DECLARATION

I do hereby declare that the thesis entitled **"SUPPLY CHAIN MANAGEMENT PROCESSES OF SOME SELECTED AGRICULTURAL COMMODITIES IN BANGLADESH: EFFICIENCY, CONSTRAINTS AND A PROPOSED MODEL"** submitted by me to the University of Dhaka, Bangladesh for the degree of Doctorate of Philosophy (Ph.D) is of my own work.

This thesis has not been submitted anywhere before for any academic degree.

Mohammad Abu Bakar Siddique

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Introduction

Background to the Problem

The enormous losses of fruits and vegetables produced in the country are mainly because of the lack of proper infrastructure for storage and transportation under controlled conditions. Of late, Supply Chain is gaining importance due to globalization. A supply chain is a set of three or more organizations linked directly by one or more of the upstream or downstream flows of products, services, finances, and information from a source to a customer.

The supply chain a term now commonly used internationally encompasses every effort involved in producing and delivering a final product or service, from the *supplier's supplier* to the *customer's customer*. Earlier, manufacturers were the drivers of the supply-chain — managing the pace at which products were manufactured and distributed. Today, customers are calling the shots, and manufacturers are scrambling to meet customer demands for options / styles / features, quick order fulfillment, and fast delivery.

Since the stake for the different players is extremely high making it imperative for the partners - including suppliers, manufacturers, distributors and customers behave as if they are part of the same company. Thus scope of supply chain management is vast.

Organizations increasingly find that they must rely on effective supply chains, or networks, to compete in the global market and networked economy. In Peter Drucker's (1998) new management paradigms, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

During the past decades, globalization, outsourcing and information technology have enabled many organizations, such as Dell and Hewlett Packard, to successfully

operate solid collaborative supply networks in which each specialized business partner focuses on only a few key strategic activities. This inter-organizational supply network can be acknowledged as a new form of organization. However, with the complicated interactions among the players, the network structure fits neither "market" nor "hierarchy" categories (Powell, 1990). It is not clear what kind of performance impacts different supply network structures could have on firms, and little is known about the coordination conditions and trade-offs that may exist among the players. From a systems perspective, a complex network structure can be decomposed into individual component firms. Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal management working of other individual players.

Therefore, the choice of an internal management control structure is known to impact local firm performance.

In the 21st century, changes in the business environment have contributed to the development of supply chain networks. First, as an outcome of globalization and the proliferation of multinational companies, joint ventures, strategic alliances and business partnerships, significant success factors were identified, complementing the earlier "Just In Time", "Lean Manufacturing" and "Agile Manufacturing" practices. Second, technological changes, particularly the dramatic fall in information communication costs, which are a significant component of transaction costs, have led to changes in coordination among the members of the supply chain network.

Many researchers have recognized these kinds of supply network structures as a new organization form, using terms such as "Keiretsu", "Extended Enterprise", "Virtual Corporation", "Global Production Network", and "Next Generation Manufacturing System". In general, such a structure can be defined as "a group of semi-independent organizations, each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration".

Statement of the Problem

Bangladesh is basically an agriculture based country and a large proportion of the population formally and informally depends on this sector. Besides official unemployment, disguised unemployment creates real problem for the country. Under the global village, food is becoming scarce and prospects of agribusiness are increasing gradually. Agribusiness can be defined as the business activities related to the agricultural product which will add value, create synergy in the production process, import-export of agricultural products and redistribution of the product starting from the wholesaler to retailers and ultimately consumers can be able to get the products. As such strategic management of agribusiness is required so that core competencies can be created and proper supply chain management along with vertical and horizontal coordination is being required.

Rationale of the Study

Human life (physical, mental and spiritual) is immensely influenced by the quantity and quality of food consumed. As the saying goes, "a man is what he eats." Several studies have linked the physical and behavioral traits of the people of specific geographical locations to the composition of food and water available to them (Baker 2009).

One of the most important requirements for ensuring healthy population on this planet is to provide quality food in sufficient quantity. Not only should food meet the gross energy requirements of human body, there should be a proper balance of major, micro and trace nutrients to ensure complete human development.

Poor nutrition contributes to 1 out of 2 deaths (53%) associated with infectious diseases among children aged under five in developing countries. Iron deficiency with its attendant anemia is the most prevalent micronutrient disorder on a worldwide basis. All forms of malnutrition's broad spectrum are associated with significant morbidity, mortality, and economic costs, particularly in countries where both under- and over nutrition co-exist as seen in developing countries undergoing rapid transition

in nutrition and life-style. In today's world, food must be wholesome sand safe for human consumption. Wholesome food availability obviates a large number of ailments and disorders leading to better quality of life and reduced expenditure on health care. It is not surprising; therefore, that food safety and quality concerns are increasingly evident today among producers, processors, marketers, regulators and consumers alike.

Fruits are an integral part of food needed to meet the mineral requirements of human body and to strengthen body defense mechanisms against various biotic and abiotic stresses. On average, fruits have been contributing to about 4% to human nutrition. Fruits consumed as fresh or in processed form have shown specific health benefits. Increased awareness about the health-related benefits of fruits consumption is leading to increased trade in fruits, especially, driven by the consumers of developed countries.

There was a double-digit growth in the export of mangos and avocados, while the overall fruit exports grew at 4.2%. While several southern hemisphere and banana exporting countries have been quick to take advantage of the growing fruit grade, the same does not hold good for the countries of Asia. In fact, among the top thirty exporters of fruits in the world, only three (Thailand, China and the Philippines) stand out from Asia.

Asia is the cradle of human civilization and domestication of crops and animals, which began first on the continent. It is, therefore, expected that the whole range of temperate and tropical fruits are grown in Asia. Asian tropical fruits such as durian, mango, pomegranate, guava and starfruit have their unique traits in the world of fruits. Asia takes some 44% of the total fruit producing area in the world and contributes about 42% to the total world fruit production, with the largest and the second largest fruit producers located on this countries, a brief description of the major Asian fruits is included in Annex to provide the reader a flavor of these unique creations of Mother Nature.

In spite of the natural advantages that the Asian fruits have in terms of variety, production scale and nutrition, the export volume of the fruit is rather low. Therefore,

while there appears to be an ample scope for increasing the intra-Asia and inter-continental trade in Asian fruits, it is important to understand the constraints in tapping the trade potential. This trade will not only provide more income for farmers in the Asian and Pacific countries, but also offer greater variety and associated health benefits to the world consumers.

Bangladesh is an agro-based country. In rural areas, most of the people depend on the agriculture. More than 80% of people living on less than $2 a day in Bangladesh live in rural areas. The spatial distribution of poverty makes capitalizing on these opportunities is fraught with challenges. The demand for food in Bangladesh and around the world is changing rapidly.

Driven by economic growth, rising incomes, and urbanization, demand is shifting away from traditional staples toward high-value food commodities. High-value agricultural commodities include fruits, vegetable, spices, fish, and livestock products, many of them are processed before reaching the markets.

In Bangladesh, additional demand for these commodities is projected to be worth about 8 billion dollar by 2020. This represents an enormous opportunity for food producers, processors, and sellers. Owing to the greater labor intensity characteristic of high value agricultural production, it also provides an opportunity to generate rural employment and raise rural incomes.

- *The aim of the research is to study the agriculture supply chain of three commodities (Potato, Turkey Cock and Poultry) in Bangladesh and measuring their efficiency and constraints. The Study proposes a model of supply chain.*
- *The study investigates following aspects:*
- *Recent changes in agricultural commodities in Bangladesh.*
- *Existing marketing and supply chain processes of three commodities.*
- *Efficiency and constraints in agricultural supply chain, and*
- *Proposed a model of efficient supply chain in agricultural commodities.*

The research follows the mixed method. The primary data were collected by two methods, first, by visiting grower's garden and farm and wholesale market, in

addition to field observations, second, gathering information through questionnaire use of purposive sample sampling technique.

For the data analysis, both qualitative and quantitative approaches were used. Appropriate statistical techniques were carried out to assess the marketing channel efficiency condition of the products and supply chain efficiency and constraints that face three agricultural products namely Potato, Turkey Cock and Poultry.

Broad Objective of the Study

The overarching goal of the study is to promote an effective agricultural logistics system, by the development of models for localization analysis and delivery strategies for a lean material flow, and by identifying possibilities for intermodal transport and route optimization, for improving the economic competitiveness and reducing the environmental impact of the agricultural sector in Bangladesh.

Specific Objective of the Study

The Specific objectives of the study are to:

- Examine the recent changes in agricultural supply chain in Bangladesh.
- Analyze the marketing and supply chain process of three agricultural commodities in Bangladesh.
- Measure the efficiency and constraints of supply chain in Bangladesh.
- Develop a model for efficient supply chain in agricultural commodities..

Approach to the Problem:

Need for the Study

While many economists think agriculture is the main pillar of the economy, many do not know how the whole process from producers to consumers works in the sector. Supply chain plays a pivotal role in the process although it is not widely recognized as such. Experts say a country's food security is largely dependent on proper supply chain management in the agricultural sector. There are many challenges to be

addressed in the sector for introducing good supply chain management in Bangladesh. Prior to the liberation war in 1971, Bangladesh economy was fully driven by agriculture. After the war, the country focused on the growth of the services and manufacturing sectors. Although the services sector is dominating the economic activities now, still a huge working force is engaged in the agriculture sector that contributes nearly 16 percent to the national economy.

Effective agriculture supply chain management is a key factor to ensuring efficiency and productivity as a high number of workers are involved in the process. Proper production plan, quality seed and other inputs, efficient marketing and proper logistics can ensure food security and make Bangladesh a self-sufficient nation.

Supply chain management is a system of organizations, people, technology, activities, information and resources involved in moving a product or service from a supplier to a customer. It is a combination of strategic and operational function of planning, sourcing, production and logistic activities. Food crop supply chain starts with the strategic planning of crop production. This plan can be based on crop rotation, demand, storage capacity, input availability and quality production. Apparently the growers are rather inefficient in planning due to inadequate information availability or a lack of access to information and cooperation from different agencies that are engaged in the agriculture sector at the field level.

We need to present a clear picture to the grower through all media and relevant organizations about the demand and supply situation of the country." To make it happen, the whole country needs to be divided into zones or districts or upzilas. The agriculture field officers posted at the Thana level can be the key agents or the managers of a successful agriculture supply chain. They can change the agricultural scenario of the country by increasing the productivity through proper planning, ensuring timely input distribution, supervision of production and helping farmers with market information.

The country's agro sector is also facing a couple of challenges that need to be resolved to ensure food security. These challenges mainly lie in appropriate planning and efficient execution. Right planning, coordination with the government and non-

government agencies at the field level and availability of agro inputs in the world market are the major challenges to manage the agro supply chains efficiently. Supply chain efficiency in the agriculture sector is essential because it will ensure food security and the right price of foods to the end consumers. The major challenge in agro supply efficiency is proper planning, considering all driving factors and availability of resources including human.

In the context of our country, most of the challenges are in planning and execution of the supply chain. In some cases we have a nice plan but poor execution and vice versa." The availability of agriculture inputs -- seeds, fertilizer, pesticide and irrigation -- is a big challenge for the growers because interruption in supply chain delays the delivery of inputs to the growers. As a result, production of crop is hampered, as our production is wholly natural and season dependent. To ensure proper distribution, the country needs to remove the unnecessary middlemen who are involved in the distribution process without adding any value to the end-consumers. Timely supply of quality inputs can be met with joint efforts of the public-private sectors. The government should increase its allocation and improve supply of quality seed, fertilizer and safe pesticide."

To encourage private initiatives the investment climate in agro business such as government regulations, taxation policy and import-export guidelines must be made friendly. Constraint on storage facility at pre and post harvest period is another challenge for production, resulting in high wastage and a significantly high cost of production. We should decentralize the storage facilities and ensure smooth supply of agro inputs because these are vital for minimizing loss and wastage and preventing price hike.

This study establishes a relationship between Supply Chain performances and the process of diffusion of practices among firms, thus opening an avenue of no-cost improvement of suppliers, on the lines of buyers. An extensive literature survey is undertaken which forms a basis of an ongoing empirical research on the subject. Scientific study on Supply Chain is little in Bangladesh. This study is an attempt to fill this gap.

Research Question

What opportunities and challenges are present or likely to arise for agriculture supply chain in Bangladesh as demand grows for agricultural commodities and as agricultural production changes in response?

Research Methodology

The focus of this study is to discuss mainly the supply chain process of selected agricultural commodities in Bangladesh. The information collected is mainly from the primary sources. Various publications, books etc were used as the secondary sources of information. Primary data was collected by using self-administered questionnaire. The sample elements were the farmers in the selected areas who produce agricultural commodities. The study utilizes convenient sampling techniques.

Sampling plan and sample size

Target Population: Farmers and Middlemen constitute the target population.

Sampling Frame: Standardized sampling frame is not available as the supply chain of agriculture commodities in Bangladesh is not organized.

Sampling Unit: Mainly the farmers and intermediaries.

Study area: The study is located in those areas where agricultural commodities are produced commercially. This is selected from Bangladesh agricultural census, conducted by the BBS.

Sampling technique: non-probability, mainly the convenience sampling technique is used.

Sample size: appropriate proportional sample from each of the three broad sample categories were selected applying the formula of proportional sample size determination.

Focused commodities: study assesses three categories of agricultural products which include Poultry, Turkey cock and Potato.

Data analysis: All relevant non-parametric tests were conducted to arrive any meaningful conclusion of the study.

Organization of the Study

The study is consisted of nine chapters. Chapter one offers introductory analysis, justifying the need and rational of the study. Chapter two gives an overview the Supply Chain Processes of Some Selected Agricultural Commodities of the domestic and international context. Chapter three reviews the literature. Chapter four outlines research design. Chapter five, six and seven describe the supply chain of three agricultural commodities of Bangladesh (Poultry, Turkey cock, Potato). Chapter eight proposes a model of supply chain. Chapter nine concludes the study.

Chapter - 2

Supply Chain Process of Agricultural Commodities

This chapter provides a selective review of the empirical research on the modern marketing channels. The amount of empirical research varies across topics, being quite limited on the backward linkages of high-value agriculture but more extensive on the poverty impact of contract farming. Given the extensive literature on some topics, the approach in this chapter is to discuss few cases in detail and summarize briefly the results from related studies.

The chapter is divided into two sections, one reviewing studies of the impact of agricultural goods on poverty reduction, the other examining the supply chain efficiency and constraint that measure the impact of modern marketing channels.

A clear distinction between the two topics is difficult because many empirical studies compare farmers involved in high-value agricultural production for supermarkets or for export to farmers producing staple crops for traditional markets. In such cases, it is difficult to separate the effect of traditional agriculture from the effect of modern marketing channels.

To our knowledge, little research has attempted to estimate the overall impact of the growth of agriculture on poverty in developing countries. A number of studies, however, demonstrate that agricultural growth is pro-poor. For example, Warr (2001) uses time-series data for four Southeast Asian countries to examine the relationship between growth of different economic sectors and poverty reduction. He finds evidence that poverty reduction is related to growth of the agricultural sector and growth in service but not to growth of industry.

Similar results have been obtained using time-series data for states in India (Datt and Ravallion, 1998) and provinces in China (Ravallion and Chen, 2004). Similar econometric approaches could be used to examine the impact of growth of specific subsectors, such as high-value agriculture, on poverty.

Truly, only a few studies have discussed the backward linkages of agriculture. In the 1950s, the concept of linkages focused on those between the agricultural sector and non-agricultural sector in the context of alternative growth strategies.

It was argued that public investment should favor the industrial sector because agriculture had few forward and backward linkages more recent research on linkages has used input-output models and social accounting matrices to estimate multipliers, which describe the overall impact on income of a one dollar increase in demand or supply of a given commodity (Delgado et al, 1998).

Kimenye (2002) discusses the backward linkages associated with green bean production for export in Kenya. She argues that green bean production has more backward linkages through the demand for chemical inputs, irrigation equipment, and tractor services than traditional agriculture, but does not estimate the magnitude of these linkages nor their poverty impact.

Ali and Abdellah (2002) use a hypothetical example to show that the same initial increase in crop income crease a multiplier effect of 3 in vegetables and less than 2 in cereals. This is attributed to the importance of purchases of fertilizer, pesticide and irrigation water in vegetable production.

On the other hand, Bautista and Thomas (1998) use a SAM for Zimbabwe and find that the GDP multiplier is larger for small-scale food production than for horticulture. The explanation is that the GDP multiplier includes forward, backward, and consumption linkages, and in Zimbabwe horticultural crops are primarily grown by large-scale commercial farms with much smaller consumption linkages.

The impact of agriculture on farm income has been the subject of numerous studies using a variety of methods. Among the products, impact of horticulture and livestock on farm incomes is most commonly studies. There is a relatively smaller literature on the impact of dairy and fisheries on farm incomes.

A number of studies compare the returns per hectare or per day of growing high-value crops compared to more traditional crops. Von Baun and Immink (1994) found that export horticultural production in Guatemala generated gross margins per hectare 15 times as large maize production and that the gross margins per Labor Day were twice as large.

Weinberger and Lmupkin (2005) summarize the results of seven studies comparing the gross margins of vegetable production and those of rice. The returns per labor-day are higher for vegetables in six of the seven studies.

Minot and Ngigi (2004) estimate that the gross margins per hectare for green bean production are about 15 times greater than that of maize in Kenya. However, vegetables are only grown on a small portion of most farms, in part because of the high labor requirements, so these finding do not necessarily imply a significant effect on overall income and hence poverty.

Some studies use qualitative methods, such as surveys that ask farmers about their perceptions regarding agricultural production. For example Mullens et al (1996) surveys dairy farmers about the impact of a program to promote intensive dairy production. They report a broad consensus among farmers that dairy production had improved their welfare, both in terms of higher income and increased milk consumption, though at the cost of more work for women.

In a survey of 307 rural households in the northern uplands of Vietnam, Minot et al (2006) finds that 83 percent of the respondent report higher standards of living compared to seven years ago. When asked for the reason, the most common responses were higher yields (64 percent), more income from livestock (50 percent), and adoption of new crops with higher profits (38 percent). Such studies are subject to the well-known limitations of qualitative surveys, but farmer perceptions of the causes of changes in welfare can potentially “control” for a wider range of factors (including weather, skills, and health) than can be incorporated in quantitative analysis.

Other studies demonstrate that farmers involved in commercial production of agricultural commodities are better off than farmers that are not. For example, Von

Braun et Al (1991) study small-scale farmers in Rwanda and find that the commercial production of potatoes is associated with higher incomes and better nutritional status.

Weinberger and Lumpkin (2005) compile results from six studies showing that horticultural smallholders earn 20 to 497 percent more than non-horticultural smallholders. Because other factors such as irrigation and farm size are not held constant, these results do not necessarily demonstrate that commercialization *causes* higher incomes.

More persuasive are studies that compare the incomes of high-value producers and other farmers, using methods to control for farm size and other factors.

McCulloch and Ota (2002) examine the linkage between export horticulture and poverty reduction with a survey of 263 households in Kenya, including packhouse workers, farm workers, horticultural smallholders, and non-horticultural smallholders. Smallholders involved in horticultural production for export had twice as much farm land and four times as much income per adult equivalent. The authors use regression analysis to show that horticultural growers have higher incomes even after controlling for farm size, education, irrigation, and other factors.

Alderman (1987) studies the impact of the Karnataka Dairy Development Project which promoted the creation of dairy cooperatives to facilitate the sale of milk from rural to urban areas in India. The study uses a sample of 806 households in 42 villages, half of which had dairy cooperatives. Econometric analysis suggests that household expenditure (a proxy for income) was 8 percent higher in villages with dairy cooperatives after controlling for education, farm size, and assets. Because cooperative villages had somewhat higher milk prices, more milk production, and equal non-dairy income, this author attributes this difference to the cooperatives.

Panel data is particularly useful because analysis of changes in income helps to control for time-invariant household characteristics both observed (e.g. farm size) and unobserved (e.g. skills).

Von Braun and Immink (1994) examine the impact of export horticulture using a sample of 399 Guatemalan farmers who were interviewed in 1983 and again in 1985. About half of the farmers were members of a cooperative that organized the export of snow peas and other vegetables, allowing the authors to compare changes in income20 among those who adopted export vegetable production and those who did not. They find that income increased 38 percent among recent adopters of export vegetable production relative to the increase among other farmers. The increase in income was even greater, 60 percent, among small farmers who adopted export horticulture production.

None of these studies, however, takes into account the fact that those who adopt high-value agriculture probably gain more than other farmers would gain by adopting. The problem of non-random selection creates an upward bias in estimates of the benefits of adopting new crops.

With regard to employment, numerous studies document the fact that vegetable production is much more labor intensive than grain production. Weinberger and Lumpkin (2005) compile results from seven Asian studies showing that vegetable production uses 1.5 to 5.3 times more days of labor per hectare than grain production. Similarly, the study of Guatemalan vegetable growers cited above found that employment increased by 45 percent on farms adopting export horticulture (von Braun and Immink, 1994).

The study of Kenyan horticulture described above shows that horticultural packhouse workers are no better off than otherwise similar wage-earners in the non-farm sector, suggesting labor mobility between the two. However, farm workers on large-scale horticultural farms (both contract farmers and exporter-owned farms) were better off than non-horticultural smallholders after holding other factors constant (McCulloch and Ota, 2002).

In the case of large-scale horticultural production, the main impact on poverty is probably through employment. Barron and Rello (2000) study the impact of tomato agro-industry in Mexico and its impact on employment in poverty stricken rural areas.

Tomatoes are grown on large farms in northern Mexico for export to the United States.

Thousands of migrant workers work in this sector, most of whom migrate annually from the poorer states of southern Mexico. Tomatoes production requires 122 days of labor per hectare compared to just 29 days per hectare for maize production. The authors find that wages are similar to wage in other regions of commercial agriculture, though lower than wages in the manufacturing industry.

In a survey of households in southern Mexico supplying tomato workers, two-thirds of the households had less than 3 hectares of land. They conclude that the tomato industry provides jobs and income for poor families from southern Mexico. However, during the study (1995-1997), there was a trend towards saturation of labor markets with significant negative effects on real wages.

Less evidence exists on the labor intensity and employment effects of other types of high-value agriculture, such as fruit and livestock production. It is likely, however, that labor intensity varies widely depending the commodity, the scale of production, and prevailing wage rates. However, a number of studies examine other aspects of employment in the growing fruit export sector in developing countries.

Jarvis and Vera Toscano (2004) describe the impact of the Chilean fruit export sector on household income and employment. As of the late 1980s, the fruit sector employed about 300 thousand seasonal workers and 120 thousand permanent workers. Based on the fruit area, this implies about 1.5 temporary workers per hectare and 0.6 permanent workers per hectare. The authors say that, while early studies claimed that workers were being exploited, more recent empirical research emphasizes that this employment contributes significantly to the incomes of relatively poor households. Their 1992 survey of 690 grape workers, 90 percent of whom were women, indicates that the workers were well informed about wages and benefits with different employers, that women earned more per day than men (partly because of their higher productivity), and that those wages contributed to more the half of household income for 25 percent of the female workers.

A regression analysis of daily earnings in different jobs taken by the workers (the average worker had five jobs over the year) reveals that agricultural labor paid better than non-agricultural labor. Although the authors found evidence of job discrimination against women, they also conclude that female workers enjoyed the financial independence that the work gave them and that most would prefer to work there for a longer period of the year.

The impact of modern agriculture on poverty via food prices is the subject of some discussion but little in-depth analysis. Any adverse effect should be most evident in countries experiencing rapid substitution from grain production to high-value agricultural production.

Between 1980 and 2002, fruit and vegetable area in China increased more than five-fold, rising from 6 million hectares to 33 million hectares, at the same time as wheat and rice area declined 18 percent, from 63 million hectares to 52 million hectares. However, higher yields have allowed grain production to keep pace with population growth (FAO, 2006).

Similarly, Vietnam has diversified into coffee, fruits and vegetables, and other high-value crops without reducing rice production. The declining share of land allocated to rice cultivation has been more than offset by increased cropping intensity and yields in rice (Minot et al, 2003). Information on food price changes for a larger set of countries would bolster the case, but preliminary evidence suggests that even rapid growth in high-value agriculture may not imply higher food prices for consumers.

This section provides a selective review of empirical evidence on the impact of modern marketing channels on poverty in developing countries.

The empirical research on the impact of modern marketing channels on *farmers* tends to focus on the impact of contract farming and impact of the growth of supermarkets. Each of these will be considered in turn.

The research on contract farming in developing countries is fairly extensive, going back to the 1970s. In an early review of the literature, Minot (1986) finds that farmers

generally benefit from contract farming because it provides them with inputs on credit, technical assistance, and (often) a guaranteed price, allowing them to produce a higher-value commodity than would otherwise be possible. At the same time, contract farming should not be considered a broad-based strategy for rural development because it is only cost-effective when large-scale buyers (such as processors or exporters) need to introduce a new crop, to obtain special product characteristics, to stagger the harvest over the year, or to control some aspect of the production methods.

Contract farming is typically used to organize production of perishable high-value commodities for a quality-sensitive market. However, cases in which buyers or farmers violate the terms of the contract are common, and a good number of contract farming schemes fail for one reason or another (Minot, 1986).

Other studies provide a more skeptical view of the benefits of contract farming. Little and Watts (1994) compile a set of seven case studies of contract farming in sub-Saharan Africa. The case studies focus on the historical and political context of contract farming, conflicts between farmers and the contracting firms, the imbalance of power between the two parties, intra-household tensions over the division of labor and the allocation of new revenues, and the increasing rural inequality as contract farmers grow wealthy enough to hire farm laborers.

In his summary of the cases, Little (1994) concludes that "incomes from contract farming increased for a moderate (30-40 percent) to a high (50-60 percent) proportion of participants" (p 221). However, this income was not enough to live on and farmers had to rely on other farm and nonfarm income. In addition, he concludes that contract farming often exacerbates income inequality by favoring middle- to large-scale growers. In several cases, households lost land that was appropriated for government-run contract farming schemes.

In review of the experience of contract farming in Africa in the early 1990s, Porter and Phillips-Howard (1997) conclude that farmers were generally better off as a result of their participation in contract farming, in spite of a number of social problems that arose in the communities.

Similarly, Singh (2002) identifies a series of problems associated with contract vegetable production in Punjab state in India: imbalanced power between farmers and companies, violation of the terms of the agreements, social differentiation, and environmental unsustainability. Nonetheless, his surveys reveal that most farmers have seen incomes rise and are satisfied with the contract arrangement.

A number of studies examine the proportion of contract farmers that are smallholders, as an indicator of the pro-poor impact of contracting.

Guo et al (2005) use data from farm-level surveys in China covering several products to estimate the likelihood of participating in a contract farming scheme as a function of household characteristics, crop mix, and farm size. The results indicate that small farmers are less likely to participate in contract farming than larger farmers.

Similarly, Runsten and Key (1999) look at contract farming by tomato processing industry in Mexico. Multi-national agro-processors from the United States first contracted with large growers but then involved also the small growers. Part of the reason was that as a lucrative market for fresh tomatoes developed, firms found it increasingly difficult to enforce contracts they had with larger growers.

A few studies give examples of buyers shifting from small-scale to large-scale farmers or the reverse. One example, cited in World Bank (2006), is an exporter in Thailand that started producing its own horticultural products on company land and later shifted to smallholder contract production.

Minot and Ngigi (2004) describe the evolution of several contract farming schemes in Kenya, including one (Del Monte pineapple) that gave up on contract production and others than have shifted from large-scale to small-scale production. These findings confirm that the comparative advantage of smallholders is not a static concept, but it can change as farmers and buyers experiment and learn from their experience. It also implies that public policy may be able to play a role in supporting the participation of small farmers in these supply chains.

Other studies provide more direct evidence in the form of income or gross margin comparisons. For example, Birthal et al (2005) compare the gross margins of poultry, dairy, and vegetable contract farmers with independent farmers producing the same commodities. The gross margins for contract dairy farmers were almost double that of independent dairy farmers, largely because contract growers had lower production and marketing costs. The gross margin for contract vegetable growers was 79 percent greater than that of independent vegetable grower's income, and for poultry, the gross margins of contract farmers was 13% higher. Although they do not use regression analysis to control for other factors, they show that contract farmers had higher gross margins for small-, medium-, and large-scale farmers. A logit analysis of participation in the contract farming schemes indicates that farm size and education are not significant predictors, implying that small farmers are not excluded from contracting.

A few studies of contract farming take into account the fact that contract farmers are generally not a random sample of the population; they may differ from the population in ways that also affect income. For example, if farmers that sign up for contract schemes are more hardworking or more skilled than others, the difference in income between contract farmers and other farmers will reflect both the effect of contracting and the effect of those characteristics. This bias can be corrected using a Heckman selection regression model or an instrumental variables model.

Warning and Key (2002) study contract farming in peanuts in Senegal. NOVASEN, a private company, contracted 32,000 growers and produced approximately 40,000 tons of peanuts annually. The authors estimate gross profits using a two-step Heckman procedure to control for selection bias. They find that the increase in gross agricultural revenues associated with contracting is statistically significant and large, equal to about 55 percent of the average revenue of non-contract farmers. Various measures of assets were not significant predictors of participation in the contract farming scheme, suggesting that contractors were typical rural households.

Another study, carried out in Indonesia by Simmons et al (2005), examined contract growers of poultry, seed maize, and seed rice. They also use a Heckman model to control for selection bias. The poultry contracts and seed maize contracts resulted in improved returns to capital, while no significant impact was found in the case of seed

rice. Contract seed growers were more likely to be large farmers compared to independent growers, but contract poultry production tended to be smaller than independent poultry growers.

They conclude that the contracts increase income and welfare, reducing absolute poverty. Ramaswami et al (2006) re-analyze the poultry survey data from the above-cited study by Birthal et al (2005), except that they use an instrumental variable regression analysis to control for selection bias. They find that average gross margins are similar between contract growers and others, but the regression analysis indicates significant gains from contracting.

The explanation is that contract growers are less experienced and have less access to credit than other growers. Thus, they gain more from the management assistance and the credit provided by the firm than would more capable farmers who already have access to credit. Thus, the incomes of contract farmers are significantly higher than they would have been without the contract, but only slightly higher than the incomes of the more-skilled independent growers. In addition, the authors also show that the variability of gross margins across production cycles is much lower for contract growers than for independent growers, revealing another benefit of contracting.

There is widespread concern that smallholders will be excluded from lucrative markets for high-value commodities due to the growth of supermarkets. Processed foods are either imported or purchased from processors, so the impact on farmers is indirect (supermarkets may increase the demand for processed foods).

Thus, research on the impact of supermarkets on poverty focuses on fresh fruits and vegetables and dairy products. Small supermarkets catering to cost-conscious consumers tend to purchase from the traditional wholesale markets. But as the supermarket chain expands and as consumers become more quality-conscious, supermarkets begin to establish their own supply chains (including dedicated distribution centers), set private standards, and establish lists of preferred growers.

These growers are generally medium- and large-scale farmers who can more easily meet the volume and quality requirements and provide a steady supply throughout the

year (see Reardon and Berdegué, 2002; Reardon et al, 2003; Weatherspoon and Reardon, 2003; and Shepherd, 2005).

These trends are most advanced in the middle-income countries of Latin America, where supermarkets generally account for over half of retail food sales and the existence of large-scale farms allows supermarkets to link up largely with large farmers. Although there are numerous descriptive studies of the growth and procurement patterns of supermarkets, there are few studies that measure the role of smallholders in supplying supermarkets.

Balsevich et al (2003) estimates that 80 percent of fresh fruits and vegetables supplied to supermarkets came from medium or large growers or packers. Information on producer prices for suppliers to supermarkets and traditional markets, as well as income profiles for different types of growers would strengthen the case that small farmers are excluded and that they lose from exclusion.

The trends in Asia are mixed, with extensive supermarket penetration in middle-income countries such as Thailand, Malaysia, and the Philippines and minimal presence in low-income countries such as Vietnam, Bangladesh, and India. As mentioned above, the penetration of the supermarkets differs across products being relatively lower in fresh fruits and vegetables than in processed food Hu et al (2004a) examines the impact of supermarkets in China, whose sales have been growing at more than 40 percent per year and now account for 11 percent of retail food sales. Supermarkets have begun to organize their supply chains and bypass wholesale markets, but they are hampered by the fact that farms are small and unorganized. Another study examines the effect of supermarkets on supply chains and small farmers in China, focusing on the growing demand for food safety (World Bank, 2006).

Another study by Hu et al (2004b) indicates that supermarkets have promoted consolidation in the dairy processing sector, as small processors merge and large ones buy small ones. At the same time, supermarkets have catalyzed the development of a unified national dairy market, creating trade from the poor, pastoral provinces in the west to the higher-income, urbanized provinces in the east. The authors do not

provide data on the characteristics of the dairy farmers in the east supplying supermarkets, but this trend may incorporate poor farmers.

Chowdhury (2005) reviews the trends in high-value agriculture, vertical coordination, and supermarkets in Indonesia. Based on rapid reconnaissance and interviews with supermarkets, he argues that supermarkets do not favor large-scale farms, partly because small farms dominate Indonesian agriculture: two-thirds of all farms have less than one hectare. Furthermore, he cites research indicating that supermarket suppliers get prices that are almost 50 percent higher than suppliers to traditional markets.

A detailed study of the tomato marketing in Ho Chi Minh City, Vietnam, also finds that supermarkets offer its suppliers higher farm-gate prices than the traditional marketing channels do. The authors do not explore the farm size of tomato farmers in the two channels to test the hypothesis that small farmers are being squeezed out. This may be because supermarkets only control 2 percent of the tomato sales in Ho Chi Minh City, so their effect on the regional tomato market is still almost negligible (Cadilhon et al, 2006).

In sub-Saharan Africa, the expansion of supermarkets is the most advanced in South Africa, where they have a 55 percent share of retail food sales. Weatherspoon and Reardon (2003) estimate that 40 percent of fresh fruits and vegetables are sold through supermarkets and that most are sourced from medium- and large-scale farmers in South Africa. On the other hand, the expansion of South African supermarket chains such as Shoprite into other African countries has facilitated the increasing use of smallholders in other countries to supply South African markets.

Neven et al (2005) analyze the impact of supermarkets on small farmers in Kenya using interviews with supermarkets regarding their procurement patterns. One chain (Uchumi) obtains just 10 percent of its fresh fruits and vegetables directly from small farmers and 40-50 percent from brokers and wholesalers, while another (Nakumatt) sources 60-70 percent directly from small farmers. The authors argue that smallholders are not currently being squeezed out of horticultural markets because, as medium and large growers begin supplying supermarkets, small farmers have less

competition in traditional markets. But eventually, the growth of the market share of supermarkets will put pressure on small farmers to either meet supermarket standards or be squeezed out of horticulture. Currently, only 6 percent of fresh fruit and vegetables in Nairobi are sold through supermarkets.

As a major horticultural exporter, Kenyan farmers are also affected by supermarket trends in the United Kingdom and elsewhere in Europe. Growing consumer interest in food safety and traceability has shifted export horticulture toward larger contract farms and vertically integrated processor-exporters, according to Dolan and Humphrey (2001). Nonetheless, Jaffee (2003) estimates that smallholders still account for about half of Kenyan fruits and vegetables exports.

Again, it is important to recognize that the rising demand for food safety and higher quality may work against small farmers in the short-term, but to the extent that they can learn new skills and otherwise adapt, the trend may be less negative or even positive in the longer term (Van der Meer, 2006). Few studies to date have addressed these dynamic issues in studying the impact of supermarkets on small farmers.

What is the effect of the growth of supermarkets on traditional traders? Most studies focus on traditional food retailers.

Gutman (2002) documents the impact of the growth of supermarkets on the traditional retailers in Argentina. The end of the 1990s, supermarkets/hypermarkets accounted for 57 percent of retail food sales in Argentina, reducing the share of traditional retailers to 17 percent. The Economic Censuses of 1984 and 1993 showed a drop of 30 percent in the number of retail stores in general and an accompanying drop of 26 percent in employment in food retail. Gutman estimates that 125,000 jobs were lost because of the decline of the traditional retail and only 22,500 jobs were created in the supermarkets.

Faiguenbaum et al (2002) look at the impact on the traditional retailers of the emergence of the supermarkets in Chile. Between 1991 and 1995, the number of retailers in general food, beverages and liquor, meat, fish, and dairy products declined by more than 20 percent. Although most shopkeepers are considered to fall into the

middle and lower income groups in Latin America, it is difficult to quantify the impact on poverty without more information on the income profile of traditional retailers and how they responded to these closures.

In Thailand, the transformation toward supermarkets is rapid enough to result in a 14% decline in the number of traditional retailers in 2001 compared to a 20% growth in the number of supermarkets (USDA, 2002). In contrast, in Indonesia the number of "independent grocers" continues to rise even as the market share of supermarkets and hypermarkets increases (USDA, 2003).

What is the impact of the growth of modern marketing channels on poverty through the consumer price of food? Few studies have examined the effect of contract farming and other methods of linking farmers to markets. One example is Alderman (1987), who examined prices, marketing patterns, and income in villages with and without a dairy cooperative. He found that milk prices were higher in villages with a cooperative because the link to urban markets raised the village price. This linkage benefited dairy producers and consumers in the cities, but hurt non-producing milk consumers in the villages.

More discussion has focused on the impact of supermarkets on consumer prices. As described in earlier, the prices charged by the supermarkets could be higher than those charged by traditional retailers because of the bundled services that supermarkets offer such as convenience, cleanliness, and the shopping experience. Alternatively, modern retail outlets could take advantage of economies of scale and thereby offer lower prices to the consumers. It is likely that the pricing strategy of supermarkets depends on the price-consciousness of their consumers.

Empirical studies suggest that the price relationship may vary by type of product. Neven et al (2005) compare prices in Nairobi supermarkets with the prices of similar products in traditional retailers. The prices of nine fresh produce items were, on average, 6 percent higher in supermarkets, while the prices of processed food products were, on average, about 3 percent lower. Consumer surveys revealed that the urban poor bought processed foods in supermarkets and fresh produce in wet markets, as would be expected given these price relationships.

A similar analysis was carried out by Ghezan et al (2002) for horticultural products in Argentina. They find that the prices for fruits and vegetables were, on average, 6 percent and 14 percent higher, respectively, than in traditional retail outlets. However, the average price for all food and beverages was 5 percent lower in supermarkets. In spite of the large market share of supermarkets in Argentina (70 percent in 2000), small fruits and vegetables shops continued to dominate horticultural retail sales. The authors cite survey results indicating that 71 percent of fresh fruits and vegetables were bought from traditional retail outlets.

One of the most comprehensive studies of the impact of modern marketing channels was carried out by the firm Global Insights (2005). The objective of the study is to determine what the U.S. economy would be like if Walmart did not exist. Although it refers to the U.S economy, the methods and results are relevant in this context. The methods include econometric analysis of panel data for 24 urban areas over 20 years and a macroeconomic simulation model.

The results suggests that Walmart has reduced consumer prices by about 3 percent and wages by about 2 percent, resulting in a 1 percent increase in real income. They suggest that the cost savings of Walmart are due to higher total factor productivity and being able to obtain imports at lower prices than other stores. Although data constraints would make it difficult to carry out a similar study in most developing countries, this study reveals the potential for using economy wide models to evaluate the poverty impact of modern marketing channels.

Numerous empirical studies have explored the impact agriculture and modern marketing channels, but they tend to focused on just a few types of impact. For example, there are few studies that examine the backward linkages in agriculture, though these linkages should be more important for high-value agriculture than for staple food crop production.

The effect of backward linkages is particularly important in the case of livestock industry, where the demand for feed affects upstream maize producers. Many studies confirm that farmers growing high-value agricultural commodities are generally better off than others, but many of these studies do not control for other factors (such as

irrigation) or take selection bias into account. There is strong evidence that fruits production is more labor intensive than staple food crop production, but less attention to other types of agriculture such as fruit and livestock production. In addition, few studies attempt to measure the relationship between additional labor demand and poverty reduction. Finally, few studies have considered the impact of agriculture on food prices, though initial indications are that the impact is likely to be negligible in many cases.

Empirical research on modern marketing channels tends to focus on supermarkets and contract farming. Studies indicate that, as supermarkets in developing countries expand and begin to cater to quality-sensitive consumers, they pay higher prices for high-value commodities than the traditional traders but they also start to establish preferred supplier lists which often exclude small farmers. Although these studies hint at an adverse impact, more information would be needed to measure the impact on incomes and poverty.

The effect of contract farming on participants generally seems positive. However, the impact on poverty is mixed because in some cases only medium- or large-scale farmers choose to contract or are invited to contract. A few recent studies have used methods which control for other variables and take into account the problem of selection bias.

A few studies indicate that growth in the supermarket sector can be rapid enough to cause an absolute decline in employment in the traditional retail sector. However, it is not clear how common this is and how much impact this has on poverty.

Finally, several studies suggest that supermarkets may have lower retail prices for processed food and higher prices for fresh fruits and compared to traditional markets. Again, this is suggestive, but does not provide enough information to assess the impact of supermarkets on the poor.

Chapter- 3

Review of Literature

The agricultural economy of Bangladesh is heavily dependent on rice. Almost three-quarters of total cropped land in Bangladesh are devoted to paddy cultivation and per capita rice consumption is one of the highest in the world. Food grain consumption for an average person has stabilized over time at about 160 and 180 kg/person/ year in urban and rural areas respectively. Rice is the main food grain product while wheat makes up just 2 percent and 6 percent of the total food grain consumption (urban and rural respectively). Rice is important in the consumption basket of poor and rich alike; the poorest quintile consumes 139 and 146 kg of rice per capita in urban and rural areas respectively. Several important changes have taken place-and continue to take place-in the domestic agricultural markets of Bangladesh.

Six major changes in the domestic agricultural markets of Bangladesh over time have been identified by the Azad (2015). First, since the 1960s food grain production and prices have changed drastically and the change is more discernible since the 2000s. The share of rice has increased from 10 percent in 1966-67 to 61 percent in 2016. This change in production patterns has led to a change in price seasonality. Such an increase in rice production is due to the ample use of chemical fertilizer, shallow tube wells and the development of high-yielding rice varieties. In the 1960s, the price spread was 15 percent between peak and trough; it has declined to less than 10 percent in the last decade.

Second, the quantities of rice marketed have dramatically increased over the years. The production of rice tripled since the 1960s. Marketing the proportion of the harvest a farmer sells has increased by a factor of six or more. Rice and paddy markets are very active. About one-third of rural households are net sellers of rice. A large number of farmers who sell paddy at harvest will buy back rice at some point in the year.

Third, the contribution of public sector procurement in food grain markets has declined over time, from 25 percent in 2000 to only 9 percent in 2016 . Private food grain imports started in 1993. As a result, large quantities are now being imported through private channels. Similarly, government procurement from local rice and wheat production declined from 4 and 5 percent (respectively) at the end of the 1980s to 2 percent and 0 percent in 2007/08.

Fourth, the importance of high-value and perishable commodities, such as, fruits and vegetables, fish, meat, and dairy products in the food consumption basket has been increasing. The share of these products was already evaluated at 40 percent and 49 percent of the food consumption basket in rural and urban areas respectively. Using demand projections based on reasonable growth rates in incomes and population, it is estimated that Bangladesh would demand an extra $8 billion of these high-value products by 2020.

Fifth, there is a shift toward the consumption of better quality food products. Based on a recent survey, it is estimated that the lower-quality coarse rice makes up 28 percent of their total rice sales. Ten years ago, the share of coarse rice in the total wholesaler turnover was evaluated to be as high as 45 percent. The increasing demand for quality rice is also seen in the rise of the share of automatic mills in the milling sector and of the share of consumers purchasing packaged rice.

Sixth, the importance of modern retail and the processing industry has been growing. Agro-processing is estimated to have grown at 8 percent per year between 1985 and 2015. Rice mills are the most important in this sector, generating 40 percent of employment. Processing of high-value products is still limited, however. Modern food retail is currently also very small, making up less than 1 percent of urban food retail markets, but it is growing rapidly as in a number of other Asian countries (Azad, 2015).

The changing demands in domestic and international markets for high-value product markets create challenges as well as opportunities for existing food supply chains. Growing demand for high-value products might provide extra opportunities, especially for rural areas. First, it generates greater employment. The export of shrimp

and fish directly employs more than 600,000 persons and it is estimated that 70 percent of the jobs related to agro-processing in Bangladesh are generated in rural areas. Second, the high-value product markets lead to higher income for farmers. For example, when assigning net profits of the export value chain of shrimp to the different stakeholders it is shown that the biggest share of the extra earnings directly benefits the farmers (Azad 2015).

There are also significant challenges in markets. For example, 90 percent of Bangladesh's milk production is produced by smallholder and landless farmers in rural areas, but due to a weak and fragmented value chain only 9 percent reaches the growing urban markets, requiring the country to import 30 percent of its total dairy consumption needs. Large formal sector processors (BRAC and PRAN Dairy) have built chilling plant collection centers throughout the country but most are operating significantly below capacity indicating that building hardware infrastructure alone is not sufficient. Two-thirds of smallholder farmers and half of landless farmers own dairy cows, but their dairy practices are usually limited to traditional subsistence farming techniques.

Bangladesh is a net agricultural importer. The country's food imports accounted for 16 percent of the total imports in 2016. Main food imports are concentrated in cereals (almost $1 billion' in 2015), vegetable oils, sugar, and vegetables. Exports of agricultural products by Bangladesh have steadily increased, almost tripling in the last two decades, from $306 million in 1990/91 to $870 million in 2015 16 (BBS 2017). Exports of raw jute, frozen foods, vegetables, fruits, tobacco and other primary products have increased over time, but exports of tea declined due to increased domestic demand and declining productivity. The fishery sector (mainly shrimp) dominates Bangladesh's food exports reaching more than $700 million in 2013.

Over the past three decades, Bangladesh has undertaken a series of policy measures toward liberalization of agricultural trade. Bangladesh has removed quantitative restrictions on trade flows, reduced tariffs, and established a market-based floating exchange rate. Policy reforms were carried out for both input and output markets in agriculture. The private sector and nongovernmental organizations (NGOs) are now allowed to import any improved inputs for research and development and to develop

facilities for producing foundation seeds. They are also allowed to import and sell seeds with the exception of five notified crops (rice, wheat, sugarcane, potato, and jute). Output market-related reforms were carried out relating to the food procurement and distribution system, import of food grains, reduction in tariff rates and removal of quantitative restrictions.

At the global level and for all products combined, Bangladesh now faces an average tariff of 4.4 percent on its exports, much lower than the tariff it applies to its imports (17.2 percent). This reflects, on the export side, the country's participation in various preferential schemes (such as the General System of Preferences). On the import side, Bangladesh has the status of a least developed country (LDC) in the World Trade Organization (WTO) which makes it subject to special and differential treatment.

Agriculture, on average, is more protected than industry. However, the gap between the average tariffs applied to agriculture and industry is much smaller, at 19.7 and 16.7 percent respectively, than observed in the rest of the world (BBS 2016). In the agricultural sector, food products are more protected, at more than a 21 percent tariff than nonfood products at 14 percent (BBS 2016). This pattern is in line with world averages, but it still reflects significant tax levels for the food consumers. The most protected products are sugar, fisheries, dairy products, rice, and vegetables. Compared to its South Asian partners, Bangladesh applies equal or higher tariffs for imports. On exports, the tariffs faced by Bangladesh follow a more heterogeneous pattern, driven by products subjected to high protection globally such as sugar (91 percent), paddy rice (77 percent), wheat (52 percent), and processed food (58 percent). Bangladesh faces the highest tariffs from India, especially for agricultural and food products: 80 and 70 percent for paddy and processed rice, respectively; and 106 and 98 percent for wheat, vegetables and fruits respectively (Economic Survey of Bangladesh 2016).

Bangladesh has relied heavily on export subsidies to boost growth of shrimp and vegetable exports in the last ten years. The efficiency and sustainability of providing subsidy is limited though subsidies have been successful and have increased income in the export sector of Bangladesh. Export subsidies can help to launch an activity, give farmers incentive to innovate, and help traders to establish new networks; they may not be maintained in the long run for several reasons.

The agriculture affects four ways on incomes and poverty of farmers; (i) through backward linkages, (ii) by affecting the income and poverty of farmers, (iii) influences the demand for labor, either by growers or by traders, processors, and others in the marketing channel, and (iv) by changing the prices of food faced by consumers (Azad 2015). The first one is called the input linkage. The second one is termed the farm linkage. The third one known as the employment linkage and the last one is called the consumer price linkage.

Backward linkage is measured against the loss of forest resources and environmental damage provided that high-value agriculture is taking place on newly cleared land. In this case, the backward linkages of agriculture must be weighed against that of traditional crop production on the same area of land.

In the long-term, the poverty impact of the backward linkages of agriculture depends on (i) the intensity of use of different factors (ii) the degree of mobility of those factors, and (iii) the ownership of factors by the poor. Labor intensity of the input sectors is the main indicator to assess the poverty impact of the backward linkages of high-value agriculture.

Income and poverty impact among farmers is measured by the cost-benefit of the involvement of farmers in agricultural production, that is, why many farmers do not adopt high-value commodities and why some farmers do adopt them. Four disadvantages to adopting agricultural commodities are (i) insufficient information; (ii) perceived risks are production risk due to weather, disease, and pests, and marketing risk, (iii) lack of finance and (iv) suitable natural conditions.

The final consumers are the key to successfully adopting agricultural commodities. The absence of quality consciousness and food safety standard among the final consumers are low and for this reason adopting the agricultural commodities in developing countries are relatively easier. On the contrary, higher-income urban consumers will generally have higher quality and food safety standards, or more precisely, enough income to pay a premium for quality and safety.

Agriculture is one of the prime sectors of Bangladesh economy as it contributes18 percent to the GDP and 62 percent to the livelihood of the nation (BBS, 2017). Thus, agricultural growth and development is inevitable for the development of the country. And development of agriculture is only possible only through transformation of subsistence agriculture to agribusiness or commercialization. Promotion of high-value agriculture (HVA) through the production and marketing is one of the vital steps for commercialization. However, the development of Bangladesh agriculture is fraught with a number of difficulties like the lack of infrastructural supports, prevalence of subsistence farming, poor irrigation and other input facilities, limited access to low cost agricultural technologies and high transportation costs etc.

Agricultural commercialization is a complex and dynamic process involving various linkages between the farm and the firm/industry encompassing the areas related to technology, markets, finance, institutions, infrastructure and social structure. The key agents of commercialization are the farmers, traders, and processors. The core problem for the agribusiness development in Bangladesh is the lack of effective value chain linkages among input providers, farmers, traders, processors, and service providers in which they all are aware of their mutual linkages and organize themselves in such a way that they can benefit from such linkages in the network. A demand-driven approach is needed where the key players themselves make investment decisions related to technology, infrastructure, marketing and capacity. Further, methods to improve marketing channels require greater coordination in terms of contracts, vertical and horizontal integration and joint efforts of all stakeholders.

Recognizing these facts, in 2000, the Agriculture Perspective Plan (APP) was brought up as a blue print of the agricultural development vision of Bangladesh that would work as a road map to all plans for the next two decades. The plan is based on more demand driven (market led) approach than the previous plans which were production oriented. The plan has clearly identified the rule of game “competitiveness”; the competitiveness through comparative advantage in production and competitiveness through the marketing efficiency. The comparative advantage in production has been conceptualized by the production of high value crops and commodities and their commercialization to attain the scale of operation. Similarly, the competitiveness

through marketing efficiency had been envisaged through agribusiness promotion and development of market, market infrastructure and marketing system.

The demand for food in Bangladesh is changing rapidly. Economic growth, rising incomes, and urbanization are combining to shift food demand from traditional staples and toward high-value foods. But poor supply chain system in agricultural product marketing makes the entire economy in a jeopardize situation. Unfortunately, there are little scientific and comprehensive study that have been assessed by any researcher as yet on efficient supply chain in agricultural commodities in Bangladesh. This necessitates the emergence of this study.

Studies on modern supply chain

This section examines the impact of modern supply chain on farmers' income, on employment, on traditional traders' income, and on consumer food prices.

Minot (1986) finds that farmers generally benefit from contract farming because it provides them with inputs on credit, technical assistance and often a guaranteed price allowing them to produce a higher-value commodity than would otherwise be possible.

Minot (1986) also noted that, contract farming should not be considered a broad-based strategy for rural development because it is only cost-effective when large-scale buyers need to introduce a new crop to obtain special product characteristics, to stagger the harvest over the year, or to control some aspect of the production methods. Contract farming is typically used to organize production of perishable high-value commodities for a quality-sensitive market.

Little and Watts (1994) reviewed seven case studies of contract farming in sub-Saharan Africa and identified the conflicts between the farmers and the contracting firms, the imbalance of power between the two parties, intra-household tensions over the division of labor and the allocation of new revenues and the increasing rural inequality as contract farmers grow wealthy enough to hire farm laborers.

Little (1994) observed that "incomes from contract farming increased for a moderate (30-40 percent) to a high (50-60 percent) proportion of participants" (p 221). However, this income was not enough to live on and farmers had to rely on other farm and non-farm income. In addition, he concludes that contract farming often exacerbates income inequality by favoring middle- to large-scale growers.

Porter and Phillips-Howard (1997) find that farmers were generally better off as a result of their participation in contract farming in spite of a number of social problems that arose in the communities.

Singh (2002) identifies a series of problems associated with contract vegetable production in the Punjab state in India that include imbalanced power between farmers and companies, violation of the terms of the agreements, social differentiation, and environmental unsustainability. However, his surveys reveal that most farmers have seen incomes rise and are satisfied with the contract farming.

Guo et al (2005) use data from farm-level surveys in China covering several products to estimate the likelihood of participating in a contract farming scheme as a function of household characteristics, crop mix and farm size. The results indicate that small farmers are less likely to participate in contract farming than larger farmers.

Runsten and Key (1999) examined at contract farming by tomato processing industry in Mexico. Multi-national agro-processors from the United States first contracted with large growers but then involved also the small growers. Part of the reason was that as a lucrative market for fresh tomatoes developed the firms found it increasingly difficult to enforce contracts they had with larger growers.

A few studies give examples of buyers shifting from small-scale to large-scale farmers or the reverse. One example, cited in World Bank (2006), is an exporter in Thailand that started producing its own horticultural products on company land and later shifted to smallholder contract production.

Minot and Ngigi (2004) describe the evolution of *several contract farming* schemes in Kenya. Their findings confirm that the comparative advantage of smallholders is not a static concept, but it can change as farmers and buyers experiment and learn from their experience. It also implies that public policy may be able to play a role in supporting the participation of small farmers in these supply chains.

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These trends are most advanced in the middle-income countries where supermarkets generally account for over half of retail food sales and the existence of large-scale farms allows supermarkets to link up largely with large farmers. Balsevich et al (2003) estimates that 80 percent of fresh fruits and vegetables supplied to supermarkets came from medium or large growers or packers.

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Hu et al (2004) examines the impact of supermarkets in China whose sales have been growing at more than 40 percent per year and now account for 11 percent of retail food sales. Supermarkets have begun to organize their supply chains and bypass wholesale markets, but they are hampered by the fact that farms are small and unorganized. Another study examines the effect of supermarkets on supply chains and small farmers in China focusing on the growing demand for food safety (World Bank, 2006).

Hu et al (2004) indicates that supermarkets have promoted consolidation in the dairy processing sector as small processors merge and large ones buy small ones. At the same time, supermarkets have catalyzed the development of a unified national dairy market, creating trade from the poor, pastoral provinces in the west to the higher-income, urbanized provinces in the east. The authors do not provide data on the characteristics of the dairy farmers in the east supplying the supermarkets, but this trend may incorporate poor farmers.

Chowdhury (2005) reviews the trends in high-value agriculture, vertical coordination, and supermarkets in Indonesia. Based on rapid reconnaissance and interviews with supermarkets he argues that supermarkets do not favor large-scale farms partly because small farms dominate Indonesian agriculture: two-thirds of all farms have less than one hectare. Furthermore, he cites research indicating that supermarket suppliers get prices that are almost 50 percent higher than suppliers to traditional markets.

Cadilhon et al, (2006) studied the tomato marketing in Ho Chi Minh City, Vietnam. They find that supermarkets offer its suppliers higher farm-gate prices than the traditional marketing channels do. The authors do not explore the farm size of tomato farmers in the two channels to test the hypothesis that small farmers are being squeezed out. This may be because supermarkets only control 2 percent of the tomato sales in Ho Chi Minh City.

The expansion of supermarkets is the most advanced in South Africa where they have a 55 percent share of retail food sales. Weatherspoon and Reardon (2003) estimate that 40 percent of fresh fruits and vegetables are sold through supermarkets and that most are sourced from medium- and large-scale farmers in South Africa.

Neven et al (2005) analyze the impact of supermarkets on small farmers in Kenya using interviews with supermarkets regarding their procurement patterns. One chain obtains just 10 percent of its fresh fruits and vegetables directly from small farmers and 40-50 percent from brokers and wholesalers while another chain sources 60-70 percent directly from small farmers.

Growing consumer interest in food safety and traceability has shifted export horticulture toward larger contract farms and vertically integrated processor-exporters, according to Dolan and Humphrey (2001). Nonetheless, Jaffee (2003) estimates that smallholders still account for about half of Kenyan fruits and vegetables exports.

Again, it is important to recognize that the rising demand for food safety and higher quality may work against small farmers in the short-term, but to the extent that they can learn new skills and otherwise adapt, the trend may be less negative or even positive in the longer term (Van der Meer, 2006).

Gutman (2002) documents the impact of the growth of supermarkets on the traditional retailers in Argentina. He found that supermarkets/hypermarkets accounted for 57 percent of retail food sales in Argentina reducing the share of traditional retailers to 17 percent. Gutman estimates that 125,000 jobs were lost because of the decline of the traditional retail and only 22,500 jobs were created in the supermarkets.

Faiguenbaum et al (2002) look at the impact on the traditional retailers of the emergence of the supermarkets in Chile. Between 1991 and 1995, the number of retailers in general food, beverages and liquor, meat, fish, and dairy products declined by more than 20 percent.

In Thailand, the transformation toward supermarkets is rapid enough to result in a 14% decline in the number of traditional retailers in 2001 compared to a 20% growth in the number of supermarkets (USDA, 2002). In contrast, in Indonesia the number of "independent grocers" continues to rise even as the market share of supermarkets and hypermarkets increases (USDA, 2003).

Alderman (1987), who examined prices, marketing patterns, and income in villages with and without a dairy cooperative found that milk prices were higher in villages with a cooperative because the link to urban markets raised the village price. This linkage benefited dairy producers and consumers in the cities, but hurt non-producing milk consumers in the villages.

Empirical studies suggest that the price relationship may vary by the type of product. Neven et al (2005) compare prices in Nairobi supermarkets with the prices of similar products in traditional retailers. The prices of nine fresh produce items were, on average, 6 percent higher in supermarkets while the prices of processed food products were, on average, about 3 percent lower. Consumer surveys revealed that the urban poor bought processed foods in supermarkets and fresh produce in wet markets as would be expected given these price relationships.

Ghezan et al (2002) conducted study for horticultural products in Argentina. They find that the prices for fruits and vegetables were, on average, 6 percent and 14 percent higher respectively than in traditional retail outlets. However, the average price for all food and beverages was 5 percent lower in supermarkets. In spite of the large market share of supermarkets in Argentina small fruits and vegetables shops continued to dominate horticultural retail sales.

One of the most comprehensive studies of the impact of modern marketing channels was carried out by the firm Global Insights (2005). The objective of the study is to determine what the U.S. economy would be like if Walmart did not exist. Although it refers to the U.S economy the methods and results are relevant in this context. The methods include econometric analysis of panel data for 24 urban areas over 20 years and a macroeconomic simulation model.

The results suggests that Walmart has reduced consumer prices by about 3 percent and wages by about 2 percent resulting in a 1 percent increase in real income. They suggest that the cost savings of Walmart are due to higher total factor productivity and being able to obtain imports at lower prices than other stores. Although data constraints would make it difficult to carry out a similar study in most developing countries this study reveals the potential for using economy wide models to evaluate the poverty impact of modern supply channels.

Finally, numerous empirical studies have explored the impact of high-value agriculture and modern marketing channels, but they tend to focus on just a few types of impact. For example, there are few studies that examine the backward linkages from high-value agriculture though these linkages should be more important for high-value agriculture than for staple food crop production.

The effect of backward linkages is particularly important in the case of livestock industry where the demand for feed affects upstream maize producers. Many studies confirm that farmers growing high-value agricultural commodities are generally better off than others, but many of these studies do not control for other factors (such as irrigation) or take selection bias into account. There is strong evidence that fruits production is more labor intensive than staple food crop production, but less attention to other types of high-value agriculture such as fruit and livestock production.

In addition, few studies attempt to measure the relationship between additional labor demand and poverty reduction. Finally, few studies have considered the impact of high-value agriculture on food prices though initial indications are that the impact is likely to be negligible in many cases.

Empirical research on modern marketing channels tends to focus on supermarkets and contract farming. Studies indicate that, as supermarkets in developing countries expand and begin to cater to quality-sensitive consumers, they pay higher prices for high-value commodities than the traditional traders but they also start to establish preferred supplier lists which often exclude small farmers. Although these studies hint at an adverse impact more information would be needed to measure the impact on incomes and poverty.

The effect of contract farming on participants generally seems positive. However, the impact on poverty is mixed because in some cases only medium- or large-scale farmers choose to contract or are invited to contract. A few recent studies have used methods which control for other variables and take into account the problem of selection bias.

A few studies indicate that growth in the supermarket sector can be rapid enough to cause an absolute decline in employment in the traditional retail sector. However, it is not clear how common this is and how much impact this has on poverty.

Finally, several studies suggest that supermarkets may have lower retail prices for processed food and higher prices for fresh fruits as compared to traditional markets. Again, this is suggestive but does not provide enough information to assess the impact of supermarkets on the poor.

Chapter- 4

Methodology of the Study

Research Approaches

One of the questions that a researcher must decide before conducting any research is which research approach will be most appropriate. The approach chosen will depend on the research question and the type of information is seeking. There are three general research approaches; descriptive, exploratory and causal (Kolb, 2008).

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- **Descriptive research**

Descriptive research is used when statistical data are needed on a fact. The tool used to conduct descriptive research is almost always surveys (Kolb, 2008).

- **Exploratory research**

Researchers use exploratory research when a research question deals with finding information on consumer attitudes, opinions and beliefs. Such exploratory research can be useful even when there is no specific problem to investigate.

Table 1 : Research studies and their use

Method	When to Use	How to Use
Descriptive	Use when details and numbers are needed	Research on customer demographics or purchase frequencies
Exploratory	Use when seeking insights on motivation/behaviour	Research on purchase motivation or attitude toward the company
Causal	Use when needing to determine effect of change	Research on effect of product of promotion change on purchase

Source: Kolb, 2008

- **Causal research**

Causal research is conducted to discover whether the change a company is planning to make will have a positive or negative effect on consumers. Research questions that

require causal research have a cause and effect – for example, such questions as 'Will a new promotion campaign using a celebrity increase purchases of books among young people'? or 'Will customers at the cinema purchase more refreshments if we have a new menu'? These issues can also be explored using qualitative techniques. Even the effect of intangible factors, such as smell and sound, on sales can be researched (Spangenberg et al., 2005).

In this study, we apply both quantitative (descriptive) and qualitative research (exploratory) i.e. mixed method design.

Sampling Technique

All sample designs fall into one of two categories: probability or non-probability sampling. Probability samples are samples in which members of the population have a known chance (probability) of being selected into the sample. Nonprobability samples, on the other hand, are samples where the chances (probability) of selecting members from the population into the sample are unknown. There are four probability sampling methods: simple random sampling, systematic sampling, cluster sampling, and stratified sampling.

Table 2: Four Different Probability Sampling Methods

Simple Random Sampling The researcher uses random numbers from a computer, random digit dialing, or some other random selection procedure that guarantees each member of the population in the sample frame has an identical chance of being selected into the sample.
Systematic Sampling Using a sample frame that lists member of the population, the researcher selects a random starting point for the first sample member. A constant *skip interval*, calculated by dividing the number of population members in the sample frame by the sample

size, is then used to select every other sample members from the sample frame. A skip interval must be used so that the entire list is covered, regardless of the starting point. This procedure accomplishes the same end as simple random sampling, and it is more efficient.

Cluster Sampling

The sample frame is divided into groups called clusters, each of which must be considered to be similar to the others. The researcher can then randomly select a few clusters and perform a census of each one (one stage). Alternatively, the researcher can randomly select more clusters and take samples from each one (two stage). This method is desirable when highly similar clusters can be easily identified, such as subdivisions spread across a wide geographical area.

Stratified Sampling

If the population is believed to have a skewed distribution for one or more of its distinguishing factors (e.g., income or product usage), the researcher identifies subpopulations in the sample frame called strata. A simple random sample is then taken of each stratum. Weighting procedures may be applied to estimate population values, such as the mean. This approach is better suited than other probability sampling methods for populations that are not distributed in a bell-shaped pattern (i.e., skewed).

Source: Burns and Bush, 2014

All of the sampling methods we have described thus far embody probability sampling assumptions. In each case, the probability of any unit being selected from the population into the sample is known, even though it cannot be calculated precisely. There are four types of non-probability sampling methods. These are briefly described below.

Table 3: Four Types Of Non-probability Sampling Methods

Convenience Sampling The researcher or interviewer uses a high-traffic location, such as a busy pedestrian area or a shopping mall as the sample frame from which to intercept potential respondents. Sample frame error occurs in the form of members of the population who are infrequent or nonusers of that location. Other error may result from any arbitrary way the interviewer selects respondents from the sample frame. Purposive Sampling The researcher uses his or her judgement or that of some other knowledgeable person to identify who will be in the sample. Subjectivity and convenience enter in here; consequently, certain members of the population will have a smaller chance of selection than will others. Referral Sampling Respondents are asked for the names or identities of others like themselves who might qualify to take part in the survey. Members of the population who are less well known or disliked or whose opinions conflict with the selected respondents have a low probability of being selected. Quota Sampling The researcher identifies quota characteristics, such as demographic or product use factors, and uses these to set up quotas for each class of respondent. The sizes of the quotas are determined by the researcher's belief about the relative size of each class of respondent in the population. Often, quota sampling is used as a means of ensuring that convenience samples will have the desired proportion of different respondent classes.

Source: Burns and Bush, 2014

Table 4 : Choosing Non-probability Versus Probability Sampling

Factors	Conditions favoring the use of	
	Non-probability Sampling	Probability Sampling
Nature of Research	Exploratory	Conclusive
Relative magnitude of sampling and non-sampling errors	Non-sampling errors are larger	Sampling errors are larger
Variability in the population	Homogenous (low)	Heterogeneous (High)
Statistical Considerations	Unfavorable	Favorable
Operational Considerations	Favorable	Unfavorable
Time	Favorable	Unfavorable
Cost	Favorable	Unfavorable

Source: Malhotra, 2010

In our study, we consider convenience sampling procedure when selecting farmers, commodities and middlemen.

Sample Plan

Up to this point, we have discussed various aspects of sampling as though they were discrete and seemingly unrelated decisions. However, they are logically joined in a definite sequence of steps, called the sample plan, which the researcher goes through to draw and ultimately arrive at the final sample. These steps are listed and described in Table below:

Table 5: Steps in A Sample Plan

Step	Action	Description
1	Define the population	Create a precise description of the group under investigation using demographics, buyer behaviour, or other relevant constructs.
2	Obtain a sample frame	Gain access to some master source that uniquely identifies all the units in the population with minimal sample frame error.
3	Decide on the sample	Based on survey objectives and constraints,

	method	endeavour to select the best probability sample method, or alternatively, if appropriate, select the best non-probability sample method.
4	Decide on sample size	If a probability sampling plan is selected, use a formula.
5	Draw the sample	Using the chosen sample method, apply the necessary steps to select potential respondents from the sample frame.
6	Validate the sample	Inspects some relevant characteristics of the sample (such as distribution of males and females, age range etc.) to judge how well it matches the known distribution of these characteristics in the population.

Source: Burns and Bush, 2014

The Confidence Interval Method of Determining Sample Size

The most correct method of determining sample size is the confidence interval approach, which applies the concepts of accuracy (margin of sample error), variability, and confidence interval to create a "correct" sample size. This approach is used by national opinion polling companies and most marketing researchers. To describe the confidence interval approach to sample size determination, we first must describe the four underlying concepts.

Sample size and accuracy

The first axiom, "*The only perfectly accurate sample is a census,*" is easy to understand. We are aware that a survey has two types of error: non-sampling error and sampling error.

Non-sampling error pertains to all sources of error other than the sample selection method and sample size, including problem specification mistakes, question bias, data recording errors, or incorrect analysis. Sampling error involves both sample selection method and sample size. With a census, every member of the population is selected,

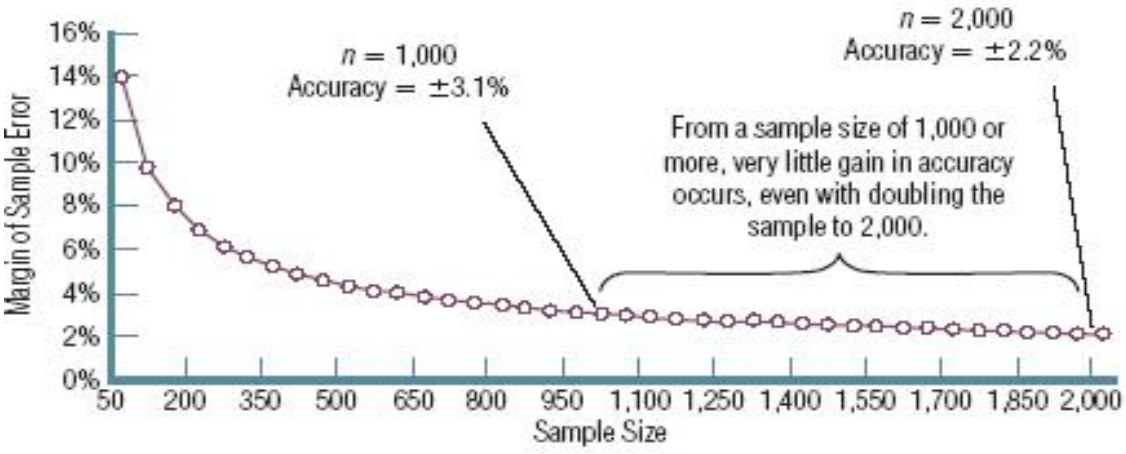
so there is no error in selection. Because a census accounts for every single individual, and if we assume there is no non-sampling error, it is perfectly accurate, meaning that it has no sampling error.

However, a census is almost always infeasible due to cost and practical reasons, so we must use some random sampling technique. This fact brings us to the second axiom, "*A random sample will always have some inaccuracy, which is referred to as 'margin of sample error' or simply 'sample error*.' " This axiom emphasizes that no random sample is a *perfect* representation of the population. However, it is important to remember that a random sample is nonetheless a *very good* representation of the population, even if it is not perfectly accurate.

The third axiom, *"The larger a random sample is, the more accurate it is, meaning the less margin of sample error it has"* serves notice that there is a relationship between sample size and accuracy of the sample. This relationship is presented graphically in Figure. In this figure, margin of sample error is listed on the vertical axis, and sample size is noted on the horizontal axis. The graph shows the sample error levels for samples ranging in size from 50 to 2,000. The shape of the graph is consistent with the third axiom because margin of sample error decreases as sample size increases. However, we notice that the graph is not a straight line. In other words, doubling sample size does not result in halving the sample error. The relationship is an asymptotic curve that will never achieve 0% error.

There is another important property of the sample error graph. If we look at the graph, we see that at a sample size of around 1,000, the margin of sample error is about ±3% (actually ±3.1%), and it decreases at a very slow rate with larger sample sizes. In other words, once a sample is greater than, say, 1,000, large gains in accuracy are not realized even with large increases in the size of the sample. In fact, if it is already ±3.1% in accuracy, little additional accuracy is possible.

Figure 1 : The relationship between sample size and sample error



Source: Burns and Bush, 2014

With the lower end of the sample size axis, however, large gains in accuracy can be made with a relatively small sample size increase. One can see this vividly by looking at the sample errors associated with smaller sample sizes in Table 5 . For example, with a sample size of 50, the margin of sample error is ±13.9%, whereas with a sample size of 200 it is ±6.9%, meaning that the accuracy of the 200 sample is roughly double that of the 50 sample. But as was just described, such huge gains in accuracy are not the case at the other end of the sample size scale because of the nature of the curved relationship. For example, comparing the sample error of a sample size of 2,000 (±2.2%) to that of a sample size of 10,000 (±1.0%): with 8,000 more in the sample, we have improved the accuracy only by 1.2%. So, while the accuracy surely does increase with greater and greater sample sizes, there is only a minute gain in accuracy when these sizes are more than 1,000 respondents.

The sample error values and the sample error graph were produced via the fourth axiom: *"Margin of sample error can be calculated with a simple formula, and expressed as a ±% number."* The formula follows:

Margin of sample error formula

$$\pm \text{ Margin of Sample Error} = 1.96 \times \sqrt{\frac{p \times q}{n}}$$

Table: 6: Sample Sizes and Margin of Sample Error

Sample Size (n)	Margin of Sample Error (Accuracy Level)
10	±31.0%
50	±13.9%
100	±9.8%
200	±6.9%
400	±4.9%
500	±4.4%
750	±3.6%
1,000	±3.1%
1,500	±2.5%
2,000	±2.2%
5,000	±1.4%
10,000	±1.0%

Source: Burns and Bush, 2014

The Sample Size Formula

To calculate the proper sample size for a survey, only three items are required: (1) the variability believed to be in the population, (2) the acceptable margin of sample error, and (3) the level of confidence required in your estimates of the population values. This section will describe the formula used to compute sample size via the confidence interval method. As we describe the formula, we present some of the concepts more formally.

Determining Sample Size via The Confidence Interval Formula

There is a formula that includes our three required items. When considering a percentage, the formula is as follows:

Standard sample size formula

$$n = \frac{z^2 (pq)}{e^2}$$

Where

n = the sample size

z = standard error associated with the chosen level of confidence (typically, 1.96)

p = estimated percent in the population

q = $100 - p$

e = acceptable margin of sample error

Sample Size Using Non-probability Sampling

The sample size formula and other statistical considerations of this chapter assume that some form of probability sampling method has been used. In other words, the sample must be random with regard to selection, and the only sampling error present is due to sample size. We know that sample size determines the accuracy, not the representativeness, of the sample. The sampling method determines the representativeness. All sample size formulas assume that representativeness is guaranteed with use of a random sampling procedure.

The only reasonable way of determining sample size with nonprobability sampling is to weigh the benefit or value of the information obtained with that sample against the cost of gathering that information. Ultimately, this is a subjective exercise, as the manager may place significant value on the information for a number of reasons. For instance, the information may crystallize the problem, it may open the manager's eyes to vital additional considerations, or it might even make him or her aware of previously unknown market segments. But because of the unknown bias introduced by a haphazard sample selection process, it is inappropriate to apply sample size formulas. For nonprobability sampling, sample size is a judgment based almost exclusively on the value of the biased information to the manager, rather than desired precision, relative to cost. Many researchers do select non-probability sampling plans, knowing their limitations. In these cases, the sample size question is basically, "How many people will it take for me to feel comfortable in making a decision." (Burns and Bush, 2014).

In our study, we apply finite sample size formula while selecting commodities, farmers and middlemen.

Reliability

There are two broad types of reliability referred to in the psychometric literature: 1) test-retest, the correlation between the same person's score on the same set of items at two points in time, and 2) internal consistency, the correlation among items or sets of items in the scale for all who answer the items.

Test-Retest

The stability of a respondent's item responses over time has not been assessed in scale use or development as frequently as internal consistency. This has been the case across disciplines (Robinson et al. 1991), and marketing and consumer behavior are no exceptions. Less than half of the scales in this text offer test-retest coefficients, but the overwhelming majority offer some estimate of internal consistency. It is unfortunate that test-retest estimates are available for so few of the scales in the marketing and consumer behavior literature. Researchers planning scale development work should give *a priori* consideration to assessing test-retest reliability in addition to other procedures of evaluating reliability and validity.

In our study, we employ Cronbach's alpha test for measuring reliability of survey. The overall Cronbach's alpha value in our study was .929.We apply this reliability statistics on 28 independent / observed variables. Most of value of reliability statistics was more than 0.9.

Chapter – 5

Prospect and Constraints in the supply chain of Potato

Potato is one of the essential vegetables in human diet. Potato has been cultivated as a staple food in at least 40 countries of the world. It is an essential sustenance trim from the earliest starting point of human progress and possessing its position soon after wheat and rice both in regard of generation and utilization. In Indian sub-landmass the development of potato was presumably begun amid the seventeenth century. In Bangladesh the development of potato was begun in the late nineteenth century. In any event in 100 nations of the world it is the most essential vegetable. Bangladesh is perceived as a rice-eating country; in any case, huge amounts of potatoes are created and devoured every year. In Bangladesh, potato has bit by bit picked up fame. Potato is utilized as nourishment trim and also vegetable by both poor people and rich individuals. As of late, the legislature has been endeavouring to differentiate nourishment propensities and urge potato utilization to lessen weight on rice. In such manner, potato can assume an essential part as an option and a multipurpose sustenance harvest of Bangladesh.

Bangladeshi strategy producers constantly confront the outrageous test of furnishing a quickly developing populace with essential needs, nourishment, work and enhanced way of life. While accomplishments in the zone of sustenance creation have been surprising since autonomy, there is an inclination among chiefs that ranchers could raise their efficiency and shoppers advance their eating methodologies gave that advertising exercises were better comprehended and enhancements in existing exchange courses of action actualized. Potatoes speak to maybe the most striking case of this worry over the connection between increments underway and utilization, and the proper advertising activities to help realize this.

With a remarkable increase in production during the last two decades and a current harvest of over 1.1 million tons, the potato presently ranks fourth behind rice, sugar cane and wheat as the country‘s most important food crop in terms of total

production. Moreover, Bangladeshi scientists and foreign experts both agree that additional increases in potato output and productivity can be achieved with available technology. Nevertheless recent bumper crops resulting in poor producer prices combined with an estimated 100000 of underutilized cold storage capacity raise a key question if Bangladeshi farmers produce more potatoes where will they marketed?

The economic problems in relation to any crop production in Bangladesh are varied and manifold. The growers have to sell major part of their produces immediately after harvesting at a very low price due to lack of storage facilities and cash need of the growers. This is known as distressed sale of the produce. Sometimes, ignorance of the growers about the prospect of future marketing of their produce becomes responsible for such type of selling. The growers are the most sufferers due to the existing storage problems of potato in Bangladesh and once they do not get enough economic gain, they may not retain much enthusiasm to go for potato cultivation for the following season.

History and Origin of Potato

Potato is originally a native of South American continent, where it used to grow as a wild plant right from about 7000 to 9000 years ago. Lake Titicaca in Andes Mountains on the border of Peru and Bolivia is believed to be the place where potato cultivation originated and used to grow in wild. It‘s interesting to know that wild potato plants grow right from semi- arid desert conditions of northern Argentina and southern Bolivia to the high rainfall subtropical forests of central and southern America. Archaeological evidences indicate that there were different forms of potato and also suggest trader of potatoes as early as1-600 AD in northern Peru specially the coastal areas.

Historical evidences establish that potato was known with different names in its growing areas in Southern American continent however, Spaniards popularized it as *papa* . Potatoes were the principal component of the food of people for centuries in high Andes and southern Chile. Andean Indians used to dehydrate potatoes in the form of Chuno and Tanta after repeated freeze drying, thawing and trampling by men and women to squeeze out water and finally dehydrating in the hot

sun. Incas had strong preference for these dehydrated potatoes and it is evident from one of the documented statement —*Stew without chuno is like life without love*‖ .

History of Bangladeshi Potato

The potato was introduced to some coastal areas of southern Asia in the late sixteenth or early seventeenth century, most likely by mariners from Portugal and subsequently other European nations. The early historical record of the potato in the region is unclear since the term "potato" is derived from "batata," the Carob term for sweet potato (*Ipomoea batatas*), which preceded the potato by eighty years in its introduction to Europe from its American site of origin (Asian Journal of Agricultural Extension). The earliest known reference to "potato" in British colonial India (including contemporary Bangladesh) is from an account by Edward Terry, who was chaplain to Sir Thomas Roe, British ambassador to the court of the Mughal Emperor Jahangir from 1615 to 1619. In his description of Indian agriculture, Terry wrote, "In the northernmost part of the empire they have good roots as carrot, potatoes and others like them are grown. It is possible that Terry's account was referring to sweet potato (sometimes called "yam," to further confuse the historical record), which was by then being 12 cultivated in India, but most likely he was referring to what we know as the potato (Agricultural).

Warren Hastings, British colonial governor from 1772 to 1785, promoted the cultivation of potato widely throughout the region, beginning in areas around Calcutta in the Bengal region. By the late eighteenth to early nineteenth century, potatoes were sufficiently established in the hills and plains that varieties had acquired local names, such as: *Phulwa* (flowering in the plains), *Gola* (round potatoes), and *Satha* (maturing in sixty days). However, the potato remained a garden vegetable of minor scale, often grown at higher altitudes by British colonizers as a summer crop.

Varieties were introduced from Europe, most of which proved unsuitable to conditions on the hot plains of contemporary Bangladesh, since they were adapted to cultivation during the long summer days of Europe, not the shorter winter days of southern Asia best suited to larger scale potato production. Initial attempts to establish the potato were also challenged by storage during hot summers and fast degeneration

of seed tubers (probably due to viral infection), although a few varieties survived at higher altitudes, such as Magnum Bonum, Royal Kidney, Great Scot, Craig's Defiance, and Up-to-Date.

Consistent with the trend for South Asia, the potato crop of Bangladesh has grown very rapidly over several decades. Average yields have generally risen at a modest, but consistent rate since the 1990s, but given the cropping intensity of arable land in Bangladesh, future production gains will have to rely more on higher yield than on expanded area of cultivation. Also consistent with a general trend in South Asia, the potato in Bangladesh is not grown as a cheap starchy staple, but is a relatively expensive source of calories grown mostly for cash sale.

Potato Production Condition in Bangladesh:

Zone scope, creation and yield of potato have expanded in most recent couple of decades in Bangladesh. The normal yield of potato is 18.08 t/ha. Its creation can be expanded up to 30- 40 t/ha utilizing high yielding assortments and enhanced generation innovation. Tuber Crop examine Centre (TCRC) of BARI has so far created 44 potato assortments which were chosen from outlandish assortments, remote germplasm and germplasm created in Bangladesh by presenting and intersection program. The formal seed potato created under seeds of the aggregate prerequisite. Be that as it may, the supply of value seeds through formal framework is amazingly expanding. The seeds providing through casual framework isn't perceived to be quality seeds on the grounds that in the casual framework seeds are not delivered by following the means of seed innovation, rather tubers for sustenance are utilized as seeds. The formal area seed potato generation is just 5-9% of the aggregate prerequisite. The utilization of these low quality seed is one of the main considerations in charge of lower potato yield. Except if quality seed potato our test for accomplishing sustenance security of the nation can't be satisfied. In organizing diverse issues of horticulture, supply of excellent potato seed to the ranchers ought to be fundamental concern. For expanding quality seed supply to the agriculturists, formal and casual part need 18 to cooperate with both contact producer and rancher level to deliver seed potato by increase of establishment seeds or tissue culture seed or

small scale tuber supply. The limit and capacity of both open and private area ought to be fortified for the change of seed potato framework in Bangladesh.

Geography and Production Zones of Potato

Physical Geography

The region of Bangladesh shapes the eastern degree of the Indo-Genetic Plain, an incredible alluvial bow extending from the Indus River framework and the Punjab Plain (navigating Pakistan and India) over the Haryana Plain east to Bangladesh. Bangladesh possesses a large portion of the gigantic delta made by a few streams - essentially the Ganga (or Ganges, regularly assigned the Padma in Bangladesh), Brahmaputra, Jamuna, and Meghna - that release water from inside their catchment regions and liquefied snows of the Himalayas (Scott). Aside from some uneven zones toward the north and southeast, Bangladesh is geologically uniform, a huge alluvial plain with heights once in a while surpassing ten meters above ocean level. This bounty of waterways over a consistently level scene brings about occasional floods which, from one perspective, add to the rural efficiency of Bangladesh by means of overwhelming testimonies of sediment made accessible to crops when the water withdraws (Scott). Be that as it may, the immersion of a significant part of the nation’s territory region constrains the developing season and has turned into the reason for genuine alluvial disintegration. Remote detecting pictures of the Ganges, Brahmaputra, and Middle 19

Meghna streams taken from 1982 to 1992 showed arrive lost to disintegration, incompletely by some gradual addition of land by means of moving stores. On adjust; nonetheless, an expected 8,700 hectares were lost by and large every year because of alluvial disintegration.

About 10,000 square kilometers of the aggregate region of Bangladesh is secured with water, and bigger territories are routinely overwhelmed amid the storm season. Due halfway to 20 concentrated water system advancements, a significant part of the water accessible to ranchers is winding up more saline, particularly in zones near the drift.

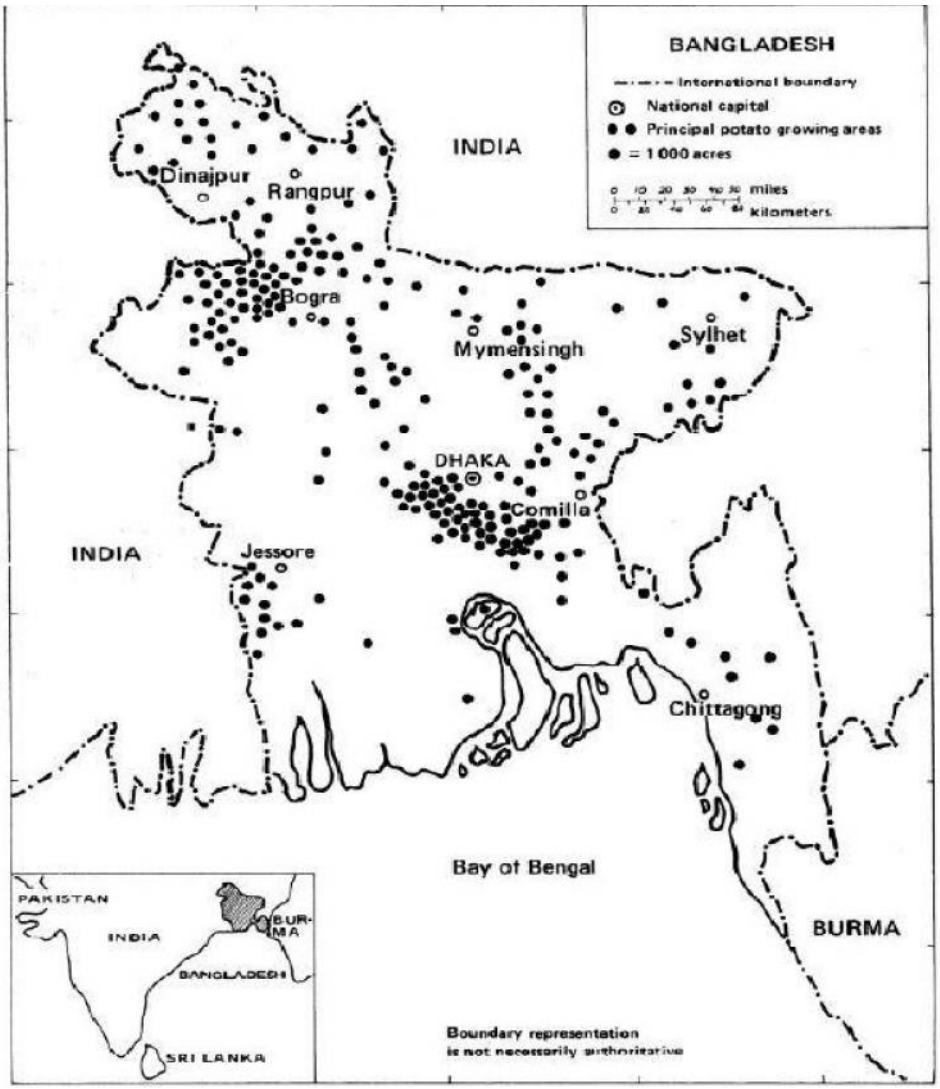


Figure 2: Geography and production zone of potato.

Production System and Constrains

The populace thickness of Bangladesh, at approximately 1,000 people for each square kilometre, is the most noteworthy of any huge nation on the planet, particularly critical given that the nation is predominately agrarian. Per capita accessibility of rural land in Bangladesh is in like manner among the most minimal on the planet. For a populace of more than 146,000,000 individuals, arable land adds up to roughly 0.06 hectares (or 600 square meters) per capita. About 70% of the aggregate land territory is in horticultural utilize (approximately nine million hectares of an aggregate thirteen million hectares), with next to no committed to lasting harvests or changeless field. Since freedom in 1971, arrive utilize has changed nearly nothing, with somewhat more land committed to nourishment yields and less to jute, a 21 business fibre edit

generally essential to the rural economy. Nonetheless, editing force of horticultural land expanded from 1971 to 1997, from a national normal of 148 percent to 176 percent. In a few zones, for example, Bijoynagar and Khazanagar, editing power has outperformed 200 percent (Scott).

Land residency is an exceptionally complex lawful and social issue in Bangladesh; however compelling control stays in libertarian. An expected 48 percent of provincial family units are landless, while a larger part of developed land is controlled by a little minority (about 6 to 15 percent) of the populace (Scott). Since legacy law as honed in Bangladesh stipulates break even with division of benefits among all children inside a family, populace development has prompted decreased possessions and expanded discontinuity of plots, with numerous families developing products on leased land, frequently under sharecropping game plans.

Potato Production Practices

Given the climatic states of Bangladesh, potato is restricted to a winter trim. Planting is attempted in October through November, for reaping in February through March. For all intents and purposes all potatoes are planted physically. Column separating is more often than not from 45 to 60 cm, with ideal profundity of planting relying upon nearby soil compose and dampness. In the event that underlying planting is shallow (around five cm profound), soil must be steadily furrowed over the lines to cover the creating tubers and shield them from light and irritations. Mulching is a typical work on, using locally accessible materials, for example, rice straw and water hyacinth, to save soil dampness and control weeds. Reaping is additionally performed physically, utilizing spades or other straightforward instruments.

Marketing Scenario of Potato in Bangladesh

Official appraisals of the yearly amount of potatoes sold across the country don't exist. Most eyewitnesses compute that well finished portion of the potatoes created every year are promoted. Some administration authorities recommend this figure might be as high as 90% of aggregate yield. By the by, given on-cultivate utilization and use as seed. 75% would appear to be a more sensible gauge of the level of potatoes sold

yearly. Both the level of aggregate creation sold and the amount of potatoes sold fluctuates by district. Ranch reviews directed over a progression of years show cultivators in the prime, potato-delivering areas, for example, Dhaka and Bogra tend to offer 80-90% of the considerable number of potatoes that they create. Makers in Noakhali and Comilla areas offer a littler offer of their aggregate reap, 77%. Those in Rangpur (76%) and Dinajpur (62%) additionally offer a lower level of 26 aggregate potato creation. Ranchers in Bogra and Dhaka can advertise a more prominent level of their potato trim since they have a tendency to have a bigger land region planted in potatoes and higher yields than agriculturists in different zones. Cultivators in Bogra likewise keep couple of potatoes for seed, most likely to a limited extent on the grounds that less cool stockpiling limit exists there than in different areas. Cultivators in more negligible creating regions (Noakhali, Dinajpur) have bring down yields, less potatoes and in this manner must keep a more prominent rate for on-cultivate use (Agricultural).

Marketing Channels, Participants and Procedures Marketing Channels

Given the geographic dispersion of the country's producers and consumers as well as the informal organization of the potato trade, Bangladesh‘s potatoes pass from farmer to final user in a variety of different ways. Nevertheless, for the purpose of analytical review and at the risk of some over simplification three principal types of marketing channels for potatoes can be identified:

- Local
- Regional
- Interregional

Local marketing channels are characterized by the tendency for fewer middlemen to intervene between potato producers and consumers, relative to regional and interregional channels. Exchange itself also tends to be more rapid in part because trading procedures are often simpler in these channels than in others. The quantity of potatoes per transaction is also smaller on average. The means of transport is therefore more likely to be bullock (or push) cart, rickshaw or simple head load (Scott).

Local marketing channels include sale (or barter) at the village to local traders or to other producers (non-potato producers). The potatoes are then utilized in the village itself. Local marketing also encompasses trade between producers and rural assemblers in one village and wholesaler/commission agents or cold storage operators in another, or in a nearby urban area. Finally, it involves producer‘s sale:

(a) To rural assemblers who in turn supply, local cold storage operators with potatoes, or

(b) To storage operators directly, for eventual re-sale to local traders, consumers or producers (in the form of seed).

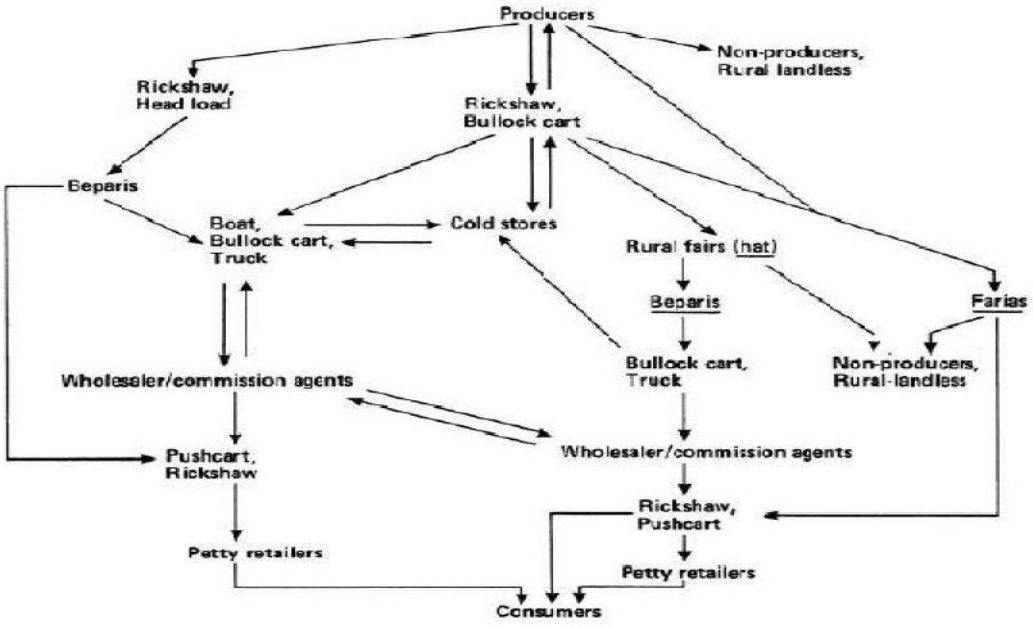


Figure 3: Distribution Channel of Potato

The bulkiness of the potatoes, its widespread cultivation throughout the country, Bangladesh‘s poor, rural road network, the seasonal scarcity of other food crops at the time of the main potato harvest and the heavy concentration of the population in rural areas especially in the preeminent potato creating regions like Comilla and Dhaka-together recommend a noteworthy offer of every table potato that are exchanged achieve the last customer through neighbourhood advertising channels. Meetings with potato merchants in Togibari, Bogra, Chandina, Rangpur and Dinajpur found that

most offer the lion's share of their potatoes inside 2 miles of their place of business. Moreover, makers who purchase potatoes have a tendency to do as such in business sectors inside five miles from home. There are no administration insights for this variable. In any case, half 60% appears to be sensible as an expected level of aggregate potato deals that are sold through neighbourhood channels. Territorial advertising channels are involved a broadened chain of delegates amongst maker and shopper. These channels are likewise discernable by the bigger amount of potatoes engaged with most exchanges and the more prominent usage of trucks and sailboats (along waterways) for transporting 'them from place of procurement to place of offer. ln local showcasing channels, the pass of time amongst beginning and completing a deal is more broadened(Because of awesome transportation time) and business techniques themselves much of the time are more entangled than in nearby showcasing channels.

Territorial promoting channels are exemplified by shipments from the ranch entryway, to country horticultural fairs (caps), to urban commission specialists, to urban retailers and finally to urban purchasers. Territorial showcasing channels likewise incorporate shipments from field to riverside, to urban discount advertise, to second discount showcase, to chilly store, to vagrant dealer, to urban/provincial purchaser. ln substance, local advertising channels comprise of bigger shipments, more prominent separations and more brokers than on account of nearby exchanging. Regardless, they are bound to a span of around 75 miles from the place of generation. Around 30% of every table potato exchanged Bangladesh is sold through local showcasing channels (Scott).

Interregional showcasing channels are for all intents and purposes by definition the longest, both as far as the quantity of brokers included and the separations over which the potatoes are delivered. Exchanging these channels about dependably requires the utilization of a truck as well as sailboat as a methods for moving extensive bunches of potatoes starting with one area then onto the next. While a few members want to set out by and by extraordinary separations to finish such exchanges, others depend on set up contacts to direct this sort of potato exchanging. The last mentioned, of need, includes more opportunity to create and support than the previous. ln expansion. Every exchange in itself ordinarily requires more opportunity to set-up, embrace and

finish than is the situation in nearby or provincial showcasing channels (because of the extra transportation required). An additional normal for interregional advertising channels is that they are most dynamic just at specific periods amid the date-book year. At these circumstances, interregional inconsistencies in cost are most noteworthy because of contrasts between nearby supply/request conditions subsequently, the prospects for long separation exchanging are ideal.

A prime case of interregional potato promoting channels would be the shipment of early potatoes from northwest Bangladesh to brokers in Bogra or Dhaka for re-deals both locally 30 and in other, more far off business sectors around the nation amid late November, early December. Somewhere in the range of 10% to 20% of all potatoes sold in Bangladesh travel through interregional showcasing channels (Scott).

Marketing Participants

Several different participants in potato marketing in Bangladesh can be identified: Producers;

- Rural assemblers;
- Wholesaler/commission agents;
- Cold storage owners;
- Petty retailers.

The division of labor between them is not always clear. Nevertheless, their principal activities can be described briefly as follows:

Producers

About all makers offer the vast majority of the potatoes they gather. In any case, the amount they offer, when they offer, where they offer and to whom they offer varies by locale and from year to year. Cultivators around Dhaka all things considered offer around 90% of the considerable number of potatoes that they create. Their first deals normally happen in February-March amid the principle potato reap. However, the

dissemination of their potatoes deals at reap time, after gather from family unit stores (April to June) or after collect yet from chilly storerooms (July-November/December) differs significantly relying upon yearly supply/request conditions (Scott).

On the off chance that costs are viewed as great, at that point these makers may offer up to of every one of their potatoes at collect and store 15% for later deal. Alliteratively, if costs at reap time are low, at that point cultivators will offer a minor rate (20%) of their potatoes at the season of burrowing and store for later deal more than 60% of aggregate creation." Similarly, the propensity is for producers in this region to make more noteworthy utilization of chilly stockpiling, given the more prominent accessibility of these offices. All things considered, not all potato makers in this area store potatoes nor do those that do as such essentially keep them in chilly stores.

About all cultivators in Dhaka region offer their potatoes at home (or at the ranch site). Fewer than 10% offer their potatoes in the market. These deals are commonly to a rustic constructing agent (bepari) for money. A few producers especially those with more noteworthy amounts to move to market will supply a distributer/commission operator (aratdar) with potatoes after the broker offers the potatoes, he deducts his bonus and the rancher gets the rest of.

In spite of the fact that cultivators in Bogra region likewise offer the vast majority of the potatoes they create. Their interest in potato showcasing has various particular qualities. While Bogra makers offer 90%-95% of the considerable number of potatoes collected, they spread out their deals amid the early gather (November-January), the late reap (February- March) and somewhat later in the year. Along these lines, in spite of the fact that Bogra cultivators offer almost the entirety of their potatoes "at reap." their deals are not confined to a generally brief timeframe as this may recommend (Scott). Despite what might be expected, the proof demonstrates that these cultivators maintain a strategic distance from simply such a circumstance by expanding their collecting over numerous months both to lessen the danger of a flitting breakdown in costs and to limit the requirement for cool stockpiling.

Bogra makers are as similarly slanted to offer their potatoes at home or in the market. As these cultivators spread their harvests over numerous a larger number of months and their yields are lower than makers around Dhaka they tend to offer littler amounts per exchange. Such deals are encouraged by forward pulling to country markets (cottages) where provincial constructing agents can buy various little parts at the same time.

Bogra cultivators offer their potatoes through a more noteworthy assortment of agents than makers in different areas. Cultivators are pitching their potatoes to in excess of one sort of purchaser. Bogra producers specifically are more acquainted with pitch to a representative (i.e. a broker who either purchases or offers potatoes (or both) on a commission premise) or to use a considerable offer of aggregate yield to pay off a generation credit.

The showcasing examples of potato makers in different locale (Comilla. Dinajpur. Rangpur) have gotten considerably less examination. Ranch reviews have discovered that cultivators in Comilla (Chandina) and Dinajpur tend to offer a littler level of what they create (60%-70%) and to utilize more potatoes for on-cultivate utilization and seed. ln Dinajpur (Scott).

Cultivators in Comilla likewise tend to offer a huge level of their potatoes to small-scale brokers (farias). These traders buy and offer small amounts of potatoes inside a brief timeframe. Such a training is logical to a limited extent by the way that Comilla makers tend to reap almost the entirety of their potatoes in a 2-multi week time span, normal ranch measure in Comilla is littler than in some other locale and there are no halfway found vast country markets to encourage provincial get together. In this way, little scale merchants bargain specifically with the various little scale potato makers to more potatoes from the field to shoppers.

Rural assemblers

Cultivators oftentimes pitch their potatoes to some sort of rustic merchant as opposed to transport them to town themselves or pitch them to nearby, provincial purchasers. Most merchants perform two, conceivably three, fundamental showcasing capacities.

To begin with, they collect little loads of potatoes into bigger amounts. Second, they transport the potatoes from generation zones to utilization focuses (Scott). Third, they may do evaluating and sacking (basic practice in rustic caps of northwest Bangladesh). The chief administrations that these merchants give cultivators include:
(a) Eliminating the time and cost associated with transporting small lots of potatoes to larger urban markets,

(b) Reducing the risk associated with marketing farm produce away from home or nearby market,

(c) Providing cash payment when and where growers want to sell.

A few unique sorts of agents are occupied with the country exchange for potatoes. Moreover, these people may expect distinctive parts relying upon the specific exchange. By and by, the "unadulterated" sorts can be indentified briefly as takes after (Scott).

A bepari is essentially a country constructing agent. He gathers little loads of potatoes for re- deal (discount) to different beparis, urban distributer/commission specialists or chilly stockpiling proprietors. He ordinarily gathers potatoes in the field, instead of end up engaged with exchange between two urban areas. He may work freely by purchasing the potatoes with his own capital or as is regularly the case, he might be utilized by some other broker to buy potatoes for his sake. Some beparis go about as a kind of commission operator. They offer to review, sack, and transport and offer the potatoes for a specific charge for every maund.

A bepari as a rule works with insignificant framework. He may lease a room. House or little working to gather and dispatch potatoes for half a month, yet he has no substantial, entrenched place of professional an intermediary, distributer, commission specialist, or cool store proprietor. Rather, he is basically a vagrant shipper.

Potato makers themselves are likewise associated with provincial exchange. A few producers offer in any event part of what they advertise direct to different fanners, to the provincial landless or to customers in close-by towns. In view of the constrained

accessible confirmation in any case, these business seem to speak to a minor offer of all potatoes showcased. Essentially, cool store proprietors and urban-based distributer/commission specialists additionally secure potatoes in the farmland. Be that as it may, they for the most part want to leave rustic get together to another person and just obtain potatoes at their built up place of business.

Transporters

Development of potatoes from field to market to shopper is done by various methods for transport. These include: rickshaws, bullock trucks, push trucks (in urban zones), trucks, and vessels. Also, potatoes are conveyed short separations by head load from pontoon to cool store, from truck to advertise. Head load and vessel are the most well-known type of transport for potatoes around Dhaka and Comilla because of the broad system of streams and inland waterways in this locale (Scott). By differentiate bullock trucks and rickshaws are all the more broadly utilized in Bogra, Rangpur and Dinajpur.

Some truck or watercraft administrators handle cargo as well as take part in purchasing and offering payload. On the other hand beparis, chilly stockpiling proprietors, or distributer/commission specialists may utilize their own particular methods for transport notwithstanding getting the administrations of autonomous proprietor/administrators. An exact breakdown of what level of transporters are locked in basically in delivery versus those associated with transportation and purchasing isn't accessible. Most transporters have practical experience in this action and leaving purchasing and pitching to brokers.

Wholesaler/commission agents

Potatoes delivered to towns and urban areas every now and again go first through the hands of urban distributer/commission operators. These brokers regularly have a godown or basic unrefrigerated distribution centre close to the focal market in Bogra and in Comilla or nearby the stream front in old Dhaka. At this area, they get and measure bunches of potatoes store 34 them incidentally in free frame. And in addition review and sack them before deal. Recognizing qualities of their cooperation in potato

promoting include: the huge amounts of potatoes they consistently handle on a discount premise, their offers of both new market and put away potatoes also, their specialization in potatoes and maybe a couple different vegetables (Scott).

Contingent upon supply/request conditions, these brokers will either purchase potatoes or get them on a commission premise. Amid and for a while after the principle reaps, they are regularly provided by beparis and bigger producers. Albeit, some distributer/commission specialists will lease space in a cool store most seem to want to leave this sort of hazard to another person. They do, nonetheless, supply potatoes to chilly store administrators keen on purchasing and putting away tubers. They likewise get table and seed potatoes kept in cool stores for discount showcasing. Urban distributer/commission specialists offer potatoes principally urban frivolous retailers, cool store administrators, urban distributer/commission operators in different towns and producers (seed).

Cold store owners

Showcasing, as of now, 156 of such units are in activity around the nation. Of this aggregate, some l44 are exclusive. 5 kept running by the Bangladesh Agricultural Development Corporation (BADC) 6 by co-administrators and 1 by a non-legislative association (NGO).

The essential administration cool store proprietors give is space in a refrigerated store, for a while of time, for a set expense. ln the wake of the expanded rivalry between chilly store proprietors in specific zones, because of the simple fast development in limit a few proprietors have been compelled to bring down their stockpiling expenses or the terms of installment (100% at the time potatoes enter the store) (Scott).

Others have begun to offer one or more of the following additional services:

Free transport from the field to the cold stores

Small cash advances upon depositing the potatoes at the store with no storage payment until the potatoes are taken out of the store

Prizes for storing potatoes.

Moreover, in various cases cool store proprietors have been compelled to fall back on different systems (to purchase potatoes) to build limit usage.

Cool store proprietors for the most part start putting away (and additionally purchasing) potatoes once the primary collect has achieved its pinnacle. In this manner they abstain from stocking pre-maturely reaped potatoes that will spoil away, purchasing potatoes before the cost has bottomed out or tying up their capital for a superfluously broadened timeframe. In down to earth terms this regularly implies they fill their stores from mid-February to mid- May.

Additionally, chilly stockpiling administrators attempt to hold off discharging potatoes on to the market initial the cost has risen adequately to at any rate make stockpiling gainful. In this way, they more often than not start to remove potatoes from capacity in the long periods of July or August intending to exchange all stocks by mid-December before the start of the following harvest.

Chilly store proprietors obtain potatoes both from merchant‘s chiefly beparis and distributer/commission specialists and from makers themselves. No official measurements exist on the amount of put away potatoes that are claimed by dealers or makers versus the amount possessed by the chilly store proprietors themselves. On the other hand, cool store proprietors pitch potatoes to dealers and producers alike. Notwithstanding, their showcasing designs have not been firmly considered, consequently an exact breakdown of their deals isn't accessible (Scott).

Petty retailers

ln country markets, towns and urban communities. Potatoes are likewise advertised by unimportant retailers. These dealers handle a couple of hundred kilos of potatoes seven days. They regularly have the most fundamental framework. e.g. a little scale for measuring potatoes and some kind of slow down or leased space in the commercial centre from which to show and offer their potatoes. The most critical administration that insignificant retailers give is that they offer the likelihood of purchasing a couple of kilos of potatoes chosen by the shopper himself and at a helpful area (Scott).

Insignificant retailers secure potatoes from distributer/commission operators. Their business customers incorporate purchasers, eating foundations, (for example, eateries, lodgings) and homestead families that don't create potatoes. ln the off-season, they may likewise pitch potatoes to potato makers who have depleted their own particular supplies.

Constraints to improved Marketing

Vital limitations to enhanced potato promoting include: the shortage of high-yielding tropicalized assortments that store well under rural conditions consistently. The simple rustic street organize, the absence of cool stores in specific territories, the lack of post-collect credit (other than to construct and prepare a vast chilly store), frail post-reap augmentation, and the restricted dissemination of market data (Asian Journal of Agricultural Extension).

Grower‘s capacity to alter the timing of their potato sales is largely influenced by:

(a) Their planting and harvesting dates and

(b) Their ability to store potatoes inexpensively

After reap, without assortments that are more adjusted to tropical developing conditions, the developing season for potatoes stays limited to the customary winter months. Subsequently, cultivator's entrance into the potato advertise is comparatively confined to certain eras. Without high yielding assortments that store well in provincial conditions past the long stretch of May, cultivators must offer their potatoes in a moderately brief period or pay for chilly stockpiling. These elements restrict their advertising choices.

The heft of the potatoes purchased and sold in Bangladesh is exchanged the farmland. Country transportation is subsequently a key fixing in deciding business sector access for cultivators and brokers. In spite of the fact that potato advertising is most exceptional in the dry, winter months when streets are more tolerable, many market members are debilitated by their geographic seclusion coming about because of dry inland channels or the lack of convenient transportation.

Government credit programs are solely for potato generation. Little makers who might want to store in any event a portion of their potatoes are kept from doing as such by their money necessities at reap, the surprising expense (for them) of capacity and the small measure of credit accessible to back post-gather exercises.

Augmentation benefit work force tends to focus solely on creation related maker exercises with some extra, though restricted, consideration committed to capacity. Field days for worker makers that attention on purchasing and offering rehearses or the arrangement of specialized data about basic potato handling are substantially less normal.

Farming Marketing Department staff positioned in local capitals routinely record and forward to Dhaka data about discount potato costs. Central station's staffs additionally gather various other information on generation, utilization and promoting. Quite a bit of this data is to a great degree helpful however it's course has a tendency to be limited to a genuinely decreased number of people and-organizations. For instance, little data about potato costs in match markets is accessible to agriculturists who go to country caps (Asian Journal of Agricultural Extension).

In rundown, the most recent 15 years have seen an amazing extension in the amount of potatoes promoted in Bangladesh. A large portion of these potatoes have been sold in nearby advertising channels for rustic utilization. Be that as it may, the decrease in genuine costs for potatoes and in addition an expansion in the relative cost of rice and different items versus potatoes particularly in the winter and spring months have impelled expanded offers of potatoes in urban territories.

These different patterns propose that the market for potatoes in Bangladesh is expanding. Given quick populace development and great prospects at declining potato costs the market seems set out toward extra extension. A key component in this situation is the arrangement of approach choices that must be made in help of potato improvement (Asian Journal of Agricultural Extension).

Conclusion and Recommendation

Through this study we have learned about Potato history around the world, Potato cultivation in Bangladesh, the current position of Bangladesh among 195 countries, Potato production area in our country. The major concern of us is to find out the channel and its impact on rice marketing. In this study we have seen that between producer and consumer there are few members doing their business and basically they are regulating the whole Potato market but they are not producing Potato at all. They are the beneficiaries and earn huge profit without participating production. On the other hand those who are producing deprived from good price. As a result consumers are paying high price.

We also find that the number of channel has an impact on Potato price. The higher the channel number, the more the Potato price. Farmers and consumers are claiming the government and respective government officials because their lack of awareness and laws these dishonest channel members are gaining more profit as a result farmers and consumer count the loss.

In this issue, most of the victims as well as some honest channel members gave their opinion to solve these major issues that are:

- Morality should be taught because it gives direction which is right or wrong.
- Development of farmer‘s co-operation can give them strength to market their rice direct to the consumers.
- Reduce channel number through proper planning.
- Government should develop laws regarding this issue to have control over this.
- Government owned channel number should be increased.
- Regular basis market monitoring can be effective in this big issue.

Chapter - 6

Supply Chain Efficiency and Constraints of Poultry Industry

The concepts of sustainability and supply chains are essential elements for modern businesses in facing the immense challenges of competition and in managing economic, social and environmental sustainability. Contemporary literature reveals that, to date, the poultry livestock sub-sector has not received sufficient consideration from academics.

This particular industry is suffering from unstructured supply chain processes, lack of awareness of the implications of the sustainability concept and failure to recycle poultry wastes. Structured supply chain processes and the sustainability concept are assumed to be mandatory to achieve additional sustainable benefits. So far, no initiatives have been undertaken by academics to close the research gap. To ensure an integrated sustainable supply chain process, research on this particular industry is worthwhile. This research incorporated the theoretical foundations of sustainability and the supply chain to examine possible improvements in the poultry production process along with waste management.

The findings revealed that integration of the supply chain could bring economic, social and environmental sustainability along with a structured production process to support the research objectives and research questions. It is also observed that the poultry industry could apply the model outcomes in their real-life practices with minor adjustment.

Introduction

Bangladesh is a developing country which has many difficulties from economic, social and environmental perspectives. Despite such difficulties, Bangladesh is still doing better in various indexes compared to other homogeneous and neighboring countries. Bangladesh is managing to supply food and other basics to its huge population of 160 million people. It has achieved self-sufficiency in food production,

more than doubled per capita income within a decade, reduced the poverty rate by a substantial percentage and controlled the birth rate, as well as many other achievements. In the livestock sector, Bangladesh has maintained the pace of growth rate as per the demand.

Among livestock species, poultry chicken meat, which is a great protein source for the human body, is most popular and part and parcel of Bangladeshis' daily consumption. The poultry industry is one of the important sub-sectors in Bangladesh, contributing in endless ways to Bangladesh's society and economy. This sub-sector has an immense reputation for creating employment opportunities, cheap sources of protein supply, and direct and indirect income sources for millions of people. Bangladesh has about 120,000-130,000 poultry farms of all sizes – small, medium and large – with a total investment of around US$2 billion. In addition, around two billion chickens in Bangladesh generate some 22 million tones of poultry litter (mixture of poultry excreta, spilled feed, feathers, and material used as bedding in poultry farming) a year. However, this industry still has tremendous scope to grow in terms of production and engaging more people for their livelihood.

Unfortunately, this industry has failed to adopt modern concepts, technologies and value addition in poultry product procurement and wastes processing. As a result, this industry fails to take the opportunity of maintaining sustainable growth. Furthermore, the poultry supply chain network in Bangladesh is scattered in nature, and each supply chain member deals with a small fragmented process. Owing to minimum coordination among supply chain players, the cost of production goes up. Moreover, farmers are facing problems in assessing market demands, which often causes over- and under- production.

The Bangladesh poultry supply chain process is also complex in nature because it deals with many uncertainties like different calamities and disasters. Supply-demand imbalance, market price, low productivity, incorrect futuristic assumption, natural disaster like flood, cyclone, seasonal variation are the few names of uncertainties.

In the past, researchers have rarely offered poultry industry executives a

sustainable process and other insights that were easily understandable.

The poultry industry in Bangladesh consists of an extended forward supply chain which starts from grandparent (GP) breed rearing and finishes with the final products of chicken eggs and meat. In addition, giant companies are managing their wastes through converting them into valuable by-products. In fact, they are managing their wastes not for profit but in order to protect their sensitive poultry breed from possible diseases. However, the profit motive is also appropriate if wastes are properly handled and reversed through an appropriate channel. There is an immense opportunity to implement reverse logistics in the poultry industry. Interestingly, a little evidence is found on reversing poultry wastes for the potential and existing market. Again, a number of supply chain members exist within the poultry forward and backward process. With such a supply chain network, the poultry industry has significantly contributed to the society and economy of Bangladesh (Salequ e and Mustafa 1997). Unfortunately, the Bangladesh poultry supply chain is not structured enough to obtain its potential maximum benefits

The specific purpose of this study is to develop a supply chain model to design a sustainable poultry process after finding out the prospects and constraints of poultry industry.

Literature Review

This section presents the literature review relevant to the current study. The literature review is focused on several aspects explaining sustainability, supply chain models, the sustainable supply chain, the sustainable supply chain in the poultry industry and the status of the Bangladesh poultry industry in light of achieving sustainability. Relevant sections highlight the literature gap while presenting the literature review. This chapter finds that there is only a little evidence of research conducted on the existing poultry process model based on system dynamics and simulation. Such studies have not considered the integrated poultry operation for achieving sustainable production. This chapter also finds the research gap in integrating forward and reverse supply chain as a whole and poultry supply chain integration in particular. The rationale of the study emerges from the existing literature helping the reader to

understand why it is important for this particular context. Relevant concepts and contexts are discussed throughout this chapter to understand the facts that can be deployed in the current study to fill the research gap. Again, the theoretical basis helps to understand the various concepts that may follow in the relevant practice. Accordingly, the research develops a conceptual framework which helps to construct a poultry process model based on the above concepts and the literature gap for this research context.

Managing an efficient supply chain

Supply chain management (SCM) has received attention since the 1990s, even though the method was introduced in the early 1980s (Oliver and Webber 1982; Svensson 2007). Typically, in SCM, the beginning point is with the suppliers or producers (Carter, Ferrin, and Carter 1995; Ellram and Cooper

1985. Lambert and Cooper 2000; and Simco 1991) while consumption denotes consumers, customers or end-users in a supply chain (Min and Mentzer 2000; Lambert, Cooper, and Pagh 1998; Jones and Riley Svensson 2007). The term 'supply chain management' has a direct relationship with 'supply chain'. The first literature found on logistics was in the 1980s, as an inventory management tactic with emphasis on the supply of raw material supplies. In the managerial literature, including within the agro sector, SCM links the purchasing function with the corporate planning process as an integral part (Vorst, Silva, and Trienekens 2007; New and Payne 1995; Scott and Westbrook 1991). In the early 1990s, academics used a theoretical stance to explain SCM clarifying how it is identical to traditional supply chain approaches off lowing materials and information (Christopher 1998). Yet again, Tan (2001) and Croom (2000) stated that SCM is a broader strategic approach to materials and distribution management. They also discussed it from various perspectives of purchasing and supply, logistics and transportation, industrial organization, marketing and strategic management. The above matters need to be considered to manage an efficient supply chain in a production process. Such discussions lead to later implementation to efficiently manage supply chain practices. The following section reviews a few supply chain models along with forward and reverse supply chains.

Supply Chain Models

A number of supply chain models have been discussed in the existing literature. The most common and simplified supply chain model starts with product conception and ends with consumption. It presents a simple supply chain starting with product conception, then raw material collection through to the end of life of a product. Maxwell and van der Vorst (2003) highlighted a simple supply chain model, in which product conception is the starting point of a supply chain network.

In another example, New and Payne (1995) depicted a supply chain network which started from collecting raw materials from the earth followed by converting processed materials; physical distribution; the ultimate manufacturers, traders, retailers and consumers; and recycling products by reversing used materials. In a competitive market, manufacturers continuously update their product

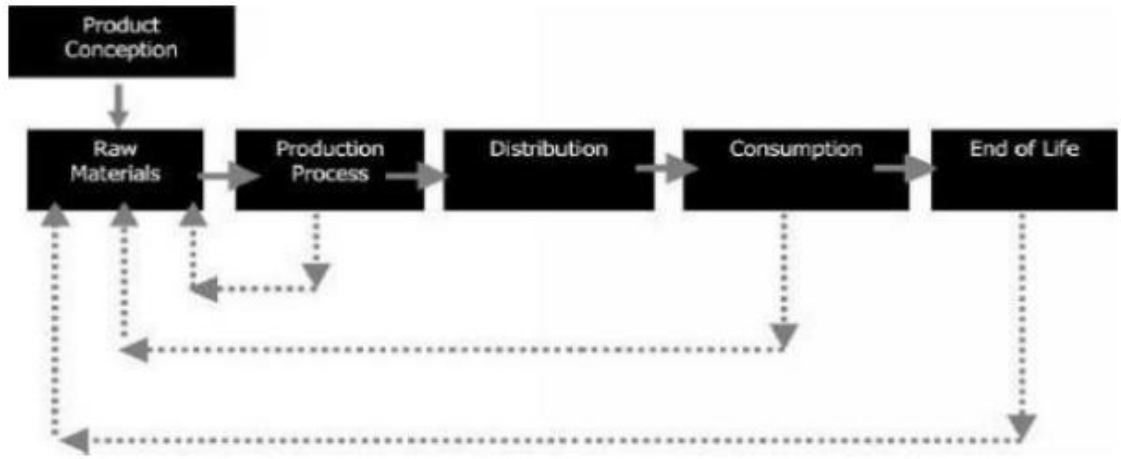


Figure 4: Simplified supply chain (Pero-et-al. 2010)

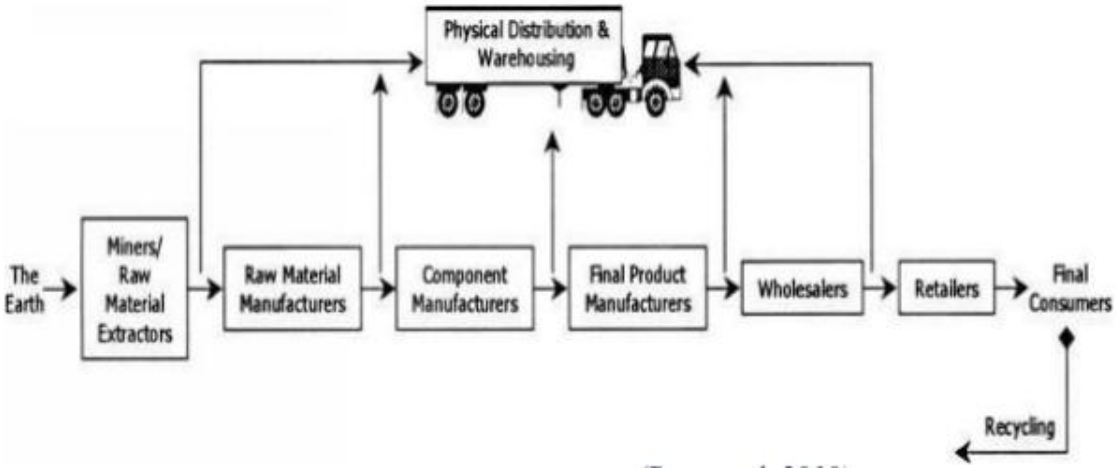


Figure 5: Normal Supply Chain (Pero et al. 2010).

Product line with assorted products (Hoek and Chapman 2007, 2006). For these frequent changes, SCM needs to be involved with product design, organizing and executing all the activities from planning to distribution along the entire value chain, including the network of suppliers, manufacturers and distributors (Childerhouse, Aitken, and Towill 2002; Vonderembse et al. 2006). The poultry industry can include new lines of products such as different breeds with production capabilities, longer life cycles, etc. The next section addresses the forward supply chain aspect.

Forward Supply Chain

The normal supply chain process concept is similarly applied to define the forward supply chain process that starts and ends with raw materials and customers, respectively (Cox, Blackstone, and Spencer 1995;Rogers et al. 2002;Poirier and Reiter 1996; Bowersox 2011). It also links the internal and external partners of suppliers, carriers, investors, policy makers and intermediaries. Briefly, the forward supply chain (FSC) is the step-by-step process of converting raw materials to finished goods (Kocabasoglu, Prahinski, and Klassen 2007).

Recently, businesses have shifted towards creating a market rather than waiting to receive demand from customers. Most businesses need a good supply chain network so they can simultaneously serve their own company's purpose and customer needs. To reach the customer quickly, the company needs to have an effective and efficient supply chain. Structured supply chains not only help to reach customers but also to

receive prompt product return and deliveries from suppliers. The collective and supportive relationships throughout the forward supply chain are needed to increase the degree of integration, to receive maximum benefits, to create a strategic position and to secure desired profits ahead of their competitors (Fuente, Ros, and Ortiz 2010).

- Fragmented chain (each supply chain member is focused on its own fragmented processes),
- Integration of decisions and processes between suppliers and clients, and
- Information systems connecting the different members of the chain.

The above characteristics can also be treated as limitations for the forward supply chain (FSC) due to the defined features. Arguably, these characteristics can achieve expertise for the individual parties of the FSC. Furthermore, the FSC is the main channel through which a product travels from producers to consumers. In addition, the FSC needs to adapt to continuous changes in the adjacent members' circumstances. Larson (2008) designed a framework in which the FSC is linked with the Reverse supply chain, regulatory requirements and sustainability issues. At the same time, Larson emphasized designing an environmentally friendly and stable product life cycle. Therefore, the FSC is concerned with producing products from quality raw materials and efficiently supplying them to customers with adequate feedback.

Reverse Logistics

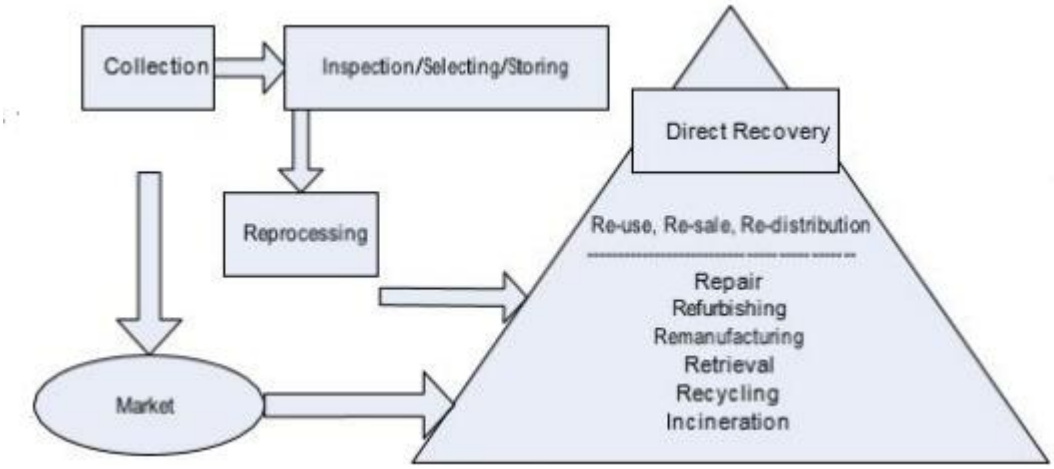


Figure 6: Reverse logistic model.

Reverse logistics (RL) is "the process of planning, implementing, and controlling the efficient, cost effective flow of raw materials, in-process inventory, finished goods and related information from the point of consumption at the point of origin in the purpose of recapturing value or proper disposal" (Hawks 2006). It is now believed that RL as a field is "unique enough to undergo specialized research" (Tibben-Lembke and Rogers 2002). This particular area has started contributing to the economy more substantially than expected. Reverse flow is increasing day by day and covers a wide range of industries (Li and Olorunniwo 2008) due to growing consensus and pressure from environmental activists (Dekker et al. 2004). For example, the RL market in the United States (USA) was worth approximately US$58 billion in 2004, comprising 10.7% of the US economy (RLEC 2007).

When a manufacturer's product normally moves through the supply chain network, it is to reach the distributor or customer. Any process or management after the sale of the product involves reverse logistics. If the product is defective, the customer would return the product. The manufacturing firm would then have to organize shipping of the defective product, testing the product, dismantling, repairing, recycling or disposing the product. The product would travel in reverse through the supply chain network in order to retain any use from the defective product. The logistics for such matters is reverse logistics. Reverse logistics refers to all procedures associated to product returns, repairs, maintenance, recycling and dismantling for products and

materials. Overall it incorporates running products in reverse through the supply chain to gain maximum value.

According to a study, companies why they didn't have a strong reverse logistics program, nearly 40% said returns management didn't seem as important as other issues. 34.3% of the supply chain executives said they didn't have the right system in place, more than one third said company policies inhibited them to do so. Such a lack of attention on reverse logistics is hard to understand. Contrary to the business world, academia researchers seem to have long shown the interests on studying reverse logistics, as early as 1993, articles with "reverse logistics" in the title started to appear.

Concentration on the forward chain rather than the reverse flow (Prahinski and Kocabasoglu 2006b). Used products and waste material flow from the ultimate customers to reverse processors has received much less consideration by academics and industry policy makers (Rogers and Tibben-Lembke 2001; Stock, Speh, and Shear 2002). According to Guide and Van Wassenhove (2002), a reverse supply chain (RSC) process requires the retrieval of a used or unused product from a customer and either disposing, reusing or reselling it. Reverse processes also include aspects such as a prompt product return policy (Daugherty, Autry, and Ellinger 2001); information support (Daugherty, Myers, and Richey 2002); supplier performance (Daugherty et al. 2005); innovation (Richey, Genchev, and Daugherty 2005); dynamic reverse logistics process (Starkowsky, Spicer, and Riddell 2009); and proper recycling (Ritchie et al. 2000).

Acquisition

The acquisition concept can be used in this study to utilize unused resources of the poultry industry. Acquisition is a procedure by which a product is returned, whether it is used, unused, and defective, damaged or wastes (Rogers and Tibben- Lembke 2001; Guide and Wassenhove 2001). The products for recovery basically come from the forward supply chain but can maintain an alternative reverse flow through junkmen, scavengers, dealers, brokers and non-OEM (original equipment manufacturer) remanufacturing (Ginter and Starling 1978). Importantly, waste streams can either be used for landfill or diverted to reuse to gain recoverable value

(Wojanowski, Verter, and Boyaci 2007). The acquisition concept can reuse poultry wastes to generate valuable by-products.

Reverse logistics

As with acquisition, reverse logistics is the process of recovering appropriate value from and disposal of products at the end ofthe product life cycle (Bayles). and Bhatia 2000). Activities include distribution, location (Fleischmann et al. 2001), storage and transportation of reusable items (Rosenau et al. 1996) and minimizing the retrieval cost to gain financial benefits (Bloomberg, LeMay, and Hanna 2002). This concept emphasizes the distribution, storage and transportation of reusable wastes. Such a concept can be used in the poultry supply chain for wastes manage.

Inspection

The quality of recovered products should go through a standard inspection with the objective being to gain customer acceptability (Carter and Ellram 1998; Johnson 1998). Inspection is an important phase for waste management as quality wastes produce quality by-products for further recovery. For example, poultry litter needs to be examined (the ingredients checked) before making plans for reprocessing.

Reconditioning

Product improvement and recovery options are determined through the disposition strategy and reconditioning process, such as refurbishing, remanufacturing or recycling (Penev and RON 1996; Scheuring, Bras, and Lee 1994). Recycling is the key concept in this study, as it is more appropriate than other concepts for waste management for the poultry industry.

Environment Friendly Supply Chain

Environmental success is an integral part of integrated sustainability. Environment has to be taken care through production process and supply chain activities. ‘The Limits to Growth’(Meadowset al. 1972) and ‘Beyond the Limits: Global Collapse or a Sustainable Future’ (Meadows and Randers 1992) were the two leading books in which authors justified their logic about the limitation of Earth’s resources.

Definitely, the Earth has a limited capacity for growing raw materials and consistently supplying it to human beings (Karlsson 1999). At the same time, it is impossible for humans to stop consuming resources to fulfill their own needs. Thus, sustainable development involves consideration of the reduced potential for depletion of resources while consuming a product (Tsoulfas and Pappis 2006). Therefore, the recovery of used products, in particular, is also named as a closed-loop supply chain (Cooper, Browne, and Peters 1991).

Chen and Paulraj (2004) developed a framework of supply chain management where supplier and buyer performance linked with strategic purchasing are based on the buyer-supplier relationship in terms of supply network structure and logistics integration. Therefore, the recovery of used products, in particular, is also named as a closed-loop supply chain (Cooper, Browne, and Peters 1991). Closed- loop and reverse logistics are the effective process and control of recovering value for competitive advantage (Porter 1985; Fleischmann 2000; Fleischmann et al. 2005). Chen and Paulraj (2004) developed a framework of supply chain management where supplier and buyer performance linked with strategic purchasing are based on the buyer-supplier relationship in terms of supply network structure and logistics integration. At the same time, they considered environmental inconsistencies or uncertainties among all the relationships.

According to poultry farm owners, a strong relationship exists between the existing supply chain, disease outbreak frequency and present environmental conditions of excess rainfall, summer heat exhaustion, humidity, floods, cyclones and contamination from pollution (Rahman 2013c; Chowan 2013; Mannan 2013). Recent studies (Van de Vorst, Beulens, and Van Beek 2000; Riddalls, Bennett, and Tipi 2000; Chang and Makatsoris 2001; Higuchi and Troutt 2004; Erkoc, Iakovou, and Spaulding 2005; Son and Venkateswaran 2007) have emphasised supply chain behaviour under catastrophes and uncertainties. Researchers have used operational research that helps to reduce the problem complexity while simulation has focused on internal and external uncertainties and actions in response (Vo and Thiel 2011). Poultry has a relatively low environmental impact compared to other animal production due to efficient feed utilization (Vries and Boer 2010)2.8 Bangladeshi Poultry Industry at a glance

The Bangladesh poultry industry has immense potential to contribute to individual livelihoods, the country's economy and aggregate GDP. The Bangladesh poultry industry started scientific farming from the mid-1990s (Kabir 2013). Over the last two decades, the poultry farming sector has grown into a formal industry attracting BDT (Bangladeshi Taka) 150 billion in investment with six million people directly and indirectly employed (Silique, 2009). Currently, there are five grandparent (GP) farms producing 280,000 parent stock (PS) per week (Rahman 2013b). According to Kabir (2013), 32 parent stock farms are producing 5.3 million day-old chicks per week. In addition, 50,000 large- and medium- scale commercial farms along with 100,000 small farms are producing over 9,800 metric tonnes of broiler meat, and 125.8 million eggs per week. Table provides evidence of the above information relating to the Bangladesh poultry industry and its status.

Particulars	**2012**
Investment	150 Billion BDT
Employment Generation	6 Million
Number of Grandparent Stock Farms	5
Production of Parent Stock/Week	2.8 Million
Production of Day-old Chicks/Week	5.3 Million
Broiler Meat Production	9,800 MT/Week
Egg Production/Week	1260 Million

Table 7: Poultry industry at a glance (Silique, 2009)

The forward supply chain is the process that starts from collecting raw materials and goes through to final consumption of the finished product (Cox, Blackstone, and Spencer 1995). In the same way, the poultry forward chain starts with gathering the grandparent (GP) mother breed from abroad followed by hatching parent stock (PS) chicks, distributing them to the parent stock/breeder farm, rearing them and collecting eggs from parent stock, hatching and distributing day-old broiler chicks, rearing them for a certain period to grow into mature broiler chickens and collecting meat from broiler birds. These processes involve many ultimate farmers, unskilled-semi-skilled workers, skilled workforce, foreign consultants, scientists, entrepreneurs and middlemen at each level. Success within the poultry industry mostlyrelies on how

each step smoothly connects with the following steps to manage steady supply as per current demand.

The reverse supply chain clearly addresses the issues of disposal, recycling, reconditioning and remanufacturing (Kocabasoglu, Prahinski, and Klassen 2007); disposal or recovery value.

Chapter Methodology

A qualitative approach was picked as the research technique for this investigation. The procedure of research includes experimental work being done with the accumulation of information which can agree, invalidate or challenge speculations which thusly considers comprehension and elucidation for various perceptions (May, 1997). Qualitative research includes a procedure known as acceptance, whereby information is gathered identifying with a particular region of study and from this information the specialist develops distinctive ideas and hypotheses. A qualitative approach was viewed as more significant to attempt this examination as it enabled more prominent ability to acquire profundity and importance in light of a person's encounters.

Semi-structured me were chosen to complete this examination contemplate. They enabled the members to expand and with that gave greater adaptability, run and along these lines the ability to evoke more data from the member. Semi organized meetings allow scope for people to answer addresses more individually terms than the institutionalized meeting licenses, yet still gives a decent structure to likeness over that of the engaged meeting (May, 1997). Kumar (2005) sees the meeting as the most appropriate approach for concentrate unpredictable and delicate regions as the questioner has the chance to set up a member before making touchy inquiries and to disclose complex ones to them face to face. While the meeting procedure is a significant method for gathering rich and inside and out information, it can turn out to be a costly and tedious process. Cooperation between the questioner and the member can contrast as each meeting is one of a kind and the nature of the reactions acquired from various meetings may differ altogether (Kumar, 2005).

Moreover, the nature of the information produced is influenced by the experience, abilities and responsibility of the questioner (Kumar, 2005). A danger of analyst inclination can likewise exist. Moreover, it can turn out to be a troublesome to increase solid information on the exploration subject if there are few members included, dissimilar to the quantitative approach which includes a higher number of members and henceforth in specific conditions can give more broad and dependable information comes about.

A semi-organized meeting is a gathering in which the questioner does not entirely take after a formalized rundown of inquiries. They will ask more open-finished inquiries, considering a dialog with the interviewee instead of a direct inquiry and answer arrange. The questioner may set up a rundown of inquiries however does not really ask them all, or contact on them in a specific request, utilizing them rather to control the discussion. At times, the questioner will plan just a rundown of general subjects to be tended to, called a meeting guide.

The semi-organized meeting design empowers two-way correspondence; both the questioner and the applicant can make inquiries, which considers an exhaustive dialog of relevant themes. In view of the conversational tone, the applicant may feel more great developing strategies and encounters that will feature the attributes that make them a solid match for the position. Semi-organized meeting is best when drilled by an all-around prepared and experienced questioner. Questioners with less experience may experience issues removing all the essential data to survey whether a competitor meets the full capabilities for the activity without a set rundown of inquiries.

The thoughts behind a particular inspecting approach shift fundamentally, and mirror the reasons and inquiries coordinating the investigation (Punch, 1998). In picking the example of members the researcher utilized a purposive sampling strategy. This type of examining is basically vital and requires an endeavor to set up a decent correspondence between inquire about inquiries and testing (Bryman, 2004). In attempted this investigation, the researcher talked with people matured between 30 to 40 years old because of the way that for most, their working vocations would have been related with constructive financial development and along these lines the advantages that originated from it. Moreover, the age limitation means to give a

more intelligent gathering, which makes examination between the subjects more significant.

Members were looked for through individual contacts of the analyst. At first seven members were selected to be met; in any case, one pulled back from partaking because of the delicate idea of the examination.

A cell phone was utilized to record the meetings. Three of the six members were associates of the analyst; the other three were enrolled through outsiders known to the scientist. All members were reached through phone with the meeting particulars. All members had the meetings completed in their homes, where they felt calmer in their environment and along these lines enabled them to talk.

A Semi-organized meeting is regularly directed with a progression of inquiries in the general type of a meeting plan anyway the grouping of inquiries can be shifted. The questioner likewise has some opportunity to test and investigate extra inquiries in light of what are viewed as noteworthy answers (Bryman, 2004), while in the meantime enabling affinity and sympathy to create between the analyst and the member. A meeting plan was set up ahead of time to help the analyst with the structure and stream of the meeting. Every member was given a comparative arrangement of inquiries. The inquiries were mostly open-ended inquiries with few shut inquiries identifying with data, for example, age. The analyst tried to utilize dialect that was intelligible and important to every one of the members being talked with.

All the interviewees were very open minded and shared information about their problems and prospects of their business. Most of them were very much concerned about the middlemen fact in supply chain. During the data collection period they were mentioning again and again about the profit they have to share with people. Semi structured interview was very effective because it brought everyone very close and sharing information was very easy and informal communication was very helpful to establish rapport.

Efficiency of Supply Chain of poultry Industry

Elimination of middlemen

Skipping ventures in the circulation channel lessens the measure of coordination's and transportation required in the development of products from maker to customer. This builds productivity fundamentally. Producers, for example, can skip wholesalers and all the more rapidly renew retailers with stock. Furthermore, organizations can offer items and sites and rapidly transport them to customers following the buy. Reaction time on modified requests likewise has turned out to be more effective after some time as organizations have disposed of ventures in the dispersion procedure. This expands consumer loyalty and income.

The essential intention to dispose of conventional purchaser and offer further up the evolved way of life is to spare cash. Makers today offer specifically to shoppers on account of Internet extension. As opposed to paying deals agents to elevate items to affiliates, organizations can advance items all alone sites, take arranges and send products specifically to the last client.

As the quantity of go-betweens is being sliced because of the change in transportation and correspondence framework, store network is as a rule more proficient. A circuitous advantage of dispensing with the broker, which a few organizations advance effectively, is better natural safeguarding. By limiting the quantity of trucks and travel time moving items starting with one stage then onto the next.

Improvement in transportation system

Bangladesh has built up a vehicle arrange that incorporates streets, railroads, inland conduits, two oceanic ports and common airplane terminals considering both local and global movement. Street transport has customarily been the focal point of the administration's consideration in this area. It is the quickest developing mode, with a normal yearly development of 8% for traveler and 9% for cargo since 1990s. Streets represent around 80% of traveler and cargo development. The street organize comprises of four general classifications. National thruways interface the national

capital with divisional base camp. Ports and global and territorial thruways frame a five-way local hall. Late improvements instreets are helpful for the store network. Padma Bridge will be an extraordinary development to the effective store network. More streets and enhanced transportation framework has been a gift for the store network effectiveness.

Available Truck and Pick-up van for transportation

All of the interviewee responded positively here. Available van and transportation are helping to increase their Business. Sellers immediately receive the required amount of poultry. Cost has become less for transportation as vehicles are available and fast.

Improved communication and payment system

Almost all the businessmen are using mobile phone for communication. Mobile and online payment system are allowing them to do business quickly. Improved communication is enabling them to connect properly with all the stakeholders are doing good business.

Frozen and packaged meat supply

Meat is a transitory item with a short timeframe of realistic usability and consequently short offering circumstances. In this manner, chilly chain administration in meat supply is of most extreme significance for the upkeep of value and security of meat/meat items. Crude meat/meat items are probably going to help the development of pathogenic microorganisms and additionally deterioration microbes, and ought to be kept at temperatures that don't bring about a hazard to wellbeing. The chilly chain ought not be hindered constantly along the meat circulation chain. Bangladeshi Poultry meat is being provided in bundle and chilly stockpiling to eateries to get together the new quality meat. Nonetheless, it can be normal that the interest for solidified or prepared grill chicken will become because of the shoppers' expanding journey for protected and advantageous nourishment.

Constraints in the supply chain of Poultry Industry

Small Firms

Small scale farming is better stewards of natural resource and contributes more to local community and economic development. The poultry production in Bangladesh is more or less small-scale farming. Intermediaries' involvement can be attributed to the fact that average farmer's marketable quantity is often small. It is not always economic to employ some shipping mode to transport for such small quantity to the marketplace. Most of the firms are not able to supply lots of quantities to the buyers, so they have to use intermediaries and thus minimizing the scale of profit.

Unwanted Extortion

It is very obvious in the supply chain to give money to political and powerful persons and traffic police in almost every phase of supply. From market to road, road to market everywhere there are many hands where they need to give unwanted money for no reason. Thus, they are losing profit significantly.

Lack of Information Flow

For proficient promoting framework, data of current circumstance in showcase is an imperative fixing. Agro business isn't out of this gathering. Advertising data causes maker to settle on balanced choice. Maker can settle on choice based on data on figure of market request and data on deals timing. This data can help not to advertise excess again it empowers the rancher about the time. Once more, understanding customer require help to enhance technique or create want sort of poultry. The most vital data is value data which empowers reasonable cost of poultry. The proficiency level of agriculturist is exceptionally poor in Bangladesh. They can't read cost in daily paper. Once more, the majority of the rancher can't bear the cost of TV. Agriculturist gets data from dealer or truck driver who come to purchase poultry which might be rely upon brokers' advantage. Most middle people get showcase data through market visits, individual perceptions and from kindred brokers. In spite of the fact that Directorate Agricultural promoting, Government of Bangladesh is occupied with the assignment of cost is accessible in their site. By and by FM radio,

scope is restricted, communicated every day advertise cost.

The advancement of Super stores is an ongoing expansion in the local retail segment of Bangladesh. To date, there are around 30 general store stores working in the nation all in all, of which 22 are situated in Dhaka. In spite of the fact that the scope of grocery store chains is still low, not even 1% of the retail division. Since grocery stores keep on playing a minor part in Bangladesh, most meat created are sold either in the neighborhood advertises, or to wholesalers who at that point transport the deliver to the city markets, i.e., Dhaka. Subsequently, generation is minimal sorted out. Wholesalers and little dealers are the real players in exchange, catching 96% of the market. Solidified meat and Packaged meat are not well known on account of the absence of value clients in general store.

Retailers' Problems

Retailers have to buy their product in cash. They don't get any credit facilities from the whole seller. So, lack of cash money may sometimes hamper the supply of Poultry. They face to carry their product from whole sale market to retail market because they don't have any permanent transport service. Customer bargaining power is higher than the retailer because of the availability.

Financing

Financing is of crucial important for poultry marketing like any type of product. The intermediaries face of lacking of sufficient finance. Sometimes intermediaries buy product from farmer on credit. 60% of intermediaries do operate their business by their self-finance. Lack of financing opportunity is making a big problem,

Risk Handling

Risk bearing offices are fundamental in any promoting exercises. Protection arrangement framework has not been produced yet in Bangladesh. Middle people bear the danger of value variety. Middle people are basic piece of sustenance inventory network in Bangladesh. They share benefit with maker. In any case, agriculturist in Bangladesh can't keep away from middle people for moving their item to advertise. The ranchers are not getting real cost. Accordingly, the genuine

makers won't get any advantage of the high cost as they are abused by the center men who suck the benefit. Absence of present day administration of poultry cultivating is additionally making negative effect. In addition, the end clients i.e. client needs to pay higher cost.

Discussion

The main objectives of this research study were to examine the efficiency and constrains in the supply chain of Poultry. This chapter provides an interpretation of the findings obtained; it illustrates why the findings are relevant to the research and relate the findings to other research carried out. The findings of this study are based on the interpretation and analysis of data obtained through the process of semi-structured interviews of six participants who are currently in poultry business.

Understanding the findings in relation to the research questions

Skipping ventures in the dissemination channel lessens the measure of coordination's and transportation required in the development of merchandise from maker to customer. This builds productivity fundamentally. Producers, for example, can skip wholesalers and all the more rapidly renew retailers with stock.

Late improvements in streets are useful for the production network. Padma Bridge will be an extraordinary development to the proficient store network. More streets and enhanced transportation framework have been a gift for the store network effectiveness. Accessible van and transportation are expanding their Business. Crude meat/meat items are probably going to help the development of pathogenic microorganisms as well as deterioration microscopic organisms, and ought to be kept at temperatures that don't bring about a hazard to wellbeing. The cool chain ought not to be hindered consistently along the meat conveyance chain. Bangladeshi Poultry meat is being provided in bundle and cool stockpiling to eateries to get together the crisp quality meat.

The vast majority of the organizations are not ready to supply loads of amounts to the purchasers, so they need to utilize delegates and hence limiting the size of benefit. The majority of the villagers in

Bangladesh are uneducated and they are not getting refresh data. Once more, likewise agriculturist have dread of promoting hazard. Solidified meat and Packaged meat are not well known due to the absence of value clients in grocery store. Middle people bear the danger of value variety. Middle people are fundamental piece of nourishment production network in Bangladesh. They share benefit with maker. In any case, agriculturist in Bangladesh can't stay away from go-betweens for moving their item to showcase. The agriculturists are not getting genuine cost.

A Sustainable and efficient poultry process

The third goal of this research was to build up an efficient poultry inventory network show with the goal that manageability would be kept up. As a general rule, the vast majority of the poultry forms are existed scattered. The flow inquiries about put a push to consolidate every single divided process under a solitary umbrella with minor augmentations to build up a powerful maintainable poultry creation process. Actually, without this steadiness, the organization can't accomplish supportability. As already specified, the Bangladesh poultry segment makes a huge commitment to society. A large number of organizations and a great many laborers are included with this industry. Presently, following talk displays how the present poultry process can be accomplished significant reasonable results as far as financial, social and natural manageability points of view. Poultry is a business which is totally subject to include and a given info will drive the accompanying store network tasks for a specific timeframe. There is no other method to build the creation or activity as it relies upon the quantity of chicks or eggs accessible simultaneously.

In addition, wastes are a foremost concern nowadays and scientists are putting their best efforts to finding ways to reuse or recycle wastes in a valuable way.

Alternatively, such wastes can be redirected to small and medium industries (SMEs) for further processing. The industry would be able to achieve all aspects of sustainability if these operations or processes could function within an integrated model. In this poultry process, by- products are generated in addition to the main

product of day-old chicks. Poultry meat processing units produce many varieties of value-added products such as chicken nuggets, samosas, etc. which are beyond the research.

In this way, SMEs can be established to process the economically viable by-products. These by-products can be consumed by different segments of customers and, perhaps, by the same industry. For example, biogas can be used for cooking burners, heating burners and generating electricity. The industry uses biogas for warming the day-old chicks (brooding stage) and cooking for the large number of employees (cooking burners). The industry has employees, and the industry canteen cooks for all of them. After using this quantity of biogas, a significant amount of gas remains as surplus. The surplus gas can be used for converting electricity as the power supply from the government authority is not enough for daily use. The industry has already signed a contract with a foreign company to implement this strategy. Electricity scarcity is common in Bangladesh where it is expensive to buy from private and government power generating agencies. Moreover, the power supplying agencies are unable to provide continuous electricity to clients as supply is significantly less than the demand. Every day, the industry has to accept load shedding for at least six to eight hours. As a result, they have to use a standby fuel generator to cover the gap which increases the chicks' cost. In a situation like this, they can use biogas as fuel for generating electricity which will benefit them financially. Therefore, most of the by-products are useful in Bangladesh context which will help the poultry industry to attain sustainability.

Process Details

At the first phase raw materials will be collected to start the production process. Choosing good suppliers is the primary challenge to start the poultry production process. Then the process will kick off and output will be chickens and eggs. These outputs should be supplied to profitable buyers. To maintain an efficient supply chain, wastes should be managed properly. From these wastes biogas can be produced and can be used again for further production process and in other industries.

The entire process will help to establish a spontaneous and efficient supply chain. As all the elements can be used properly and all the raw materials can be used, so the

entire industry will be beneficiary. If this process can be followed properly, an efficient supply chain will be ensured. The entire process will give the best result if less middlemen can be used.

Activity	Sustainable Benefit
Rearing parent chicks	Social and Economic
Rearing mature parent	Social and Economic
Hatchery operation	Social and Economic
Producing chicks	Social and Economic
Distributing chicks	Social and Economic
Middlemen operation	Social and Economic
Employ agent and sub agent	Social and Economic
Crating ultimate broiler farmers	Social and Economic
Selling chicken to middlemen	Social and Economic
Extend farming operating	Social and Economic
Making profit	Social and Economic
Proper dumping of poultry wastes	Social and Environmental
Using by products	Social, Economic and Environmental
By-product processing	Social, Economic and Environmental
Bakery production	Social, Economic and Environmental

Table 8: Economic and Social Benefit.

The earlier discussion on poultry activities and sustainability has revealed that sustainability theory and its components were covered by the activities operated by the case industry. Nevertheless, a particular point of concern was that some of the operations managed by third party companies were undertaken in an unorganized and unscientific way. The industry would be able to achieve all aspects of sustainability if these operations or processes could function within an integrated model. In this poultry process, by- products are generated in addition to the main product of day-old chicks. Poultry meat processing units produce many varieties of value-added products such as chicken nuggets, samosas, etc. which are beyond the research.

Social Activities in Poultry Farming in gaining efficiency

Social benefits are one of the components for sustainability which are mostly a concern for society and community. Social indicators in sustainability concepts are listed in the various reports of GRI, AICHE and Dow Jones. A number of direct and indirect social benefits can be gained through a sustainable poultry supply chain process.

Social Factors	Poultry Activities
Job creation	Hatchery, Broiler Farming
Reduction of Poverty	Supply chain worker and others
Self Employment	Distributor, Agent, Supplier, By-Products Processor, Ultimate Farmers
New Ventures and Family Business Creation	Small Medium-scale, By products processor, Sub agent
Social Welfare and Care	Profit, Recycle and Reuse of poultry wastes.

Table 9: Social benefits of poultry industry.

Business creation is one of the fundamental worries for look into question one as it investigates regardless of whether the forward production network of a poultry procedure makes work. Work age is a noteworthy pointer of the social parts of manageability. Destitution decrease is an enormous tension for the Bangladesh economy as over 40% of its kin are living under the neediness level (BBS 2010; Yunus 2007). Most organizations don't know how they can add to destroying destitution. It isn't viewed as important for an industry to track how it adds to tending to social issues. Making independently employed youthful business visionaries is fortifying for a general public as it gives the chance to youngsters to act naturally utilized: manageability execution can be judged in light of what number of business people are included inside a business arrange. Social welfare and care are an extreme obligation regarding the organization that makes considerable benefits from an economy.

Environmental Activities in Poultry Farming in gaining efficiency

Environmental management within the supply chain domain has been gradually building but remains scarce. Environmental activities have become important for manufacturers as they face intense pressure from supply chain members. The poultry industry is no exception as it generates a number of wastes which need to be appropriately dealt with. Otherwise, they will damage the environment in many ways.

Economic Activities in Poultry Farming in gaining efficiency

Economic gain is the main factor of concern in achieving sustainability. The company is always striving to reach its optimum targeted profit to accomplish other responsibilities such as social and environmental care. Three economic activities were observed in the poultry industry in Bangladesh which are discussed in the following sections.

Economic Factor	Poultry Activities
Profitability	Making optimum profit by optimum sell
Value Addition	Producing by products and chicken processed food.
Sales and cost of goods	Maximum sales and reducing cost.

Table 10: Economic activities of poultry farming

Conclusion and Recommendations

In Bangladesh, the advance of poultry business improvement has been wonderful over the most recent two decades in spite of the fact that the division is confronting diverse issues and the future viewpoint is certain in light of the fact that the interest for poultry items is required to build given its present low level of per capita utilization and foreseen development in populace and family unit earnings. The advance is absolutely in the private area. The development of the business poultry

division has brought about a decrease in genuine costs of poultry items and utilization has subsequently expanded. Notwithstanding family poultry creation did at a little scale, generally with indigenous poultry, the poultry segment is delivering business grill and eggs to take care of up the demand of the customers. By and by, the poultry part has utilized colossal labor of both specialized and non-specialized foundation laborers and anticipated that would make more space for work later on. In Bangladesh, the business part included incubation facility, raiser cultivate (both GP and PS), feed plant, solutions and antibodies producing and additionally showcasing and lab administrations and so on., every one of the segments being a particular wander.

In Bangladesh, the accessibility of meat and egg is much lower than the request and there is a shortfall condition to be gotten together. To satisfy the national request of poultry and poultry items it is have to extend the poultry business to everywhere throughout the nation. It isn't instantly conceivable to set up an across the country poultry business in the short run, since foundation of such business requires immense credit bolster from the saving money framework for different players and for guaranteeing quality yield. Beside that banks need to embrace proactive and liberal approach in financing poultry segment to exploit openings tossed open because of the usage of strategy on poultry advancement. Then again, the legislature needs to screen regardless of whether poultry ranches are caring for the advantages of all classes of agriculturists. Joined with positive government strategies like expansion of endowments to poultry agriculturists and exporters and security from imports, will assist Bangladesh with playing a huge part in worldwide poultry items exchange other than meeting the consistently expanding residential request. It can be proposed that to build poultry creation and build up the poultry business, the legislature and also other private integrators can take activities to set up a viable and efficient poultry cultivating framework in Bangladesh.

Recommendations

- More appropriate vehicles should be used in transportation and temperature of vehicles should be controlled properly.
- Drastic steps should be taken against extortion; law enforcing agencies must be

addressed properly.

- Home delivery system and direct marketing should be introduced to ensure optimum profit.
- The accompanying suggestions ought to be considered:
- Open and private joint exertion is crucial. Key participation between private division and the governing body can be made and non-tenant Bangladeshis should be asked to place assets into this portion
- Tax exception ought to be reached out till 2030
- Bank progress in the poultry territory should be organized at a 5-7% clear advance cost for every annum. Conditions should be encouraged. What's more, banks should approach through opening remarkable windows for acknowledge and excellent organizations for the objective that new agents can place assets into this section
- The cost of chicken and egg, if settled ought not be settled for just a few months, but rather for the entire year considering the generation cost
- Farms influenced by avian flu ought to get endowment from government instantly in the wake of separating
- The government should approach to manage the issue of avian flu. It needs earlier arranging and readiness for feathered creature influenza and ought to mastermind fitting advances with the goal that ranchers can keep up bio-security and keep solid condition inside and outside the homesteads
- A extraordinary store might be made by the administration to encourage the real makers
- Poultry protection ought to be presented promptly. Insurance agencies should approach with such strategies
- Electricity supply plan is required for the poultry ranches
- To produce the honorable stream of talented HR in poultry area, proficient coach is obligatory for all. Proficient mentor ought to be enlisted from residential or remote assets to take specialized learning, appropriate instruction, preparing and inspiration to the ranchers
- Transportation costs for eggs and chicken and chicken related items ought to

be kept negligible so the shoppers can buy at a sensible cost

- A close-by connection between the mechanical system and the enlightening system is critical to the upside of both. The informational system is dependent on cash related assistance from a profitable and gainful industry. Without this cash related help suited direction and research, a beneficial movement of preparing and research can't be expert. Along these lines, the industry is penniless
- Upon the insightful world to give a procedure with stream of semi-gifted work who can quickly be set up to wind up fruitful experts in the mechanical structure. Furthermore, financing sensible or examining wanders give rousing power to scientists who will discover new learning or new applications for the business. Consequently, here is a close-by relationship among preparing and the business.
- Coordinated exertion among national and overall research affiliation is imperative to exchange considerations and made headways between them. Progressing headways in the field of biotechnology have blended much excitement for standard scientists in making countries. Some biotechnology may be used as a device by specialists to redesign or stimulate the difference in smallholder poultry creation, for instance, in the fields of inoculation age and nutritious change.

Future Direction

The learning picked up from leading this exploration identifying with maintainability, inventory network; recreation and the Bangladesh poultry industry can be additionally extended to address different prospects.

At the point when a model is created in a particular kind of industry for a specific nation, it may not be fitting for a similar task in another nation. In any case, the examination has ventured out a particular domain which can be stretched out through joining diverse situations. In dispersing the results of the ebb and flow consider, more nations may demonstrate their enthusiasm for consolidating the present research information into their task. To do as such, the exploration demonstrate should be

balanced in view of the planned inventory network activity to work fittingly. In the meantime, the ebb and flow explore model can be tried different things with and used by a comparable sort of industry in Bangladesh. To do as such, no progressions would be consolidated as the customer would have an indistinguishable example of activities from the current research's case industry.

Chapter - 7

Supply Chain Management of Turkey Farming

Bangladesh may be a hotspot not only for turkey rearing and intake, however also export. Of the 70 nations that produce turkey, about 80 percent of worldwide production comes from just five countries -- the USA, Germany, Brazil, France and Italy. Exporting turkey meat has proven to be economically useful. In Bangladesh, a nicely reared turkey weighing five-six kilograms can get up to Tk 2,000-2,500, if sold at Tk 400 per kilogram. A farmer will need Tk 1,200-1,500 to correctly rear a turkey, in which case, every turkey sale will make Tk 500 earnings. Thinking about the demand of small-scale farming, the call for turkey will increase within the subsequent 3-4 years. At present, turkeys are being bought at Tk 3,000-10,000 depending on coloration and weight. Turkey meat additionally has dietary values considering its low ranges of fats, and can be a good alternate to red meat. It's also extra cost-effective than beef or mutton. Producing, eating, and exporting turkey meat has every potential to be the next agricultural feat for Bangladesh. Yet notwithstanding a growing demand for turkey meat, the enterprise is developing slowly, in particular because of the shortage of available markets and loan facilities.

Introduction

During the last few many years production of poultry meat and eggs has grown faster than that of some other main food inside the developing countries this is due to increasing call for animal products because of boom in populace profits, urbanization and westernization of diet. That is in addition to era switch and emergence of economically lively and producing groups in growing nations, which means that continuous rising call for food of which poultry paperwork a crucial aspect. While North individuals have fun Thanksgiving, of all of the pageant dishes none is extra massive than roast turkey. Inside the up and someplace else, turkey is the most conventional fare for Christmas dinner. There may be something in its rich however delicate flavor that befits celebration. However in Bangladesh this largest of poultry

retains novelty. Turkey farming is but a nascent industry.

The demand for poultry items has been increased rapidly in Bangladesh, and moved by rising levels of wage, populace and urbanization. Involvement shows that climate of Bangladesh is helpful to raise distinctive poultry species. Poultry meat alone contributes 37% of the whole meat generation in Bangladesh (Begum et al., 2011). Poultry transform feed into animal protein very rapidly. Poultry intake in developing nations is projected to develop at 3.4% per annum to 2030, followed via beef at 2.2% and ovine meat at 2.1%, and within the global as a whole, poultry consumption is projected to develop at 2.5% per annum to 2030, with different meats growing at 1.7% or less (FAO, 2007). The natural effect of poultry generation could be a proceeding challenge and it is predicted that worldwide utilization of poultry meat will increment between 2000 and 2030 at a normal annual rate of 2.51% (Fiala, 2008).

Turkey has many advantages. The meat is low in both fat and calories, high in protein and contributes important vitamins and minerals to the diet. At the same time, turkey is a very versatile meat with its mild flavor and suitability to a range of cooking styles. And last but not least, turkey meat represents good value for money. For food value reported that turkey carcasses contain higher percentages of protein than chicken carcasses (Smith, 1990). Grimes et al., [11] stated that turkey is excellent insect's foragers and that most crops that are troubled by insect population including vegetable crops are candidates for insect control by turkeys. Healthy turkeys will range giant distances if allowed. Turkeys can use many types of ranges and pastures to flourish. Local ranges can provide a wealth of edible flowers and insects for them. No matter these kinds of attributes turkey manufacturing and intake inside the Sudan remained very low as compared to intake of other fowl species mainly that turkey merits include- utilization of turkey as foraging animals just like ruminants. Unlike, chickens, turkeys may be herded a great deal similar to sheep. Turkeys have great versatility in nearby marketing and may be offered or traded in small batches at any age whilst big sufficient to be butchered. Turkey meat can be cooked complete or sliced or grounded and may be roasted, barbecued, fried or boiled or smoked. Furthermore, turkey meat can be made in soup, sausages and different preparations. Chickens and pigeons that are each rose both for home consumption or buying and selling. Turkey production is an imperative and exceedingly beneficial rural industry with a rising worldwide

demand for its items (Yakubu et al., 2013), and they are versatile to wide range of climatic conditions (Ogundipe and Dafwang, 1980).

Karki (2005) expressed that utilization of turkeys and broilers as white meat was rising around the world and a comparable trend also existed in developing nations. Within the entirety world, add up to generation of turkey meat was 5.6 million ton in 2012, which was higher than 5.1 million ton in 2003, a decade prior (FAOSTAT, 2012).

Turkey farming has not been fully exploited in Bangladesh counting other creating nations in spite of its gigantic potential over other poultry species. In reality, turkey may be a recently presented poultry species in Bangladesh. Agriculturists are raising turkey as an ornamental fowl with a restricted degree without having earlier involvement. Basically interested ranchers began turkey farming by bringing in day-old turkey chicks (Poults) from neighboring nation, India. Its ubiquity is increasing gradually since of gamey flavor of meat with lower fat substance. So, it may have tall potential for production and promoting in Bangladesh.

Literature Review

"The supply chain - a term increasingly used by logistics professionals – encompasses every effort involved in producing and delivering a final product, from the supplier's supplier to the customer's customer. Four basic processes – plan, source, make, deliver – broadly define these efforts, which include managing supply and demand, sourcing raw materials and parts, manufacturing and assembly, warehousing and inventory tracking, order entry and order management, distribution across all channels, and delivery to the customer" (F J Quinn 1997).

A focal point on supply chains is a step towards the broader adoption and development of sustainability, because the supply chain considers the product from initial processing of raw materials to delivery to the customer. However, sustainability also must integrate issues and flows that extend beyond the core of supply chain management: product design, manufacturing by-products, by-products produced during product use, product life extension, product end-of-life, and recovery processes

at end-of-life (Linton, Klassen, and Jayaraman 2007).

Supply chain can be stated as: all the activities involved in delivering a product from raw material through to the consumer including sourcing raw materials and parts, production and assembly, warehousing and inventory monitoring, order entry and order control, distribution throughout all channels, transport to the client, and the statistics structures vital to monitor all of those activities.

Supply chain management arranges and integrates all of these exercises right into a constant put together. It joins all the accomplices inside the chain inclusive of departments inside an organization and the outdoor accomplices counting companies, providers, 0.33-birthday party organizations, and information frameworks providers. Administrators in corporations over the supply chain take an intrigued in the achievement of other corporations. They work together to create the whole supply chain competitive.

They have got the statistics around the commercial, they understand a component about competition, and they arrange their exercises with those in their buying and selling accomplices. It consists of the forms critical to make, supply, make to, and to convey to demand. They utilize innovation to build up records on show off requests and change data between businesses. A key point in supply chain administration is that the whole prepare have to be seen as one framework. Any inefficiencies brought approximately over the supply chain (providers, fabricating plant life, stockrooms, customers, and so forth.) have to be surveyed to determine the genuine talents of the method. (Lummus and Vokurka 1999). Poultry keeping is an integral part of the rural household that provides family income for the small, marginal and landless poor.

The farmers who cannot afford to rear cattle and goat can easily rear poultry. However, among the livestock sector, the poultry industry (specially, commercial broiler and layer) is in the line to be destroyed due to severity of avian influenza (bird flu). Thus, it is crying need to search the alternative protein source to meet up the increasing demand. In order to maximize food production and meet protein requirements in developing countries, variable options need to be explored and evaluated (Owen et al., 2008).Various developing nations have seen a rise in the level

of production faming. An important reason behind is to improve the socio economic standard of those farming it.

According to World Bank, Poverty in Nigeria has amplified intensely with 66% of the population living below National Poverty line, compared with 43% in 1992. This has socio-economic suggestions to the Nigerian armed force as well. As a result, numerous officers have turn to chosen agrarian undertakings particularly Turkey generation as a way of easing the financial circumstance.

The major cause that upgraded turkey production among troopers was salary and past cultivating involvement. The venture was not only profitable but moreover practical. Endeavors ought to be made to empower more officers to grasp this undertaking (Mbanasor and Sampson, 2004). Turkey raising within the Philippines as a developing nation expressed on the ranchers conclusion that turkey raising is productive as long as the poults are legitimately bolstered and taken care of. Cost of production is cheap as nearly 50% of the nourish they eat is green vegetables, field grasses and commercial nourishes as a supplement (Soliven, 1984)

Each industry begins its exchange primarily based on market it opportunity, exhibit possibilities or opportunities, customers' acceptability, societal have an effect on, herbal dangers, monetary yield, costing and authorities regulations and regulation. Poultry industry in Bangladesh is not exemption of those. Feed, remedy & vaccines, skilled-unskilled-semi-skilled labors, administration alternatives, egg generation values, mortality prices, utilities which includes power, fuel, water, transportation and authorities choices are predominant input inside the poultry industry in Bangladesh. Those factors are greatly vital for this industry as all the financial victories are depends on the ones.

Poultry enterprise starts from pure line breed which can be an exceptionally beat commerce mystery breed kept up by way of France, USA, China and so. Bangladesh fowl enterprise begins from grandparent which is one step underneath of unadulterated line breed.

The deliver chain may be upgraded from ultimate item of meat and eggs towards

numerous prepared nourishment. Typically the predominant scope of doing encourage inquire approximately as well. Its miles always complicated for the company to mix sustainability and supply chain control concerned with their production process. In Bangladesh, thousands of poultry farms have grown up via non-public ownership without getting adequate scientific understanding on it. Plenty of poultry owners practices triple bottom line of sustainability however now not in organized way. There may be plethora research works on it in order that farmers or its stakeholders can understand what they have to do for the powerful sustainability within this industry.

Most of the farmers used to no longer hold document of farming sports properly. So, farmers provided statistics recalling their recollections. Because of this, in a few cases value judgment was carried out to have important records. Established questionnaires, non-public interviews and reference information were used for the look at. Statistics gathered included respondents' characteristics, breeding, rearing and housing structures, feeding and disorder troubles, advertising and marketing and uses.

Condition of Turkey Farming in Bangladesh

Each industry starts its trade based on market possibility, showcase prospects or possibilities, customers' acceptability, societal affect, natural dangers, financial yield, costing and government rules and regulation. Poultry industry in Bangladesh isn't exemption of those. Feed, medication & vaccines, skilled-unskilled-semi-skilled labors, administration choices, egg generation values, mortality rates, utilities such as power, gas, water, transportation and government choices are major input within the poultry industry in Bangladesh.

These elements are greatly imperative for this industry as all the financial victories are depends on those. Poultry industry begins from pure line breed which may be an exceptionally beat commerce mystery breed kept up by France, USA, China and so. Bangladesh poultry industry starts from grandparent which is one step underneath of unadulterated line breed. The supply chain can be upgraded from ultimate item of meat and eggs towards diverse prepared nourishment.

Livestock is playing a crucial position inside the countrywide economic system,

contributing appreciably to agriculture and the gross national product. 44% of human daily consumption of animal protein comes from livestock products. Moreover it performs a pivotal position inside the rural socio financial system as most families directly involved in farm animals. Funding in poultry sector has to be doubled within the next decade and it will enhance the growth of this sector and make a contribution in the GDP and creates employment possibility. In the Nineties overall funding on this region was only BDT 15 hundred crores taka, however now it's far more than BDT 15 thousand 15 crores it has created job opportunity for more than 60 lakhs people. The poultry industry has been engaging supply of satisfactory protein to the Bangladesh populace at the lowest rate within the global. country's persistent poverty may additionally bound the variety of individuals who can have the funds for to eat chicken more than suggested by way of the easy relationship among consistent with capita GDP and chicken intake.

However, lately present government is attempting hard to lessen poverty degree and arranging vitamins for the inferior segment of the society in terms of arranging earnings capability. As buying strength is lower in particular for the aforesaid group, employment possibility will create their redistributionary profits impact. However, we should be extra cautious to remove bird flu issues for which not only government. Machineries but also local supportive tools are being required. Moreover, price of the feed of the poultry rises around 30% in the course of final six months. Poultry industry does not count in the SME sector of the country. Most commercial banks aren't interested to finance this zone as they suppose it as a volatile sector.

Growing population, slight boom of per capita income and higher income elasticity of demand for farm animals' products are likely to deliver a further boom in the call for livestock products. The demand for milk and eggs has accelerated by 6 percent, 5.2 per cent respectively that is well above countrywide average within the beyond. Bangladesh is a densely populated country. Agricultural land is restrained and is lowering at a rate of 1 percent per annum. As such shortage of manufacturing of agricultural product will be felt. Fish & cattle manufacturing are reducing. Those additionally require longer time to produce. However poultry manufacturing is particularly simpler if both public and private sector projects move side by side.

Poor nutrients represent a major health problem. It’s far evident that a giant majority of the population be afflicted by various degrees of malnutrition, such as protein-energy malnutrition, micro-nutrient deficiencies, iodine deficiency sickness, Iron deficiency and iron deficiency anemia, and diet deficiencies. Poultry sector on this regard has been playing a large function in presenting protein at a decrease price. Most likely it's far the simplest zone which can develop vertically and bring most amounts of egg and chicken using the minimum land. A file titled 'weather alternate as a safety chance' said that the likely lack of arable and residential lands through flooding in this part of the arena (Bangladesh and its community) might bring about boom of internal and external environmental migration and strained relations between countries.

A solution to the problem of farmland depletion will be system of realistic and realistic land-use coverage. Furthermore, from the poultry sector biogas plant and organic fertilizer may be organized. Farmers did not recognize the scientifically widely wide-spread area requirement for rearing turkey. They gave area on the idea of assumption. Furthermore, they have been no longer aware about using of appropriate litter substances and their management. Many farmers did now not take unique care at some point of intense warm and cold scenario which ultimately hampered the production overall performance of birds. Feeds for turkey are not synthetic through any feed mill in Bangladesh. So farmers fed their turkeys via their homemade feed as well as a combination of homemade and broiler/layer feed. They did no longer know the medical requirement of power, protein and different vitamins for one-of-a-kind classes of turkey.

Comparable matters become occurred. Although turkey is a superb forager, some of the farmers did not recognize this reality in order that they could not lessen feeding cost. Farmers did no longer have knowledge to formulate balanced rations for turkey, thereby counting on rations at the start formulated for layer and broiler fowl, with the assumption that Chook feed could convey equal or better consequences. On this connection Etuk (2005) mentioned that lack of understanding of obstacles of feed elements used in turkey feeds ends in bad boom. But right nutrition is a fundamental prerequisite for a success hen manufacturing (Kekeocha, 1984), to increase resistance to sicknesses and explore genetic potentiality.

The existing study showed that although maximum of the farmers had been rearing turkey for hatching egg and meat purposes, a massive percent of farmers were raising turkey only for decorative motive. However there's a massive opportunity to increase production for meat purposes due to its increasing call for to customers of Bangladesh. Brant (1998) mentioned that exclusive sorts of turkey are grown for satisfaction and for opposition at suggests and exhibitions with the aid of hobbyists and fanciers in the United States. Maximum of the farmers had been dependent on other farmers than authority's cattle places of work for having technical help. The interviewed farm animal's officials informed that as turkey is a brand new species to them, so that they do not have adequate cognizance, knowledge and talent on it. It turned into found that none of the farmers obtained any sort of training on turkey rearing. Common flock length of turkey changed into small due to newness of the company.

It was observed that a few farmers were elevating turkeys with other home hen like chook and duck in semi-in depth device. Maximum of the farmers reared both white and black turkeys. But white turkey is the most desired globally for meat (Osama et al., 2013). From dialogue with farmers and farm remark it was assumed that the prevailing black and white birds would be the outcomes of crossing between wide Breasted Bronze, broad Breasted White and Beltsville small white range. They used sand, rice husk, wood shavings, and coarse paper and so on.

Even it became discovered that some farmers had not used any litter for mature turkey. It might be possible due to decrease quantity of turkey in a flock. However in case of larger flock size adequate supply of appropriate dry clutter is a have to boom consolation and decrease disease incidence. Most of the farmers used traditional broiler and layer brooding device for turkey. They used electrical brooder with bulbs and maintained temperature among 90ºF to 95ºF. But few farmers did not observe general procedure for brooding which caused death of many poults at early degree.

Normally young poults by means of nature are reluctant to devour and drink in the first few days of life because of bad eye sight and nervousness; and for this reason force feeding is necessary during brooding duration. But farmers were not privy to it. It turned into observed that occasionally farmers fed poults manually without

understanding the main motive. results imply that maximum of the farmers have been no longer privy to turkey management in terms of housing, lighting, maintenance of hot and cold period.

There may be absence of possibility for capacity building of turkey farmers in phrases of receiving education, getting information, collaborating in workshop and seminar. As maximum of the priority stakeholders are not conscious enough approximately turkey farming in Bangladesh, farmers are not getting required records and talent.

Consequently they'll be the use of conventional manner for rearing turkey. But egg weight, fertility, hatchability and overdue embryonic mortality diverse substantially between conventional and cutting-edge-day breeding control device. At present turkey marketplace is limited to a few particular customers as an ornamental chicken as well as for meat functions; and its fee is higher than other hen species. There is an amazing variety of Christian in Bangladesh who is keen on turkey meat in Christmas day. So there may be huge opportunity to make bigger turkey market in Bangladesh in addition to in overseas.

Turkey manufacturing remains at primitive degree in Bangladesh. It is characterized by manner of terrible housing, feeding, breeding and healthcare practices in addition to inadequate availability of scientific information, technical offerings, credit centers, training and advertising and advertising and marketing opportunities. So, to enhance the turkey manufacturing, active public extension service, education for farmers, organizing of diverse avenues for studies on turkey and identifying advertising and marketing and advertising strategies, are at once needed in Bangladesh.

Supply Chain and Turkey Farming

Feed, medicine & vaccines, skilled-unskilled-semiskilled labors, management decisions, egg manufacturing values, mortality prices, utilities which include energy, gas, water, transportation and government policy/selections are the fundamental input within the poultry enterprise in Bangladesh. Those factors are extraordinarily critical for this industry as financial successes are relies upon on the ones. Within the middle of the figure one is imparting the principle technique of this enterprise. Fowl industry

starts from natural line breed that is top-most breed conserved by fundamental countries of France, Canada, United States of America, China and so.

Bangladesh poultry enterprise starts off evolved from grandparent that's one step beneath of natural line breed. The supply chain can be stronger from ultimate product of meat and eggs closer to specific processed meals. This segment generates lots of chicken wastes, normal hen meat and eggs, culled birds, day antique chicks and hatching eggs. Fowl wasted includes manure, muddle, damaged eggs, rejected eggs, waste feed, fowl gut and duck feed and feather. Some of these can be used for similarly raw materials in exceptional styles of industry like small scale energy production commercial enterprise via biogas, pillow making enterprise through the use of feather, fertilizer manufacturing enterprise from manure and wastes, fish feed from intestine and rejected eggs, charcoal from rooster muddle and so. This process can easily determine what number of birds might be last inside the farm after having mortality, ailment etc. The one of a kind by-merchandise which come from poultry wastes via similarly process. Most of these by using-merchandise are very important and basic desires for Bangladeshi agriculture area. Thus, it could in addition make a contribution to different industry as properly to the economic and social aspect of Bangladeshi fowl farms. In fact, plenty of people are enticing with this enterprise at one- of-a-kind degrees. The researcher only concentrated the three styles of farming within the poultry industry along with grand farms, breeder farms and broiler/layer farms. on this entire method, society is getting large blessings which include generating new companies and entrepreneurs, lessen unemployment, reduce dependence charge, empowering women and many others.

Raising turkeys could be a modern-day cultivating activity in Bangladesh. Farmers are raising turkey for ornamental, both egg and meat, and both meat and ornamental functions, in my view. The farmers seek out technical aid from diverse sources. Farmers took technical assist from Department of Livestock Services (DLS), internet and DLS, internet and other farmers, and other farmers, respectively. Farmers have been raising turkey in free variety, semi-extensive and extensive system, in my view.

The largest turkey farm in the country is in Dhania, Savar run by a Mr. Amir Hossain Sarkar. He, himself, started his business first as a passion. He imported 27 poults from

USA to Bangladesh. He initially bought 550 sq. of area for the farming. Within two years, the number of poults in his farm increased to 1,000 and from then he started to run his business. Majority of the turkey farmers beginning their enterprise sources their poults from him. Mr. Sarkar sells the 15 day old poults at tk700-tk800. He takes payment from 22 the farmers through banks/Bkash/cash. After receiving the payments, he arranges the delivery by van/truck/pickups as necessary.

Few farmers informed that they took extra care amid hot duration for comfort of turkey; others did now not take any extra care. However, minority of the breeder took more care amid wintry weather season whereas large part did not take more care. It was found that whereas few breeders taken after lighting strategy for breeder turkey, maximum did not take after. Most of the ranchers did now not utilize scientifically built nest box to encourage lying of eggs by means of hen. Meat and eggs are not the most effective products that customers can get from the poultry enterprise.

There are some different output like bi-products (manure, bio-fuel, feather, fish feed, charcoal), day old chicks, culled birds which may be sold inside the market for customer consumption, eggs (clean and rejected), meat (ready market and further processing) are generating as a poultry industry output. besides that masses of associate industries are concerning with poultry enterprise which includes feed, medicine, pathological resources, logistics, cages, know-how, breed dealer, importers, vendors and other associated farmers. Its miles always tough to hold all the stakeholders without imposing effective deliver chain into this industry.

The unique output that may without difficulty categorized into three exceptional ways. Within the financial view factor, fresh meat, sparkling eggs and processed meat are the main economic products for the fowl owner. Besides that, there are massive possibilities to make bi-merchandise from chicken wastes the ones also excellent economic feasible bi-products.

In social view point, Bangladeshi fowl enterprise is without a doubt rich which engages greater than 15 million human beings (according to authorities reliable) immediately or in a roundabout way. This commercial enterprise is extending out in the remote regions which help to lessen poverty, lessen unemployment, and empower

women. Subsequently, proper poultry waste control meeting up environmental side of sustainability that keeps environment unchanged or intact and recycle or reuse the wastes economically.

Except that the monetary components may be very vivid in this technique as each circle denotes one unmarried enterprise with required investments and employments because of commercialization of hen industry. In every single stage of poultry supply chain procedure model indicates social, environmental and monetary well-being which is very plenty crucial to gain sustainability inside a business operation.

It is able to generate big employment through fowl rearing, can provide social popularity as an entrepreneurs or businessman, meet up social requirement of protein and meals values, and can reduce poverty degree which may be very powerful for United States like Bangladesh. Except that, this form of expansion can convey plenty of merits inside the society like create young and girls entrepreneurs, alternative income generating enterprise, engagement of idle family participants in efficient manner, reduce unemployment rate, part time working centers and so on. Those types of activities can trade entire society as an efficient nature. There are insignificant use of rooster wastes make the environment polluted and destroying residing environment as well. The pattern respondents are performing some environmental practices which help them too loose from rooster sickness, blockade of lands and making some money by way of creating bi-products (bio-fuel, fertilizers and fish feed) from wastes.

The financial troubles of poultry industry in Bangladesh

In reality, the whole model is meeting up financial elements inside the context of producing cost delivered merchandise, distinct varieties of small scale enterprise and making more earnings. On this precise monetary phase that's rotated by way of square dots can generate massive economic enhance by growing manufacturing.

Bangladesh is a small country with 153.5 million peoples who need to get most fulfilling amount of protein deliver from poultry enterprise. This is the scope lying in this industry that may supply the big advantages to its all stakeholders which include ultimate clients, governments, entrepreneurs, providers, banks and so forth. Supply

chain could be very plenty associated issue with this proposed sustainable supply chain poultry version. Only effective supply chain can put in force the entire device as potential and profitable. In this situation, forward supply chain (FSC) and reverse supply chain (RSC) problems will be the important thing to increase the whole enterprise in a sustainable manner.

Consequently, Bangladesh can achieve high-quality fulfillment if they can combine sustainability and supply chain attribute of their poultry industry. We found out that farmers used commercial, homemade, and both homemade and commercial feed, respectively for feeding their turkey. None of the interviewed turkey farmers calculated feed efficiency (FE) and wastage of feed found happened in many farms due to lack of using proper feeding methods. Most of the farmers fed both homemade and commercial broiler and layer feed for feeding turkey. In case of homemade feed, they used a mixture of maize, wheat, broken rice and vegetables like cabbage, water spinach (Ipomoea aquatic), Malabar spinach (Basella Alba) and grass.

They allowed the turkey flock for foraging. Farmers were not aware about feed efficiency.

We also found out that few farmers had encountered diseases like New Castle disease, Fowl cholera, Fowl pox, Mycoplasmosis etc.; most had not experienced any disease. Similarly, while minority of the farmers had used vaccine, the majority of them had not used any vaccine. Currently the country has been affected by Avian Influenza and as a resultant factor suffered losses around BDT 700 core taka (as per Breeder's Association of Bangladesh). This is a huge loss for the producers and they did not get any sort of financial help to mitigate this huge losses.

Bangladesh and other five nations India, China, Egypt, Indonesia and Vietnam have been enduring from the H5N1 virus. This is often since of 'firmly entrenched' due to a great extent to 'weak producer and benefit associations' to support farmers. In aforementioned nations avian flu is still endemic due to destitute veterinary and animals' generation administrations impede suitable uncovering and managing of disease. Due to bird flu the farmers were able not know send out chicken in Nepal additionally Center East nations. As such negative affect has been felt. Development

of veterinary services including vaccination is fundamental.

Within the nation the plague of a few diseases coupled with increment in feed cost sometimes emerge to be the foremost noteworthy hinders for this industry.

Farmers did now not maintain report for which cause the customers purchased turkey. Normally, clients who intended to farming, bought turkey in pair i.e. one male and one female. Commercial turkey breeding hens produce best about 45 live poults (chicks) every year. Turkey eggs take 28 days to hatch. A turkey can lay eggs whilst its six-month-old and it may keep as much as four years. But, the charge of eggs and day-old chick (DOC) of turkey is quite excessive.

There need to be a few kind of mechanism wherein small farmers can also develop turkeys. Four eggs price Tk 800 taka. A 15-day- old turkey expenses Tk 700 to Tk 800. There are types of turkey internal this farm. One named, Carbon red is the priciest. Two of these cost Tk 70,000 (The daily star, 2018). At the same time as some natural breeds of turkey are maintained with the aid of way of hen fanciers, the turkeys raised commercially for meat are specially bred hybrids (a move among or more unique breeds).

Industrial turkey breeding has ended in hybrid traces that grow plenty quicker and convert feed to body weight a superb deal greater successfully than pure breeds. below first-class situations with a nicely-balanced ration, a cutting-edge white hybrid turkey can reach 6 kg in weight by means of 10 weeks of age, with a feed conversion ratio (the ratio of the quantity of feed eaten to border weight gain) of approximately 2:1.

Commercial turkeys are bred mainly to have greater meat in the breast and thighs. White feathered turkeys are normally favored, considering they do not have unpleasant pigment spots at the pores and skin whilst plucked. Weight of available adult tom, bird and egg in Bangladesh had been extraordinarily lower than that of advanced countries. This is probably due to lighter sorts of turkey reared through the farmers of Bangladesh. Marketplace of turkey is unlike broiler and layer in Bangladesh.

There is absence of properly-prepared marketplace for turkey and its merchandise.

No established marketplace value chain has been recognized however in Bangladesh. Farmers purchase and sell turkey especially through private conversation, internet offerings (Bikroy.com, Facebook and so on.). The middlemen purchases from the wholesalers at bulk amounts. Sometimes they purchase in pairs of male and female turkey. After they receive the delivery from the farmers, they sell the turkeys after 7-8 months.

Farmers have been concerned about the facts many people do now not know approximately the high-quality of turkey meat. The turkey sellers focus on the big hotels and restaurants, especially in those places which are frequented by foreigners. Turkey meat is being sold in department stores in capital city Dhaka and cities like Chittagong, Cox's Bazar, and Sylhet. Despite the fact that, a large numbers of purchasers have been no longer habituated of taking turkey meat. They just buy the meat from their interest. There's some other problem of advertising and marketing.

Turkey farms are developing every day; it will be problems within the future if the market isn't created. Farmers said the authorities have to take initiative for this. There's an extremely good demand of turkey meat inside the markets, especially within the restaurants. The commonplace peoples are actually also interested by buying turkey meat. The purchasing strength of the peoples has extended than the beyond such a lot of people are actually shopping for turkeys.

Turkey meat is becoming the alternative source of protein in our country. Turkey relies upon on natural grass for meals. Farmers do no longer need to pay extra cash to get their meals. And, turkeys are hardy birds with low susceptibility to disease. The meat quality is amazing and when one considers that it's normally cholesterol-free, it is well widespread worldwide.

Considering most of these factors, many entrepreneurs have commenced their turkey farms. Turkey farming is gaining recognition some of the youths of 5 upazilas in Rajbari as turkeys are clean to take care of, earn right profit and run much less chance

of contracting sicknesses (Correspondent, 2018).

Challenges of Supply Chain Management of Turkey Farming

Transporting eggs is much more convenient than transporting turkeys in terms of quantity and processing (packaging, labelling etc.). Problems of keeping the correct temperature during the transportation, the condition of the road transportation, technological inadequacy of hatching hampers the ability of buying eggs. For this reason, buyers still prefers purchasing live turkeys despite it being less cost effective in terms of quantity. That is why turkey farming is flourishing at a lower rate that it could have been. Farmers can raise hens in cages but turkeys require open spaces. Farmers are unable to make as much profit in per sq. ft. with turkey compared to chickens. Again, this is because they are selling less turkey than chickens because of less demand and longer sell period of turkeys compared to chickens.

As a white meat, its quality is superior and it is scrumptious than any other meat. Despite that, people are still not buying turkey as much as beef, mutton etc. This is because average consumers are still not considering turkey meat to be a valid alternative to red meat. Instead they are comparing chicken with turkey meat. Consumers are comparing these white meat as the price per piece and preferring chicken over turkey.

There are technological problems with hatching the eggs. It is difficult to get the proper incubators to keep the eggs at the correct temperature. Farmers gain their information from YouTube videos, the internet at large. However there is still a lack of formal education about rearing and supplying this poultry.

Further Directions and Conclusions

This thesis shows there is some budding interest for turkey production in Bangladesh though still on primitive and traditional management and productive systems. It also indicated potentials for development through more motivation by government authorities and educational institutes.

Acknowledgment of the most recent innovation in poultry division particularly to control environment and process of automation are being required. These require to feed, drink, and other administrative and day to day operational exercises and to construct capacity. This will add creation of value. Productivity and adequacy of production ought to be brought through cost-cutting method and decreasing overwhelming reliance on high-cost imported raw materials for this segment. Elective course of action ought to be created locally for cheap nourishing taken a toll as well as discuss cleaning mechanism. Specialized ability requires being cautious in cooperation farmer and extension levels. Locally available craftsmen might be prepared to create modest equipment, like feeders, consumers, etc.

This industry has colossal scope for the nation through following points: i) Changing livelihood & nourishment propensity; ii) Decrease of reliance of meat related to Bovine and goat, iii) Ultimately has positive affect on GDP development rate of the nation. The turkey production industry has been making advance in spite of: i) Avian Influenza/bird flu flare-up; ii) Price rises of crude materials within the universal showcase; iii) Lack of infrastructural support.

Arrangement for training through lives stock agencies, NGOs and private agencies are necessary for mutually farmers and labors associated in this sector as well as extension level which may include: sickness management, accommodation and tools, give food to, inherited step up and promotional activities. Important records in precise type of poultry grounding and composition also are crucial to apprehend the inspiration of the exceeding matter. Accommodation and organization might be improved from side to side through arranging suitable farmer guidance, if feasible manner to run the farm smoothly. This specific poultry sector has immense potentialities in the economic development provided public-private partnership with join collaboration and be arranged so that nutrition especially meat and eggs can be available for the poorer section at a cheaper rate. If bird flu can be removed we can be able to export meat and eggs in foreign countries for which special strategy is being required.

Accommodation of turkey meat in the total meat production in Bangladesh as a cheap animal protein source for which Bangladesh has many supportive merits. More care

and stress from the relatively responsible government authorities and educational institutes on turkey production, processing and consumption as a high quality animal protein source on range or in modern accommodation systems.

Whilst broiler meat market is facing troubles of more diseases and decrease in taste, turkey meat can be an alternative for customers. So it could be an effective alternative source of protein. Furthermore, this poultry is pretty appropriate for inspiring livelihoods of small and marginal farmers as it could be without difficulty reared in free variety and under each intensive and semi-intensive machine with little investment for housing, device and control. It can create properly opportunity for unemployed youths to begin farming and earn earnings. As natural mating is not resulting fertile egg, so there may be an opportunity to promote AI method in turkey for the production of commercial hatching eggs. It will decrease cost for rearing more tom. Farmers are relatively knowledgeable and that they have been self-starter. So there may be massive possibility to broaden turkey entrepreneurs in Bangladesh. They'll be able to receive technical knowhow on selection, brooding, breeding, feeding, housing and so forth on turkey rearing effortlessly. There is a need to encourage more investment in this sector. Such a step would allow improving the condition of transportation on an individual basis.

The price of turkey and egg, if fixed, should not for only some months however whole year thinking about the production cost so that manufacturer deficit no longer occurs. Price of turkey and egg must hold stable and hassle of middlemen can be reduced down through arranging effective and green supply chain management with the aid of the government as well as private sector via maintaining in mind about the clients' safety and lowering financial disparity and removing poverty. Supply chain management must be advanced so that the poultry farmers can without delay supply to the retail shops and middle men cannot suck the earnings. Bank loan in the poultry sector have to be arranged at a 5-7% simple interest charge in keeping with annum thinking about thrust sector. Conditions of loan providing should be eased. moreover, bank need to come ahead in order that new entrepreneurs as well as NRBs can come forward to put money into this region through starting special window in every bank arranging now not only bank loan but additionally imparting special offerings beginning from pure line farms and Hatcheries to customers. Banks who could not be

involved to make investments in the poultry sector can be penalized by means of the Bangladesh Bank. This industry also treated underneath SME sector. Again the government has to lower the rate of taxes on import of the technological machineries like the incubators. The taxes also need to be reduced to import the eggs and turkey from abroad. The government has to take initiatives to improve the infrastructure to ensure a smooth supplying process. A pioneer turkey farmer cooperative must be encouraged with the aid of authorities to serve as morale booster and a forum for supporting other new entrants who would possibly broaden interest. There may be need for policy direction geared toward encouraging youths to use their idle time or leisure time to embark on small-scale turkey production. Especially as it has the potential of enhancing the socio-economic fortune of the alternative ranks or the extraordinarily low income group. The volume to which the ability of this interest would be more advantageous will rely on the degree to which government policy on turkey importation is enforced. The effective implementation of the law on indiscriminate importation of turkey will enhance the development of appropriate and cost-effective farm-stage technology for attracting the youths, the unemployed.

Commercial sellers of turkey have to focus on positioning this meat correctly. The turkey meat needs to be positioned in such a way that the end consumers considers it has the alternative for not only chicken but also red meat. The sellers also need to target the hotspots frequented by the youths who are more open to trying new variety of food. The transportation sector needs to be developed to accommodate the scientific methods of carrying the eggs from one place to another.

The position of the farmers are laudable and that could export turkey products to foreign market if an ability building can be advanced and boom of strategic alliance amongst private sector, government, Bangladeshi embassies and NRB may be developed .Turkey industry desires special attention from the authorities as this area will not only mitigate large deficit of protein associated meals at an inexpensive price authorities needs prior planning and training for bird flu and should set up suitable steps in order that farmers can hold bio-security and keep healthy surroundings outside and inside the farms.

Department of livestock need to come forward to holistic technique for developing the

turkey zone. Organogram of livestock can be restructured and it has to be set up workplace at least union level. Efficient and dynamic personalities ought to be appointed. They ought to now not fix maximum price of one-day chick and its miles unjustified. To mitigate deficiency of veterinary medical doctors, four years diploma courses after SSC degree may be delivered. Trade courses will also be introduced so that technicians can be available to mitigate instantaneous shortage of nursing of the poultry industry. To import products from outside the country in place of lock chicken and eggs massive quantity of valuable foreign exchange can be spent. As such subsidy must be given to the nearby industry and protect safeguard to the local entrepreneurs of the poultry industry. Vaccine, vaccinations services, opportunity to vaccine offerings, antibiotic feed components and different inputs and services of the turkey sector ought to be evolved locally.

Chapter- 9

Proposed Supply Chain Model

Agriculture plays a vital role in the world economy. However, the production of most agricultural products is affected by a lot of external factors, such as the weather changes, seeds quality, and culture methods, which are not in full control by the supply chain members. The situation is further complicated by the fact that there is a long lead time in the production of agricultural product. It means that it is impossible to adjust the production plan when the environment changes. For the agricultural product producers, they lack the market information and are not certain of the final output when going into production. They are more blindfold to choose what to produce and how much to produce, especially in the uncertain environment. Then oversupply and shortage of the agricultural product are quite popular in the agricultural product market, which reduce the profit of the supply chain and hurt the enthusiasms of the supply chain members. How to reduce the effects of the fluctuations and share the risks facing the supply chain members is an important topic in the supply chain management.

Coordinating supply chain has been a major issue in supply chain management research. Supply chain contracts are contractual agreements governing the pricing and exchange of goods or services between independent members in a supply chain. Properly designed supply contracts are an effective means to share the demand and supply risk and better coordinate the decentralized supply chain. It is widely recognized that the supplier and retailer can both benefit from coordination and thereby improve the overall performance of the supply chain as a whole. Many well-known contract forms such as buy-back, revenue-sharing, quantity flexibility, sales rebate, two-part tariff, and quantity discount have shown to coordinate the supply chain. In this paper, a dynamic model in a one-supplier-one-retailer fresh agricultural product supply chain that experiences supply disruptions during the planning horizon

is studied. The two-part tariff contract that can coordinate the fresh agricultural product supply chain with supply disruptions effectively is determined.

One stream of the literature related to the research is on fresh agricultural product supply chain. Samuel et al. [1] examined contract practices between suppliers and retailers in the agricultural seed industry. Xiao et al. [2] researched on the optimization and coordination of fresh-product supply chains under the Cost Insurance and Freight business model with uncertain long distance transportation delays and devised a simple cost sharing mechanism to coordinate the supply chain under consideration. Wang and Chen [3] introduced the options contracts into the fresh produce supply chain and took the huge circulation wastages both from quantity and quality into account. Cai et al. [4] considered a supply chain in which a fresh-product producer supplies the product to a distant market, via a specialized third-party logistics (3PL) provider, where a distributor purchases and sells it to end customers. An incentive scheme is proposed to coordinate the supply chain. Yu and Nagurney [5] developed a network-based food supply chain model under oligopolistic competition and perishability with a focus on fresh produce and proposed an algorithm with elegant features for computation.

This chapter is also closely related to supply chain coordination management and disruption management. In a decentralized decision-making setting, the optimal supply chain profit is usually not achieved due to double marginalization. Double marginalization means the fact that each supply chain member's relative cost structure is distorted when a transfer price is introduced within a supply chain. Designing coordination contract is an important issue which aimed at reconciling conflicts and achieves a better profit among supply chain members. Lariviere [6], Tsay et al. [7], and Cachon [8] provided excellent introduction and summaries on coordination contracts. Our coordination contract is closely related to Jeuland and Shugan [9], Moorthy [10], and Georges [11]. Georges [11] investigated under which conditions the manufacturer can reach the vertically integrated channel solution through the use of a two-part wholesale price in a static marketing channel where demand also depends on players' advertising.

For the literature on disruption management, Qi et al. [12] first introduced the disruption management into supply chain management. They investigate a one-supplier-one-retailer supply chain that experienced a disruption in demand during the planning horizon. They examined how the original production plan should be adjusted after demand disruptions occurred and how to coordinate the supply chain using wholesale quantity discount policies. Xiao et al. [13] further studied the coordination of the supply chain with demand disruptions and considered a price-subsidy rate contract to coordinate the investments of the competing retailers with sales promotion opportunities and demand disruptions. Xiao and Yu [14] developed an indirect evolutionary game model with two vertically integrated channels to study evolutionarily stable strategies (ESS) of retailers in the quantity-setting duopoly situation with homogeneous goods and analyzed the effects of the demand and raw material supply disruptions on the retailers' strategies. Xiao and Qi [15] studied the disruption management of the supply chain with two competing retailers, where the manufacturer faces a production cost disruption. Chen and Xiao [16] developed two coordination models of a supply chain consisting of one manufacturer, one dominant retailer, and multiple fringe retailers to investigate how to coordinate the supply chain after demand disruption. They considered two coordination schedules, linear quantity discount schedule and Groves wholesale price schedule. Li et al. [17] investigated the sourcing strategy of a retailer and the pricing strategies of two suppliers in a supply chain under an environment of supply disruption. They characterized the sourcing strategies of the retailer in a centralized and a decentralized system. They derived a sufficient condition for the existence of an equilibrium price in the decentralized system when the suppliers were competitive. Huang et al. [18] developed a two-period pricing and production decision model in a one-manufacturer-one-retailer dual-channel supply chain that experienced a disruption in demand during the planning horizon. They studied the scenarios where the manufacturer and the retailer were in a vertically integrated setting and in a decentralized decision-making setting. They derived conditions under which the maximum profit can be achieved. Anastasias et al. [19] proposed generic single period inventory models for capturing the tradeoff between inventory policies and disruption risks in a dual-sourcing supply chain network both unconstrained and under service level constraints, where both supply channels were susceptible to disruption risks. The models were developed for both

risk-neutral and risk-averse decision-makers and can be applicable for different types of disruptions.

There are two main differences between the works cited in this chapter paper. First, most previous results are dependent on the assumption that the supply is deterministic or obeys a certain distribution. Only few studies examine the supply chain with supply disruptions. Second, most research related to the supply chain disruptions focuses on the demand disruptions. In this paper, a dynamic model in a one-supplier-one-retailer fresh agricultural product supply chain that experiences supply disruptions during the planning horizon is proposed, and the agricultural product supply chain with supply disruptions is coordinated.

A fresh agricultural product supply chain composed of a supplier and a retailer is studied in the paper. The supplier produces fresh agricultural product with a long production lead time and a short lifecycle. The supplier sells the fresh agricultural product to the retailer, and the retailer sells the product to the customers in a single selling season. The supplier and the retailer are assumed to be risk neutral and pursue profit maximization.
The demand of the fresh agricultural product is d = D – kp, where D is the market scale, k is the price sensitive coefficient and d is the real demand under the unit retail price p.

Since the supplier produces fresh agricultural product with a long production lead time, the supplier must make the production plan before the retailer makes the order decision. While making the production plan, the supplier does not consider the supply disruptions, since the supply disruptions cannot be anticipated. Usually there is no supply disruption, that is, the supplier puts q_s units into production, and the final output is exactly q_s units. If there are supply disruptions, the supplier still puts q_s units into production and the final output is uncertain to be q_s.

When the agricultural product harvests and the selling season comes, the final output of the supplier is found to be $Q(=q_s+\Delta q_s)$, where the supply disruptions are

captured by the term Δq_s. To be reasonable, there is an upper bound $\Delta\bar{q}_s$ of Δq_s and a lower bound $\Delta\underline{q}_s$ of Δq_s, where $\Delta\bar{q}_s \geq 0$ and $\Delta\underline{q}_s \leq 0$. The upper bound of final output is $\bar{Q}(= q_s + \Delta\bar{q}_s)$, and the lower bound of final output is $\underline{Q}(= q_s + \Delta\underline{q}_s)$. After the final output is realized, the supplier decides the wholesale price, and the retailer makes the order decision according to the wholesale price.

c is the unit distributing cost of the fresh agricultural product from the supplier to the retailer. p_s is the unit supplying cost from the spot market incurred by the supplier when the retailer's demand cannot be satisfied by the product produced by the supplier, and v_s is unit salvage cost of the supplier when there are surplus products. To be reasonable, the following assumption is given.

Assumption 1 ($c > v_s$). $c > v_s$ is assumed, otherwise the supplier can earn infinite profit by distributing infinite products.

Assumption 2 1 ($p_s > v_s$). $p_s > v_s$ is assumed since the fresh agricultural product is of little salvage value.

The following mathematical notation is used. $®_j^i$ denotes the profit function for channel member *j* in supply chain model *i*. Superscript *i* takes values ID, D, and C, which denote the centralized supply chain, decentralized supply chain and supply chain with coordination contract, respectively. The subscript *j* takes values *r* and *s*, which denotes the retailer and the supplier.

The Centralized Supply Chain with Supply Disruptions

It is obvious that the supply chain performs best if the channel is centrally controlled. The decision variable in the centralized supply chain is only the order quantity *q*.

When the supplier's final output is Q, the total supply chain profit is

$$\pi^{ID}(q) = q\left(\frac{D-q}{k} - c\right) + v_s(Q-q)^+ - p_s(q-Q)^+ \qquad (1)$$

The following conclusions about the optimal order quantity in the centralized agricultural product supply chain are got.

Theorem 1. When the final output is Q, the optimal order quantity q^{ID*} of the retailer is

(i) when $\underline{Q} \le Q \le (D - k(c + p_s))/2, q^{ID*} = (D - k(c + p_s))/2$;

(ii) when $(D - k(c + p_s))/2 \le Q \le (D - k(c + v_s))/2, q^{ID*} = Q$;

(iii) when $(D - k(c + v_s))/2 \le Q \le \overline{Q}, q^{ID*} = (D - k(c + v_s))/2$.

From Theorem 1, the optimal profit in the centralized agricultural product supply chain can be got.

Theorem 2. When the final output is Q, the maximum total profit in the centralized supply chain π^{ID*} is

(i) when $\underline{Q} \le Q \le (D - k(c + p_s))/2, q^{ID*} = (1/k[(D - k(c + p_s))/2]^2 + p_s Q$;

(ii) when $(D - k(c + p_s))/2 \le Q \le (D - k(c + v_s))/2, ®^{ID*} = Q(((D - Q)/k) - c)$;

(iii) when $(D - k(c + v_s))/2 \le Q \le \overline{Q}, ®^{ID*} = (1/k)[(D - k(c + v_s))/2]^2 + v_s Q$.

The Decentralized Supply Chain with Supply Disruptions

In this section, the problem that the supplier and the retailer make decisions with wholesale price contract in a decentralized way under the disrupted output is discussed. In this case, the supplier acts as the leader, and the retailer acts as the follower. When the agricultural product harvests, the supplier first decides on the wholesale price ω, and the retailer decides the order quantity *q* accordingly. The supplier distributes *q* units fresh agricultural product to the retailer. If the final output cannot satisfy the retailer, the supplier buys the remaining products from the spot market. If there is surplus after satisfying the retailer, the residual products are salvaged.

Because the supplier is the leader, the best-response function of the retailer should be got at first. For a given ω, the retailer's profit is

$$\pi_r^D(q) = q(\frac{D-q}{k} - \omega) \qquad (2)$$

The retailer aims to maximize his profit. The objective function is concave in ω, and the retailer's first-order conditions characterize the unique best response: $q_r^{D^*}(\mu) = (D - k\mu)/2$.

The supplier's optimization problem can be stated as

$$\pi_s^D(q) = (\omega - c)q_r^{D^*} + v_s(Q - q_r^{D^*}) + -p_s(q_r^{D^*} - Q)^+ \qquad (3)$$

Lemma 3. When the final output is Q, the optimal wholesale price ω^{D^*} of the supplier is

(i) when $\underline{Q} \le Q \le (D - k(c + p_s))/4, \mu^{D^*} = (D + k(c + p_s))/2k$;

(ii) when $(D - k(c + p_s))/4 \le Q \le (D - k(c + v_s))/4, \mu^{D^*} = (D - 2Q)/k$;

(iii) when $(D - k(c + v_s))/4 \le Q \le \overline{Q}, \mu^{D^*} = (D + k(c + v_s))/2k$.

It is not hard to get Theorems 4 and 5 from Lemma 3.

Theorem 4. When the final output is Q, the optimal order quantity $q_r^{D^*}$ of the retailer is

(i) when $\underline{Q} \le Q \le (D - k(c + p_s))/4, q_r^{D^*} = (D - k(p_s + c))/4$;

(ii) when $(D - k(c + p_s))/4 \le Q \le (D - k(c + v_s))/4, q_r^{D^*} = Q$;

(iii) when $(D - k(c + v_s))/4 \le Q \le \overline{Q}, q_r^{D^*} = (D - k(v_s + c))/4$.

Theorem 5. When the final output is Q, the maximum supplier profit $®_s^{D^*}$, the maximum retailer profit $®_s^{D^*}$, and the maximum total profit $®^{D^*}$ in the decentralized supply chain are

(i) when

$$\underline{Q} \le Q \le (D - k(c + p_s))/4, \pi_s^{D^*} = (2/k)[(D - k(p_s + c))/4]^2$$
$$+ p_s Q, \pi_r^{D^*} = (1/k)[D - k(p_s + c))/4]^2, r^{D^*} = (3/k)[(D - k(p_s + c))/4]^2 + p_s Q;$$

(ii) when $(D-k(c+p_s))/4, \le Q \le (D-k(c+v_s))/4, \pi_s^{D^*} = (((D-2Q)/k)-c)Q, \pi_r^{D^*} = (1/k)Q^2, \pi^{D^*} = (((D-Q)/k)-c)Q;$;

(iii) when $(D-k(c+v_s))/4, \le Q \le \overline{Q}, ®_s^{D^*} = (2/k)[(D-k(v_s+c))/4]^2 + v_s Q, , \pi_r^{D^*} = (1/k)[(D-k(vs+c))/4]^2, ®^{D^*} = (3/k)[(D-k(v_s+c))/4]^2 + v_s Q;$.

Theorem 6. The optimal order quantity in the centralized and decentralized supply chains with supply disruptions satisfies $q_r^{D^*} \le q^{ID^*}$.

Let $q_1^{D^*} = (D-k(c+v_s))/4, q_2^{D^*} = (D-k(c+p_s))/4,$ $q_1^{D^*} = (D-k(c+v_s))/2,$ and $q_2^{D^*} = (D-k(c+p_s))/2;$ The optimal order quantity in the decentralized supply chain is always less than that in the centralized supply chain.

From Theorems 2 and 5, Theorem 7 can be got.

Theorem 7. The maximum total supply chain profits in the centralized and decentralized supply chains with supply disruptions satisfy $®^{ID^*} \ge ®^{D^*}$.

From Theorem 7, the maximum total supply chain profit in the decentralized supply chain is less than that in the centralized supply chain. Supplier can further improve the profits in the decentralized supply chain by offering the coordination contract.

Design of Coordination Contract

It is shown that when the supplier and the retailer make decisions in a decentralized way, the wholesale price contract cannot coordinate the supply chain and must be modified to achieve the optimal total supply chain profit.

Theorem 8. When the final output is Q, to ensure that the retailer's order quantity equals the optimal order quantity in the centralized supply chain, the optimal wholesale price μ^{C^*} is

(i) when $\underline{Q} \le Q \le (D-k(c+p_s))/2, \omega^{C^*} = c+p_s;$

(ii) when $(D-k(c+p_s))/2 \le Q \le (D-k(c+v_s))/2, \omega^{C^*} = (D-2Q)/k;$

(iii) when $(D-k(c+v_s))/2 \le Q \le \overline{Q}, \omega^{C*} = c+v_s$.

From Theorem 8, Theorem 9 can be obtained.

Theorem 9. When the wholesale price $\mu^* = \mu^{C*}$, the decentralized supply chain can be coordinated.

When the wholesale price $\mu^* = \mu^{C*}$, the profits of the supplier and the retailer are

(i) when $\underline{Q} \le Q \le (D-k(c+p_s))/2, \pi_s^{C*} = p_s Q, \pi_r^{C*} = (1/k)[(D-k(p_s+c))/2]^2$;

(ii) when
$(D-k(c+p_s))/2 \le Q \le (D-k(c+v_s))/2, ®_s^{C*} = (((D-2Q)/k)-c)Q, \pi_r^{C*} = Q^2/k$;

(iii) when $(D-k(c+v_s))/2 \le Q \le \overline{Q}, ®_s^{C*} = v_s Q, \pi_r^{C*} = (1/k)[(D-k(c+v_s))/2]^2$.

It can be verified that $\pi_s^{C*} + \pi_r^{C*} = \pi^{ID*}$.

Theorem 8 indicates that, in a decentralized supply chain, to coordinate the fresh agricultural product supply chain with supply disruptions, the optimal wholesale price depends on the final output. The optimal wholesale price is a decreasing piecewise function of final output. To ensure that the supplier and the retailer both have incentives to accept the coordination contract, the profits of the supplier and the retailer should satisfy $\pi_s^C \ge \pi_s^{D*}, \pi_r^C \ge \pi_r^{D*}$. This problem can be easily solved by offering a lump-sum fee $F(\underline{F} \le F \le \overline{F}$, where $\underline{F} = \max(\pi_s^{D*} - \pi_s^{C*}, \pi_r^{D*} - \pi_r^{C*}, 0)$, $\overline{F} = \max(\pi_s^{C*} - \pi_s^{D*}, \pi_r^{C*} - \pi_r^{D*})$. (Since $\pi_s^{C*} + \pi_r^{C*} \ge \pi_s^{D*} + \pi_r^{D*}$, $\underline{F}$ and $\overline{F}$ are different.) When $\pi_s^{D*} \ge \pi_s^{C*}$, that is, the supplier earns less with the coordination contract, the retailer should pay the lump-sum fee *F* to the supplier. The profits of the supplier and the retailer are $\pi_s^C = \pi_s^{C*} + F, \pi_r^C = \pi_r^{C*} - F$. Otherwise, the supplier should pay the lump-sum fee *F* to the retailer. The profits of the supplier and the retailer are $\pi_s^C = \pi_s^{C*} - F, \pi_r^C = \pi_r^{C*} + F$, . Then $®_s^C \ge ®_s^{D*}$ and $®_r^C \ge ®_r^{D*}$ are satisfied.

Numerical Example

A numerical example is given to illustrate some of results derived throughout the chapter.

Suppose the supplier's unit distribution cost c = 2, the unit buying cost p_s = 5, and the unit salvage cost v_s = 1. The demand function is q = 40 – p.

When there are supply disruptions and the supplier's production is q_s, the final output Q is not certain. The supply disruptions are captured by the term Δq_s, where Δq_s lies in the interval $[-q_s, 0.5q_s]$. That is, the final output Q lies in the interval $[\underline{Q}, \overline{Q}]$, where $\underline{Q} = 0, \overline{Q} = 1.5q_s$.

When the supply disruptions happen and the final output is found to be Q, in the centralized supply chain, the retailer's optimal order quantity q^{ID^*} is (i) when $0 \le Q \le 16.5, q^{ID^*} = 16.5$; (ii) when $16.5 \le Q \le 18.5, q^{ID^*} = Q$; (iii) when $18.5 \le Q \le \overline{Q}, q^{ID^*} = 18.5$.

Correspondingly, the maximum supply chain profit $®^{ID^*}$ is

(i) when $0 \le Q \le 16.5, ®^{ID^*} = 272.25 + 5Q$;

(ii) when $16.5 \le Q \le 18.5, ®^{ID^*} = Q(38 - Q)$;

(iii) when $18.5 \le Q \le \overline{Q}, ®^{ID^*} = 342.25 + Q$.

In the decentralized agricultural product supply chain, when the supply disruptions happen and the final output is found to be Q, the optimal wholesale price μ^{D^*} of the supplier is

(i) when $0 \le Q \le 8.25, \mu^{D^*} = 23.5$;

(ii) when $8.25 \le Q \le 9.25, \mu^{D^*} = 40 - 2Q$;

(iii) when $9.25 \le Q \le \overline{Q}, \mu^{D^*} = 21.5$.

Correspondingly, the optimal order quantity q_r^{D*} of the retailer is (i) when $0 \le Q \le 8.25, q_r^{D*} = 8.25$; (ii) when $8.25 \le Q \le 9.25, q_r^{D*} = Q$; (iii) when $9.25 \le Q \le \overline{Q}, q_r^{D*} = 9.25$.

The supplier profit $®_s^{D*}$, the retailer profit $®_r^{D*}$, and total supply chain profit $®^{D*}$ are

(i) when $0 \le Q \le 8.25, ®_s^{D*} = 136.125 + 5Q, ®_r^{D*} = 68.0625, ®^{D*} = 204.1875 + 5Q$;

(ii) when $8.25 \le Q \le 9.25, ®_s^{D*} = (38 - 2Q)Q, ®_r^{D*} = Q^2, ®^{D*} = (38 - Q)Q$;

(iii) when $9.25 \le Q \le \overline{Q}, ®_s^{D*} = 171.125 + Q, ®_r^{D*} = 85.5625, ®^{D*} = 256.6875 + Q$.

For a given final output Q, it can be verified that $q_r^{D*} \le q^{ID*}, \pi^{D*} \le \pi^{ID*}$. The decentralized supply chain should be coordinated to achieve the optimal total supply chain profit. To ensure that the retailer's order quantity in the decentralized supply chain equals that in the centralized supply chain, the optimal wholesale price μ^{C*} is (i) when $0 \le Q \le 16.5, \mu^{C*} = 7$;

(ii) when $16.5 \le Q \le 18.5, \mu^{C*} = 40 - 2Q$; (iii) when $18.5 \le Q \le \overline{Q}, \mu^{C*} = 3$.

The retailer's profit is (i) when $0 \le Q \le 16.5, ®_r^C(q) = q(33 - q)$;

(ii) when $16.5 \le Q \le 18.5, ®_r^C(q) = 2qQ$; (iii) when $18.5 \le Q \le \overline{Q}, ®_r^C(q) = q(37 - q)$.

Then the retailer's optimal order quantity is (i) when $0 \le Q \le 16.5, q_r^{C*} = 16.5$;

(ii) when $16.5 \le Q \le 18.5, q_r^{C*} = Q$; (iii) when $18.5 \le Q \le \overline{Q}, q_r^{C*} = 18.5$.

Correspondingly, the maximum supplier profit $®_s^{D*}$, the maximum retailer profit $®_r^{D*}$, and the maximum total profit $®^{D*}$ in the decentralized supply chain are

(i) when $0 \le Q \le 16.5, ®_s^{C*} = 5Q, ®_r^{C*} = 272.25, ®^{C*} = 272.25 + 5Q$;

(ii) when $16.5 \le Q \le 18.5, ®_s^{C*} = Q(38 - 2Q), ®_r^{C*} = Q^2, ®^{C*} = Q(38 - Q)$;

(iii) when $18.5 \le Q \le \overline{Q}, ®_s^{C*} = Q, ®_r^{C*} = 342.25, ®^{C*} = 342.25 + Q$.

It is obvious that $®^{C*} = ®^{ID*}$, and the supply chain is coordinated.

To ensure that the supplier and the retailer both have incentives to accept the coordination contract, the profits of the supplier and the retailer should satisfy $®_s^C \geq ®_s^{D*}, ®_r^C \geq ®_r^{D*}$.

(i) When $0 \leq Q \leq 8.25, ®_s^{D*} \geq ®_s^{C*}, ®_r^{D*} \leq ®_r^{C*}$. In this case, $\underline{F} = ®_s^{D*} - ®_s^{C*} = 136.125$, $\overline{F} = ®_r^{C*} - ®_r^{D*} = 204.1875$ and the retailer should pay the supplier a lump-sum fee $F(\underline{F} \leq F \leq \overline{F})$. The profits of the supplier and the retailer are $®_s^C = ®_s^{C*} + F, ®_r^C = ®_r^{C*} - F$.

(ii) When $8.25 \leq Q \leq 9.25, ®_s^{D*} \geq ®_s^{C*}, ®_r^{D*} \leq ®_r^{C*}$. In this case, $\underline{F} = ®_s^{D*} - ®_s^{C*} = Q(33 - 2Q)$, $\overline{F} = ®_r^{C*} - ®_r^{D*} = 272.25 - Q^2$ and the retailer should pay the supplier a lump-sum fee $F(\underline{F} \leq F \leq \overline{F})$. The profits of the supplier and the retailer are $®_s^C = ®_s^{C*} + F, ®_r^C = ®_r^{C*} - F$.

(iii) When $9.25 \leq Q \leq 16.5, ®_s^{D*} \geq ®_s^{C*}, ®_r^{D*} \leq ®_r^{C*}$. In this case, $\underline{F} = ®_s^{D*} - ®_s^{C*} = 171.125 - 4Q$, $\overline{F} = ®_r^{C*} - ®_r^{D*} = 186.6875$ and the retailer should pay the supplier a lump-sum fee $F(\underline{F} \leq F \leq \overline{F})$. The profits of the supplier and the retailer are $®_s^C = ®_s^{C*} + F, ®_r^C = ®_r^{C*} - F$.

(iv) When $16.5 \leq Q \leq 18.5, ®_s^{D*} \geq ®_s^{C*}, ®_r^{D*} \leq ®_r^{C*}$. In this case, $\underline{F} = ®_s^{D*} - ®_s^{C*} = 171.125 - 37Q + 2Q^2$, $\overline{F} = ®_r^{C*} - ®_r^{D*} = 38Q - Q^2 - 85.5625$. The retailer should pay the supplier a lump-sum fee $F(\underline{F} \leq F \leq \overline{F})$. The profits of the supplier and the retailer are $®_s^C = ®_s^{C*} + F, ®_r^C = ®_r^{C*} - F$.

(v) When $18.5 \leq Q \leq \overline{Q}, ®_s^{D*} \geq ®_s^{C*}, ®_r^{D*} \leq ®_r^{C*}$. In this case, $\underline{F} = ®_s^{D*} - ®_s^{C*} = 171.125$, $\overline{F} = ®_r^{C*} - ®_r^{D*} = 256.6875$ and the retailer should pay the supplier a lump-sum fee $F(\underline{F} \leq F \leq \overline{F})$. The profits of the supplier and the retailer are $®_s^C = ®_s^{C*} + F, ®_r^C = ®_r^{C*} - F$. Then $®_s^C \geq ®_s^{D*}$ and $®_r^C \geq ®_r^{D*}$ is satisfied.

The supplier and the retailer both benefit from the coordination contract and have incentives to accept the contract.

Summary and Conclusions

In this chapter, supply disruptions are introduced in the analysis of a one-supplier-one-retailer fresh agricultural product supply chain. The optimal decisions in the centralized and decentralized supply chain are analyzed. It is found that the retailer's optimal order quantity and the maximum total supply chain profit in the decentralized supply chain are less than that in the centralized supply chain. A two-part tariff contract is proposed. It shows that the supply chain can be coordinated leaving both the supplier and the retailer better off with a two-part tariff contract.

The aim of the paper is to develop a supply chain coordination scheme for adjusting the sale plan after supply disruptions occur, rather than making decisions considering all possible uncertainties in the planning stage. Of course, formulating a good plan based on certain probability assumptions is important, but, realistically, it is not possible for the decision-maker to anticipate all contingencies. In practice, for most agricultural products, the final output cannot be estimated precisely, so providing guidance for adjusting a predetermined plan can be as important as making the plan itself.

In the study, one-supplier-one-retailer fresh agricultural product supply chain is studied. There are abundant opportunities for research on extensions ranging from multiple suppliers, multiple periods, and longer supply chains.

Chapter - 9

Summary, Conclusion and Policy Implications

The enormous losses of fruits and vegetables produced in the country are mainly because of the lack of proper infrastructure for storage and transportation under controlled conditions. Of late, Supply Chain is gaining importance due to globalization. A supply chain is a set of three or more organizations linked directly by one or more of the upstream or downstream flows of products, services, finances, and information from a source to a customer.

The supply-chain — a term now commonly used internationally — encompasses every effort involved in producing and delivering a final product or service, from the *supplier's supplier* to the *customer's customer*. Earlier, manufacturers were the drivers of the supply-chain — managing the pace at which products were manufactured and distributed. Today, customers are calling the shots, and manufacturers are scrambling to meet customer demands for options / styles / features, quick order fulfillment, and fast delivery.

Since the stake for the different players is extremely high making it imperative for the partners - including suppliers, manufacturers, distributors and customers behave as if they are part of the same company. Thus scope of supply chain management is vast.

Organizations increasingly find that they must rely on effective supply chains, or networks, to compete in the global market and networked economy. In Peter Drucker's (1998) new management paradigms, this concept of business relationships extends beyond traditional enterprise boundaries and seeks to organize entire business processes throughout a value chain of multiple companies.

During the past decades, globalization, outsourcing and information technology have enabled many organizations, such as Dell and Hewlett Packard, to successfully operate solid collaborative supply networks in which each specialized business partner focuses on only a few key strategic activities. This inter-organizational supply

network can be acknowledged as a new form of organization. However, with the complicated interactions among the players, the network structure fits neither "market" nor "hierarchy" categories (Powell, 1990). It is not clear what kind of performance impacts different supply network structures could have on firms, and little is known about the coordination conditions and trade-offs that may exist among the players. From a systems perspective, a complex network structure can be decomposed into individual component firms. Traditionally, companies in a supply network concentrate on the inputs and outputs of the processes, with little concern for the internal management working of other individual players. Therefore, the choice of an internal management control structure is known to impact local firm performance.

In the 21st century, changes in the business environment have contributed to the development of supply chain networks. First, as an outcome of globalization and the proliferation of multinational companies, joint ventures, strategic alliances and business partnerships, significant success factors were identified, complementing the earlier "Just-In-Time", "Lean Manufacturing" and "Agile Manufacturing" practices. Second, technological changes, particularly the dramatic fall in information communication costs, which are a significant component of transaction costs, have led to changes in coordination among the members of the supply chain network.

Many researchers have recognized these kinds of supply network structures as a new organization form, using terms such as "Keiretsu", "Extended Enterprise", "Virtual Corporation", "Global Production Network", and "Next Generation Manufacturing System". In general, such a structure can be defined as "a group of semi-independent organizations, each with their capabilities, which collaborate in ever-changing constellations to serve one or more markets in order to achieve some business goal specific to that collaboration".

Bangladesh is basically an agriculture based country and a large proportion of the population formally and informally depends on this sector. Besides official unemployment, disguised unemployment creates real problem for the country. Under the global village, food is becoming scarce and prospects of agribusiness are increasing gradually. Agribusiness can be defined as the business activities related to the agricultural product which will add value, create synergy in the production process, import-export of agricultural products and redistribution of the product

starting from the wholesaler to retailers and ultimately consumers can be able to get the products. As such strategic management of agribusiness is required so that core competencies can be created and proper supply chain management along with vertical and horizontal coordination is being required.

Human life (physical, mental and spiritual) is immensely influenced by the quantity and quality of food consumed. As the saying goes, "a man is what he eats." Several studies have linked the physical and behavioral traits of the people of specific geographical locations to the composition of food and water available to them (Baker 2009).

One of the most important requirements for ensuring healthy population on this planet is to provide quality food in sufficient quantity. Not only should food meet the gross energy requirements of human body, there should be a proper balance of major, micro and trace nutrients to ensure complete human development.

Poor nutrition contributes to 1 out of 2 deaths (53%) associated with infectious diseases among children aged under five in developing countries. Iron deficiency with its attendant anemia is the most prevalent micronutrient disorder on a worldwide basis. All forms of malnutrition's broad spectrum are associated with significant morbidity, mortality, and economic costs, particularly in countries where both under- and over nutrition co-exist as seen in developing countries undergoing rapid transition in nutrition and life-style. In today's world, food must be wholesome sand safe for human consumption. Wholesome food availability obviates a large number of ailments and disorders leading to better quality of life and reduced expenditure on health care. It is not surprising; therefore, that food safety and quality concerns are increasingly evident today among producers, processors, marketers, regulators and consumers alike.

Fruits are an integral part of food needed to meet the mineral requirements of human body and to strengthen body defense mechanisms against various biotic and abiotic stresses. On average, fruits have been contributing to about 4% to human nutrition. Fruits consumed as fresh or in processed form have shown specific health benefits. Increased awareness about the health-related benefits of fruits consumption is leading

to increased trade in fruits, especially, driven by the consumers of developed countries.

There was a double-digit growth in the export of mangos and avocados, while the overall fruit exports grew at 4.2%. While several southern hemisphere and banana exporting countries have been quick to take advantage of the growing fruit grade, the same does not hold good for the countries of Asia. In fact, among the top thirty exporters of fruits in the world, only three (Thailand, China and the Philippines) stand out from Asia.

Asia is the cradle of human civilization and domestication of crops and animals, which began first on the continent. It is, therefore, expected that the whole range of temperate and tropical fruits are grown in Asia. Asian tropical fruits such as durian, mango, pomegranate, guava and starfruit have their unique traits in the world of fruits. Asia takes some 44% of the total fruit producing area in the world and contributes about 42% to the total world fruit production, with the largest and the second largest fruit producers located on this countries, a brief description of the major Asian fruits is included in Annex to provide the reader a flavor of these unique creations of Mother Nature.

In spite of the natural advantages that the Asian fruits have in terms of variety, production scale and nutrition, the export volume of the fruit is rather low. Therefore, while there appears to be an ample scope for increasing the intra-Asia and inter-continental trade in Asian fruits, it is important to understand the constraints in tapping the trade potential. This trade will not only provide more income for farmers in the Asian and Pacific countries, but also offer greater variety and associated health benefits to the world consumers.

Bangladesh is an agro-based country. In rural areas, most of the people depend on the agriculture. More than 80% of people living on less than $2 a day in Bangladesh live in rural areas. The spatial distribution of poverty makes capitalizing on these opportunities is fraught with challenges. The demand for food in Bangladesh and around the world is changing rapidly.

Driven by economic growth, rising incomes, and urbanization, demand is shifting away from traditional staples toward high-value food commodities. High-value agricultural commodities include fruits, vegetable, spices, fish, and livestock products, many of them are processed before reaching the markets.

In Bangladesh, additional demand for these commodities is projected to be worth about 8 billion dollar by 2020. This represents an enormous opportunity for food producers, processors, and sellers. Owing to the greater labor intensity characteristic of high value agricultural production, it also provides an opportunity to generate rural employment and raise rural incomes.

The aim of the research is to study the agriculture supply chain of three commodities (potato, poultry and turkey firm) in Bangladesh and measuring their efficiency and constraints. The study proposes a model of supply chain.

The study investigates following aspects:

1. Recent changes in agricultural commodities in Bangladesh.
2. Existing marketing and supply chain processes of three commodities.
3. Efficiency and constraints in agricultural supply chain, and
4. Proposed a model of efficient supply chain in agricultural commodities.

The research follows the mixed method. The primary data were collected by two methods, First, by visiting grower's garden and wholesale market, in addition to field observations, second, gathering information through questionnaire use of purposive sample sampling technique.

For the data analysis, both qualitative and quantitative approaches were used. Appropriate statistical techniques were carried out to assess the marketing channel efficiency condition of the products and supply chain efficiency and constraints that face three agricultural products namely Potato, Turkey Cock and Poultry.

The overarching goal of the study is to promote an effective agricultural logistics system, by the development of models for localization analysis and delivery strategies

for a lean material flow, and by identifying possibilities for intermodal transport and route optimization, for improving the economic competitiveness and reducing the environmental impact of the agricultural sector in Bangladesh

While many economists think agriculture is the main pillar of the economy, many do not know how the whole process from producers to consumers works in the sector. Supply chain plays a pivotal role in the process although it is not widely recognized as such. Experts say a country's food security is largely dependent on proper supply chain management in the agricultural sector. There are many challenges to be addressed in the sector for introducing good supply chain management in Bangladesh. Prior to the liberation war in 1971, Bangladesh economy was fully driven by agriculture. After the war, the country focused on the growth of the services and manufacturing sectors. Although the services sector is dominating the economic activities now, still a huge working force is engaged in the agriculture sector that contributes nearly 16 percent to the national economy.

Effective agriculture supply chain management is a key factor to ensuring efficiency and productivity as a high number of workers are involved in the process. Proper production plan, quality seed and other inputs, efficient marketing and proper logistics can ensure food security and make Bangladesh a self-sufficient nation.

Supply chain management is a system of organizations, people, technology, activities, information and resources involved in moving a product or service from a supplier to a customer. It is a combination of strategic and operational function of planning, sourcing, production and logistic activities. Food crop supply chain starts with the strategic planning of crop production. This plan can be based on crop rotation, demand, storage capacity, input availability and quality production. Apparently the growers are rather inefficient in planning due to inadequate information availability or a lack of access to information and cooperation from different agencies that are engaged in the agriculture sector at the field level.

We need to present a clear picture to the grower through all media and relevant organizations about the demand and supply situation of the country.” To make it happen, the whole country needs to be divided into zones or districts or upzilas. The agriculture field officers posted at the Thana level can be the key agents or the

managers of a successful agriculture supply chain. They can change the agricultural scenario of the country by increasing the productivity through proper planning, ensuring timely input distribution, supervision of production and helping farmers with market information.

The country's agro sector is also facing a couple of challenges that need to be resolved to ensure food security. These challenges mainly lie in appropriate planning and efficient execution. Right planning, coordination with the government and non-government agencies at the field level and availability of agro inputs in the world market are the major challenges to manage the agro supply chains efficiently. Supply chain efficiency in the agriculture sector is essential because it will ensure food security and the right price of foods to the end consumers. The major challenge in agro supply efficiency is proper planning, considering all driving factors and availability of resources including human.

In the context of our country, most of the challenges are in planning and execution of the supply chain. In some cases we have a nice plan but poor execution and vice versa." The availability of agriculture inputs -- seeds, fertilizer, pesticide and irrigation -- is a big challenge for the growers because interruption in supply chain delays the delivery of inputs to the growers. As a result, production of crop is hampered, as our production is wholly natural and season dependent. To ensure proper distribution, the country needs to remove the unnecessary middlemen who are involved in the distribution process without adding any value to the end-consumers. Timely supply of quality inputs can be met with joint efforts of the public-private sectors. The government should increase its allocation and improve supply of quality seed, fertilizer and safe pesticide."

To encourage private initiatives the investment climate in agro business such as government regulations, taxation policy and import-export guidelines must be made friendly. Constraint on storage facility at pre and post harvest period is another challenge for production, resulting in high wastage and a significantly high cost of production. We should decentralize the storage facilities and ensure smooth supply of agro inputs because these are vital for minimizing loss and wastage and preventing price hike.

This study establishes a relationship between Supply Chain performances and the process of diffusion of practices among firms, thus opening an avenue of no-cost improvement of suppliers, on the lines of buyers. An extensive literature survey is undertaken which forms a basis of an ongoing empirical research on the subject. Scientific study on Supply Chain is little in Bangladesh. This study is an attempt to fill this gap.

What opportunities and challenges are present or likely to arise for agriculture supply chain in Bangladesh as demand grows for agricultural commodities and as agricultural production changes in response?

The focus of this study is to discuss mainly the supply chain process of selected agricultural commodities in Bangladesh. The information collected are mainly from the primary sources. Various publications, books etc were used as the secondary sources of information. Primary data was collected by using self-administered questionnaire. The sample elements were the farmers in the selected areas who produce agricultural commodities. The study utilizes convenient sampling techniques.

Sampling plan and sample size

1) Target Population: Farmers and Middlemen constitute the target population.
2) Sampling Frame: Standardized sampling frame is not available as the supply chain of agriculture commodities in Bangladesh is not organized.
3) Sampling Unit: Mainly the farmers and intermediaries.
4) Study area: The study is located in those areas where agricultural commodities are produced commercially. This is selected from Bangladesh agricultural census, conducted by the BBS.
5) Sampling technique: non-probability, mainly the convenience sampling technique is used.
6) Sample size: appropriate proportional sample from each of the three broad sample categories were selected applying the formula of proportional sample size determination.

7) Focused commodities: study assesses three categories of agricultural products which include Poultry, Turkey cock and Potato.
8) Data analysis: All relevant non-parametric testes were conducted to arrive any meaningful conclusion of the study.

During the last four decades Bangladesh has witnessed a great many changes in the patterns of production, consumption and trade in agriculture. One is the shift in the pattern of production and consumption from granular and other starchy staple crops to higher value agricultural produce such as meat, milk, eggs, fish, fruits and vegetables. Another is the burgeoning modem agricultural marketing outlets including the expansion of processing, large-scale retail outlets (e.g. supermarkets), and food services industries (e.g. restaurants), all of which create a need for multiple forms of vertical coordination.

It is imperative to understand the implications of these changes on poverty in order to formulate appropriate policies, but tracking the manifold effects of these drifts on households is not a simple task. Both the trends offer new opportunities as well as challenges for farmers and trade bodies, but the real impact on poverty hinges on many other details. Are poor farmers able to respond to these fast-growing markets? How can one quantify the employment generated in agricultural production and processing? How labor-intensive are contemporary marketing outlets compared to traditional ones? And how much is the impact of retail consolidation on conventional traders and consumers?

The debate on these issues has been hindered by the lack of a comprehensive conceptual chain of events that describes the various processes by which these trends affect the poor households. Most of the studies of the effect of high-value agriculture and the modernization of food marketing chains in the developing countries have been descriptive or have emphasized on the impact on one type of household. For example, studies of high-value agriculture often centers round on the effect on households as agricultural producers with less emphasis on the impact on households as wage-earners or consumers. Similarly, some studies of retail consolidation have explored the one-sided impact on small-scale retailers excluding the impact on consumers.

What are the types and dimension of the shift in agricultural production and food consumption toward agriculture? In what ways are food trading outlets in developing countries becoming more “modern”? And what is the proof to date regarding the effect on poverty? The address of these questions are the objects of this study with special emphasis on supply chain management.

The primary driving force behind the shift toward agriculture is the rising income although changes in lifestyle with speedy urbanization and changes in the demographic structure have also contributed notably. As incomes rise the share of the budget earmarked for food tends to decline, but the composition of the food budget also changes commensurably. Households allocate a smaller share of the food budget to cereal and other starchy staples and a greater share to meat, milk, fish, fruits, vegetables, processed and prepared foods. Thus, income growth leads to palatable substitution away from grains and lentils toward high-value agricultural produce.

Since 1992, the global per capita income growth had been 1.85% per year, higher than in any decade since the 1960s. However, per capita income rise has differed substantially over time and across the regions. Since 1992, per capita income had grown at an average rate of over 5% per annum in East and Southeast Asia and at over 3% per annum in South Asia. The per capita income growth over the same period in sub-Saharan Africa, Latin America and the Caribbean, the Middle East and North Africa has been markedly slower (0.4% to 0.8% per year), but admirably faster than in the 1980s.

Alongside the economic growth, there has been a continuous momentum on urbanization as well particularly in the developing countries. Urbanization alters diets simply because the urban consumers purchase a greater share of their food (rather than growing it), also urban consumers face have a broad range of foods to choose from and because urbanization has integrated women's participation in the workforce reducing the time available for cooking food . Globally, the number of the population living in urban areas has jumped from about one-third (33%) in 1960 to almost half (49%) in 2014. In the developing countries, the urban stake is smaller but growing more quicker than in the industrialized countries.

Economic growth, demographic changes and urbanization have together stimulated diversification in food consumption menus. The changing pattern is corroborated by the higher growth in per capita consumption of high-value foods relative to grains and pulses in most developing countries.

The agricultural production patterns have favorably responded to the shift in food consumption that has surfaced over the past few decades. An increasing swath of the arable and permanent land is being used for vegetable and fruit production.

Furthermore, most of this increase is taking shape in developing countries. The proportion of the arable land used for vegetable and fruit cultivation has remained static in the developed countries, but has augmented markedly in most developing countries including Bangladesh.

Since 1971, global export of agri-products have grown at an annual rate of 3.0% in real terms, on average, whereas agricultural production has grown at 0.7% per annum. The resultant share of agricultural production that is exported has notably doubled rising from 19% in 1971 to 40% in 2013. The composition of agricultural exports has accordingly changed as well. The surge in processed agricultural exports relative to primary products points to two trends. First, as mentioned above, as incomes rise the share of food budgets spent on processed food products rises increasingly. Second, some processing jobs are being entrusted with the exporters in developing countries to take the benefit of lower wages.

The steady growth in the share of agricultural exports encompasses almost all commodity categories. The exceptions to this pattern are fruits and vegetables: both primary and processed fruits and vegetables have increased their share of world agricultural exports over this period, but growth in fresh fruit and vegetable exports picking up higher stake. This reflects both consumer inclination to pay more for fresh produce as well as improvements in transportation and logistics.

Another trend is the shift in the composition of agricultural commodities for exports. Not surprisingly, export of grain and cereals have fallen drastically as a proportion of the total value of agricultural trade declining from 15% in the 1960s to a paltry 8% in

the 1990s. During the corresponding time, exports of higher-value agricultural products such as fruits and vegetables, meat, dairy products, eggs, fish and seafood have strengthened from 29% to 42% of the total over the same period. The share of fish and seafood, in particular, has more than doubled from less than 5% to over 13% of world agricultural trade.

Livestock and livestock products represent about one-seventh of the total agricultural trade, but the share is progressively growing over time. Developed nations continue to account for the bulk of world trade. Import of livestock and livestock products by developing countries is increasing with the rise being more prominent for dairy products and meat. World dairy trade is small relative to the production, mainly due to highly perishable nature of the products. Exports of dairy products are dominated by processed items like cheese and milk powder. Even though India is one of the biggest milk producers in the world international trade in dairy products is dominated by middle- and high-income countries.

Worldwide export of fisheries meant for human consumption has grown more than six folds since the mid 1970s to approximately US$ 60 billion by 2012. China has recently emerged as the world's top exporter of fish overtaking Thailand. The main impetus to this faster increase resulted from local and foreign investment in fish processing and attaining the ability to meet quality and food safety standards in high profile developed countries.

One aspect of the modernization of food marketing channels is the setup of large-scale retail outlets which include supermarkets and hypermarkets. It is obvious, however, that supermarkets and other modem retailing outlets are growing rapidly in most developing countries. Among the developing countries, the share of the retail food market is the highest in middle-income countries such as Brazil, Argentina and Thailand and the lowest in low-income Asian countries such as Bangladesh and Vietnam. Finally, these supermarket chains- are also gradually spreading their presence beyond bigger urban centers.

The Supermarkets have the quality to handle processed foods and fresh products with a longer shelf life, but they have to face difficulties in handling leafy vegetables and other perishable produce. In Bangladesh, the supermarkets appear to have a small

share of the market in the fresh fruit and vegetable segment but have been able to consolidate their market share in the processed food items.

The consolidation of retail mega shops has manifold implications for the rest of the food supply chain. The most obvious effect is the displacement of small-scale vendors. Depending on the dimension and pace of growth of the supermarket outlets this may mean slowdown in growth or actual shrinking of the traditional poor retailers. Second, the larger supermarket chains often entrench dedicated distribution outlets bypassing the food wholesalers. Third, for uninterrupted and a steady supply of high-quality and safer agricultural products particularly the perishable ones the supermarket chains often establish preferential supplier relationships with the selected farmers or traders. These trade relationships involve a passage from spot markets to more vertically coordinated markets.

There is a widespread apprehension that small farmers will be debarred from these channels because of the high-transaction costs of monitoring and collecting produce from many small growers Finally, the multinational supermarket chains resort to international sourcing exposing local farmers to crippling competition from the suppliers and from other origins but also providing a passage by which local farmers may supply stores in other countries.

Multiple institutional arrangements have been work out to link the farmers with the emerging modern marketing channels in Bangladesh. The supermarkets and the processors operating at lofty scale and often catering to high-pitched markets need to secure their supply lines by maintaining quality and quantity of inputs or supplies. This pressing need has made the link-up with the farmers an imperative. Contract farming, for example, between the downstream firm and the local suppliers are becoming increasingly a common phenomenon. Our study found that, in the newly formed linkages between the supermarkets and the farmers, there is positive indication that small producers can fruitfully join the supply chains to the supermarkets in a manner that boosts their livelihood.

In addition, there has been a marked shift in the consumption trend towards more value-added products. The heightened value addition has occurred on two counts.

First, there is more sorting, processing and packaging to cater to the need for year-round supply and consumption of seasonal products, ready-to-cook and ready-to-eat products with reassured quality and food safety. Furthermore, there is more value addition in the retail and food service industries to create a more convenient and catchy experience for the consumer. Supermarkets, for example, have transited from a food store to a place where one can purchase a multiple services under one roof, thereby multiplying the convenience of one-stop shopping.

Rising per capita income and the ever increasing share of the population living in urban areas are altering the composition of food demand. The families are bringing variety to their diets away from grains and other staple foods into meat, dairy products, fish, fruits and vegetables. In addition, the share of processed food and food eaten outside the house is on the rise. These shifts in demand are manifested in the growing emphasis on high-value agriculture in production and international trade. For example, the value of fruit and vegetable exports from developing countries now outstrip the combined export value of coffee, tea, cocoa, tobacco and cotton.

In parallel to the changes in the composition of agricultural production and consumption is a transfiguration of agricultural marketing outlets. First, the importance of supermarkets is on the faster growth track and they now poised for a large share of food bought in lower-middle and upper-middle income developing regions. This trend is powered by rising incomes, urbanization and external investment in the retail sector. Second, the food services industry including restaurants and fast-food outlets is growing quickly in response to many of the similar trends. Third, the food processing industry is responding to the surging demand for processed food. We have shown that the contribution of food processing to the agri-food system grows from less than one-quarter when per capita GDP is US$ 900 to about one-half when it is US$ 10,000.

Agro-food processing firms (and manufacturing firms in general) in Bangladesh have consistently rated electricity outages as their most serious constraint in Investment Climate Surveys conducted between 2002 and 2005. The unreliable provision of electricity is a national problem and not restricted to only agriculture or agro-business, yet it severely compromises prospects for growth in these sectors which would greatly

benefit from its resolution. The decision for plantation made by farmers and investment and business operation decisions made by the processors are unjustifiably affected by worries over the likelihood of rising electricity costs or service disruptions.

Improvements in market infrastructure are also desirable. The development of efficient and competitive markets is a catalyst for promoting growth in strong supply chain in agriculture. While Bangladesh has quite a high density of markets-of its 16,476 markets 2,050 are marked out as growth centers and 392 are "notified" markets -many markets need significant improvements in infrastructure to grapple with highly perishable fruit, vegetable, fish, and animal produce. A large part of the problem seems to arise from how markets are managed. Responsibilities for day-to-day market operations, fee collection and infrastructure development are split among different individual entities.

The technical skills and knowledge required to produce and manage high-value agricultural products need to be improved. University curricula needs upgrading and training programs should be developed to improve the pool of skilled technicians and extension agents available to farmers and enterprises. Training Bangladeshi technicians will be critical for the sustainability of this industry. Similarly the lack of qualified technicians in the poultry sector is a major drawback in terms of delivering effective advisory services to SMEs. Investments in farmers' training systems are also needed in the greater interest of highly productive agriculture.

Farmers require continued assistance to reduce the informal subjection to extortion and tolls against fresh produce while it is being transported from farm to market. The enhanced costs that such tolls impose are ultimately shared by the final consumers as well as the farmers and they disadvantage both the parties. A continued effort should also be made to reduce informal tolls for routine handling of export consignment through the Port of Chittagong and Hazrat Shahjalal International Airport. Like informal road extortions these illicit payments serve as a hurdle on export growth; they reduce farmers' incomes and consumers' welfare.

Models must be developed for joint public and private financing and management of research institutions to conduct research with practical applications on topics important to producers and enterprises engaged in high-value agriculture and relevant agro-business.

The extension system also needs to be reoriented to better develop and disseminate technology related to high-value agricultural commodities and in assisting farmers identify market opportunities. There is a lack of reliable agricultural and industry data on most high-value agricultural commodities which is a major constraint and requires immediate attention to provide credible information for formulating policy. Benchmarking costs and productivity along the value chain will provide an important tool for assessing competitiveness and addressing bottlenecks.

The best practices related to value chains within Bangladesh need to be identified, documented and scaled up. There are many innovative approaches that have been piloted and refined, but knowledge of successful interventions is not widely disseminated and therefore rarely scaled up.

Contract farming is on rapid pervasion in Bangladesh which now has set many examples of well-accomplished contract farming arrangements. Contract farming-in which producers enter into forward agreements, sometimes at a predetermined price, to produce and supply agricultural commodities in return for production support (such as technical advice, inputs, or finance) from the purchaser (processors, retailers, or exporters)-is an increasingly important institutional catalyst for the growth of high-value agriculture and relevant agro-business. The vertical coordination between growers and purchasers becomes indispensably valuable for high-value agricultural products as it may ward off the high transaction costs and the accompanying risks. In a production process where quality control is particularly important contract farming enables processors, exporters, and retailers to supply quality inputs, ensure adherence to codes of practice, and ultimately procure either raw materials for production or finished product for export/domestic retail that conform to specific requirements.
Contract farming also offers small-scale producers an opportunity to remain glued to agriculture. Contract farming can cut short the number of intermediaries, wastage, transaction costs, and unnecessary market risks. Contract farming schemes are

associated with significant improvements in farmer productivity, less fluctuation in returns (in comparison with those received by noncontract farmers), and credit for smallholders. Gulati et at. reported that contract farmers attain higher net returns than noncontract farmers because both production and marketing costs are lower. The share of marketing cost in total cost for noncontract farmers was 20 percent for milk and 21 percent for vegetables, but only 2 percent in both cases for contract farmers.

Despite contract farming's numerous advantages the enforcement capability of contracts poses a challenge in Bangladesh where breach of contract is liberally common among producers and purchasers alike. Other countries have set in place legal and regulatory mechanisms to address contract enforcement related issues and it would be useful to conduct a careful review of contract farming arrangements in Bangladesh to better understand how contracts currently safeguard the interests of the parties and to minimize the scope for anticompetitive and abusive practices. Ultimately, the best way of improving contract enforcement is to build trust, although this may take time. Innovative contract specifications and self-enforcing contracts that include flexible conditions to anticipate market changes could mitigate the problem. The public sector can help by building capacity in contract design and developing a contract design knowledge base that draws public lessons from the individual experiences of firms. Strengthening producer organizations may also help enforce contracts on the farmers' side, and alternative dispute resolution institutions (such as industry associations) can also play an important role.

Building capacity for market research, developing market information systems and strengthening market-related know-how is vital for farmers, traders, processors and exporters involved in supply chain related agro-business. There is a need to incorporate appropriate technology (such as radio broadcasts and SMS messages via cell phones) to provide farmers and their marketing agents with real-time information on market prices and volumes for the range of domestic markets where high-value agricultural products are sold.

Long-term technical support through NGOs and other agencies would help to build and strengthen producer organizations. Such organizations give small-scale farmers a platform to conduct business with large input suppliers, traders, processors and

retailers. As a group, small-scale producers can achieve economies of scale in buying the inputs and selling the products. They can pool resources to undertake activities that would not be feasible to pursue individually and they can provide easier contact points for support services, share risks, facilitate learning and provide social support in times of crisis.

In this study we observed that supply chain of three agricultural commodities are traditional, unorganized and most inefficient. This is mainly due to the fact that entire supply chain process is controlled by the intermediaries. Growers have no voices on the distribution process. Poor infrastructure, unhygienic environment, lack of conscious on organic food of the customers, huge transportation costs, inadequate warehouse/cold storages, subscriptions in every distribution stages, unplanned demand estimation, lack of necessary logistics, lack of appropriate government policies and timely intervention of the government are the major causes of inefficiency in the existing supply chain of most of the agricultural commodities as viewed by the farmers.

The opinions of the intermediaries on the existing distribution channel are traditional which include lack of transportation, high transportation cost, tolls in every sphere, seasonal variation of production, adverse weather condition, excessive operating cost in storage and business syndicate are the important causes of inefficiency in the present distribution system. Proposed model can minimize to a lesser extent these anomalies subject to further empirical evidences.

Further research may be conducted on fruits, vegetables and high-valued agricultural commodities" supply chain process with large sample size.

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