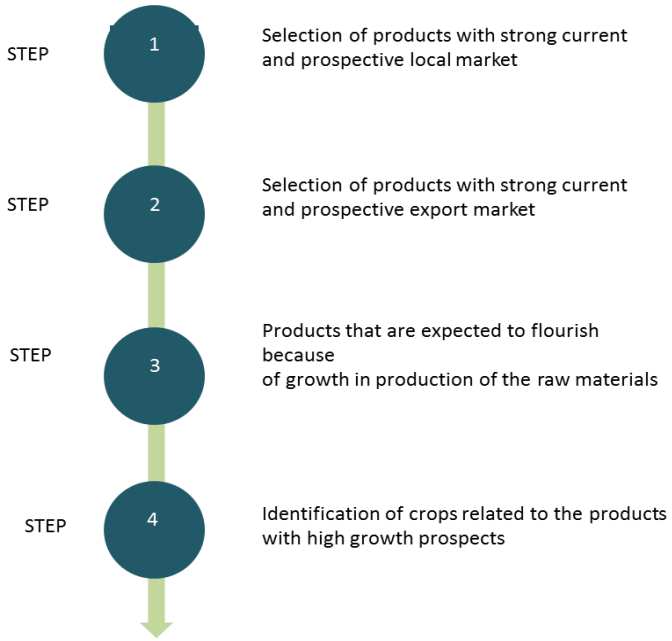
Hence, a staggeringly large amount of maize goes into feed production, very little in starch or human consumption. A cultural shift is needed, e.g. through promoting consumption of corn flakes among the masses, to bring about any prospect for growth in food using maize. Hence, there is tight space for growth.

According to Mr. Syed Akthar Hasan Uddin Ellis, MD, Maar Ltd, one probable reason for huge imports is that it allows transfer of money abroad. For example, Maar Ltd. supplies starch to Nestle, and is certified by Nestle. So, essentially there is no question about quality criterion. Still, local buyers will opt for imports. Pharmaceuticals alone import 1000 MT starch/year. Another reason for this could be the requirement of foreign buyers, as was seen in the case of Square.

Fish

- Is the consumer behavior conducive towards the diversification of processed fish product?

2. Sector Selection Exercise



The food processing sector includes processing of cereals, pulses & oilseeds, bakery and confectionary, fruits and vegetables, dairy, carbonated beverages and non-carbonated fruit juices, drinks, other beverage and various other food items. While selecting the major processed crops in Bangladesh, a 4 step approach was utilized. The first step was to select products with string current and prospective local market. Step 2 selected products with strong current and prospective export market. The third step was shortlisting products that are expected to flourish because of growth in production of the raw material and the last step was to identify the crop related to the products with high growth prospects.

Step 1: Identification of the major agro food products available in the local market

The major agro food products available in the local market were identified through retail shop visit (grocery shops, general store and departmental stores), consultative workshop, key informant interviews and literature review. The major agro food products were: Juice, Spices, Ketchup/Sauce, Snacks and Edible Oil. Dairy and Poultry product were also identified however were excluded as these do not fall under the scope of the study.

Step 2: Identification of major agro food product that are exported

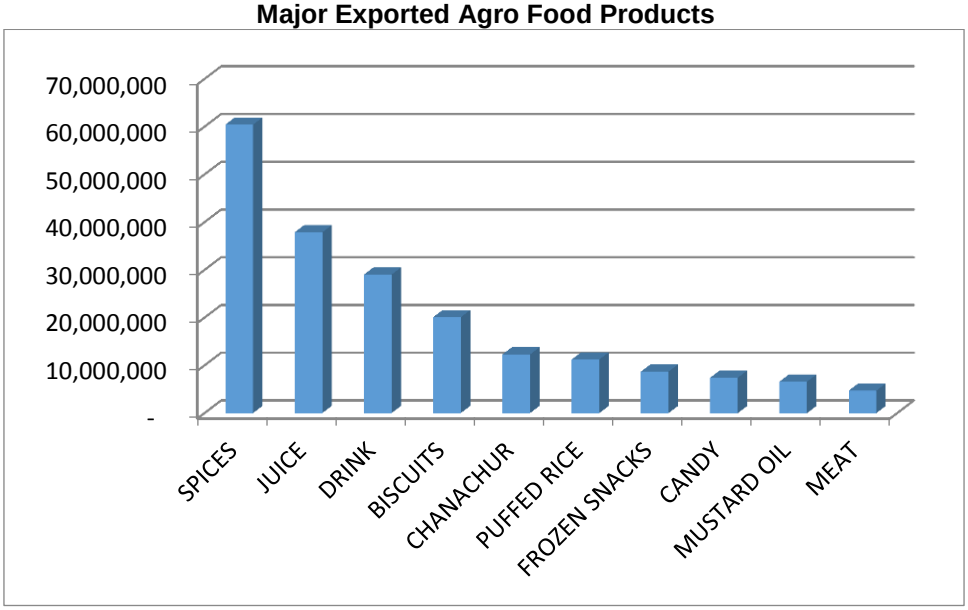
According to Export Promotion Bureau (EPB), the major products that are being exported are: edible oil, sugar, Rice, Wheat, Fruits & Vegetable, Potato, Tea and Spices. According to Bangladesh Agro Processors Association (BAPA), the major products being exported are: Spices, juice, Drink, Biscuits, Chanachur, Puffed Rice, Frozen snacks, Candy, Mustard oil and Meat.

Table: Major agro food products that are exported

Major segments in food processing (EPB)	Edible oil, sugar, rice, wheat, fruits and vegetables, potatoes, tea and spices
Major products being	Spices, juice, drinks, biscuits, chanachur, puffed rice, frozen snacks, candy,

exported (BAPA)	mustard oil and meat

Juice, Spices, Snacks, and Edible Oil were chosen among these as these products constituted the largest volume exported among the other products. The following graph depicts the top ten agro food products that are exported. Among these biscuits, candy and chanachur falls under snacks and rice & meat are not included in the scope of the study.



Source: BAPA

Step 3: Products with high potential

Starch and fish fillet were identified as products which do not hold a substantial market share however identified as highly prospective by industry experts and policy makers for both local and export market. This selection was done through key informant interviews with industry experts and consultative workshop. Starch was selected as there is scope for promoting usage in the pharmaceuticals and textile industry and fish fillet as there has been significant investment in fish processing plants.

Step 4: Selection of major crops that are related to the major agro food products:

The first three steps resulted in selection of existing and potential major agro food products in the local and international market. These agro food products are: Spice, Ketchup, Juice, Snacks, Edible Oil, Fish Fillet and Starch. The final step involved selection of major crops that are used in the making of these food products. The below table explains this process:

Products	Major Crops	Rationale
Spices	Turmeric	Chili and Turmeric constitute the major portion of the spices market
	Chili	
Sauce/ Ketchup	Tomato	Tomato sauce/ketchup is the most popular product

Juice	Mango	Mango juice constitutes the lion's share of the locally produced juice market
Snacks	Potato Pulses (Mung)	The most popular snacks item such as Singara, potato chips, dal fry and chanachur utilize potato and mungbeans
Edible Oil	Mustard	Of the various oil seeds used for edible oil, only mustard is primarily sourced through local production
Fish Fillet	Pangasius and Tilapia	Only these two species are suitable for making fish fillet as they have high flesh content
Starch	Maize and Potato	Starch is primarily produced from maize and potato

3. List of respondents from launching workshop

Sl	Name and Designation	Contact Details
	Processors	
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	Others	
10	**Bani Amin** Deputy Chief of Party USAID-Agricultural Value Chains DAI, House# 05, Road# 78, Gulshan-2, Dhaka	Phone: +880 2 9840927-9 Bani_Amin@dai.com
11	**Md. Serajul Islam** Team Leader, Non-Food Value Chains USAID AVC Project, DAI House-05, Road-78, Gulshan-2, Dhaka	Phone: 9840927-9, ext: 118 Cell: 01711947878 Email: serajul_islam@dai.com
12	**Dr. Tonmoy Islam** Assistant Professor, Economics Elon University, North Carolina, USA	01718417875
13	**Prof. Nazrul Islam** Professor Horticulture Sher-E-Bangla Agricultural University	01552498640 nislam2000@gamil.com
14	**Dr. AnisurRahman** DCOP,CCBA, Winrock-USAID	01720010936 anisur58@gmail.com

4. Questionnaires

Questionnaire for Agro Processors

Contact Information

Name:
Designation:
Organization/ Company:
Contact Details:
Date of Interview

Market Trends and Dynamics

1. What are the principal products and services?
2. What do you see as your main needs/opportunities in accessing markets?
3. To whom do you sell your product or service (large firms, small firms, wholesalers, exporters, retailers, direct to consumers, etc.)? What percentage goes to each?
4. Describe the relationships you have with these buyers (who determine what to produce, product specifications, prices, and amount purchased?). How much input do you have?
5. How do you promote and market your products/services?
6. How strong is the market for your products/services right now? Next year? What trends do you see?
7. Are some customer groups better than others in terms of sales and revenue growth? Which ones?
8. Who are your major competitors?

Standards and Certifications

9. What standards or certification requirements do your products need to conform to?
10. Who sets these standards and requirements?
11. Who helps you to confirm of the standards and requirements?
12. Do you have any problems in this regard?

Technology/Machinery/ Skills (Support industries)

13. What are your major needs/opportunities/ competitive advantages in product design and manufacturing (or service delivery)?
14. What other products do you produce/sell? What percentage does each product represent in terms of your gross revenue?
15. What have you done recently to improve your products or services?
16. Where do you source your machinery and equipment from?
17. Is your current equipment or machinery an impediment to growth? Explain. If so, what kind of equipment or machinery could improve your business?
18. Is the current level of your workers training holding back growth? If so, what additional training do they need?

Input Supply

19. What are your major needs/opportunities in the areas of input cost, quality, and availability?
20. Who are your most important suppliers and what do you buy from each?
21. What are the geographical locations from where you source inputs? Please identify actors from whom you obtain inputs (e.g. traders, wholesalers, farias)
22. Are there problems in obtaining some important inputs? Explain.
23. Do you source any of your inputs from abroad? If yes, what bars you from doing so locally?
24. Do your buyers, e.g. foreign or institutional, dictate what inputs you utilize?

Finance

25. What are the sources of finance for your business?
26. Do you get production financing from your buyers? What are the terms?
27. Do you offer contract farming/ any other financing method for contracting input suppliers?
28. Do you have need for additional financing at the moment? If so, what would it be used for?
29. What sources (formal or informal) have you approached for loans and what have been the key problems, if any?
30. Other (repayment rates in the sector, risk management insurance, etc.)

Policy/Regulation

31. What government policies/regulations benefit your business (registrations, inspections, subsidies, incentives, etc.)?
32. What government policies /regulations are obstacles to growing your business?

Infrastructure

33. What are the most important infrastructure constraints affecting your business' growth and profitability (road/transport conditions, telephone service, electric supply, crime/corruption, storage, etc.)?
34. What is your industry doing about these problems?

Business Membership Organizations

35. Isyourindustry/tradesectorrepresentedbynationalorlocalbusinessassociations? If so, please name them.
36. Are you a member of national or local business associations? If yes, which ones? If not, why?
37. What are the primary functions and benefits of the associations?
38. What additional services should they provide?

Generic Industry Questions

39. What are the major incentives you have for investing in / promoting change in the value chain?
40. What risks or constraints do you face in making these investments?
41. What do you think are the strengths of your industry locally and/or internationally?
42. What are the main weaknesses of your industry?
43. What do you think is the greatest challenge facing your industry today?

Questionnaire for KII

Name……
Organization……. Designation……

1. Within the selected subsectors of the study, what kinds of products have potential market opportunity, domestically and internationally?
2. Are there any supply side constraints that need to be addressed to tap into these markets?
3. What is the status quo for the support industries (machineries, technologies, consultancies, financial services, quality assurance services etc.)? Is there room for further improvement that may drive growth in this industry?
4. What apex bodies are involved in enforcing standard and issuing certification?
5. What is the scope of pro-poor and women involvement in the value chain for these products?
6. What is level of involvement of the government, development partners and donor organizations in these fronts? What more can they do to stimulate growth in this sector?

Questionnaire for Farmers

1. Do you sell any of your produce to agro-processors?
2. Who are the agro-processors who buy from you? Name some companies.
3. Do they buy directly from you or via contract farming? Or do they source your products from traders/intermediaries.
4. How much of your produce do you sell to agro processors?
5. What price do your products fetch if sold directly in the market?
6. What price do the agro processors pay you? Are you better off selling to the agro processors?
7. Are there any other benefits that you can avail from being connected to agro processors (e.g. extension services, credit facilities, storage facilities, better crop harvesting and management technology, better inputs etc.)?
8. Do you produce different "processing varieties" alongside traditional varieties? If yes, how did you gain access to these processing varieties-were they introduced by agro processors? Do they have higher yield, or better prices?
9. If you are or are not growing processing variety, why or why not?
10. What is the size of your business? (If large), do you think that has to do anything with being targeted by agro-processors?

Questionnaire for Traders

1. Who are the agro-processors who buy from you? Name some companies.
2. Do they buy directly from you? Or do they source your products from traders/intermediaries/representatives.
3. How much products do you procure from farmers (in kgs/tonnes)? How much of this do you sell to agro-processors? How much to other customers?
4. What price do your products fetch if sold directly in the market?
5. What price do the agro processors pay you? Are you better off selling to the agro processors?

6. Are there any other benefits that you can avail from being connected to agro processors (e.g. extension services, credit facilities, storage facilities, better crop harvesting and management technology, better inputs etc.)?
7. What is the size of your business? (If large), do you think that has to do anything with being targeted by agro-processors?

5. List of respondents from Validation Workshop

Sl No.	Name and Designation	Contact Details
	Agro-Processor	
1	Kbd. Ahsanul Islam, Manager, PRAN Agro Business Ltd.	Mbl No. 01924602999, pran457@prangroup.com
2	Md. Ayub Ali, Partex Agro Ltd.	Mbl. No. 01755644478, ayub.ali@psgbd.com
3	Md. Mostafijur Rahman, AGM, Marketing, Partex Agro Ltd.	Mbl No. 01755629427, mostafijur@psgbd.com
4	Khurshid Ahmed Farhad, Head of Export, Square Food and Beveredge Limited	Mbl No. 01713032359, kafarhad@squaregroup.com
5	Major Syed Munibur Rahman, DMD, Rahman Chemicals Ltd	Mbl No. 01714178619, munibchokka@gmail.com
6	Minhaz Ahmed, Deputy Managing Director Ahmed Food Products (PVT.) Ltd.	Cell: 01911023310, 0188047748 Email: ahmedfd@dhaka.net
7	ABM Shoeb, Asst Manager (Mkt), Virgo Fish & Agro Process Limited	Mbl No. 01847198232, shoeb.abm09@gmail.com
8	K.M. Sorower Hasan Kiron, Asst. Manager (Aquacultural) Virgo Fish and Agro Process Ltd	Mbl No. 01847198220, sorower@virgo.com.bd
9	Md. Moniruzzaman, DGM, Banoful & Co. Ltd	Mbl No. 01712056642, aponlition@yahoo.com
10	Nazrul Islam, E.D., Kishwan Agro Products Ltd.	Mbl No. 01819371140, info@kishwan.com
11	K.M. Masbah Uddin Shaheen, Program Specialist, BRAC Seed and Agro Enterprise	Mbl No. 01729070230, masbah.us@brac.net
12	Harunor Rashid, S.K Food	Mbl no. 01918683879
	Government Associations/Government Project/Associations	
13	Md. Mizanur Rahman, Bangladesh Agricultural Research Institute, Senior Scientific Officer	Mbl No. 01720117251, milon343@yahoo.com
14	Md. Mostafa Kamal, Scientific Officer, Regional Spices Research Centre, BARI, Gazipur	Mbl No. 01818285794, mamun_src@yahoo.com
15	Md. Matin Akand, Scientific Officer, Regional Spices Research Centre, BARI, Gazipur	Mbl No. 01912668024, mmakand.bari@yahoo.com
16	Md. Zakaria Islam, Account Officer, Bangladesh Maize Products Ltd.	Mbl No. 01730352684, islammd.zakaria@yahoo.com
17	Md. Golam Rabbani, Marketing Officer, Bangladesh Maize Products Limited	Mbl No. 01730352675, bmpl-rabbani@yahoo.com
18	Dr. AHM Monirul Haq Naqvi, Former General Manager (Seed and Horticulture Wing), BADC, Dhaka.	Mbl No. 01712044146, 01552457540, badcnaqvi@yahoo.com
19	Dr. Md. Shahjahan, Visiting Professor, BSMRAU, Gazipur	Mbl No. 01716174288, shah_phd@yahoo.com
20	Dr. Md. Abdus Sattar, Senior Scientific Officr, Horticulture Research Centre, Bangladesh Agriculture Research Institute	Mbl No. 01715015778, sattar72@gmail.com
21	Shoumen Saha, Director, Plant Quarantine Wing, DAE	Mbl No. 01712636367, dpqw@dae.gov.bd
22	A F M Fakhrul Islam Munshi, President Bangladesh Agro-Processors' Association	Phone: 9885799 Cell: 01819221309 munshibd452545@gmail.com
23	Abul Ashraf, SCDP, DAE	Mbl. No. 01922242852, ashraf2n@gmail.com

Development/Donor Funded Organization		
24	Arifur Rahman Siddiqui, Senior Programme Officer Agriculture & Livestock DANIDA Embassy of Denmark, Bangladesh	Mbl No. 01713-365-686; arisid@um.d
25	Peter B James, DANIDA	Mbl No. 01730150156;
26	GB Banjara, Head of Sectors	Mbl No. 01730324346; gbbanjara@gmail.com
27	Tamjid Ahmed, Senior Business Consultant, Katalyst	Mbl No. 0171722442; tamjidahmedananda@gmail.com
28	Minhaz Chowdhury, Austrailian Trade Commission-Country Manager	Mbl No. 01711560753, minhaz.chowdhury@austrade.gov-au
29	Abu Saif Ansari, Manager, IC, Swisscontact-Katalyst	Mbl No. 01771466666, saif.ansari@swisscontact-bd.org
30	Mahmud Hasan, Deputy Team Leader, USAID's AVC Project, DAI	Mbl No. 01716288398, mahmud.hasan@dai.com
31	Ananya Paul Powshi, Business Consultant, Katalyst	Mbl No. 01717072416
32	Md. Mahe Alam, Food Safety Advisor, SNV Netherlands	Mbl No. 01718241332, malam@snvword.org
33	Keith Thompson, Leader, Growth and Private Sector	Mbl No. 01713149939, k-thompson@dfid.gov.uk
34	Samira Mastafa, Senior Business Consultant, Maize and Fertilizer, Katalyst	Mbl No. 01715024061, shamira.mostafa@swisscontact-bd.org
35	Ashfaq Enayet, Head of Cross Sectors	
36	John Macy, Economic Growth/Private Enterprise Officer	Mbl No. 01713141190, jmacy@usaid.gov
37	Shah Rear Kabir, Principal Business Consultant, Katalyst	Mbl No. 01717727063, shahrer.kabir@swisscontact-bd.org
38	Mehedi Hasan, Senior Business Consultant, Katalyst	Mbl No. 01712590756, mehedi.hasan@swisscontact-bd.org
39	Nahin Ferdous, Senior Business Consultant, Katalys	Mbl No. 01673406986, nahin.ferdous@swisscontact-bd.org
40	Asiful Islam, Intern, Katalyst	Mbl No. 01674928688, ai.saikat18@gmail.com
41	Fortunat Diener, Head of MRM, Katalyst	Mbl No. 01755639068, fortunat.diener@swisscontact-bd.org
42	Tahsin Akbar, Katalyst	Mbl No. 01730795636
43	Mehjabin Ahmed, Manager, Katalyst	
44	Tashfiq Ahsan, Edge	
45	Jannat Adib, Katalyst	

6. List of Respondents

Sl No.	Name	Designation	Organization/ Project/ Type of Product	Contact Details	Date of Interview
1	AKM Sayadul Hauq	AGM	Bengal Meat	01714097416; alamin@bengalmeat.com	18 June, 2016
2	S Khaledur Rahman	Managing Director	Rahman Chemicals	01711522167; info@rclbd.net	18 June, 2016
3	Md. Mahatab Uddin	COO	Pran Agro Business Ltd.	01912257597; op29@prangroup.com	18 June, 2016
4	Dr. Nazrul Islam	Professor, Horticulture	Sher-E-Bangla Agricultural University	01552498640; nislam2000@gmail.com	19 June, 2016
5	Dr. Manirul Haque		Cold Chain Bangladesh Alliance	01712044146; badcnaqvi@yahoo.com	20 June, 2016
6	Syed Akthar Hasan Uddin (Ellis)	Managing Director	MAAR Ltd.	01787744632; md@maarltd.com	20 June, 2016
7	Ershad Bhuiyan	Asst. General Manager	Taiwan Food & Processing Ind. Ltd.	01966660311; ershad@shepherdbd.com	21 June, 2016
8	Zia Hayder Mithu	Chairman	Easy Cook Food Procssing Ltd.	01711635930; mithuapu@gmail.com	21 June, 2016
9	Khurshid Ahmad Farhad	AGM, Export	Square Food & Beverage Ltd.	01713032359; kafarhad@squaregroup.com	21 June, 2016
10	Minhaj Ahmed	Managing Director	Ahmed Food Products (PVT.) Ltd.	01937444222; ahmedfd@dhaka.net	21 June, 2016
11	Mr. A F M Fakhrul Islam Munshi	President	Bangladesh Agro-Processors Assocation	01819221309; info@bapabd.org	22 June, 2016
12	Ms. Panna	Project Associate	EU Inspired	8144536; info@bapabd.org	22 June, 2016
13	Abdul Ashraf	Deputy Team Leader & Post Harvest Technology and Marketing Specialist	Second Crop Diversification Project, Department of Agriculture Extension, Ministry of Agriculture	01922242852; ashraf2n@gmail.com	23 June, 2016
14	Mitul K Saha	Assistant General Manager	Hortex Foundation	01711370491; mitulsaha@hortex.org	23 June, 2016

15	Md. Shafiqur Rahman Bhuiyan	President	Bangladesh Auto Biscuit Bread Manufacturers Association (BABBAMA)	01711228747; babbma07@yahoo.com	23 June, 2016
16	Dr. Abdus Sattar	Senior Scientific Officer, Horticulture Research Centre	Bangladesh Agricultural Research Institute	01521416711	23 June, 2016
17	Dr. Hafizur Rahman	Principal Scientific Officer, Post-Harvest Technology Division	Bangladesh Agricultural Research Institute		23 June, 2016
18	Dr. Siddique	Senior Scientific Officer, Horticulture Research Centre	Bangladesh Agricultural Research Institute		23 June, 2016
19	Md. Motin Akand	Scientific Officer, Spices Research Institute	Bangladesh Agricultural Research Institute	01912668024; mmakand.bari@yahoo.com	23 June, 2016
20	Md. Ashikur Rahman	Sr. Manager; Supply Planning and Procurement	Golden Harvest	01755676287; ashik.sc@goldenharvestbd.com	9 August, 2016
21	Mr. Rashed	Manager	RS Traders	8950828	12 July, 2016
22	Md. Alom	Manager	Juliet Traders		12 July, 2016
23	Mohammad Anowar Hossain	Chairman	Mawola Traders Ltd.	01711442238; mtg_152@yahoo.com	12 July, 2016
24	Kbd. Md. Kamruzzaman Tito	Manager	Pran Agro Business Ltd.	01936013084; paipabl@pal.pranggroup.com	27 July, 2016
25	Md. Al Masud	S M (QC)	Pran Agro Ltd.	01912257337	27 July, 2016
26	Golam Mastafa Sarwar	Deputy Director	DAE, Dinajpur	01716654471	27 July, 2016
27	Mohammad Aslam	Arotdar	Potato	01711968938	26.07.2016
28	Mohammad Ikbal	Arotdar	Ada, Holud	01716728774	26.07.2016
29	Siddik Mollah	Agent	Holud	01716143006	26.07.2016
30	Abdur Rahman	Foriah	Turmeric	01725085741	26.07.2016
31	Abdus Sattar	Foriah	Turmeric	01734353532	26.07.2016
32	Shahabur Rahman	Comissiond Agent	Turmeric	01720517543	26.07.2016
33	Jillur Rahman	Agent	Turmeric	01734640514	26.07.2016
34	Md. Bashar Uddin	Big Agent	Turmeric, Mustard, Mung Bean	01713775895	26.07.2016
35	Rafiqul Islam	Agent	Mung Bean, Pulses	01718823579	26.07.2016
36	Ashim Kumar	Agent	Mung Bean, Pulses	01716486084	26.07.2016
37	Ahmed Ali	Agent	Mung Bean, Pulses	01725874212	26.07.2016
38	MD. Shahin Alam	Mill & Agent	Mung Bean, Pulses	01733175221	26.07.2016
39	Imtiaz Ahmed	Farmer	Tomato	01720337525	26.7.2016

40	Md. Rajeeb	Farmer	Tomato	01715672329	26.7.2016
41	Md. Mahbubur Rahman	Farmer	Tomato	01716413182	26.7.2016
42	Md Faruk	Arotdar	Mango	01721012113	26.07.2016
43	Syed Abu Kalam	Arotdar	Mango	01719249832	26.07.2016
44	Belal	Arotdar	Mango	01731893188	26.07.2016
45	Anis	Arotdar	Mango	01730983996	26.07.2016
46	MdAlam	Local Retailer	Mango	01734996228	26.07.2016
47	MdRustam Ali	Arotdar	Mango	01724569971	26.07.2016
48	Md Moshuir Rahman	Farmer	Chili	01740989055	26.07.2016
49	Md Latifur Rahman	Farmer	Chili	01799300150	26.07.2016
50	Md Masud	Farmer	Chili	01774162292	26.07.2016
51	Md Sayedur Rahman	Farmer	Chili	01770931792	26.07.2016
52	Md Mahabur Rahma	Farmer	Chili	01743941902	26.07.2016
53	MdMohsin Ali	Farmer	Chili	01772938658	26.07.2016
54	Md Mokhles Ali	Farmer	Chili	01982907354	26.07.2016
55	Md Ansar Ali	Farmer	Chili	01744732641	26.07.2016
56	Md Selim	Farmer	Chili	01721568127	26.07.2016
57	Md Jamin	Farmer	Chili	01711386591	26.07.2016
58	Md Shahajahan	Farmer	Chili	01746225003	26.07.2016
59	Rejaul Islam	Farmer	Chili	01755101389	26.07.2016
60	Ayub Ali	Farmer	Chili	01713776299	26.07.2016
61	Ratan	Farmer	Chili	01738682061	26.07.2016
62	As Salam	Farmer	Chili	01713792699	26.07.2016
63	Ms Matiur Rahman	Farmer	Chili	01780847140	26.07.2016
64	Jewel	Farmer	Chili	01941224382	26.07.2016
65	Alam	Farmer	Chili	01711199975	26.07.2016
66	Ruhul Amin	Farmer	Chili	01737017809	26.07.2016
67	Atihar	Farmer	Chili	01788770251	26.07.2016
68	Kashem	Farmer	Chili	01705914202	26.07.2016
69	Ar Rashid	Farmer	Chili	01773452434	26.07.2016
70	Masum Rashid	Farmer	Chili	01773283448	26.07.2016
71	AbulKashem	Agent	Mango, Tomato	01734340629	27.07.2016
72	Aslam Sheikh	Agent	Mango, Tomato	01740883510	27.07.2016
73	Md. Jamshed Ali	Mill owner	Mung Bean, Pulses	01724982126	27.07.2016
74	Md. Abdur Rahim	Mill owner	Mung Bean, Pulses	01727146195	27.07.2016
75	Altaf Hossain	Mill owner	Mung Bean, Pulses	01711821104	27.07.2016
76	Md. Rafiqul Islam	Mill owner	Mung Bean, Pulses	01727712881	27.07.2016
77	Md. Bablu Miah	Arotdar	Mango	01712218187	27.07.2016
78	Md. Foyjon Ali	Arotdar	Mango	01713705084	27.07.2016
79	Md. Hossain Ali	Farmer	Tomato	01938378168	27.07.2016

80	Abdul Rashid	Farmer	Tomato	01956904642	27.07.2016
81	Md. Abdus Sattar	Lease farmer	Mango	01715360095	27.07.2016
82	Omor Faruk	Lease farmer	Mango	01742820977	27.07.2016
83	Md. Alam	Lease farmer	Mango	01731128704	27.07.2016
84	Md. Ikbal Ali	Farmer	Tomato	01713740827	27.07.2016
85	Md. Masud	Farmer	Tomato	01831838164	27.07.2016
86	Md. Nazmul	Farmer	Tomato	01821253607	27.07.2016
87	Md. Imdadul	Farmer	Tomato	01747561642	27.07.2016
88	Md. Rafiqul Islam	Farmer	Tomato	01731281814	27.07.2016
89	Md. Abu Rayhan	Farmer	Tomato	01822590743	27.07.2016
90	Md. Nazrul Islam	Farmer	Tomato	01770652263	27.07.2016
91	Md. Abdul Rajjak(Bablu)	Farmer	Tomato	01716509970	27.07.2016
92	Md. Selim Reza	Farmer	Tomato	01761590175	27.07.2016
93	Md. Narul Islam	Small Agent	Tomato	01821253602	27.07.2016
94	Md Uzir Hossain	Arotdar	Vegetable, Tomato, Mango	01715842595	27.07.2016
95	Md Afsarul Haque	Arotdar	Chili, Turmeric	01714570086	27.07.2016
96	Baltu	Trader	Chili	01720413859	27.07.2016
97	Wayes Kuruni	Trader	Chili	01722034210	27.07.2016
98	Guljar	Trader	Chili, Turmeric	01719667117	27.07.2016
99	Md. Ayub Ali	Chatal Owner	Maize	01716438118	27.07.2016
100	Manjur Jaman	Representative	Maize	01730325256	27.07.2016
101	Abu Bakar Siddiqui	Stocker	Maize	01733132150	27.07.2016
102	Biswa Nath	Farmer	Mango	01756271264	27.07.2016
103	Ansarul Islam	Farmer	Mango and Maize	01724858525	27.07.2016
104	Abdur Rahman	Farmer	Mango	01710048365	27.07.2016
105	Abdul Mannan	Farmer	Mango	01711415415	27.07.2016
106	Md Mozammel Haque	Farmer	Mango and Maize	01729616566	27.07.2016
107	Robiul Islam	Farmer	Mango	01713711531	27.07.2016
108	Monarullah	Farmer	Maize and Mango	01722841491	27.07.2016
109	Md Enamul Haque	Businessman	Maize and Mango	01761596308	27.07.2016
110	Md Abu Bakar Siddique	Farmer	Maize	01713798188	27.07.2016
111	Mrittunjoy Ray	Farmer	Maize	01718844269	27.07.2016
112	Shoilafa Dev Sharma	Farmer	Maize, Mango, Litchi	01751153291	27.07.2016
113	Bajlur Rahman	Farmer	Mango	01725444744	27.07.2016
114	Majedur Rahman	Farmer	Mango and Maize	01723361446	27.07.2016
115	Krishno Chandra Rai	Farmer	Maize and Potato	01721416343	27.07.2016
116	Moniruzzaman (Manik)	Farmer	Maize and Potato	01772834599	27.07.2016
117	Md Atiqur Rahman	Farmer	Mango and Maize	01719541284	27.07.2016
118	Md. LutforRahman	Arotdar	Mung Bean, Pulses	01710183066	27.07.2016

119	Md. Bashir Mondal	Farmer	Mung Bean, Pulses	01729629437	27.07.2016
120	Md. Monirul	Farmer	Mung Bean	01987488716	27.07.2016
121	Abdul Majid	Farmer	Pulses	01733469124	27.07.2016
122	Tanmoy Saha (MA)	Arotdar	Mung Bean, Pulses	01818722195	28.07.2016
123	Golap Mondol	Farmer	Mung Bean	01960936647	28.07.2016
124	Asadul	Farmer	Mung Bean	01960936647	28.07.2016
125	Rejaul Islam	Farmer	Mung Bean	01719631111	28.07.2016
126	Abdul Ohab	Farmer	Mung Bean	01916616645	28.07.2016
127	Shohidul Islam	Farmer	Mung Bean	01960936647	28.07.2016
128	Rabiul Islam	Farmer	Pulses	01735033835	28.07.2016
129	Nazrul Islam	Farmer	Pulses	01743857990	28.07.2016
130	Mofazzal	Farmer	Pulses	01916616645	28.07.2016
131	Arabinda Roy	Farmer	Pulses	01839728410	28.07.2016
132	Md Jewel	Arotdar	Potato	01744760725	28.07.2016
133	Hafizuddin	Farmer	Potato	01744690503	28.07.2016
134	Nurul Haque	Farmer	Potato	01768889783	28.07.2016
135	Shafiqul Islam	Farmer	Potato	01717110365	28.07.2016
136	Abu Taher	Farmer	Potato	01727551883	28.07.2016
137	Alimuddin	Farmer	Potato	01713714394	28.07.2016
138	Md. Masum Parvez	Grower and commission agent	Potato	01724641792	28.07.2016

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