

A Seminar Paper On

**Agricultural Input Intensification, Productivity Growth and Transformation
of Bangladesh Agriculture**

Course code: AEC 598
Term: Summer'18

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ABSTRACT

This paper examines the extent of input intensification and transformation taking place in last few years. Bangladesh is an agro-based country. Agriculture plays an important role to the economic growth and economic development in Bangladesh. The agricultural sector contributes a lot to the country's GDP, Provide employment for nearly half of the labor force and supplies raw materials. Agriculture alone provides 45 percent of total national employment. Besides providing food agriculture is the main supplier of raw materials to the industry. With time agriculture has changed from subsistence to commercial. The demand for food has increased with the increasing population. As a result to cope up with this increasing demand new technologies has been invented and adopted which has resulted in tremendous transformation in Bangladesh agriculture. Along with crop sector there has been a growth in livestock, poultry, fisheries and agroforestry sector. Cropping pattern and cropping intensity has also been changed over time. According to Ministry of Agriculture and Bangladesh Bureau of Statistics the cropping intensity is 192%. Bangladesh has almost achieved self-sufficiency in food grain production. The import of agricultural product has decreased on the other hand there is an increasing trend in export of agricultural product in recent years. The contribution of agriculture sector in GDP has also increased. The growth rate of agricultural GDP from FY2014-15 to FY2016-17 is 8.63, 8.62, and 8.89 respectively. The sectoral growth rate of GDP by crops and horticulture, livestock, forestry and fisheries in 2016-17 was 6.98, 8.63, 12.44 and 12.34 respectively.

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CHAPTER 1

INTRODUCTION

1.1 Background and Rationale

Bangladesh is mainly an agricultural country. Agriculture is the single largest producing sector of the economy and contributes about 11.70% to the total Gross Domestic Product (GDP) of the country. This sector also accommodates around 42.7% of labor force. GDP growth rate of Bangladesh mainly depends on the performance of the agriculture sector. (BBS, 2017)

Because of its very fertile land and favorable weather, different varieties of crops grow in this country. But due to natural calamities every year farmer faces loss of production in both food and cash crops. In recent years, there has been a tremendous increase in food grain production. Agricultural holding in Bangladesh is generally small but use of modern varieties, inputs and equipment is gradually increasing. Rice, jute, sugarcane, potato, pulses, wheat, tea and tobacco are the principal crops of Bangladesh. Crop diversification program, credit supply, extension work, research and input distribution policies pursued by the government are yielding positive results. The country is now on the threshold of attaining self-sufficiency in food grain production.

Agriculture sector has performed remarkably well over the years. Between 1973/74 and 2014/15, agricultural GDP has increased by 5.8 times. Value of agriculture GDP has increased from 5.21 billion dollars to 28.92 billion dollars. All sub-sectors of agriculture (crop, livestock, fisheries and forestry) have increased substantially. Crop GDP has increased by 4.4 times, livestock GDP has increased by 5.8 times and forestry GDP has increased by eight times. On the other hand, fisheries GDP has increased by more than six times. During this period, Total GDP has grown by 20.8 times, increased from 8.92 billion dollars to 185.43 billion dollars. (Deb, 2016)

High population pressure and the rapid pace of human activity including urbanization, industrialization and other economic activities have led to a dwindling supply of arable land per capita and a process of agricultural intensification in South Asia. While this process has significantly increased food production to feed the growing population, it has also entailed considerable damage to the physical environment, including degradation and depletion of natural resources and unsustainable use of land and water resources. Agricultural intensification has

been accompanied by a set of innovations, collectively referred to as the Green Revolution, which has increased food production significantly. (Mohammad Alauddin, 2007)

Agricultural input intensification can be defined as the increased use of modern inputs such as hybrid seeds, mineral fertilizer, herbicide, and pesticide in agriculture. Input intensification in a sustainable manner is the most promising path to increasing crop productivity.

Bangladesh economy has been growing over the last three decades. Among the three subsectors of economy, agriculture plays an important role to generate employment for its population by increasing productivity and growth. Bangladesh is a country with a population of almost 160 million (BER, 2016) increasing at a rate of 1.3 percent adding about 2 million labor force every year. If we only consider the rural economy, agriculture alone provides employment for more than 70 percent of the rural labor force. (Md. Tanjil Hossain)

The growth rate of area, production and yield were found increasing steadily from the year 1980-81. A substantial change has been started from the year 1998-99. The trend of inputs used was found increasing. Almost all the partial as well as the input, output and total factor productivity indices were also found increasing. (M. A. Baset, 2009)

The varying performance of crop sector has emphasized the need for evolving regionally differentiated strategies for ensuring sustainable and inclusive agricultural growth in a state and consequently in the country. The instability in productivity continues to persist and there are wide variations in instability across different districts. To mitigate the consequences of persisting instability, large-scale promotion of stabilization measures like insurance should be pursued vigorously. The analysis of district level data has revealed the important role of modern inputs in enhancing the productivity of crop sector. The use of fertilizers has turned out to be the most important input. Along with fertilizer-use, rainfall, irrigation, source of irrigation, better human resources and road connectivity have emerged as the other critical determinants of agricultural productivity. These results signify the importance of use of modern inputs and prudent management of rainfall water, particularly in the low productivity districts. (Kumar, 2013)

The main elements of the agricultural intensification have been the increased use HYV seed, fertilizers, pesticides, irrigation and agricultural machinery. Since independence, a rapid expansion of fertilizer, irrigation and modern variety seeds caused technological transformation

in Bangladesh agriculture and productivity advances due to technological improvements. The intensive use of land, labor, fertilizers, tractors, institutional credit, and irrigation leads to higher agricultural productivity. Higher proportion of area under high-value crops contributes to higher productivity. The availability of better human resources capital of the workforce enhances its capacity in terms of performance of work, awareness about technology and efficient utilization of inputs and services. All these tend to augment agricultural productivity. It could be attributed to the fact that the access to institutional credit induces the farmers to higher adoption of improved seeds, increased fertilizer-use and irrigation and its influence could be included in the impact of these inputs.

While agro-chemicals such as pesticides, fungicides, and herbicides are often promoted as inputs that increase agricultural productivity by limiting a range of pre-harvest losses, their use may have negative human health and labor productivity implications. Agro-chemicals use is associated with increased value of harvest, but is also associated with increases in costs associated with human illness, including increased health expenditures related to illness and time lost from work due to sickness in recent past. (Megan Sheahan, 2016)

1.2 Objectives of the Study

- to assess the increased use of different inputs in agricultural sector
- to examine the trends in growth in Bangladesh agriculture
- to identify the consequences of input intensification and agricultural transformation

CHAPTER 2

METHODOLOGY

This seminar paper is exclusively a review paper so all of the information has been collected from the secondary sources. The secondary sources included topic relevant books, journals, articles, proceedings, reports, publications etc. The study is based on the secondary data compiled from various sources. The information was compiled from different web sites, publications brought out by the Bangladesh Bureau of Statistics, Food and Agriculture Organization, Statistical Yearbook of Bangladesh, Ministry of Agriculture. No primary data and empirical analysis was done to write the paper.

To satisfy the first objective data on the use of different inputs such as seed, fertilizer, land etc. was collected from different statistical yearbook and statistical database of Food and Agriculture Organization. Data on production, area and yield rate was used to show trend in agricultural growth.

CHAPTER 3

RESULTS AND DISCUSSIONS

3.1 Contribution of Agriculture to GDP

Until the 1980s, share of the crop and horticulture sector to the total Agricultural GDP was slightly less than eighty percent. Forestry contributed about 5.5 percent to the agriculture sector in the early seventies which has gradually increased to about 11 percent in 2014/15. Animal farming particularly poultry, dairy, egg production and animal fattening for meat production has contributed towards many-fold increase in livestock production. Small scale commercial poultry farming has expanded in the periphery of towns and cities. Share of animal farming to the Agricultural GDP has increased from about 7 percent in the seventies to about 11 percent in 2014/15. In the early seventies, fisheries sector contributed about 10 percent which was declining in the seventies and eighties. Fisheries sector contributed about 23 percent of the total agricultural GDP in the recent years. Thus, Bangladesh agriculture has successfully been transformed to a diversified sector in the recent years from mostly crop oriented agriculture in the seventies. (Deb, 2016)

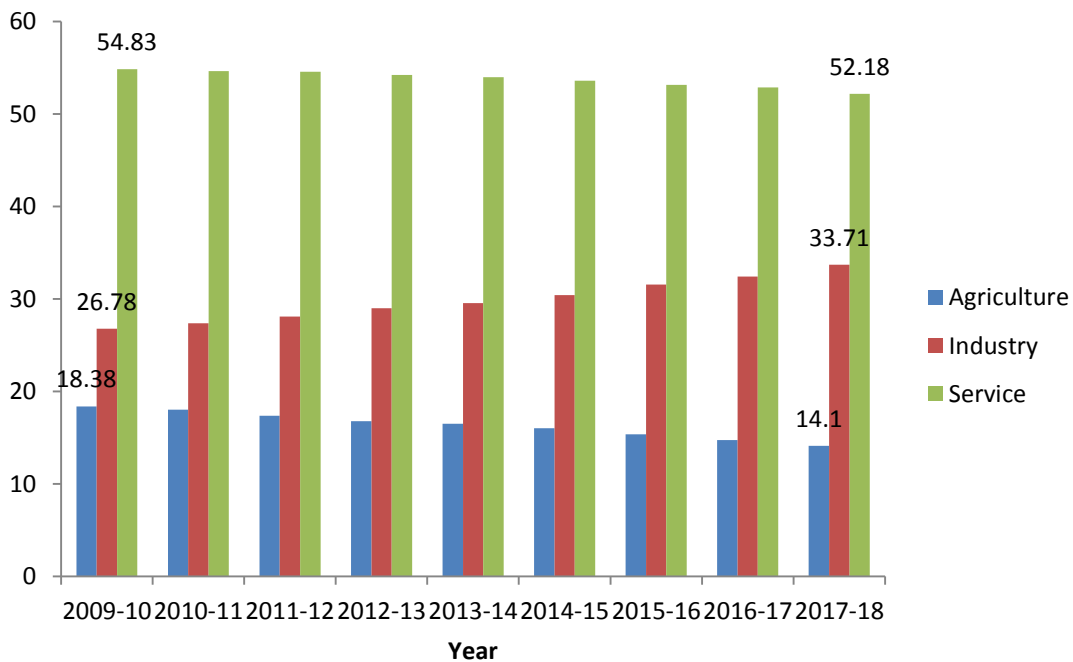


Figure 1 Contribution of Different Sector in GDP, 2009-2018

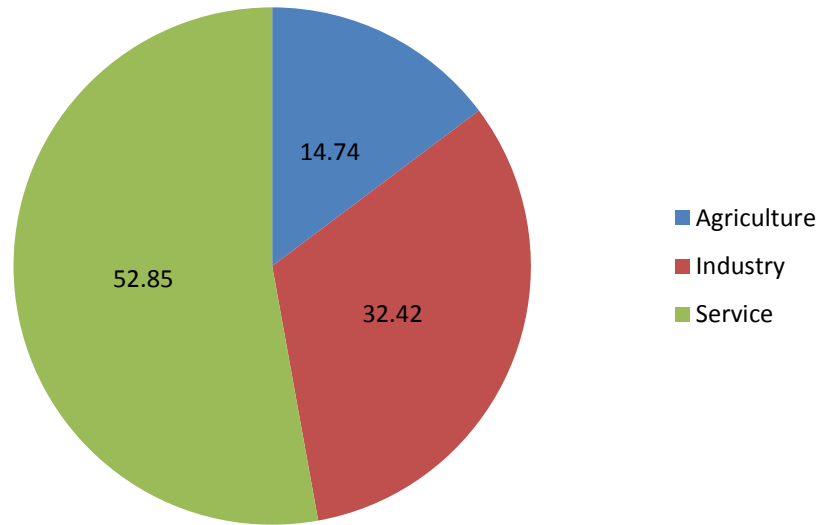


Figure 2 Sectorial Share of GDP at Constant Price, 2016-17

Figure 1 and figure 2 shows that during 2009-10 to 2016-17 the share of agricultural GDP has decreased. In 2009-10 the share of agriculture in GDP was 18.38%, but in 2016-17 this share has fallen to 14.74%. Figure 2 shows that the largest share of GDP is by the service sector. The growth rate also shows the same evident (figure 3).

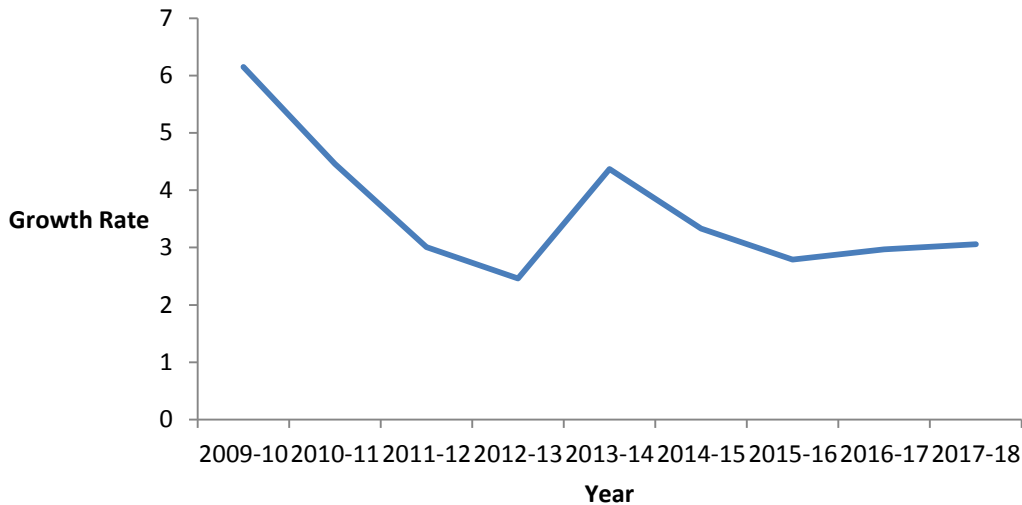


Figure 3 Growth rate of agricultural GDP at Constant Price, 2009-2018

Though share and growth rate of agricultural GDP compared to other sector has decreased in last few decades but in terms of volume agricultural GDP shows an increasing trend. In 2009-10 agricultural GDP was 1065108 million BDT, but in 2016-17 it becomes 1340511 million BDT.

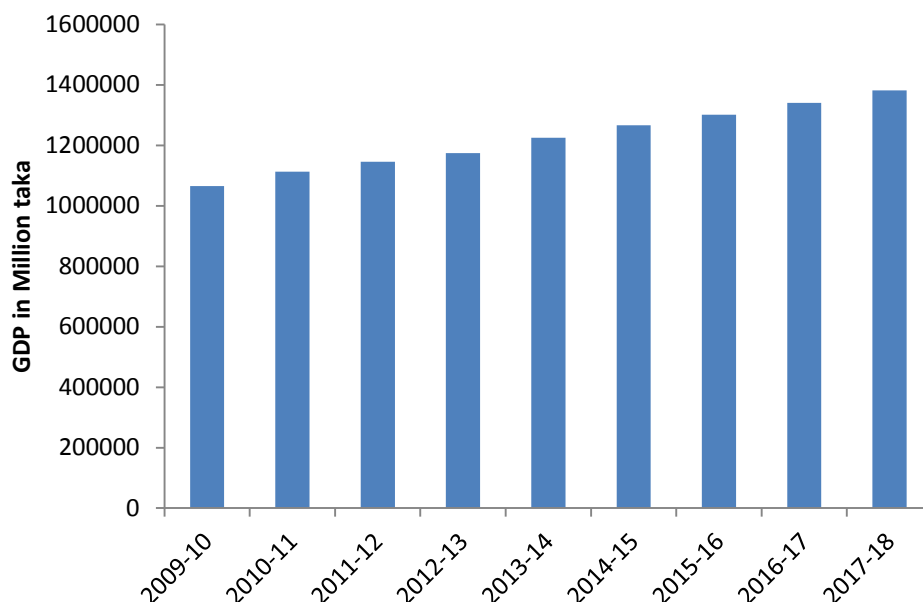


Figure 4 Trends in Agricultural GDP at Constant Prices

In terms of growth, Bangladesh agriculture performed remarkably well both in the long-term (FY1973/74 to FY2007/08) and in the short term or recent years (FY2008/09 to 2014/15). Annual growth rate in the overall agriculture sector ranged between 1.6 percent in FY2013 and 4.4 percent in FY2014. For crop & horticulture subsector it varied between 0.6 percent (in FY2013) and 3.9 percent (in FY2011). Animal farming experienced annual growth between 2.6 percent (in FY2011) and 3.1 percent (in FY2015). On the other hand, forest and related services had annual growth in the range of 5.0 percent in FY2014 and 6.0 percent in FY2012. Fishing had annual growth between 5.3 percent in FY2012 and 6.5 percent in FY2015. (Deb, 2016)

3.2 Different Inputs Utilization

3.2.1 Improved Seed Distribution

Quality seed is one of the most important agricultural inputs to ensure food security. Seeds in Bangladesh are procured from two different sources, locally produced and imported seed. The seed sector has made impressive progress over the last three decades. The quantum of quality seed supplied increased from 7000 mt. ton to 2 lakh mt. ton. Seed distribution system in Bangladesh has improved to a great extent in last few decades. During January 2009 to June 2017 the release of HYV of rice was 44 respectively. Besides this 9 variety of wheat, 50 varieties of potato and 10 variety of jute was released during the same period. (MOA, 2017) Figure 5 shows the trend of distribution of improved seed during 1990-91 to 2007-08.

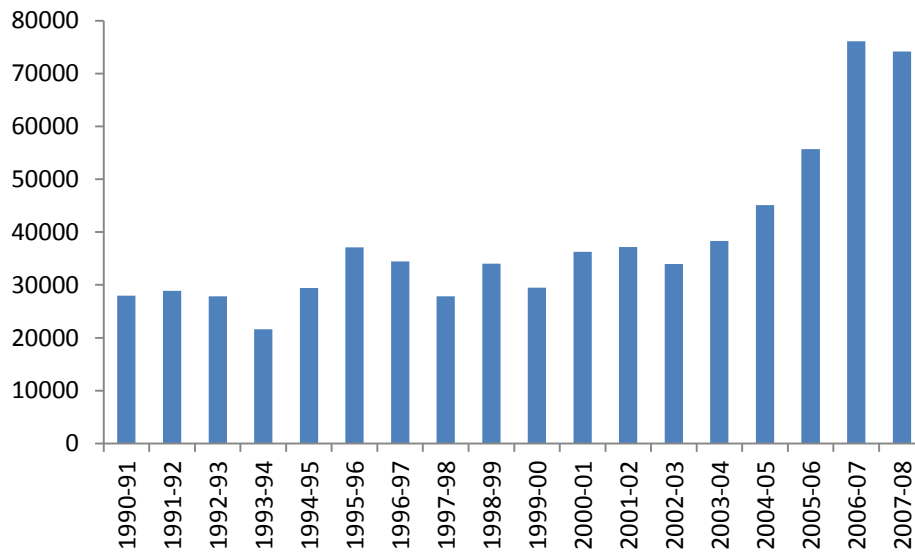


Figure 5 Distributions of Improved Seed

3.2.2 Fertilizer and Pesticide Use

With increase in population the demand for food has increased to a great extent, but land holding remain the same. As a result to satisfy the increasing demand and to expand crop production the uses of fertilizers and pesticides have also increased.

Table 1 Fertilizer use from 2000 to 2016

Year	Fertilizers Use		
	Nitrogen (N)	Phosphate (P2O5)	Potash (K2O)
2002	1079064	321758	156017
2003	951340	200266	167070
2004	954039	272838	162900
2005	993327	326713	244350
2006	1098892	298610	124836
2007	1048507	256050	136800
2008	1287000	109700	164400
2009	1156139	170219	145939
2010	1166810	296086	196306
2011	1274820	399740	289200
2012	1129780	500020	367800
2013	1111740	500480	342600
2014	1230260	564880	346200
2015	1320940	606740	384000
2016	1172300	638480	436200

Source: (FAO, 2018)

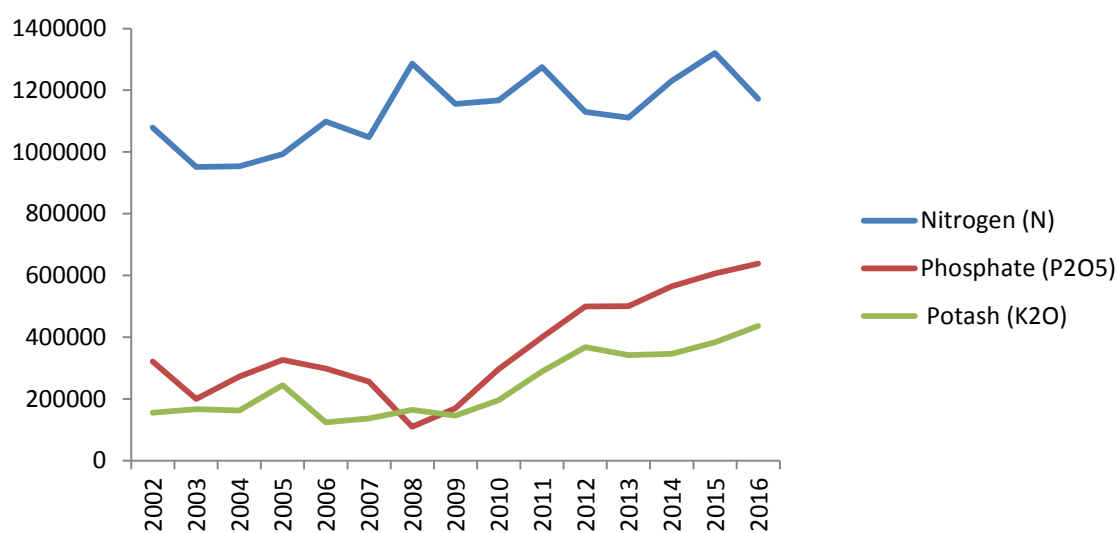


Figure 6 Trends in Fertilizer Use

Table 2 Different Types of Pesticide Use in Agriculture

(tons)

Year	Insecticides	Herbicides	Fungicides & Bactericides
2000	1909	80	1155
2001	11936.79	860	603
2002	10310.34	697	553
2003	11833.31	1248	746
2004	13214.87	3367	1082
2005	15606.15	2652.79	1623.91
2006	18218.21	3078.46	1951.14
2007	22915.01	3571.37	2344.3
2008	27051	4214.2	2766.29
2009	2475.78	774.09	10477.84
2010	2681.68	658.54	9883.7
2011	2410.73	638.2	11719.4
2012	1907.21	749.33	10617.59
2013	1747.4	699.23	12874.22
2014	1596.3	734.19	13517.93

Source: (FAO, 2018)

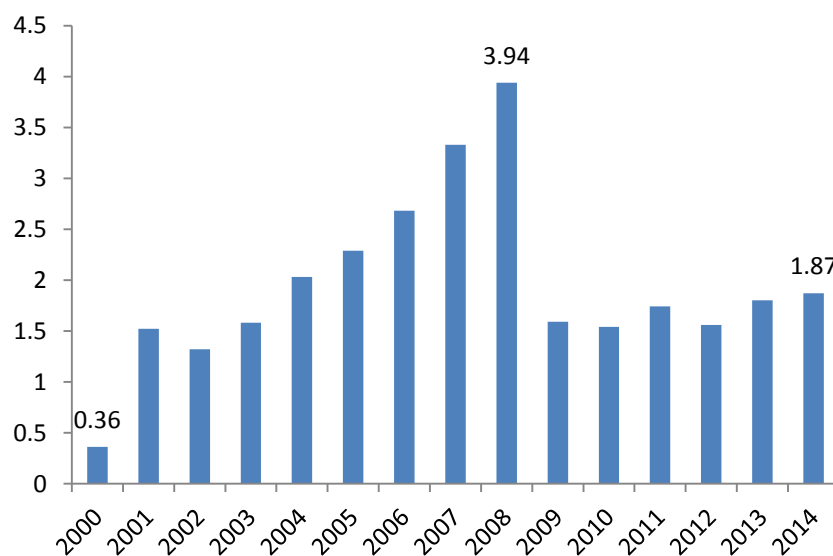


Figure 7 Average use of Pesticides, kg/ha

3.2.3 Land Utilization

Due to increasing population, the pressure on agricultural land is very high. As a result, the share of arable land shows a decreasing trend in recent few decades. The resource base for agriculture has been shrinking. The land area operated by rural households has declined from 9.2 million hectares in 1983-84 to 8.2 million hectares in 1996, indicating that, on average, nearly 82,000 hectares of land are going out of agriculture due to increased non-agricultural uses such as growth of physical area under municipalities and cities (607,000 hectares), increase in homestead land within rural areas (142,000 hectares) and development of rural roads and other infrastructure (252,000 hectares). As a result, the average size of a farm holding has declined from 1.70 hectares in 1960 to 0.91 hectare in 1983-84 to 0.68 hectare in 1996 and 0.40 hectare in 2008. (Shahabuddin, 2016)

Table 3 Amount of land utilized in Agricultural Production

Year	Agricultural area	Arable land	Arable land as % of Agricultural Area
2000	9400	8350	88.83
2001	9403	8303	88.30
2002	9353	8253	88.24
2003	9328	8228	88.21
2004	9323	8143	87.34
2005	9311	7911	84.96
2006	9280	7880	84.91
2007	9266	7816	84.35
2008	9253	7803	84.33
2009	9246	7796	84.32
2010	9241	7791	84.31
2011	9128	7678	84.11
2012	9120	7670	84.10
2013	9108	7678	84.29
2014	9099	7669	84.28
2015	9194.21	7764.21	84.45

Source: (FAO, 2018)

3.3 Crop Production Status

Bangladesh is the most rice-intensive country in South Asia followed by Nepal, Sri Lanka and India. Pakistan is the most wheat-intensive and least rice-intensive country while Bangladesh is the least wheat-intensive country in South Asia except for Sri Lanka, which produces negligible quantities of wheat. Bangladesh has experienced the highest degree of intensification of agriculture because of multiple cropping, which requires a substantial increase in the relative

intensity of all non-land inputs. The incidence of multiple cropping grew as a result of the adoption of dry season irrigation as part of the Green Revolution. (Mohammad Alauddin, 2007)

Production of food grains and other agricultural commodities have increased by many times. Though there were ups and downs but production of food grains generally experienced an upward trend. Increase in production of food grains was substantial during the last four decades. Total production of food grains (rice and wheat) has increased by 3.2 times and average annual production increased from 10.96 million tons in the early seventies to 35.60 million tons in the mid- 2010s (see Table 4). During the same period, total rice production has increased by 3.2 times (from 10.85 to 34.30 million metric tons). Traditionally, Aman rice was the major source of rice in Bangladesh but share of Boro rice to total rice production superseded that of Aman rice since 1998/99. Thus, Bangladesh has experienced a structural shift in its rice production from a largely weather influenced crop to an irrigated crop, which is much more sensitive to the quality of public policy and governance than the vagaries of nature (Deb, 2002). Now, Boro rice contributes about 55 percent to the total food grains production against only 18 percent in the early seventies. Wheat production increased from a low base (109 thousand metric tons) until 2000 (1706 thousand metric tons), and then started to decline. In the recent years, wheat production increased to 1302 thousand metric tons.

Table 4 Area, Production and Yield of Some Crops

Year	Rice			Wheat			Potatoes		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
2009	11353532	48144000	42404	394612	849046	21516	395000	5268000	133367
2010	11529000	50061200	43422	376256	901490	23959	435000	7930000	182299
2011	11528000	50627000	43917	373708	972085	26012	460197	8326389	180931
2012	11423000	50497000	44206	358181	995356	27789	430446	8205470	190627
2013	11372000	51534000	45317	416416	1255000	30138	443934	8603000	193790
2014	11319490	52325620	46226	429770	1303000	30319	461710	8950000	193845
2015	11371775	51278400	45093	437647	1348000	30801	471013	9254285	196476
2016	11385953	52590000	46188	445003	1348186	30296	475699	9474099	199162

Source: (FAO, 2018)

Production of non-cereal crops has also increased substantially except for sugarcane and jute. Between early seventies and mid-2010s, potato production has increased by 11.8 times (from 827 thousand metric tons to 8,777 thousand metric tons) while vegetable production has increased by 4.2 times (from 803 thousand metric tons to 2,954 thousand metric tons). Spices production has increased by 5.7 times. Tea production has increased by 2.6 times. Total oilseed production in the early seventies was about 274 thousand metric tons which gradually increased to 483 thousand in the mid-eighties and then declined with a fluctuating trend to 333 thousand tons in the late-2000s. In the recent years, oilseeds production has increased to 464 thousand metric tons in mid-2010s. Jute production has declined from 865 thousand bales to 854 thousand bales in the late-2000s. In recent years, jute production has concentrated in some areas and increased to 4.43 million bales. Sugarcane production in the recent years was about two-third of the production in the early seventies. Sugarcane production has declined from 6.9 million metric tons in the early seventies to 4.43 million metric tons in the mid-2010s. Average annual production of pulses was about 259 thousand metric tons in the early seventies which increased until mid-nineties but then declined to 217 thousand metric tons in the late 2000s. Since then gradually increased to 309 thousand metric tons in mid-2010s. (Deb, 2016)

3.4 Livestock

Production of milk, meat and eggs increased substantially. Prior to independence livestock was an integral part of the farming systems but commercial farming for dairy, meat and egg production was limited. Court-yard production was common. Between 1991/92 and 2014/15, milk production has increased to 5.2 times (from 1,352 thousand tons to 6,970 thousand tons), meat production has increased to 12.7 times (from 460 thousand tons to 5,860 thousand tons) (Figure 3). On the other hand, egg production has increased to 7.2 times (from 1,517 million eggs to 10,995 million tons eggs). In the recent years (FY2008/09 to FY2014/15), growth in milk, meat and egg production was 22.9, 32.1 and 15.0 percent respectively. (Deb, 2016)

Rahman, Begum and Alam (2014) analysed the actual headcounts and growth of livestock resources over a period of 60 years period (1949-2008). During this 60 year period, average annual growth in bovine population was 1.0 percent per year and for small ruminants (sheep and goats) it was 5.2 percent.

3.5 Fisheries

During the time of independence, fish cultivation was limited and most of the fish were caught from the water bodies. Between 1988/89 and 2012/13, total fish production increased by 4.1 times, from 841 thousand metric tons to 3410 thousand metric tons. During this period, inland capture fisheries increased by 2.3 times, from 424 thousand metric tons to 961 thousand metric tons. Inland culture fisheries have increased by 10.1 times, from 184 thousand metric tons to 1860 thousand metric tons. Production of marine fisheries has increased by 2.5 times, from 233 thousand metric tons to 589 thousand metric tons. In the late 1980s (FY1989), contribution of inland culture fisheries to the total fish production was 21.8 percent which has increased to 54.5 percent in the recent years (FY2013).

3.6 Forestry

Increased demand and remunerative prices for forest products (timber, fruits, etc.) has contributed to the increase in agro-based forestry in the country. Forestry GDP has increased annually at the rate of 5.3 percent during the Sixth FYP against long-term growth of 3.6 percent.

3.7 Performance in Agricultural Trade

Bangladesh has transformed itself from an aid-dependent nation to a trade dependent nation over the last four decades. Value of both agricultural exports and imports has increased substantially over time.

3.7.1 Export of agricultural commodities:

In the early seventies raw jute, tea and leather were main agricultural products for exports. Over time it has changed. During the last two decades (FY1996 to FY2015), value of export of primary and processed agricultural products has tripled, increased from 801 million dollars to 2420 million dollars. During this period, export of frozen foods has increased by 81 percent while leather export increased by 88 percent. Export of jute and jute products quadrupled, increased from 220 million dollars to 868.53 million dollars. During the Sixth FYP, export of all agricultural commodities increased by 49 percent, from 1622 million dollars in FY2010 to 2420 million dollars in FY2015.

3.7.2 Import of agricultural commodities:

Bangladesh is a net importer of both rice and wheat even in normal years. It is also a net importer of pulses, edible oils, spices, fruits, sugar, milk and milk products. Prior to 1993, private sector was not allowed to import food grains. Only government agencies used to import rice and wheat. Since 1993, the government allowed private sector to import food grains. Total import of food items increased from 408 million dollars to 5.104 billion dollars. Compared to 1993/94, value of total import of food grains (rice and wheat) in 2014/15 was 10.4 times while it was 8.2 times for milk & dairy products, 9.8 times for spices and 14.3 times for pulses. In case of oilseeds, import value was 8.9 times and for edible oil it was 13.1 times than that of 1993/94. On the other hand, total value of sugar import has increased from 13 million dollars to 730 million dollars in 2014/15.

Table 5 Import and Export Value of Agricultural Products

Year	Total Agricultural Products(000' \$)	
	Import Value	Export Value
2006	2742004	258861
2007	3521365	334170
2008	3056548	227546
2009	4061832	256536
2010	5742148	364943
2011	7367798	459826
2012	6318903	414617
2013	7193350	451144

Source: (FAO, 2018)

3.8 Positive impacts of intensification

Most directly, the use of pesticides and insecticides reduces the incidence of harmful pests and insects, respectively, which can severely limit yields, contribute to both pre- and post-harvest losses, or even directly impact human health as disease-carrying vectors. This increase in yields and food availability should translate into increased incomes, decreased malnutrition, and improved human health for farming households. Moreover, herbicide use reduces the drudgery

associated with hand-weeding, which may increase quality of life and decrease energy expenditure as well as physical hardship and risk of injury. Indirectly, farmers benefit through revenue gains from more marketable agricultural surplus or the reduced need to buy food, both of which facilitate the purchase and consumption of nutrient-rich foods or better health-related practices (like visiting a doctor preemptively, procuring medicines, purchasing and using a mosquito net to prevent malaria, etc.). Similarly, if these agro-chemicals are labor-saving technologies and relatively less expensive, then farmers enjoy increased profits not only from increased revenues but also from reduced costs of other agricultural inputs. Consumers benefit through increased food supply which should result in decreased food prices in areas not well integrated into national and global food markets. This may be a particularly important point in developing countries where increased access to food may mean healthier communities and more energy to engage in the labor market productively.

3.9 Negative impacts of intensification

Agro-chemicals are often toxic to humans, as is well documented in the toxicology literature. Occupational pesticide exposure can have minor to acute negative neurological, respiratory, immunologic, and reproductive effects, and the use of certain types of agro-chemicals is positively related to diagnoses of cancer. Research also shows that pesticides, especially, can damage human immune systems, increasing the incidence of short term sickness over time. Harmful encounters with these chemicals can occur in a number of situations. Most directly, farmers or other agricultural laborers applying chemicals to crops risk contact via exposed skin and eyes, both of which can absorb chemicals at potentially toxic levels, or through ingestion via the mouth and nose. Beyond the time of application, contact with chemical residues during other agricultural tasks (like weeding, thinning, and harvesting) can also be problematic. Limiting exposure is possible by wearing protective clothing and utilizing other equipment that keeps the chemicals away from the body. Non-agricultural laborer members of a farm household with agro-chemical application are also likely to come into contact with these agro-chemicals. Other household members — particularly children — are likely to walk through or play in fields with chemical treatment, especially those located near dwellings.

Deteriorating water quality also results from the leaching of nitrates into groundwater as a result of the use of chemical fertilizers in crop production. The increased intensity of cropping, including multiple cropping, has led to declining soil fertility. Soils in many areas of Bangladesh

suffer from declining micronutrients. Increased deforestation due to logging, extension of agriculture in some areas and intensification of slash and burn agriculture has reduced the length of the rotation cycle in jhum (shifting) cultivation. Deforestation has a number of serious environmental consequences such as more rapid soil erosion and loss of wildlife with implications for reduced genetic diversity. Greater siltation and sedimentation cause fluctuations in river flows. Reductions in stocks of inland fish have been caused by environmental changes such as reduced water availability and quality in streams and rivers and the draining and filling of water bodies. Land quality has also declined. Agricultural intensification featuring increasing and indiscriminate use of agro-chemicals combined with poor irrigation management and waterlogging have resulted in a significant decline in organic matter. (Mohammad Alauddin, 2007)

Irrigation, primarily based on groundwater has played an important supporting role. Most of these innovations have been land-saving, but capital-intensive and water intensive. However, this process of agricultural intensification has also entailed considerable damage to the physical environment including the loss of genetic diversity, degradation and depletion of natural resources and unsustainable use of land and water resources.

3.10 Determinants of Agricultural Transformation

Several factors have contributed towards agricultural transformation in Bangladesh. These include rapid technological change and more options for farmers created through agricultural research, increased market opportunity, higher level of profit and income. Farmers' aspirations and positive attitude towards change were ably supported through policies, public investment in agriculture and delivery of essential inputs. Development and diffusion of improved crop varieties with useful traits and higher yield and profitability, expansion and better management of irrigation through innovative ways such as introduction of prepaid cards in the Barind region for use of DTWs, effective input (seed and fertilizer) delivery, expanded credit facility for agriculture sector, policy reform and investment in agriculture. Access to input and output markets through better road networks in the country and to the international market through trade policy reform (reduction of tariff rates for inputs and cash incentive for export of vegetables and fisheries products) also contributed towards increase in domestic production and increased availability of food items to the consumers.

CHAPTER 4

CONCLUSION

Bangladesh has made remarkable progress in agricultural development and structural transformation has taken place over the years. Production of various agricultural commodities (crops, livestock, fisheries and agro-forestry) has increased and diversified. Increased rural credit for farm and non-farm sectors and separate credit program for the tenant farmers with opening Bank Accounts for more than 10 million farmers contributed towards financial inclusion of the rural households. More than 70 new varieties and hybrids of different crops were developed and released along with new breeds for poultry during last six years. In FY2015, compared to FY2010, value of exports of agricultural commodities has increased by 49 percent. During the same period, import of agricultural commodities has also increased by 18 percent.

Care should be taken for improving yield levels of usual slow growth crops like minor cereals, pulses and oilseeds. This is to accelerate the trends of crop diversification. The fluctuation in yield is the major cause for the fluctuation in the production and hence the fluctuations in yield have to be controlled to bring in stability in the production. This would mean concerted research efforts in developing new varieties of crops whose yield potential is stable across different agro-climatic regions.

The use of modern inputs plays an important role in enhancing the productivity of crop sector. Use of fertilizer has turned out to be the most important input. Along with fertilizer-use, irrigation, source of irrigation, better human resources, improved seed, credit facilities have emerged as other critical determinants for agricultural productivity.

Over a period of the last four decades, Bangladesh agriculture has experienced significant intensification. The process of agricultural intensification due to a range of factors is both a cause and an effect of the extraordinary growth in groundwater irrigation and fertilizer use. However the continued increase in groundwater and fertilizer intensity of agriculture has caused significant damage to the physical environment and threatened the sustainability of agricultural production.

REFERENCES

- Alia, D. Y. (2017, July 14). Agricultural Input Intensification, Productivity Growth and The Transformation of African Agriculture.
- BBS. (2017). *Statistical Year Book of Bangladesh 2016* (36 ed.). Dhaka, Bangladesh: Ministry of Planning.
- BBS. (2017). *Yearbook of Agricultural Statistics 2016* (28 ed.). Dhaka, Bangladesh: Ministry of Planning.
- Deb, U. (2016). Agricultural Transformation in Bangladesh: Extent, Drivers and Implications.
- FAO. (2018). *FAOSTAT Database*. Retrieved April 20, 2018
- Kumar, A. (2013). Growth and Instability in Agricultural Productivity: A District Level Analysis., 26, pp. 31-42.
- M. A. Baset, M. R. (2009, June). Measurement and Analysis of Total Factor Productivity Growth in Modern Variety Potato. *Journal of Agriculture & Rural Development*, 7(1 & 2), 65-71.
- Md. Tanjil Hossain, D. A. (n.d.). Climate Change, Agricultural Transformation and Food Security in Northern Bangladesh.
- Megan Sheahan, C. B. (2016). *The Unintended Consequences of Agricultural Input Intensification: Human Health Implications of Agro-chemical Use in Sub-Saharan Africa*. African Development Bank, Abidjan.
- MOA. (2017, November 11). Retrieved April 24, 2018
- Mohammad Alauddin, J. Q. (2007). Agricultural intensification, irrigation and the environment in South Asia: Issues and policy options. *Ecological Economics*.
- S Rahman, I. A. (2014). Livestock in Bangladesh: distribution, growth, performance and potential. *Livestock Research for Rural Development*, 26(10).
- Shahabuddin, D. Q. (2016). *Structural transformation of agriculture*. Dhaka: The Daily Star.

