



Agro Based Industries of Bangladesh, Challenges and Opportunities- A Way Forward

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ABSTRACT

Agro-based industries play a pivotal role in the economic development of Bangladesh, leveraging the country's rich agricultural resources. However, these industries face significant challenges, including inadequate infrastructure, limited access to financing, technological gaps, and vulnerability to climate change. Despite these hurdles, there are substantial opportunities for growth, such as the increasing demand for processed foods, the potential for export expansion, and the rise of organic and sustainable farming practices. To navigate these challenges and capitalize on opportunities, a multi-faceted approach is essential. Strategies should focus on enhancing value addition through food processing, investing in research and development, and promoting sustainable agricultural practices. Strengthening market access and improving infrastructure will enable better distribution and reduce post-harvest losses. Additionally, fostering public-private partnerships and providing financial support to farmers and entrepreneurs can stimulate innovation and investment in the sector. In conclusion, by addressing existing challenges and leveraging emerging opportunities, Bangladesh can significantly enhance its agro-based industries, contributing to economic growth, job creation, and improved food security. The way forward lies in collaborative efforts among government, private sectors, and communities to build a resilient and sustainable agro-based economy.

Keywords: Agro-based industries, Agriculture, Economy, Government, BRAC,

Introduction

1. Bangladesh is one of the promising agro based countries in the Southeast Asian region. Despite having millions of population beyond the capacity of the size of land she has made great progress and achievements in the field of production of food. Today Agriculture is the most promising sector in Bangladesh. In addition she has made moderate progress in diversifying agriculture by expansion into higher value added products, combining with technology. For example, most part of the population is engaged in production of one or more types of fruits, vegetables, poultry, dairy and fishery. Though significant development has taken place in food and agricultural sector, yet Bangladesh is not self-sufficient in these fields. Government of Bangladesh has given a lot of emphasis on the issue but no national level or countrywide agro industrialization programmed is undertaken yet. Development thinkers have suggested that technology based industrialization has been the single most important source of development and growth in the agro based industries in Bangladesh. Technology-based development involves participation of all levels of planning and implementation agencies. Inability to identify right technology and apply it in productive activities is a major cause for the slow progress of developing countries. Bangladesh is now within first 10 developing countries of the world. Considering the widely diverging characteristics of technologies used in different development programmers it may be necessary at the first step to consider Sector-Based Technology Policy and Technology Plan.

2. Agriculture is the main occupation of the people employing 68.5% of the labour force. This sector directly contributes around 25% to the Gross Domestic Products (GDP). Bangladesh has got one of the most fertile lands but due to paucity of capital and lack of knowledge of new inputs and techniques, its yield per acre is one of the lowest in the world. Rice, wheat, jute, sugarcane, tobacco, oilseeds, pulses and potatoes are the principal crops. Various kinds of vegetables and spices are also produced here. The country produces about 51 million kg of tea per year, a sizeable quantity of which is exported to foreign markets after meeting the internal demand. Bangladesh produces about 1057 thousand metric tons of superior quality jute annually and 16% of the export earning come from raw-jute manufactures. Among the fruits and nuts grown in Bangladesh bananas, papayas, pineapples, mangoes, jackfruits, guavas, plums and coconuts are important. Coconuts, bananas, and papayas are grown and available throughout the year, others are seasonal.

3. In agro-economy, fisheries and livestock also play an important role in Bangladesh. Fisheries sub-sector accounts for about 9% of agricultural GDP and contribute about 60% of the nation's protein intake. About 6% of total export earning comes from fishery sector. It also provides full time employment to approximately 1.2 million people and also generates part time employment for some 11 million people. Leather, wool etcetera (etc.) also render significant contribution to earn foreign currency. Livestock sub-sector accounts for about 3.12% GDP in 2004-2005 financial years. However there are many impediments for the development of agro-industrialization. There is no concrete national policy on agro-industry development in Bangladesh. Although Bangladesh can produce a lot of crops but most of those crops are for fresh consumption, not aimed at processing. Lack of

infrastructure development and expertise also contributed to agro-based industry negatively. Recent government emphasis may be helpful for Bangladesh in developing agro based industrialization.

4. In this paper the context will be limited within the role of agriculture in the economy of Bangladesh, agro products for industrialization, potential of agro based industries and suggested development sectors of agro based industries in Bangladesh.

Agriculture in the Economy of Bangladesh- An Overview

5. Agriculture is the principal source of income and livelihood of the vast majority of the population, employing approximately 65% of the labour force in Bangladesh. 57% of the labour force is engaged in the crops sector, which represents about 78% of the value added in the agricultural sector. The share of agriculture in GDP has fallen from around 57% in the 1970s to 25% in recent years, but is still the largest in the economic sector. It is also the source of many of the small industrial sector's raw materials; such as jute, and accounts for 32% of the value of exports. In short, agriculture is the driving force behind economic growth in Bangladesh. As a result, increasing food and agricultural production have always been major concerns form Bangladeshi policy-makers. Within the crop sector (rice, wheat, pulses and jute), rice dominates, with an average 71% share of the gross output value of all crops. So, growth in the agricultural sector essentially mirrors the performance of rice production, although the share of livestock and fisheries has increased steadily in recent years to 22% of the value added in agriculture.

6. Bangladesh is the world's leading exporter of raw jute and its products, including carpet backing, twine and sacking. It accounts for as much as 25% of world jute production, 85% of world jute fiber exports and 44% to 55% of exports of jute manufactures. The fiber's prominence in agriculture, as well as in the economy of Bangladesh, slipped during the 1970s and 1980s as world demand fell as a result of competition from synthetic substitutes. Consequently, the jute industry, which contributed 54% of total export earnings in 1984/85, accounted for only 11% a decade later. Overtaking jute in 1987/88 as an export earner, the garments industry has emerged as the country's most important export sector. Garment exports comprised 57% of export earnings in 2004/2005 up from 11% a decade earlier. Since garments exports require corresponding imports of other items, such as fabrics, yarn and buttons, the net benefit of the garments industry to export earnings in 2004/2005 was, however, only 29% of the Sector's gross export earnings. There are clear indications that the industry is beginning to lose momentum and speculations are that pressures on the industry are likely to intensify as countries such as China and Vietnam developed their garments industries. The recent unrest in the garments sectors has alarmed the policy matters not to be too much dependent on this sector. However with the beginning of the world free trade economy the fear of losing the buyers of Europe could overcome with the bold and swift action taken by the exporters and manufactures.

7. Foreign currency income from fish and fish products, particularly shrimp, are also sizeable followed by the leather industry. Natural gas production is of increasing importance. Its major product, urea fertilizer, has been more than doubled in output in the last decade and the country now exports fertilizer, mainly to neighbouring Asian countries. Within the agricultural sector, tea follows jute as an important cash crop and export product.

8. The agricultural sector in Bangladesh clearly has major potential for contributing to overall GDP growth and poverty alleviation, especially considering that 62% of household income is spent on food. However, increasing rice production is not enough. Bangladesh is now entering a new challenging phase of agricultural development; as has been seen, the opportunities and constraints facing the agricultural sector over the coming years are different from those of the past two decades.

9. The food self-sufficiency objective must be viewed in terms of compatibility with other needs of the people and the economy, including foreign trade. It is time for a departure from rice-led growth to a more diversified production base that includes several non-rice crops, such as vegetables, fruits and horticulture fields. The diversification of agriculture, based on a better exploitation of international markets, is essential for broad-based growth in agriculture. Agricultural research and the identification of comparative advantages of agricultural products have to be re-examined in light of the need for diversification.

Agro Products for Industrialisation

10. **General.** The primary function of an agro-based industry is to process an agricultural product for prolonged use or value addition for marketing. Agricultural industries are needed for the expansion of agro business. Primary agricultural products in their original states have less of demand. Marketing in the present complex societies is an art, which needs careful observation and study of consumer psychology. Value addition to agro-products, and service industry based on agriculture may create many job opportunities in an over populated country like Bangladesh. As development of advanced industries will attract people from primary industries, thus advanced industries will create many job opportunities. On the other hand, shortages of manpower in primary industry will lead cultivation towards mechanization and significantly increase production. Thus, production cost will be reduced automatically. Industries in Bangladesh in the past were established basically keeping an eye on agriculture; such as sugar, jute, tea, shrimp processing, and machine tools etc. However, government owned these industries, but could not perform well due to many reasons.

11. **Present Agro-Based Industries in Bangladesh.** In Bangladesh the biggest industries for agriculture are fertilizer production and power pump manufacturing. Which are not considered as agro-based industries here. Anyway, Country Bangladesh has following agro-based industries;

11.1. **Fisheries.** Shrimp processing, ice factory, salted-dehydrated dry fish, fish and shrimp feeds, fishmeal manufacturing, shrimp hatchery and fish hatchery.

- 11.2. **Fruits and Grains.** Fruit juice, jam and jelly, pickles, paste, frozen vegetables, flour, baking & dairy, rice mills, corn processing.
- 11.3. **Livestock.** Hide and skin, bone meal. Ice cream, cheese, butter, yogurt and sweets, hatchery, chicken processing and chicken feeds, feather processing.
- 11.4. **Fiber.** Jute mills, cotton mills, carpets.
- 11.5. **Tobacco.** Leaf processing, traditional and modern cigarettes.
- 11.6. **Tea.** Leaf processing, packaging.
- 11.7. **Sugarcane.** Sugar, molasses processing.
- 11.8. **Edible Oils.** Mustard oil, groundnut oil, coconut oil, oil cakes, crude palm & soybean oil processing and packaging.
- 11.9. **Spices.** Powder and paste.

Potential of Agro Based Industries in Bangladesh

12. Bangladesh grows substantial quantities of perishable fruits and vegetables of high nutritional value. Most of these fruits and vegetables are available during the respective season of production. Among these fruits; mango, banana, jackfruit, litchi, papaya, pineapple, watermelon, guava, lemon, star fruit, honeydew etc. are available during the full summer season between May to July. Similarly, high quality vegetables such as; potato, tomato, carrot, brinjal, cauliflower, cabbage, green beans, long beans, peas, pumpkin, cucumber are available during the winter season between November to February.

13. Fishery sector plays a very significant role in food supply especially animal protein, balance of payment by earning foreign exchange through export of fishery products, employment generation and helping the creation and expansion of its allied industries. These facts indicate that the sector plays a key role in priority programmes of the country in generating employment, raising nutritional standard of the population, contribution to Gross Domestic Product (GDP) and earning foreign exchange.

14. Livestock plays an important role in the agricultural economy of Bangladesh. Though we import thousands of cows & goats throughout the year for our computation the magnitude of contribution of the livestock sub-sector to the country's GDP is 3.1% and to agricultural GDP is about 11%. The share of the livestock sub-sector to agricultural GDP has been increased steadily in recent years.

15. Bangladesh is a net importer of milk, milk products and living cattle. It means that a substantial amount of foreign exchange is being spent on imports of those items putting a pressure on the balance of trade. The development of livestock sub-sector can bring about an improvement in the balance of trade through the reduction of import bill on powdered milk and living cattle.

Processing Fruits, Grains and Vegetables

16. **Production & cultivation.** The annual requirements of fruits and vegetables in the country are about 6800,000 MT and 11200,000 MT respectively. But the productions in 2003-2004 were 1494,120 Metric tons and 624,735 Metric tons respectively. Therefore, the country is highly deficient in fruits and vegetables production. In Bangladesh the farmers in the rural areas usually cultivate fruits and vegetables. The general characteristics of fruits production are more or less similar to that of vegetables production. The most important horticultural production unit in Bangladesh is the homestead. Recently, commercial production of vegetables is also getting momentum and farmers with proper knowledge and skill are coming forward increasingly to undertake this venture.

17. **Marketing Facilities.** The focus of all marketing activities is to satisfy the consumers. The consumer's purchase or acceptance of a product is the index of success for marketing. It is therefore, necessary to survey the market strategy before releasing a product. Marketing is the main link between the production and sales. In this connection, it may be mentioned that the local people prefer to consume fresh fruits and vegetables compared to processed products. According to FAO (2000) survey about 82% of farmers in all the regions sell horticulture crops immediately after harvest. The FAO survey also indicates that about 19% of retailers, 41% of traders and 21% of consumers buy vegetables directly from farmers. Although Bangladeshi vegetables are being exported to more than 30 overseas markets. The major buyers are United State of America United Kingdom and Middle Eastern countries.

18. **Fruit Processing.** There are about 630 registered food processing industries operating in Bangladesh of which about 30 are producing fruit jam, jellies, squashes, fruit juices, pickle, chutneys, sauces, canned pine apple juice and slices and canned mango juice. Most of these products are aimed at local market. A few industries both in public and private sector have tried to produce jams and jellies for export, but they have limited success. For example, in the public sector, Multiple Juice Concentrate Plant in Chittagong started exporting juice concentrate in 1985. It produced only 22 MT of pineapple juice concentrate in 1998-99 against potential production of 1600 MT and only 80 MT in 2003-2004. It has been suggested that it could enhance its production with more effective plant management. In the private sector, there are four major processors and exporters of fruit products. The biggest, Rangamati Food Products Limited, is a major food processing plant and began operation in 1988. Its main products are pineapple juice, slices, jams jellies, tomato juice, paste and puree. Few years back Pran Agro Products, Starships and ACME has started producing fruits juice for local market.

19. **Vegetable Processing.** Processing of vegetables is not so popular in Bangladesh because of limited market. Consumers prefer fresh vegetables because, processed vegetables does not satisfy their taste buds. However, some vegetables have processing values and are being processed in traditional cottage type industries. At present proper industrial base for these commodities is yet to be developed. Though at some scale processed vegetables are being exported as syrup to USA& UK and achieved success.

20. **Grain and Oilseed Processing.** The agro ecological conditions in Bangladesh are well suited for production of these crops. However, it is necessary to improve production of the concerned crops and improve the product quality of local food processing industries and upgrading their production technology, and ensuring availability of quality inputs to substitute local goods for the imported goods. Capacity utilization in local food processing industries has to be improved to reduce the unit cost of production to make the goods competitive in the international market. Improvement of post harvest technology, grading and standardization are necessary for improved product quality to reduce system loss of crops. There is scope for joint ventures in grain and oilseed processing industries. Backward linkages and improvement of the marketing system are needed to minimize preharvest-postharvest price differences, increase productivity and diversify crop production.

Prospect of Fisheries

21. **Fishery Resources.** By virtue of its geographical location, close to the great Himalayan Ranges in the north and the Bay of Bengal in the south, Bangladesh has the unique advantage of possessing the world's largest river delta, the Ganges Delta, which offers vast and varied fisheries potentials in its fresh and marine waters. The country is also blessed with a network of innumerable rivers tributaries, canals, large lakes and land depressions along with huge floodplains during the monsoon. Several great river systems such as the Padma, the Meghna, the Jamuna, and the Brahmaputra are situated in this country. Besides, there are numerous large and small rivers have criss- crossed the whole country. 260 indigenous and 11 exotic species of fish and 25 species of prawn inhabit the inland waters of Bangladesh. The marine waters of the Bay of Bengal are blessed with about 475 finfish and 38 shrimp species.

22. **Fish Storage Facilities.** There has been substantial improvement in the ice supply situation during the last few years. Many ice plants have been established in Cox's Bazar, Chittagong, Khulna, Barisal, Chandpur, Rajshahi, Patharghata, Sathkhina and other small fish project areas in the coastal belt. Most of the mechanized fishing boats carry ice for fish storage. During bumper Hilsa catches, which coincides with full moon and new moon periods for a short period of 3 to 5 days, there is often a shortage of ice.

23. **Freezing Plants and Frozen Storage.** Bangladesh has considerably developed a big shrimp processing industry. There are about 115 processing plants with a total daily capacity of processing 800 MT of shrimp and fish. Availability of raw materials does not match the installed capacity of the freezing plants. Raw materials of shrimps for export is hardly around 40 MT of the live animal or about 25 MT of shrimp processing plants are either lying idle or have diversified towards fin-fish processing and freezing for export and domestic marketing.

24. **Marketing Infrastructure.** Infrastructure facilities for domestic marketing of fishery products are still in a poor state. Since the market is completely in the hand of traders and intermediaries, they hardly think of developing infrastructure facilities. In big cities and towns, the city corporations and municipalities have developed certain infrastructure facilities in the form of space, shade, platform etc. But the system is yet to be developed for proper management. At the village level, there are virtually no such facilities. Very recently the Ministry of Local Government and Rural Development (LGRD) has taken initiative to construct village level fish marketing centers. Although outlets have come into the view, inlets or leading/berthing centers are yet to be considered for infrastructure development. It has constructed modern fish harbours and fish landing centers in the coastal regions like Chittagong, Cox's Bazar, Barishal, Khepupara, Patharghata, Khulna and also in Mymensingh. The landing centers with proper facilities for berthing, landing auctioning, ice plants, freezer storage, freezing plants and transport facilities have been developed in Rangamati, Kaptai and Rajshahi.

25. **Domestic Consumption & Marketing.** Fish assumes special status in the food habit of Bangladeshis. Nearly 95% of the total harvested fish in the country are consumed domestically. As compared to the export market, domestic market is huge, varied and complex. In terms of volume, value and employment the domestic fish market in Bangladesh is great. This market annually handles over a million MT of fish. Due to involvement of intermediaries, a large number of people are also employed in the process. Except for high value products like shrimp, prawn and other less preferred items such as crab, turtle and certain varieties of finfish, other marine products are also consumed locally. However, in spite of increasing trend in fish production, the availability of fish for domestic consumption is far below the Asian average of 25 kilogram/year. The reason is mainly attributed to the population growth. As per the estimated fish production the per capita daily fish supply is about 25 gram. It is likely that in future the margin between the supply and demand will also be widened.

26. **Fish Export Marketing.** There has been a phenomenal growth in the export of fisheries products in terms of volume and value. It was a non-traditional and negligible area at the time of independence. The country exported a meagre amount of marine products worth US \$ 4.49 million in 1972-73. Within a span of 30 years it has been increased to \$ 174.70 million in 1999-00. During 1999-00, 31.83 MT of fishery products amounting to \$ 221.98 million have been exported. The trend is further increasing. Frozen shrimp, prawn, fish, and frog legs (now banned due to environmental consideration) dry fish, salted and dehydrated fish, shark-fin, fish maw, crab, tortoise and turtle are the major items of export. In terms of volume hardly 3% of the fisheries products are exported. The major export markets during 2002-2003 for frozen shrimp and prawn of Bangladesh were U.S.A (45%), EEC (4.10%), Japan (11.24%), and Germany (9.56%). Regional countries of Asian/SE Asia bought only 1.88 %.

Prospect of Livestock

27. **Livestock Products.** The income elasticity of demand for livestock products is very high in Bangladesh. The elasticity's are estimated to be 1.35 for milk, 1.23 for meat and 2.00 for eggs in recent years. If the population increases by 1.8% per year up to the year 2010, the demand for milk, meat and eggs will be increased 4.4%, 3.9% and 5.0% respectively by the year 2010. Recent records of growth rates are much lower than the annual rates of growth required meeting the increasing demand for livestock products (particularly milk and meat) in the future. A break-through is expected to occur only in egg production due to expansion of the poultry sector.

28. **Leather Industry.** There are already a substantial number of domestic leather industries in place, mostly export-oriented. In this sector footwear is the important addition. This is the fast growing sector for leather products. Most of the livestock production is domestic. The hides and skins have a good international reputation. Foreign direct investment in this sector in production of tanning chemicals appears to be highly rewarding. Having the basic raw materials for leather goods as of low cost with inclusion of trainable labour force together with tariff concession Bangladesh can be a potential of leather and leather products manufacturing with low cost but high quality.

29. **Bones.** The bones, horns and hooves from large and small ruminants have great economic value. Bangladesh produces about 5,115 tons of bones in a year from cattle and buffaloes. There are 20 bone-crushing factories in Bangladesh. The country earned Taka 19.0 million by exporting crushed and uncrushed bones in 2000-2001.

30. **Poultry Farming.** Poultry farming has emerged as an integral part of agro-business of the farming community in Bangladesh. The villagers who cannot afford to rear cattle or goats can easily maintain a small poultry farm. About 75% of rural households and 89% of rural livestock households rear poultry under domestic condition. It is an important source of income for the poor families, particularly for rural women. It provides eggs and meat. The per capita availability of these products are very low in the country indicating the urgency of rapid expansion of poultry enterprise in rural as well as in sub-urban areas. The productivity of those birds is low but the small poultry rears can make substantial profit because they use very little or no purchased inputs. Obviously poultry sector has great prospect to contribute in country's economy by earning foreign exchange. But beforehand Bangladesh has to meet the domestic requirement. Business consultation, feed formulation, feed mill installation, market promotion, processing, product development, disease management are the prejudices to promote the poultry sector in international level.

31. **Subsidies for Dairy Farms.** The Government has taken steps to encourage the farming the Black Bengal goat which is one of the best species available in the world. The quality of skin & meat are very best in the world. The Government has been providing subsidy for mini dairy farms since 1993. Those who have at least five crossbred cows are eligible to receive this facility. The rate of subsidy varies from 20 to 25% depending on the size of farm. The full amount of subsidy is payable to the farmers in hard cash. The Government had decided to provide 100 percent financial support to meet the transportation cost of importing high-breed cattle. The decision was made to encourage entrepreneurs in the private sector.

Impediments to the Development of Agro-Industrialization

32. **Lack of Explicit National Policy.** There is no concrete National Policy on Agro-Industry's development for Bangladesh. This has to be prepared. It is an important policy to be declared explicitly for all concerned.

33. **Lack of Government Supervision.** There might be some organizations, which need to work on the development of agro-industry. Post-harvest technology division of Bangladesh Agricultural Research Institute (BARI) has done some work on the training of women. There is food technology and rural industry Department at Bangladesh Agricultural University (BAU), Mymensingh. But none of this organization has taken a lead in formulating policies for agro-industry development in Bangladesh at the national level. Agro based Industries and Technology Development Project (ATDP) Phase-II is also endeavoring to facilitate development of agro-processing and entrepreneur-ship in the country. A clear agreement of how these different organizations and Projects relate to each other is extremely important.

34. **Lack of Coordination among Ministries.** Many Ministries involved with agro-industry development e.g. Ministry of agriculture (involve with the supply of raw materials), Ministry of industry (involve with how to set up small scale food industry), Ministry of public health should be involved in implementing Food and Drug Act (FDA), Ministry of finance have to provide fund as loan, Ministry of commerce may have to help on developing marketing system etc. The Bangladesh Standard and Testing Institute (BSTI) have to announce appropriate 'food-code' of the processed foods. To get many Ministries to work together, there is need of a very strong and efficient national committee. Members of the committee may come from concerned Ministries.

35. **Inadequate Production of Raw Materials.** Bangladesh produce a lot of agricultural crops and most of those are for fresh consumption, not aimed at processing. A classic example is tomato. But these varieties cannot be used for making tomato paste with cost effectiveness. For processing to paste, different variety is needed, which gives high solid content and red colour. Another good example is baby corn; one needs to have proper variety of baby corn for canning. It is not possible to use animal feed corn as a substitute for baby corn. Alfanso mango or a nearest alternative needs to be in large-scale production for extracting pulp for juice drinks.

36. **Lack of Trained Personal.** Skilled personnel have to be trained in food technology departments. At present may be few Universities have such departments. One is with Dhaka University, Food science and nutrition department and the other is the Home Economics College. Another not exactly food science or food technology, but food engineering at the Bangladesh Agricultural University at Mymensingh. Compared with this, Thailand

for example, exports a lot of processed food products, has 36-food science or food technology department and another four faculty of agro-industry, consisting food science or food technology department & food-engineering department, biotechnology department, agro-product development department and packaging technology department.

37. **Insufficient Research and Development Facilities.** There are 4 to 5 organizations that carry out research and development on agro-industry with substantial limitation in budget and skilled manpower. Not much research work has so far been carried out in this country, particularly on processing and packaging field. We need an intensive research and development in this sector including development of marketing systems for the products.

38. **Insufficient Technology on Agro-Industry Development.** Since not enough was done on research and development, Bangladesh is lacking proper intermediate technologies to give momentum for the processing activities. Processing revolution requires appropriate production and handling technologies for many agricultural produces in Bangladesh. Most of food processing equipment is imported. These equipment need to be designed and produced locally. Local production of equipment will ensure easy availability and at an affordable price.

39. **Less Number of Investor in Food Processing Industry.** There will be more industrial investment in Food Industry, if the government becomes serious in promoting the agro-processing industrialization in the country. However, currently there are few interested entrepreneurs in agro-processing industries. Tax holidays and medium to long-term loan facilities have to be provided to potential agro-processing industrialists.

Suggested Development Sectors of Agro Based Industries

Need For Development in Agricultural Technology

40. **Technology for Agro Products in Bangladesh.** Bangladesh has been endowed with substantial agricultural resources. Still majority of the population is dependent on Agriculture. The soils are responsive and so far have sustained continuous cropping. The climate is conducive for year round production. Given the required technological inputs, two or even three crops can be conveniently grown round the year. The dry season from November to March restricts production except where soils have sufficient water holding capacity enabling a crop to be raised with the residual moisture. Thus, provision of irrigation facilities can ensure year round cropping. The near flat topography creates drainage and flood problems in the flood areas. The technology that has been introduced in the rural areas of Bangladesh is mainly homestead technology. It may be broadly classified into two groups, technology related to agricultural production and that related to post-harvest agro-processing. Four major recognizable types of agricultural production technology have a significant role in rural Bangladesh. These are:

- a. Biological Technology, such as improved varieties of seeds and Breeds.
- b. Chemical Technology, such as fertilizer, insecticides and Pesticides.
- c. Land Augmenting Technology in the form of irrigation and water management.
- d. Mechanical Technology, such as power tillers.

41. **Import and Generation of Technology.** Decisions related to import of new agricultural technology are taken under the Ministry of Agriculture. The various organizations engaged in agricultural research, extensively carry out digestion, adaptation and improvement of imported varieties of crop. The National Seed Certification Board and the National Agriculture Standardization Committee also play important role. The Bangladesh Agriculture Development Corporation (BADC) provides agricultural input as seeds, credit, fertilizer and pesticides and supplies equipment to the farmers. Thus BRRI has been very successful with its adaptive research on rice varieties developed by the International Rice Research Institute (IRRI). Similarly, BARI has been very successful in adoption, adaptation and improvement of wheat, pulses and mustard seeds and all non-rice crops.

42. **Development of Technological Capabilities.** The agricultural research system in Bangladesh has attained a reasonably high level of expertise in almost all the fields of scientific investigation. Cropping or farming systems research is done to design optimum-cropping systems for different soil conditions in the country. Irrigation is the key to the solution of the food problem. Low cost technologies in this field are being tested throughout the country. Machines for post-harvest operations are also being designed and fabricated in the country-both in the public and private sectors.

43. **Concept of Appropriate Technology.** An appropriate technology is the best technologies that can be adjudged corresponding to a particular surrounding and objective function. The surroundings include population, resources, as well as economic, technological, environmental, socio-cultural and politico-legal system. Objective functions used in the development of technology are maximization of opportunities and minimization of losses. The surroundings differ not only from place but also over time. Technological appropriateness is a dynamic concept. It means what is appropriate today may not be appropriate tomorrow and what was inappropriate before may be appropriate today.

Examples.

- 43.1. For safe drinking water in rural areas, technological alternatives of hand tube wells are boiling of water, water purification tables and chemical treatment.
- 43.2. Improved biomass fuel burning stove and solar panels may be considered as an appropriate technology in rural areas to save fuel and to provide a better kitchen environment.
- 43.3. Use of power tillers for land preparation is an appropriate technology in the face of shortage of animal draft power.

- 43.4. For processing paddy, use of huller mills as an intermediate technology is appropriate rather than dheki or modern rice mills.
- 43.5. The improved parboiling unit consisting built-in aluminum pan for boiling water and two paddy containers with perforated bottoms is appropriate for rice processing in rural Bangladesh.
- 43.6. Black smithy is a big business in Bangladesh, though its workshops are small. The country has approximately 10000 black smithy enterprises that use appropriate technology and contribute 5 percent of the country's gross output. This contributes largely to the agricultural sector.
- 43.7. In order to create an effective flood action plan in this flood prone Bangladesh, it is important to understand how people already cope with the flood and its aftermath and how do they respond to the flood control measures. This would help to identify local level flood protection activities and plan appropriate measures. This can save agriculture sector from the devastation of flood.
- 43.8. Drum seeder technology imported from Vietnam has attracted the attention of farmers which has minimized their labor.
44. **Technologies in Rural Manufacturing Sector.** A wide variety of products are produced in rural industries. These are coir rope, recycling and dyeing of yarn, fishing net, carpentry, basketry, tailoring, hogla mats and biri making, black-smithy, pottery, gold-smithy, brick making and jute handicrafts are all. Use of machinery is not very widespread in the case of rural industries. In other words the rural industries have not undergone significant technological up gradation. Most of these industrial activities are characterized by very high labor intensity, and little technological input. Efforts to upgrade these technologies are required for increasing the income of the rural people.

Agricultural Policy of Government

45. Bangladesh Government has been pursuing following agricultural policies:
- a. Expansion and strengthening of the production base for self-sustaining growth of food and cash crops.
 - b. Maximization of the utilization of land and water resources along with the use of the required inputs.
 - c. Full exploitation of the physical and financial potentials of the farming Community for maximization of returns.
 - d. Increasing the income of farming community through improvement of their access to resources and marketing opportunities.
 - e. Encouragement to the production of import substituting and Export diversifying crops.
 - f. Augmentation of forestry resources.
 - g. Institute of appropriate price policies facilitating allocation resources by the farmers for optimization of benefits for investment.

Ministry of Agriculture utilizes its various agencies to implement above policies in spirit and actions. Planning Commission as a policymaking body shapes agricultural development strategy.

Agricultural Research Institutes

46. Agricultural research in Bangladesh has made significant contribution to increasing production and building up an effective infrastructure. The activities of few major research institutes are as under.
- 46.1 **Bangladesh Agricultural Research Council (BARC).** It has the responsibility to plan, promote, support, coordinate, monitor and evaluate agricultural research in the country including coordinating national and international donor assistance and establishing linkage between national and international research and allied organizations.
- 46.2 **Bangladesh Agricultural Research Institute (BARI).** BARI carries out R&D on all non-rice crops like wheat, maize, pulse, oilseeds, tobacco, potato, vegetable, cotton and citrus fruits. It also does on-farm applied research.
- 46.3 **Crop-based Research Institutions.**
- 46.3.1. **Bangladesh Rice Research Institute (BRRI).** Undertakes research on all aspects of rice in close association with the International Rice Research Institute (IRRI).
 - 46.3.2. **Bangladesh Jute Research Institute (BJRI).** Takes care of all aspects of research and development of jute.
 - 46.3.3. **Sugarcane Research and Training Institute (SRTI).** This Organization conducts research on sugarcane and uses farmers land and farms of sugar mills for carrying out trials.
 - 46.3.4. **Other Research Institutions.** Tea Research Station (TRS), Forest Research Institute (FRI), Bangladesh Institution of Nuclear Agriculture (BINA) are some amongst many other agencies carrying out research in their respective fields. In addition, Agriculture university also carry out research works.

Agricultural Extension

47. Innovations and technological advancement evolved in the Research Institutions for the farmers can reach them successfully only through effective extension media. In the infrastructure of agricultural extension service, the Department of Agricultural Extension (DAE) is in force which uses motivational and promotional approach for innovations to be adopted by the farmers. Bangladesh Water Development Board (BWDB) handles the irrigation projects. Besides several mono-crop extension agencies for jute, cotton, tobacco, sugarcane, tea and horticultural products have also been set up.

Agricultural Credit

48. Agricultural credit plays an important role in attaining the optimum benefit from the agriculture sector. Agricultural credit is given for all agricultural activities as crop production, processing, storing and marketing, agro-based industries and all allied activities like poultry, fishery, livestock etc. There are two broad sources of agricultural credit, Institutional and Non-institutional. Rates of interest vary depending on various aspects. Institutional sources are various banks as Bangladesh krishi Bank (BKB), Nationalized Commercial Bank (NCB), Bangladesh Rural Development Board (BRDB) and Bangladesh Samabaya Bank limited (BSBL). Non-institutional sources are village moneylenders, relatives and friends, the rural rich, market intermediaries, shopkeepers etc.

Agricultural Equipment

49. All traditional farm tools and equipments are manufactured by village carpenters, but engine powered equipments are mostly imported. Recently Army has taken charge of Bangladesh Machine Tools Factory (BMTF) aims at manufacturing agricultural equipments in near future.

Agricultural Marketing

50. Improved marketing organization intensified cultivation through commercialization of agriculture. For Bangladesh, a supporting arrangement of market development would be the promotion of viable farmer organizations. Marketing costs constitute part of the total cost of production. The goal of all successful marketing must be the cheapening of goods the ultimate consumer without affecting the interest of the producer. A reduction in the cost of marketing benefits the community as a whole.

Employment Generation

51. Agricultural employment lies in the crop production and in other types of agriculture. The unemployment issue is clouded by seasonal labour needs and a lack of understanding of the total use of labour within a subsistence economy. Labour demand is high during April and May, again in November and December. Two conclusions are obvious regarding employment issue in Bangladesh. First, agriculture is the largest sector employer. Second, agriculture cannot totally absorb the projected increase in the labor force. Recently the projects of fishery, poultry, dairy and vegetable gardens have significantly generated self-employment in our country. For implementation of all rural development activities, employment generation will automatically be done.

Need for Enhanced Participation of Women

52. Women constitute about half of Bangladesh's manpower. The capability of women in all sectors of life is well tested by now. We need to utilize their contribution as a force multiplier to our national development. This is very much applicable in the agricultural sector as well. It is women who play the vital role at home in post-harvesting operation. Women are involved in various self-employment projects as guided by government and non-government organization. The success of women is remarkable in these projects. Other than hard laborious jobs, women contribute significantly at all activities related to agriculture.

Need For Foreign Direct Investment in Agro Based Sector

53. Foreign investors may be offered for opening up separate and exclusive Export Processing Zone (EPZ) only on the agro based sector. This greatly needs government assurance to the investors in terms of providing spacious area and security and value for money. We should try to follow the policies adopted by Japan, Korea, Taiwan, China and India for the management of technology for development. For this innovations and entrepreneurship should be encouraged. It can bring continuing chain effect in enhancing economic growth and prosperity.

Conclusion

54. Agriculture is one of the most important sectors of Bangladesh's economy. It is the principal source of income of the majority of the population. Although Bangladesh can produce a lot of crops but most of those crops are for fresh consumption, not aimed at processing. Lack of infrastructure development and expertise also contributed to agro-based industry negatively. Recent government emphasis may be helpful for Bangladesh in developing agro based industrialization. The diversification of agriculture, based on a better exploitation of international markets, is essential for broad-based growth in agriculture. Agricultural research and the identification of comparative advantages of agricultural products have to be re-examined in light of the need for diversification. Industries in Bangladesh in the past were established basically keeping an eye on agriculture; such as sugar, jute, tea, shrimp processing, and machine tools etc. However, government owned these industries, but failed to perform well due to many reasons.

55. Commercial production of vegetables is also getting momentum and farmers with proper knowledge and skill are coming forward increasingly to undertake this venture. Very few of the new products distributed in the markets actually become commercially successful. Marketing is the main link between the production and sales. A few industries both in public and private sector have tried to produce jams and jellies for export, but they have

limited success. Processing of vegetables is not so popular in Bangladesh because of limited market. The export oriented industries have to be guided and encouraged with necessary policy support plus the flow of information regarding markets and technologies for expansion of value added processing of crops.

56. The country is also blessed with a network of innumerable rivers tributaries, canals, large lakes and land depressions along with huge floodplains during the monsoon. Bangladesh fisheries Development Corporation has established total 16 ice plants with cold and frozen storage's at important landing centers. Cold storage having provision of chilling fish is yet to attract attention of the private sector. Fish assumes special status in the food habit of Bangladeshis. Nearly 95% of the total harvested fish in the country are consumed domestically. As compared to the export market, domestic market is huge, varied and complex.

57. For livestock products (particularly milk and meat) in the future, a break-through is expected to occur only in egg production due to expansion of the poultry sector. Poultry sector has great prospect to contribute in country's economy by earning foreign exchange. Business consultation, feed formulation, feed mill installation, market promotion, processing, product development, disease management are the prejudices to promote the poultry sector in international level. The Government has been providing subsidy for mini dairy farms since 1993.

58. There is no concrete National Policy on Agro-Industry's development for Bangladesh. A clear agreement of how these different organizations and 'Projects relate to each other is extremely important. To get many Ministries to work together, there is need of a very strong and efficient national committee. Members of the committee may come from concerned Ministries. Bangladesh produce a lot of agricultural crops and most of those are for fresh consumption, not aimed at processing. We do have tremendous lacking of well-trained human resource in food processing sub sectors. Not much research work has so far been carried out in this country, particularly on processing and packaging field. Bangladesh is lacking proper intermediate technologies to give momentum for the processing activities. Tax holidays and medium to long-term loan facilities have to be provided to potential agro-processing industrialists.

59. The technology that has been introduced in the rural areas of Bangladesh is mainly homestead technology. BARI has been very successful in adoption, adaptation and improvement of wheat, pulses and mustard seeds and all non-rice crops. Low cost technologies in this field are being tested throughout the country. Machines for post-harvest operations are also being designed and fabricated in the country-both in the public and private sectors. An appropriate technology is the best technologies that can be adjudged corresponding to a particular surrounding and objective function. The rural industries have not undergone significant technological up gradation. Ministry of Agriculture utilizes its various agencies to implement policies in spirit and actions. Planning Commission as a policymaking body shapes agricultural development strategy. Agricultural research in Bangladesh has made significant contribution to increasing production and building up an effective infrastructure. Innovations and technological advancement evolved in the Research Institutions for the farmers can reach them successfully only through effective extension media. Agricultural credit plays an important role in attaining the optimum benefit from the agriculture sector. Improved marketing organization intensified cultivation through commercialization of agriculture. For Bangladesh, a supporting arrangement of market development would be the promotion of viable farmer organizations. For implementation of all rural development activities, employment generation will automatically be done. The capability of women in all sectors of life is well tested by now. We need to utilize their contribution as a force multiplier to our national development. Foreign investors may be offered for opening up separate and exclusive Export Processing Zone (EPZ) only on the agro based sector. This greatly needs government assurance to the investors in terms of providing spacious area and security and value for money.

Recommendations

60. After having discussed about the agro-based industries in Bangladesh, following recommendations may be put forward:

60.1. **Inclusive National Policy.** Government may have a vision with time limit to take the agro based development up to a goal. The think tankers may establish a goal which to be achieved. This should include the plan as to how there can be more production within the limited land. What percentage of the land should be used for which crops, what are the priorities of crops? How farmers can be given adequate support and lastly how the products can be processed to export?

60.2. **Research & Development Centre.** Not depending on the foreign countries, Government may establish few research centers. These centers may be based on priority of crops needed for domestic market and other type is priority on export oriented crops which will not be used domestically. Technology or ideas may be imported initially but gradually our scientists should be adequate enough to develop those.

60.3. **More Importance on Fruit Production & Culture.** Government may take deliberate plan and influence people to plant for more fruit producing trees. Simultaneously their should be proper research towards making citrus fruits to make it more sweet.

60.4. **Proper Utilizations of Human Resources.** The unemployed people should be oriented with agricultural field. They may be given basic investment to establish small scale agro industries. In the later stage this may be further augmented by foreign investment. These investments may be directed towards increasing the production of food (fruits, crops, fish, and poultry) as well food processing to export. The graduates from different universities may be leading the front.

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