

VOLUME I

**ACTIONABLE POLICY BRIEF AND
RESOURCE IMPLICATIONS**

**AGRICULTURE SECTOR REVIEW
(CROP SUB-SECTOR)**

**MINISTRY OF AGRICULTURE,
GOVERNMENT OF BANGLADESH**

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Study Team

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Methodology of the Study

The team started work on April 13, 2004. A combination of analytic, investigative, participatory and inclusive approaches to problem diagnosis and solution articulation characterizes the overall methodology adopted in preparing the policy briefs contained in this report.

First, a conceptual framework was developed putting the longer-term prospect of agricultural growth and structural change within the context of macroeconomic growth taking into account the emerging trend towards market and trade liberalization, regional development with neighboring countries and globalization.

Second, meetings were held with key stakeholders including the Honorable Minister of Agriculture, donor agencies and others to carefully review and finalize the scope and direction and methodology of the study.

Third, linked with the second, through two meetings of the National Steering Committee for Agriculture Sector Review, guidance was obtained on the key questions to be looked into and the key thrusts of the study.

Fourth, the vast array of available literature on Bangladesh agriculture was carefully reviewed to come to grips with the current wisdom on the problems and prospects of the sector and the general perception as to its current direction. Available secondary data supplemented by some first hand data collected quickly from the relevant sources were used to examine the comparative advantage, competitive strength and profitability of various crops grown in the country.

Fifth, field missions were carried out between April 16 and April 26 to about 30 districts in the north, northeast and northwest, and south and southeast of the country to observe in person the state of Bangladesh agriculture and to meet with all stakeholders and learn first hand their problems, what they see as major impediments to future development and what they feel should be done collectively by all concerned to overcome these constraints. Visits were made to local offices of the Ministry of Agriculture, training institutes, agricultural research stations, local markets at various levels, agricultural farms, seed stores, fertilizer distribution/sale points, irrigation pumps, agriculture machinery sale and repair stores, fish hatchery, seed and grain storage facilities, rice mills and wayside mechanical threshing operations. A short proforma was used to collect information on the cost of production of 34 selected crops in various locations. Focus group discussions were held with MoA officials at all levels, farmers, seed dealers, fertilizer dealers, Bangladesh Fertilizer Association, NGOs and agricultural traders. These discussions were invaluable for the Team to understand key issues as perceived by participants. These meetings were also used as sounding board for various policy options recommended and their likely impact, positive or negative. Field visits and focus group discussions were used to collect spot data on recent price movements and supply situation of major inputs, output and agricultural wages and rent as well as costs and returns from agricultural production at farmers level. In the same vein an attempt was made to understand the dynamics of poverty and labor market at micro level in rural areas as well as the linkages between farm and non-farm activities and their impact on poverty and labor market.

Sixth, a series of brainstorming sessions were organized in Dhaka with eight groups of sub-sector experts and functionaries and private sector operators (producers, importers, manufacturers of farm machineries and dealers) as well as NGOs to review mission's findings and policy recommendations. These sessions covered research and extension, mechanization, marketing, seed, water, and fertilizer. Broad areas of agreement were reached with each group on major recommendations of the Sector Review Team. To firm up these understandings, the Team met with key officials of the Department of Agricultural Extension (DAE), Bangladesh Agricultural Development Corporation (BADC), Department of Agricultural Marketing (DAM) and Bangladesh Water Development Board (BWDB) for follow up in-depth discussion.

Continued on next page

Scope and Limitations

The study covers crops sector only. Livestock, poultry and fisheries will be taken up during in-depth sector review. This was dictated by the fact that at the request of the Ministry of Agriculture, the study Team had to complete its work in about a month's time including the time spent in the field. Also due to time and resources constraint it was not possible to undertake any special study in support of the broader work. This has to wait the outcome of and reaction to the first phase. The field visit too was inevitably short limiting the possibility of in-depth investigation on ground to bring out more of inter and intra-regional variations. While the Team did its best to meet farmers, farms and villages, logistic and time problem implied a close-to-road bias, a gap to be filled during detailed sector review. It was possible to collect only limited amount of relevant data from the field. It was not possible to cross check all information in the field. This had to be done in Dhaka with data from more traditional source such as Bangladesh Bureau of Statistics (BBS). The focused group discussions were only meant to be snapshot of rapid rural appraisal in improvised environment. There is need to bring out the role of women in the agriculture of the future, another gap in the current phase of the study. Because of the local election fever running throughout the country during the Team's field visits, interaction with local political leaders was limited. There is significant scope for expanding NGO consultation in the next phase, especially with those involved in agriculture. Finally, in the next round greater emphasis has to be given to industrial crops and agro-processing for which a separate sub-sector review has to be undertaken.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABFL	Aftab Bahumukhi Farms Limited
ADP	Annual Development Plan
ADP	Agribusiness Development Project
APB	Actionable Policy Brief
ARMP	Agricultural Research Management Project
ASC	Agricultural Services Center
ASIRP	Agricultural Services Innovation and Reform Project
ASSP	Agriculture Support Services Project
ATDP	Agro-Based Industries and Technology Development Project
ATI	Agricultural Training Institute
BADC	Bangladesh Agricultural Development Corporation
BAPA	Bangladesh Agro-Processors Association
BARC	Bangladesh Agricultural Research Council
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BCIC	Bangladesh Chemical Industries Corporation
BFA	Bangladesh Fertilizer Association
BFRI	Bangladesh Forest Research Institute
BMDA	Barind Multipurpose Development Authority
BINA	Bangladesh Institute of Nuclear Agriculture
BJRI	Bangladesh Jute Research Institute
BKB	Bangladesh Krishi Bank
BLRI	Bangladesh Livestock Research Institute
BRDB	Bangladesh Rural Development Board
BRII	Bangladesh Rice Research Institute
BS	Breeder Seed
BSC	Bangladesh Seed Corporation
BSRI	Bangladesh Sugarcane Research Institute
BSTI	Bangladesh Standard and Testing Institute
BTRI	Bangladesh Tea Research Institute
BWDB	Bangladesh Water Development Board
CDP	Crop Diversification Project
CIMMYT	International Center for Wheat Improvement
CIP	International Potato Center
CS	Certified Seed
DAE	Department of Agricultural Extension
DAEM	Directorate of Agricultural Extension and Management
DAM	Department of Agricultural Marketing
DAP	Di-amonium Phosphate
DARE	Directorate of Agricultural Research and Education
DG	Director General
DTW	Deep Tube Well
FAO	United Nations Food and Agriculture Organization
FCD	Flood Control and Drainage
FCDI	Flood Control, Drainage and Irrigation
FINA	Farmers' Information Needs Assessment
FS	Foundation Seed
GAP	Good Agricultural Practices
GDP	Gross Domestic Product
GHMP	Good Health and Manufacturing Practices
GMO	Genetically Modified Organism
GOB	Government of Bangladesh
GVP	Good Veterinary Practices

HRD	Human Resource Development
HYV	High Yielding Variety
IADP	Integrated Agricultural Development Plan
IARC	International Agricultural Research Centers
ICRISAT	International Center for Research in Semi Arid Tropics
IFDC	International Fertilizer Development Corporation
IHANDP	Integrated Horticulture and Nutrition Development Project
IRRI	International Rice Research Institute
IUCN	International Union for Conservation of Nature
LDC	Least Developed Countries
LG	Local Government
LGED	Local Government Engineering Department
LLP	Low Lift Pump
LV	Local Varieties
MDG	Millennium Development Goals
MFA	Multi Fiber Agreement
MIS	Management Information System
MOA	Ministry of Agriculture
MP	Muriate of Potash
MT	Metric Ton
MV	Modern Varieties
NAEP	New Agricultural Extension Policy
NAP	National Agricultural Policy
NARS	National Agricultural Research System
NCDP	Northwest Crop Diversification Project
NGO	Non Governmental Organizations
NMS	New Marketing System
NSB	National Seed Board
NSP	National Seed Policy
OLD	Marketing System
PDB	Power Development Board
PKSF	Polly Karma Shahayak Foundation
QS	Quality Seed
RDA	Rural Development Academy
RDRS	Rangpur Dinajpur Rural Service
REB	Rural Electrification Board
RTS	Ready to Serve
SAIP	Smallholder Agricultural Improvement Project
SCA	Seed Certification Agency
SEDF	South Asia Enterprises Development Facilities
SHOGARIP	Shashya Gudam Rin Prokalpo
SPS	Sanitary and Phytosanitary
SRDI	Soil Resources Development Institute
SSP	Single Super Phosphate
STW	Shallow Tube Well
TBRT	Technical Barrier to Trade
TCCA	Thana Central Co-operative Associations
TDP	Transportation Discount Point
TLS	Truthfully Labeled Seed
TSC	Thana Sales Center
TSP	Triple Super Phosphate
TTMU	Technology Transfer and Monitoring Unit
UNFPA	United Nations Population Fund
USD	United States Dollar
USG	Urea Super Granule

VAT Value Added Tax
WTO World Trade Organization

EXECUTIVE SUMMARY

This Actionable Policy Brief (APB) was prepared in a participatory manner, using available information, field visits and consultation with all the major stake holders. Though the primary focus of this APB remains the crop sub-sector, its preparation was coordinated with the ongoing work on Interim Poverty Reduction Strategy Paper (IPRSP) and the Governments' evolving strategy to meet the Millennium Development Goals. The recommendations provided in this document were guided by two profound considerations. First is the longer-term prospect of agricultural growth and structural change within the context of macroeconomic growth, taking into account the emerging trend towards market due to trade liberalization and globalization, regional development likely to take place with the neighboring countries, and the development trend seen in the rural areas of Bangladesh. The current development trend in rural areas clearly indicates that Bangladesh is likely to be a linear urban sprawl with agriculture being a hinterland of this urban conglomerate. Rural economy is also likely to be more diversified and linkages, forward and backward, would bring rural Bangladesh closer to urban Bangladesh. Agriculture would be transforming itself from subsistence to a more commercial base.

Second is the ground realities dominated by the fact that while economic activity is being diversified in rural areas in response to changing environment and new opportunities in both agriculture and non-agriculture sector, a large mass of population still live below the poverty line in rural Bangladesh. Clearly, productivity, profitability and net return to family labor in agriculture must grow significantly to pull this vast majority of rural dwellers out of poverty in a sustained way. The problem is that compared with many neighboring countries, the farmers of Bangladesh are at a disadvantage in terms of lower productivity and higher cost of production due to higher unit costs of seed, fertilizer, water and labor. Low-profit of rice agriculture is due to high cost of production, particularly HYV rice. High price of seed, fertilizer, fuel for irrigation, pesticides on the one hand and lower price of produce on the other have made it a non-profit pursuit. Fertilizer/rice price ratio has increased by 50% between 1985-1986 and 2001-2002. Subsidy in agriculture in Bangladesh is very negligible compared to other countries of the world. India has an elaborate system of support for agriculture. The public sector has to play a more active role in improving the production environment of the farmers who need assistance to compete with neighboring countries from a position of strength. The margin of profit of farmers can be further enhanced and agricultural produce can be made more competitive in the international market with appropriate policy and institutional reforms many of which have already been initiated by the present Government. More measures are envisaged in this report for consideration of the Government.

Food production to feed all Bangladeshis will continue, but more efficiently and in line with changing food habits resulting from income increases and urbanization. Structural transformation would call for increasing productivity of rice, diversifying crop production to non-rice crops including industrial crops, improving processing, product development and post harvest management, and expanding non-crop agriculture. Production will be for domestic consumption and exports, both should follow Bangladesh's comparative advantage profile and competitive strength except for rice whose production will continue from the point of view of national security and not just food security. The agriculture sector can play the role envisaged here in the context of future growth of the economy realizing the objectives of food security, employment generation, alleviation of poverty and natural resource conservation by (a) increasing land (including water) productivity, (b) increasing labor productivity, (c) increasing investments in agriculture, and (d) improving risk management.

Policy support creating enabling environment in the agriculture sector has to target factor productivity, investments and risks by (a) rationalizing public expenditure allocation, increasing public investment in infrastructure and services (public good) and promoting private investment in agriculture, (b) inducing shift in relative prices of input and output to correct market distortion, rationalize the incentive structure for investment and mitigate negative impact on the environment, and (c) putting in place appropriate legal and regulatory framework and (d) effecting institutional reform and good governance making both public and private sector more transparent, accountable to people and efficient which will help conserve both public and private resources and encourage

investments in the agriculture sector. Designed and administered properly, (a) to (d) will increase land and labor productivity in agriculture, increase investments, and reduce natural hazard risks and market risks. Only then, Bangladesh will be able to improve its competitive strength in both domestic and international market subject of course to compliance with quality control requirements and there will be a sustained decline in the proportion of people living below the poverty line.

However, increase in agricultural production and productivity ultimately will depend on the farmers' ability and willingness to adopt technology and engage in productive activities. In this context it is fundamental that the problems of farmers are listened to and constraints facing them are addressed.

In the seed sector, the farmer is concerned with timely availability of quality seed in adequate quantity at a reasonable price. In the case of fertilizer again, the farmer is concerned with timely availability of quality fertilizers (Urea, TSP, MP, DAP) in adequate quantity at a reasonable price. Imbalanced use of fertilizers linked to relative prices of different types of fertilizer is serious, because soil nutrients lost are not replaced properly. There are other concerns too, namely, adverse movement in fertilizer/rice price ratio, quality of fertilizer sold, the bag weight, price fluctuations due to international price changes and unethical practices of private dealers, anomalies in the fertilizer distribution system, buffer stock, and government import. For the future, the key irrigation challenges are water use efficiency, water quality, surface water management, conjunctive water use, technology shift in water management and monitoring of water quality and quantity. No less important is the energy supply for irrigation, electricity and diesel. Cutting across all is lack of access to credit.

Marketing is the weakest aspect of Bangladesh agriculture. The most critical problems are infrastructure (e.g., feeder roads, markets, cold storage, threshing floors), storage, and processing, packaging, transport and market delivery, domestic and foreign.

The agricultural marketing chain is highly fragmented. Many actors like local collectors, local traders, local market aratders and their agents, urban wholesalers and their commission agents, rural and urban retailers constitute the important component of the marketing system. The wholesalers and their agents mainly determine the market price of fresh produces. The marketing of surplus produce in the peak period faces problems due to insufficient agri-preneurial development in the country to undertake agro-processing and marketing. Bangladesh suffers from serious lack of information on agro-processing and marketing thereby limiting the reach of potential investors. There is no institution, public or private to fill this gap. This requires priority attention, particularly when many farmers are engaged in diversifying production as per government policies.

The private sector agribusiness is just evolving. Many of these enterprises have developed contract farming of cereals, fruits, vegetables, pulses, oilseeds and others. Several companies are players with a relatively short history. Some have emerged as important success stories which bode well for the development of commercial/industrial agriculture in Bangladesh provided impediments could be removed.

The greatest challenge for the future lies in making agricultural research and extension more clients oriented and demand driven. The research bodies need operating fund. In the recent past, intensive effort to organize agricultural research contributed significantly to agricultural growth. The largest contribution was made by the Bangladesh Rice Research Institute (BRRI) and the Bangladesh Agricultural Research Institute (BARI). BRRI has released 43 high yielding rice varieties, including one hybrid. BARI has released 228 high yielding varieties of various crops, including 21 wheat varieties and 32 potato varieties. BARI has also released 41 vegetable and 11 spices varieties.

Despite this commendable achievement, the shortfall in non-cereal crops has become a chronic threat. The output levels of these crops have either remained static or declined in absolute terms. HYV rice yield has also slowed, showing sign of stagnation or even decline in some cases. From this angle alone, the achievement of the NARS has remained substantially short of what might have been otherwise expected. The key problems appear to be associated with limited operating funds, inappropriate incentive structure, erosion of scientific skills, and serious institutional and management constraints.

In this policy brief, based on a quick review of the agriculture sector and taking into account the vast literature available and on-going studies, an array of carefully selected recommendations is made to address key constraints faced by farmers. The recommendations are grouped into immediate and medium term priorities and are given in Chapter 10. All these recommendations need to be considered in their totality. Adoption of the immediate measures without attention to the medium term recommendations may not lead to sustainable impact. For example, the recommendations related to providing subsidies to the farmers to encourage balanced use of fertilizer for environmental and soil fertility concerns and to restore their ability to compete with the neighboring countries, who are subsidizing their own farmers, are due to the critical nature of the crisis and the realization that implementation of the medium term measures, focusing on institutional and policy reform and adequate infrastructure and public goods to make the farmers competitive without direct subsidies will require time. Therefore it is critical that the Government gives as much priority to the medium term measures to restore the sector's competitiveness as quickly as possible so that the subsidies can be withdrawn as indicated in this report.

Market oriented economy does not imply that the government should sit back and pursue a completely laissez-faire policy toward agriculture. Agriculture has traditionally depended a great deal on public investments, support and above all policies. In the new environment, the role of government is changing. private sector is now a major partner in development. in recognition of this, there is an urgent need for a "revised up-to-date policy", anchored on a vision for a competitive, commercial and diversified agriculture (inclusive of livestock, forestry and fisheries), which will clearly lay down an effective and transparent framework of governance in the agriculture sector.

During the process of preparing this APB, as well as the PRSP, it has been found that the available information and data are not adequate for the formulation of a policy framework with a vision for the future and road map to commercialization of agriculture, including policies for non-farm income generation and diversification. There are no reliable and systematic information, review and analysis of what is happening with respect to farm level productivity, agro-industries, marketing and trade of agricultural products, including livestock, fisheries and forestry, as well as the transformation which is taking place in the rural areas and in particular the extent to which the farmers are actually benefiting from all the services and support provided to them by the government. In fact the issues related to governance and efficient functioning of the government at grass root level affecting the poor farmers are yet to be clearly reviewed and analyzed. Hence there is an urgent need for a broad based review of the sector, including livestock, fisheries and forestry, with focus on how to maximize impact on poverty, governance and efficient delivery of public services, promotion of private sector and commercialization of the agriculture sector within a diversified rural economy.

ACTIONABLE POLICY BRIEFS AND RESOURCE IMPLICATIONS

CHAPTER 1

Overview of Agriculture

A. Introduction: the Vision and the Conceptual Framework

1. The vast majority of population of Bangladesh depends on agriculture, directly and indirectly. An estimated 62.93% of the total labor force, 15 years and above was directly engaged in Agriculture (crops, livestock, forestry and fisheries) in 1999-2000. In 1989, this share was higher, 72.47%.¹ Agriculture contributed 23.46% to Gross Domestic Product (GDP) in 2002-2003, down from about one-half in early 1970s.² However, considering linked activities, the share of agriculture in total GDP is still high, over 50%. Within agriculture, the share of crops was 57.1% in 2002-2003. Ninety-eight percent of food comes from agriculture. Agriculture and agro-based commodities accounted for 11.2% of exports in 2002-2003.³ GDP at constant 1995-1996 prices grew annually at 5.0% over 1992-1993 to 2002-2003 period, agriculture and crop sectors at 3.1% and 2.2%, respectively.⁴ On average, the rate of agricultural growth was higher than the rate of population growth.

2. Agriculture is the driver of Bangladesh economy and it will remain so in the foreseeable future. Yet productivity and income in agriculture is much lower than non-agriculture. Incidence of poverty is higher in rural than in urban areas, 53% against 37% in 2000.⁵ Budgetary allocation, both recurrent and development, to agriculture has declined markedly over past two and half decades. ADP share has declined from 31% in 1971-1972 to under 3% in 2003-2004, recurrent budget share from 10% in 1991 to 1.2% in 2003-2004.⁶ Nonetheless, many imperatives will likely to see a more vibrant agriculture emerging in the future linked to a robust growth of the overall economy. Already there are signs that the Bangladesh economy is ready to take off, growth rate accelerating from present encouraging rate in excess of 5% per annum to a more sustained 8%-10% over next three to four decades. This is both feasible and desirable if one hopes to achieve critical elements of the Millennium Development Goals (MDG's), particularly of reducing income-poverty to 25% of total population by 2015.

3. The macroeconomic growth would imply that the broadly defined agriculture sector (crops, livestock, forestry and fisheries) should be growing at annual rate of 4-5%. This has to be accomplished in the context of declining availability of agricultural land, if the present trend of urbanization, industrialization, and commercialization continues. Agricultural land would have to give way to the demand of the latter. Bangladesh is likely to be a linear urban sprawl with agriculture being a hinterland of this urban conglomerate. Rural economy itself would be much more diversified and linkages, forward and backward, would bring rural Bangladesh closer to urban Bangladesh. Agriculture sector would be transforming itself from subsistence to a more commercial base. It will be driven by objectives of food security, economic growth, employment generation, alleviation of poverty and natural resource conservation. With less land and very little growth in agricultural labor force since most of the incremental rural labor force will shift to non-agricultural activities, agriculture sector will be able to attain its objectives as outlined here and retain the economic 'driver ship' role only through increases in the productivity of land (including water) and labor and continued structural transformation consistent with the changing nature of the economy, labor force and consumers and emerging regional and global trade environment. Food production to feed all Bangladeshis will continue, but more efficiently and in line with changing food habits emanating from income increases and urbanization. Structural transformation would call for increasing productivity of

¹Ministry of Agriculture, Hand Book of Agricultural Statistics, May 2003. Table 2.02.

²Government of Bangladesh, Ministry of Finance, Bangladesh Economic Review 2003, June 2003, Appendix 5.

³*Ibid.*, Appendix 42.

⁴Calculated from *ibid.*, Appendix 3.

⁵Bangladesh Bureau of Statistics, Statistical Yearbook of Bangladesh 2001, Table 14.24.

⁶Handbook of Agricultural Statistics, *op.cit.* Table 3.02, and Bangladesh Economic Review 2003, *op.cit.* Appendix 1 33.3 and 13.4.

rice, diversifying crop production to non-rice crops including industrial crops, improving processing, product development and post harvest management, and expanding non-crop agriculture. Production will be for domestic consumption and exports, both should follow Bangladesh's comparative advantage profile and competitive strength except for rice whose production will continue from the point of view of national security and not just food security. The growth perspective and prospect for the agriculture sector outlined here would require substantial increase in investment/capital accumulation in the sector and improved management of the agricultural enterprise with built in provisions for risk management. Two types of risks need to be addressed: market risks and natural disaster related risk. Existing policies would have to be reviewed, fine tuned, modified, discarded if need be or replaced with new ones so that the agriculture sector can play the role envisaged here in the context of future economic growth of the economy realizing the objectives of food security, employment generation, alleviation of poverty and natural resource conservation by (a) increasing land (including water) productivity, (b) increasing labor productivity, (c) increasing investments in agriculture, and (d) improving risk management. The present review of crop sub-sector of agriculture and the Actionable Policy Brief (APB) is an attempt in that direction. The brief outlines (a) priority immediate measures, (b) priority medium term measures and (c) priority long-term measures for consideration of the Government. Some of these recommendations are well founded, others will require further investigation when the in depth sector review is undertaken. The agriculture sector and the environment in which it is operating are very dynamic and it will be important to monitor the situation very closely and respond to emerging realities rapidly. In certain critical areas such as agricultural research, the future would have to be anticipated and the agenda for action would have to be set accordingly. The policy brief itself will remain a work in progress since realities on ground are ever changing.

B. Evolution of the Agriculture Sector:

Growth

4. Bangladesh agriculture has achieved significant structural changes over the past three and half decades. Despite many problems and constraints a quiet agricultural revolution has taken place which is still evolving in response to natural calamities, sociopolitical changes, population growth, urbanization, new technology in agriculture and new opportunities in rural non-agriculture sector, commercialization and changes in macro policy and sector policy reforms including market and trade liberalization and substantial reduction in public sector intervention in agriculture. From largely a peasant based subsistence activity, agriculture today is more of a commercial entrepreneurial activity than ever before. Sub-sector growth performance indicates diversification in favor of fisheries. Growth of crop sector was unstable than growth of other sub-sectors in agriculture.⁷ Growth of non-cereals, mostly horticultural products accelerated from 1.01% over 1990-1996 to 3.21% over 1996-2000 period.⁸ Vegetable production increased by 84% between 1992-93 and 2000-01.⁹ The Review Team observed the increasing phenomenon of diversification of Bangladesh agriculture during field trips to different parts of the country over a two-week period in April 2004. Agricultural productivity as measured by value added per worker increased by 24% between 1990-1991 and 1999-2000, as

⁷Growth rate of agricultural production, 1980 through 2000 (Percent/year)

Sectors	1980-1985	1985-1990	1990-1995	1995-2000
Crops	2.1	2.3	-0.4	3.7
Livestock	2.0	2.2	2.4	2.6
Fisheries	5.6	6.8	7.8	8.7
Forestry	2.7	3.0	2.8	4.5
Total Agriculture	2.4	2.8	1.6	4.2

Source: Ahmed, Raisuddin, Public Expenditure and Rural Development, Bangladesh, International Food Policy Research Institute, Washington D.C., May 2002.

⁸Mujeri, Mustafa K., Agricultural Growth -Poverty Linkages: Issues and Implications for Policies in Bangladesh, Working Paper No. 08, MIMAP Bangladesh, Bangladesh Institute of Development Studies, Dhaka, Bangladesh, June 2002. Table5.

⁹ Statistical Yearbook of Bangladesh 2001, *op.cit.*, Table 4.61.

compared with 104% for industry. Productivity in the service sector was stagnant over this period.¹⁰ Movement in the percentage of population living below the poverty line¹¹ is associated with GDP and agricultural growth despite declining share of agriculture in total GDP.¹² Percentage of population living below the poverty line declined from 62.6% in 1983-1984 to 44.3% in 2000, though in absolute term, still 55.6 million people live below the poverty line in 2000.¹³ Agriculture must grow well in excess of 4% and GDP in excess of 7% in a sustained way over next several decades to reduce poverty to an acceptable limit of, say, the millennium development goal (MDG). Other Asian countries with higher growth rates substantially reduced poverty.

Technological change

5. Technological change coupled with market forces greatly influenced Bangladesh agriculture in mid-sixties and seventies. From a relatively stagnant sector in the pre-Green Revolution period, Bangladesh agriculture emerged as a dynamic sector in the Green Revolution period. There was a significant growth in institutional infrastructure as well as a shift towards liberalization from government control. Total rice production in 1971 was 10 million tons; in 2001-2002 it was 26 million tons. In other words, rice production during the last three decades increased by 2.5 times. Cropping intensity increased from 150% in the early 1980s to about 180% in 2000-2001.¹⁴ Total arable land is 13.9 million hectares. Paddy is cultivated in 10.7 million hectares (77.0%). Long-term trend of rice production shows that the dominant factor in growth is rice yield, stimulated by high yielding varieties (HYV), fertilizer, and irrigation technology. Investment in research was small, yet there was technological progress, as evidenced by release of 43 HYV rice varieties by BRRI and 228 high yielding varieties of various crops by BARI. Extension too played a role although the much discussed T & V system collapsed, the lesson being that market should spread new technology, farmers should seek out extension with queries and problems and agents should be there to assist. Hence a strong case for building Specialized Service Centres at Upazilas with one stop extension service at the Union. Rice yield increased from 1.22 metric ton per hectare in 1975-1976 to 2.28 metric tons per hectare in 2001-2002; HYV *Boro* from 2.54 metric tons per hectare to 3.20 metric tons per hectare.¹⁵ HYV occupies 60% of rice area sown in late 1990 compared with 13% in mid 1970s. Over the same period, fertilizer use increased from 48 kg per hectare to 190 kg per hectare and the proportion of irrigated rice areas, from 12% to 29%.¹⁶ The bulk of the gain was achieved through expansion of rice in the *Boro* season. Fertilizer use became popular across all groups of farmers.

¹⁰ Trends in value added per worker (Index 1985/86=100)

Sector	Value added per worker		
	1990-1991	1995-1996	1999-2000
Agriculture	58.1	61.1	72.0
Industry	73.9	135.5	150.6
Services	109.1	95.6	108.3
Total	72.6	83.2	96.8

Source: Mujeri, Mustafa K., Agricultural Growth -Poverty Linkages: Issues and Implications for Policies in Bangladesh, Working Paper No. 08, MIMAP Bangladesh, Bangladesh Institute of Development Studies, Dhaka, Bangladesh, June 2002. Table 8.

¹¹ Poverty line corresponds to an intake of 2122 kcal/person/day and a non-food allowance, which corresponds to nonfood expenditure among households whose food expenditure equals the food poverty line.

¹² Poverty trend and agricultural growth

Period	Poverty trends	Annual growth rate (%)	
		GDP	Agriculture
1984-1986	Declining	4.2	2.5
1986-1989	Increasing	3.5	0.5
1989-1992	Increasing	4.2	2.6
1992-1996	Declining	4.6	1.2
1997-1999	Declining	5.4	4.8

Source: Mujeri, Mustafa K., Poverty Trends and Growth Performance: Some Issues in Bangladesh, Working Paper No. 04 MIMAP, Bangladesh Institute of Development Studies. February 2002. Table 7.

¹³ Statistical Yearbook of Bangladesh 2001, Table 14.23.

¹⁴ Handbook of Agricultural Statistics, *op.cit.*, Table 4.01.

¹⁵ *Ibid.*, Table 5.05.

¹⁶ Ahmed, Raisuddin, Retrospects and Prospects of the Rice Economy of Bangladesh, Dhaka: The University Press Limited, 2001, page 9.

According to 1996 Agricultural Census, 83% of farm holdings applied fertilizer involving 71% of gross crop area.¹⁷ Irrigation development was a major factor behind spread of HYV and consequent yield increase. From an initial focus on surface water, irrigation emphasis shifted to development of ground water (69% of all irrigation in 2002-2003) with the advent of shallow tube well promoted by market liberalization. Irrigated area increased by 5.5% annually from 1975-1976 to 1996-1997, ground water based irrigation by a phenomenal 18.6%.¹⁸ Other concurrent developments include increasing mechanization of agricultural operations, including power tillers for cultivation, pumps for irrigation and threshers and rice mills for converting paddy into rice. In some regions, power tiller use has reached 60% of the area cultivated; up from 28% reported in 1996 Agricultural Census in response to shortage of human and animal labor raising the cost of both.

Agriculture Sector Policy reforms (crops)

6. In the late 1960s and much of 1970s, spread of new rice technology and production expansion took place under the auspices of Bangladesh Agriculture Development Corporation (BADC) which was responsible for procurement and distribution of fertilizer, irrigation pumps, pesticides and quality seeds. Reforms in input markets (pesticide, fertilizer, minor irrigation equipment) starting in late 1970s, particularly through privatization of fertilizer and minor irrigation by taking them out of BADC's control, boosted production although in the case of urea where the share of private trade reached nearly 100% by 1992, the market suffered several supply shortages leading the Government to reverse its free market policy with regard to urea. Following the fertilizer crisis of mid 1990s, fertilizer subsidy was reintroduced for urea, and the distribution system was thoroughly reformulated barring fertilizer movement out of an Upazila to which it is allotted. Dealers appear to be unhappy with this restriction and also with allotment of equal quantity of urea for each Upazila. It is claimed that dealers are unable to respond to fertilizer shortage in other parts of the district or even in a neighboring Upazila belonging to another district. Similarly, fear of oligopoly in the case of imported TSP and MP and others persist. Free import of equipment has hampered domestic production though farmers received short term benefits from low cost equipment, and response to seed and pesticide liberalization has been modest.¹⁹ Under the same liberalized policy regime, wheat production increased from 0.11 million tons in 1974 to 1.8 million tons in 2000. There was impressive growth in potato and vegetable production. Area under vegetables increased from 40,000 hectares in 1979-1980 to 118,000 hectares in 2000-2001.

7. The Government of Bangladesh approved a National Agricultural Policy (NAP) in April 1999 with 18 subsidiary objectives and 18 program areas to be implemented within the framework of the ongoing macroeconomic and agriculture sector reform based on market and trade liberalization that was accelerated by the then Government in the early 1990s to promote private sector and competition and reduce public sector intervention in the economy. At the request of the Government, United Nations Food and Agriculture Organization (FAO) prepared a Plan of Action (POA) in 2003 to implement NAP. The POA highlighted certain shortcomings and inconsistencies of NAP related to (a) increasing crop diversification in the face of the pursuit of the goal of cereal self-sufficiency, (b) managing the rice surplus in bumper crop year, (c) reducing the observed "yield gap", (d) widening the scope of mechanization, (e) export promotion, (f) promotion of industrial crops and agro processing, (g) clearly delineating the role of public and private sector and strengthening the latter with a level playing field, (h) correcting the fertilizer balance, with due attention to the depletion of nitrogen and potassium and inefficient use of urea, (i) managing tube well irrigation and dealing with water quality, and (j) dealing with the issues of deteriorating quality of diets and food safety. Moreover, the NAP lacked a clear vision for the longer-term growth of the economy in which agriculture would be playing a vital role based on its competitive strength in an increasingly liberalized market and open trade regime. There was no road map to facilitate transition from subsistence to industrial/commercial agriculture. A long menu of issues and actions were listed without giving a sense of priority and an indication of critical areas in which public sector

¹⁷ *Ibid.*, page 10.

¹⁸ *Ibid.*, page 13.

¹⁹ *Ibid.*, page 38.

intervention must be brought in. This policy brief and the forthcoming agriculture sector review are attempts to fill this gap and go beyond by developing longer term perspective and a vision for the growth of the agriculture sector of Bangladesh and delineating a few areas for priority action by the Government to unleash the entrepreneurial spirit of the private sector spearheaded by individual farmers so that they can take advantage of opportunities opened up by market liberalization and competitive economic environment with adequate safeguard against unfair business practices and ensuring food security for all Bangladeshis.

Public Sector Expenditure in Agriculture

8. In the early 1970s, agriculture sector including rural development and institutions and flood control and water resources claimed the largest share of both development and current expenditures of the Government. Over time this importance has been diluted in favor of other sectors (Table 1). The share of agriculture alone (including livestock, forestry and fisheries) declined from 14.5% in 1976-1981 to 4.5% in 2000-2001. The broader sector of agriculture did not loose as much implying that there has been a shift of resources from agriculture to other linked sectors such as rural development and water resources. A similar trend is observable in the distribution of recurrent expenditures. As part of public expenditure reform, Government gradually reduced subsidy on food and agriculture since mid-1980s until subsidy on urea fertilizer was reintroduced in mid-1990s. During the mid-1980s, subsidy on food, fertilizer, and state owned enterprises claimed 8 to 10% of the current budget. Fertilizer subsidy, for example, was estimated at Tk. 1,000 million in 1996 rising to Tk. 5,000 million in 2000. Current year allocation is Tk. 3,000 million. A total amount of Tk. 10,000 million is being talked for next year. In the absence of detailed breakdown of subsidy in the budget documents, it is no longer possible to say how much went to agriculture or fertilizer for that matter. Implicit amount can be inferred from the difference between domestic cost of production of urea and TSP and mill gate price paid by registered dealers.²⁰ There is no subsidy on imported fertilizer. The economic subsidy implicit in the difference of unit cost of production and border price is even higher. There is implicit subsidy on seed because prices of seeds sold by BADC do not reflect full costs especially those related to production, processing and storage facilities and personnel costs. The same is true of breeder seeds sold by research stations and irrigation water provided by Bangladesh Water Development Board (BWDB).

TABLE 1. SHARE OF AGRICULTURE IN TOTAL BUDGET (%)

Item	1976-1981	1984-1990	1991-1995	1995-2000	2000-2001
Annual Development Program					
Agriculture	14.0	7.0	5.9	4.7	4.5
Rural Development & Institutions	3.7	3.4	6.4	8.7	10.8
Flood Control & Water Resources	12.9	12.3	9.1	7.2	5.6
Recurrent Budget					
Agriculture, Institutions & Water		3.82	4.11	4.18	4.10
Intra-sectoral allocation of development expenditure in Agriculture					

²⁰Fertilizer subsidy is implicit in the following table:

Domestic Cost of Production and Sale Price of Urea (Taka/ton), 2004

Fertilizer type	Production cost/ton	Sale price/ton
Urea	5,500	4,800
Natural Gas Fertilizer Factory Ltd.	6,000	4,800
Polash Urea Fertilizer Company Limited	6,000	4,800
Urea Fertilizer Factory Limited	6,000	4,800
Jamuna Fertilizer Company Limited	5,000	4,800
Zia Fertilizer Company Limited	4,500	4,800
Chittagong Urea Fertilizer Limited	4,700	4,800
TSP Complex Limited		
TSP	12,000	11,000
SSP	4,500	5,300

Source: Field mission data collected by the Agriculture Sector Review Team.

Crops	68.6	50.5	45.8	51.5	48.0
Forestry	7.1	13.6	16.3	16.6	20.6
Food Marketing	12.9	8.1	7.2	5.8	4.6
Fisheries	7.8	16.0	16.9	11.7	12.8
Livestock	3.6	11.8	13.8	14.4	13.9
Functional Distribution of Public Expenditure in Agriculture and Rural Development					
Agricultural Research	2.95	4.73	4.14	3.57	3.84
Extension and Training	5.31	4.02	9.65	6.03	5.00
Market & Institution	21.27	17.33	27.52	6.75	5.75
Rural Infrastructure	6.09	9.03	15.69	47.64	56.60
Water Control and Irrigation	46.72	64.30	42.65	28.95	25.47
Mixed Types	1.04	0.59	0.35	1.16	2.15
Miscellaneous	16.62	0.0	0.0	4.91	2.19

Source: Ahmed, Raisuddin, Public Expenditure and Rural Development, Bangladesh, International Food Policy Research Institute, Washington D.C., May 2002. Tables 3.2, 3.4 and 3.6.

C. Comparative Advantage, Competitive Strength and Profitability of Bangladesh Agriculture (crops)

9. A recent BIDS study²¹ demonstrates Bangladesh's comparative advantage in the production of most crops, rice for import substitution, and vegetables (brinjal, radish, cucumber, long bean, arum, tomato and cabbage), potato, cotton, pulses and onion. Bangladesh does not have comparative advantage in the production of wheat, oilseeds, sugarcane, chilies and spices. Although these results are sensitive to assumptions about important parameters like input prices, shadow exchange rate and production technology, directions are encouraging. High risks of marketing and difficulty of producing rice and non-rice crops in the same service units are said to hinder full exploitation of this potential. Under prevailing condition, the competitive strength of Bangladesh agriculture vis-a-vis exporters in the neighboring countries is questionable. The problem lies in yield differences and unit cost of production (Annex 1).

10. In rice, Bangladesh yield is comparable to India, but in other crops, the country lags the most productive state of India (Punjab). Unit (ton) cost of rice production in Bangladesh is lower than West Bengal but higher than Punjab, Thailand and Vietnam. This can be traced to differences primarily in costs of irrigation and labor. Irrigation is subsidized in India, Thailand and Vietnam. Indian Farmers benefit from low subsidized electricity tariff and low prices of fertilizer (Appendix 1). The wage rate is lower in Bangladesh, but the amount of labor input is much higher because the level of mechanization is still low compared with other countries. Unit cost of production without reference to demand in the international market is a poor indicator of either comparative advantage or competitive strength. On the other hand, direct comparison of average cost of production or prices of agricultural inputs between countries is problematic due to variation in parameters that influence costs and prices. Comparison of physical yield corrected for product and soil quality differences is more helpful to indicate the type of support needed to improve comparative advantage and competitive strength. Bangladesh is clearly handicapped by low yield and low labor productivity reflected in low wages (there are many factors influencing labor productivity). Most crops suffer from an observed "yield gap" between farmer yield and experiment station yield (Annexes 2 through 5). Even with the observed "yield gap", many crops are quite profitable (Annex 2) and rice yield increased by 60% over the period 1984-1985 to 2001-2002 (Annex 6). This led to a modest 15% increase in real wage. However, both gains were neutralized by 50% increase in fertilizer/rice price ratio and 40% decline in real price of rice impacting negatively on the welfare of rice producers without really making them competitive with Thailand and India (Annex 7). Urban and rural consumers purchasing rice benefited from rice price decline. What is of particular concern is that the Sector Review Team observed during field visits, that net return to family labor from an acre of land varied between a low of Tk. 1,000

²¹Shahabuddin, Quazi and Paul Dorosh, Comparative Advantage in Bangladesh Crop Production, International Food Policy Research Institute (IFPRI), Washington D.C. October 2002.

(producing one boro crop) in Sylhet district and Tk. 3,000-5,000 (producing paddy and high value diversified crops) in northwestern part of the country. Under reasonable assumption about the average family size (4.8) and the percentage share of income from crops (20%) in total family income, the observed income falls below the poverty line. While diversification and intensification of agriculture in Bangladesh has created the paradoxical situation of location specific labor scarcity in a labor abundant country, the observed range of wage rate was Tk.80-Tk.145 (including one meal) implied below poverty level income assuming average family size of 4.8, annual fulltime equivalent employment of 200 days and the percentage share of income from wages (50%) in total family income. Clearly, productivity, profitability and net return to family labor in agriculture must grow significantly to pull this vast majority of rural dwellers out of poverty in a sustained way. The margin of profit can be further enhanced and crops can be made more competitive in the international market with appropriate policy and institutional reforms many of which have already been initiated by the present Government. More measures are envisaged in this report for consideration of the Government.

11. Policy support creating enabling environment in the agriculture sector has to target factor productivity, investments and risks by (a) rationalizing public expenditure allocation increasing public investment in infrastructure and services (public good) and promoting private investment in agriculture, (b) inducing shift in relative prices of input and output to correct market distortion, rationalize the incentive structure for investment and mitigate negative impact on the environment, and (c) putting in place appropriate legal and regulatory framework and (d) effecting institutional reform and good governance making both public and private sector more transparent, accountable to people and efficient which will help conserve both public and private resources and encourage investments in the agriculture sector. Designed and administered properly, (a) to (d) will increase land and labor productivity in agriculture, increase investments, and reduce natural hazard risks and market risks. Only then, Bangladesh will be able to improve its competitive strength in both domestic and international market subject of course to compliance with quality control requirements, macroeconomic and agriculture sector growth will be accelerated with fiscal, monetary and price stability and there will be a sustained decline in the proportion of people living below the poverty line. Specific policy recommendations will emerge from an analysis of key constraints confronting different aspects of Bangladesh agriculture.

D. Constrains to Going Forward

12. Low-profit of rice culture is due to high cost of production, particularly HYV rice. High price of seed, fertilizer, fuel for irrigation, pesticides on the one hand and lower price of produce on the other have made it a non-profit pursuit. Fertilizer/rice price ratio has increased by 50% between 1985-1986 and 2001-2002. Subsidy in agriculture in Bangladesh is very negligible compared to other countries of the world. India has an elaborate system of support for agriculture. In 1999-2000, total input support amounted to about 9% of the value of output (appendix 1). Agriculture is still in the subsistence level. Growth in agricultural production in terms of HYV yield has slowed, showing signs of stagnation or even decline in some cases. Seed-fertilizer-irrigation technology, which phenomenally increased agricultural production in the 1970s and 1980s, resulted in: (i) the decline of soil fertility due to nutrient mining; (ii) ground water depletion; (iii) high incidence of pests; and (iv) salinity and arsenic hazards that invited environmental problems. At the same time, cultivated land has been shrinking and agriculture is being pushed into marginal and vulnerable areas due to population growth, rapid urbanization, growth of small industries, expansion of infrastructures, etc. Bangladesh agriculture today faces new challenges not only because of changes that are internal to the country, but also because of changes in the global environment: climate change, globalization, changes in global and regional trade regimes, and the IPR regimes. Agriculture is no more a mere domestic affair, it is a commercially competitive sector exposed to the global market.

13. In this scenario, production increase is still critical, particularly for alleviation of poverty. Equally critical are improvements in quality and product diversification for increasing incomes, reducing the level of malnutrition, satisfying consumer needs, and entering into competitive export market. In the past, agricultural development focused only on increasing production. In the new environment, focus

has also to be placed on improving the quality of both primary and secondary agricultural products, besides production increase.

E. Key Challenges

14. There are several area specific challenges, which have to be dealt with as the country tries to sustain a high rate of growth of GDP over the longer term with the agriculture sector making commensurate contribution. In the area of seed, the farmers are concerned with timely availability of quality seed in adequate quantity at a reasonable price. This is easier said than done when the seed sector has been largely privatized. One has to deal with questions related to the relative role of public versus private sector in seed production, processing, storage and distribution. In particular, there is a need to redefine the role of the Seed Wing of BADC and its status as a competitor in the seed area. BADC still sells TL seeds at a subsidized rate against the approved seed policy of 1993.

15. The Seed Wing of BADC is plagued with a number of critical problems. In addition to sharing of heavy overhead costs and management problems, it suffers from shortage of trained staff, inadequate storage facilities, dearth of funds for replacement and rehabilitation and maintenance of equipment, inflexible procedures, and inadequate financial liquidity and control. A level playing field would have to be created through institutional reform of BADC and implementing the 1993 Seed Policy and its updated version of 2004. Changes are also needed in the Seed Wing of MOA, which is under-staffed and has no technical personnel. DG is frequently changed and the location of the office itself is a problem because of limitation of access to it.

16. The Government would also have to grapple with the legal and regulatory framework of the seed industry, especially that pertain to quality control. One has to take a hard look at the mandate and capacity of the Seed Certification Agency (SCA). There is a serious lack of fund and manpower in this organization. In view of the enormous volume of work and responsibility vested upon it, SCA is pathetically under-staffed and the officers of SCA are always on deputation from DAE. SCA being an essential regulatory body should have been accorded a realistic treatment by the planners as far as its independence and manpower policy are concerned. Secondly, almost all the technically trained personnel of the Variety Testing and Seed Testing Wings of SCA have been transferred to various other posts of DAE/MOA. Thirdly, there is frequent change of director at SCA hampering chronological and cohesive decision making process. The private seed industry is in its infancy and needs technical and institutional backstopping from BADC and SCA. At present the private suppliers seem to have an image problem regarding the quality of the seed sold.

17. In the case of fertilizer again, the farmer is concerned with timely availability of quality fertilizer, Urea, TSP, MP and others, in adequate quantity at a reasonable price. With the withdrawal of subsidies, the price of fertilizer (TSP, MP, DAP) has increased beyond the purchasing power of the farmers. Price is a major issue linked to imbalanced use of fertilizer that is not only adversely affecting production but also causing serious resource conservation problem. Other problems include adverse movement in fertilizer/rice price ratio, timely availability of fertilizer, quality of fertilizer, bag weight, price fluctuations due to international price changes and unethical practices of private dealers, anomalies in the fertilizer distribution system, buffer stock, government import and others (ref. Policy Brief 3-Fertilizer). Each one of these issues deserves close attention by policy makers in order to ensure continued smooth functioning of the fertilizer market. Demand assessment, access to credit, and exposure to risks, inefficient use of urea and the current fertilizer distribution system are other areas of concern/issues that have to be addressed.

18. Irrigation, especially ground water based irrigation has expanded rapidly over past two and half decades. Market liberalization has helped this process. For the future, the key challenges are water use efficiency, water quality, surface water management, conjunctive water use, technology shift in water management and monitoring of water quality and quantity. These challenges demand changes in the traditional role and mandate of the Irrigation Wing of BADC. BADC has served the purpose for which it was created. With the privatization of pesticide, fertilizer and irrigation equipment BADC's role and mandate has changed. In fact, continuation with the name BADC is no longer justified. The need of today to respond to new challenges is different, and it calls for structural reorganization and

functional rationalization of the Irrigation Wing. No less important is energy supply for irrigation, electricity and diesel. Uninterrupted supply of electricity and timely availability of diesel in adequate quantity at a reasonable price are two key concerns of farmers in the field. Irrigation cost constitutes a major part of production cost due to high price of diesel and electricity. Access to credit to purchase irrigation equipment is another key issue. A new approach is required to improve on farm water management. Water conservation is an important area that requires urgent attention, for example, finding a way to conserve wet season water for use in the dry season. Institutionally, the roles of the Irrigation Wing of BADC in ground water management and that of BWDB in surface water management need to be reviewed keeping in view the contents of the Government's National Water Management Plan.

19. Land is a complex and sensitive issue. The current land ownership pattern and tenurial system has given rise to many questions regarding economic size of land holding, problem of subdivision and fragmentation, land as collateral for access to credit, adoption of new technology, distribution of benefits from adoption of new technology, commercialization and others. A land market has not yet fully developed although there are signs that the society is moving that way. But the use of land has become a commodity under pressure of commercialization and diversification, which in many areas, is removing barriers to entry, including size of holding and tenancy status. Application of labor, especially family labor, is no longer a unilateral or linear decision given alternative use of labor in non-agricultural activities in rural areas. For many families, rich or poor, agriculture is only a partial source of income, a minor part in that for some.²²In this evolving scenario, it will probably be desirable and more productive to focus on land use planning on the basis of agro ecological zone (AEZ), soil degradation, loss of land to non-agriculture and others and land administration. More important is the issue of risk management with regard to natural disaster affecting land and crop.

20. Mechanization of agricultural operations is on the rise promoted by labor scarcity, drudgery of agricultural work, market liberalization, and land use efficiency. For the future, key challenges are efficient use of machinery, training and promotion, vocational education, changes in tax/tariff policy to encourage domestic production of agricultural implements and machinery, incentive to farmers in terms of fiscal/price support and access to credit, improved servicing, technology development and adaptation for Bangladesh condition.

21. Development of marketing chain is the key to commercial/industrial agriculture. This is the weakest aspect of Bangladesh agriculture. There are many challenges; the most critical are infrastructure (e.g., feeder roads, markets, cold storage, harvesting floors), storage, and processing, packaging, transport and market delivery (domestic and foreign), value chain linkages and management, food safety and food hygiene. Besides, both farmers and traders need assistance to manage market related risks. Grain banks, crop insurance, infrastructure, price support and procurement, processing and others are important issues requiring attention.

22. The challenge of credit in Bangladesh agriculture is well known but solutions has been difficult to come by. Operational efficiency and reach of Bangladesh Krishi Bank (BKB) and Rajshahi Krishi Unnayan Bank (RAKUB) need improvement. Could micro credit programs be encouraged to lend more to agriculture? What about adjusting the mandate and criteria of PKSF? There may be a need to consider establishing a new institution to cater to the requirements of the so-called "missing middle".

23. The greatest challenge for the future lies in making agricultural research and extension more clients oriented and demand driven. The research system is suffering from inertia due to critical institutional, management and funding problems. The Institutes are not geared to face the challenges of the 21st Century. Given the backdrop of Bangladesh agriculture and its competitive strength, research efforts of the future should focus on land, labor and water saving technologies; and product development and quality improvement for value addition. Extension has to make breakthrough in disseminating new technology and information in terms of bottom up service delivery, promotion of community based systems and farmer training.

²² Hossain, Mahabub, Rural non -farm economy in Bangladesh: A view from household surveys, International Rice Research Institute, Philippines, 2002.

24. The challenges outlined above and others are discussed in detail in the following chapters and a way forward is charted out in terms of key priority policy reforms for immediate and medium term use in a matrix in Chapter 10. At this stage the Team preparing the APB focused on few critical areas, which the team was able to analyze with the limited time frame and available information. During the process of preparing this APB, as well as the PRSP, it has been found that the available information and data are not adequate for the formulation of a policy framework with a vision for the future and road map to commercialization of agriculture, including policies for non-farm income generation and diversification. There are no reliable and systematic information, review and analysis of what is happening with respect to farm level productivity, agro-industries, marketing and trade of agricultural products, including livestock, fisheries and forestry, as well as the transformation which is taking place in the rural areas and in particular the extent to which the farmers are actually benefiting from all the services and support provided to them by the government. In fact the issues related to governance and efficient functioning of the government at grass root level affecting the poor farmers are yet to be clearly reviewed and analyzed. Hence there is an urgent need for a broad based review of the sector, including livestock, fisheries and forestry, with focus on how to maximize impact on poverty, governance and efficient delivery of public services, promotion of private sector and commercialization of the agriculture sector within a diversified and market oriented rural economy.

25. It should also be noted that market oriented economy does not imply that the government should sit back and pursue a completely laissez-faire policy toward agriculture. Agriculture has traditionally depended a great deal on public investments, support and above all policies. In the new environment, the role of government is changing. private sector is now a major partner in development. in recognition of this, there is an urgent need for a “revised up-to-date policy”, anchored on a vision for a competitive, commercial and diversified agriculture (inclusive of livestock, forestry and fisheries), which will clearly lay down an effective and transparent framework of governance in the agriculture sector.

Appendix 1 Agricultural subsidy in India

Indian agriculture receives non-product input subsidies on several inputs like irrigation, fertilizer, credit and seeds.

Input Price (Non-product Specific) Support (Budgetary Support) (Rs. Million)

Item	1990-1991	1995-1996	1999-2000	2000-2001	2001-2002
Canal irrigation	24680	54070	77157	80000	80000
Credit	884	2337	3922	4000	4000
Fertilizer N				9481	8304
Fertilizer P & K				4319	4504
Total Fertilizer	4389	74673	12750	13800	12808
Power	39600	136060	245409	246992	281233
Seed	823	-97	-246		
Total input support	70376	267042	387460	344792	378041
Value of Agricultural Output	1706980	3425350	5358100		
Total support as % of value output	4.12	7.70	8.57		

Fertilizer Subsidy

Urea

The farm gate price of urea at present fixed at Rs.4,830 per ton. On an average, a subsidy of little more than Rs. 4,100 per ton is given to Urea. The estimated subsidy in 2002-2003 would be about Rs. 7,000 crores.

P & K

The rates of price concession (subsidy) on these fertilizers have been fixed at Rs. 3,700 per metric ton for indigenous DAP, and Rs. 1,550 per metric ton for imported DAP, and Rs. 3,150 per metric ton for MP. The rate of concession for SSP during 2001-2002 applicable from April 1, 2001 is Rs. 700 per metric ton. The level concession has been proportionately fixed for various complex fertilizers taking into account their NPK content. Under the concession scheme, Maximum Retail Price (MRP) of DAP and MP has been fixed at Rs. 8,900 and Rs. 4,255 respectively from February 29, 2000.

Selling Price of Fertilizer Products (Rs/metric ton)

Type of fertilizer	Selling Price
Urea	4,600
Di-amonium Phosphate	8,900
Muriate of Potash	4,255
Complex Fertilizers	6,620-8,520
Single Super Phosphate	Varies from state to state

Total subsidy on P & K during 2002-2003 is estimated to be Rs. 4,224 crores.

Power

The average cost of supply of electricity has increased from 215.6 paisa per kWh in 1996-1997 to 349.85 paisa per unit during 2001-2002. The average price paid by agriculture has only increased marginally from 21.2 paisa in 1996-1997 to 41.54 paisa in 2001-2002. This means that despite some increase in agricultural tariff, the subsidy per kWh to power supplied to agriculture has increased from 194.4 paisa per kWh in 1996-1997 to 308.31 paisa per kWh in 2001-2002.

CHAPTER 2

Production and Distribution of Seed

A. Background/Overview

1. Agricultural production can be increased by 15-20% through use of quality seed keeping other things constant. Demand for good quality seed is high but supply low. In particular, seed production and distribution is not sufficient to meet the demand, yet private sector seed production is not adequately supported as envisaged in the 1993 National Seed Policy (NSP). At present seed producing agencies produce only about 5-6% of the total seed requirement of all crops. In accordance with the NSP of 1993, BADC is to provide some assistance to the private sector, but such assistance has not been significant. The national Seed Policy of 1993 also asked for gradually raising the price of BADC-produced Truthfully Labeled Seed at par with the cost of its production. This policy has not been implemented. There is serious apprehension that continued involvement of BADC in TLS production and distribution at a heavily subsidized rate will impede growth of the private sector.

2. Annual requirement of various seeds is about 0.95 million metric tons, out of which rice 0.4 million tons, wheat 0.1 million tons and potato 0.4 million tons. BADC's major seed production efforts are geared to produce rice, wheat and potato seed (Table 2). BADC receives Breeder Seed from Agricultural Research Institutes (ARIs) and produces Foundation Seed in its own farms; Truthfully Labeled Seeds (TLS) are produced through contract growers. The seed multiplication diagram is presented in Figure 1. Annual production of TLS is about 40,000 metric tons, which is only about 5% of the total seed used in the country. Private Sector Seed firms include BRAC, PROSHIKA, East-West Seeds, Grameen Krishi Foundation, Rangpur Dinajpur Rural Service (RDRS), Aftab Seeds, and Supreme Seeds. These firms produce mainly improved varieties of vegetables and grain crops. Of the total quantity of seed used in the country, only about 25% is said to be of good quality, the balance is deemed inferior.

Table 2. Distribution of Certified and Foundation Seeds 1997-1998 to 2001-2002 (metric tons)

Name of Seed	1997-1998		1998-1999		1999-2000		2000-2001		2001-2002	
	Foundation	Certified	Foundation	Certified	Foundation	Certified	Foundation	Certified	Foundation	Certified
Aus	32	1,002	23	425	53	330	34	221	39	Data not available
Aman	147	5,306	131	4,599	760	6,340	496	4,510	1,042	
Boro	77	3,824	145	5,080	784	7,474	886	7,618	1,181	
Total	256	10,132	299	10,104	1,597	14,144	1,416	12,349	2,262	
Paddy										
Wheat	670	12,051	1,400	23,966	1,417	9,793	1,348	21,356	2,565	
Maize		149	9	815	2	214	1	163		
Vegetable	12	17	5	21	7	11	9	12	12	
Potato	1,486	7,357	1,338	6,540	1,396	6,175	1,659	6,313	1,400	
Jute	23	274	23	308	31	209	31	335	51	
Pulses	19	65	19	182	24	142	28	226		
Oilseeds	36	301	23	275	26	219	39	386		
Total	2,502	30,346	1,686	42,211	4,500	30,907	4,531	41,140	6,290	

Source: BADC.

B. Constraints/Issues

3. Institutional weaknesses of public sector organizations and absence of consistent policies and their implementation to promote growth of private seed enterprises are affecting production and supply of quality seeds in adequate quantities at a reasonable price. BADC has not been able to produce more than 5% of the total requirements of quality seeds per year since its creation. The target given to

BADC for increasing seed production from 5% to 20% with its current capacity and resource and management constraints under the existing set up is over ambitious.

4. There is genuine dearth of quality seeds (genetically pure, healthy and free from mixer with high rate of germination). Farmers themselves supply most seeds but since they have inadequate knowledge of producing and preserving good seeds, quality of seeds at farmers' level deteriorates very fast. There is a need to train farmers regarding seed preservation and also to develop programs of support for farmer seed producers. Breeder seed supply by ARIs to BADC is inadequate due to lack of physical facilities and manpower and funding constraints. It is somewhat paradoxical, while policy shift has taken place in favor of promoting private sector seed industry; farmers seem to be more satisfied with BADC seeds for quality than seeds supplied by the private sector and Non Governmental Organizations (NGOs). However, small farmers have limited access to BADC seeds. Frequent complaints have been noted from the field about non-availability of BADC seeds, and poor quality seeds of some of the private sector seed companies and NGOs with low or no germination and mixer with seeds of other varieties. Seed adulteration is becoming a common phenomenon. Seed quality is also a victim of poor testing and monitoring capacity.

5. Manpower, funds, and facilities are inadequate in BADC, hampering production of increased quantities of quality seed. Seed processing and storage facilities of BADC are inadequate to cater for both public and private sector needs. Seed production, processing and storage require elaborate infrastructure and sizeable capital, beyond the capacity of most NGOs and private sector enterprises. It is almost impossible for any one agency to solve the full range of seed-related problems unassisted. Activities of the Government, private sector, NGOs and farmers need co-ordination. It is not surprising that most of the private sector seed companies prefer importation rather than production of seed. There is a lack of regulation to this effect. Major portion of vegetable seed is imported and consequently is very costly. Difficult import procedures and restricted access to credit are constraints to private seed industry development.

6. In the present situation, the Seed Certification Agency (SCA) can not assure quality control of seed through inspection and certification. There is serious lack of trained manpower and funds at SCA. Technically trained and experienced manpower has been transferred to other offices of the Department of Agriculture Extension (DAE). Secondly, there is frequent change of Director at SCA hampering cohesive decision-making. The Seed Wing (SW) of the Ministry of Agriculture is understaffed and there is dearth of technically qualified personnel in it. DG is frequently transferred. The location of the DG office in Bangladesh Secretariat makes it inaccessible to the officers of public and private organizations, seed importers and producers. The SCA is responsible to advise the National Seed Board (NSB) about the status of seed quality. It cannot perform its duties due to shortage of manpower. Advising seed producers regarding quality seed by SCA are insignificant. Collation and publication of quality data are highly inadequate. Plant Variety Rights have not been established yet. Consumers' Protection Regulation is lacking and the updating of the Plant Quarantine Regulations is overdue.

7. Human Resource Development in the seed sector is limited in NARS, BADC, SCA, DAE, PS and NGOs. Lack of systemic monitoring of market demand for and supply of quality seed is lacking.

8. The issue of Genetically Modified (GM) varieties has yet to be addressed. India is already growing GM cotton and planning to release GM mustard¹⁵ and brinjal. Entry of these GMOs into Bangladesh through the porous border is a matter of time only. Regulatory instruments are urgently required to monitor the entry of GMO seeds. Bangladesh has an obligation not only for fulfilling its commitments to various International Treaties, particularly the Cartagena Protocol on Biosafety but also to have her own regulatory measures in place for promoting national research, technology generation, technology acquisition and technology transfer.

Constraints of the Private Sector

9. Private Sector is a blend of myriads of business types e.g., farmer seed entrepreneurs to importers, wholesalers, individually owned companies and joint-venture companies. Recently some NGOs are undertaking commercial ventures. Despite support from the Government and donors, the growth of the private seed industry is constrained by the following factors:

- Dearth of knowledge and skills about technical aspects in the seed chain.
- Seed processing equipment and storage facilities belong almost entirely to BADC. NGOs and private sector enterprises, although supported by the NSP, do not get opportunity to utilize those during peak periods. For small enterprises some of the equipments belonging to BADC are too big.
- Availability of credit to the emerging seed sector is limited. Although the seed industry has been included in the Industrial Investment Schedule, access is not easy. Seed entrepreneurs are the so-called “missing middle” with no access to institutional credit.
- There is a perception that NGOs producing seeds constitute a threat to the seed enterprises because they sell their seeds at a lower price than the private sector due to hidden subsidies.
- BADC sells seed at a subsidized rate which is also impeding growth of the private seed sector

10. The entire situation is aggravated by weakness of the Seed Wing of the Ministry of Agriculture (MOA) and its inability to monitor and foster the growth of the seed industry and to provide adequate support to the NSB and its two committees. Linkages between SCA, Plant Quarantine and National Seed Pathology Laboratory are almost absent. Similarly, co-operation among NARS, BADC and SCA is not optimal.

Constraints Faced by Farmers

11. Seeds, especially of rice, wheat and potato are not available as per demand during peak sowing seasons. Seeds bought from the dealers are adulterated although dealers get Certified Seeds from BADC. Adulteration at dealers’ level is a serious problem. Farmers do not know how to produce and preserve good quality seeds. Their seeds are neither sufficiently pure nor having good germination level, and hence high seed rate is required, resulting in high cost of production.

C. Review of Current Policy

12. The current national seed management is composed of three systems e.g. formal, sub-formal and in-formal systems. Any program to improve the seed management system will have to incorporate improvement of all the three sub-systems. Supplying good quality seed is a challenge. The 1993 Seed Policy stipulated to promote balanced development of private and public sector enterprises, simplify procedures of import of high quality seeds, to provide training and technical support to all involved in the sector, to monitor, control and regulate the quality and quantity of seeds produced by all actors, and commercialization of the sector. These were to be achieved by (i) strengthening institutional

¹⁵ Shaikh, M.A.Q., Introducing ‘National Agricultural Scientist’ System in Bangladesh, Consultancy Report, Bangladesh Agricultural Research Council, Dhaka, May 2001.

capability of all sectors, seed certification, quality control and seed testing facilities,²³ (iii) simplifying procedures for effective compliance with plant quarantine requirements, and (iii) facilitating import of seed materials by the private sector²⁴. There are big gaps in implementation of the National Seed Policy, which need to be filled as a matter of priority.

D. Policies for the Future

13. The Agriculture Sector Review Team recommends the following immediate and medium term measures for consideration of the Government. These measures are designed to address key constraints of the seed sector thereby contributing to sustained increase in land and lab or productivity in agriculture and promote concomitant investments for facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1: Restructure BADC with its Seed and Irrigation Wings and rationalize its staffing or transform the Seed Wing of BADC into Bangladesh Seed Corporation (BSC), with the function defined in line with the current seed policy of the government, which gives BADC the full responsibility of producing Foundation Seeds (FS) as public good. BADC/BSC will continue production and distribution of Truthfully Labeled Seeds (TLS) until the private sector takes it over fully, and sell TLS at market rate to create level playing field for the private seed producers. Expand seed processing and storage facilities of BADC/BSC to increase seed production capacity; and share the facilities with the private seed enterprises, where possible, on lease or rent at market rate.

Advantages: BADC/BSC will be able to augment seed production and distribution, and catalyze and facilitate growth of private seed sector, thus ensuring seed security in the country.

Limitations: Competitive efficiency may not be achieved if BADC/BSC continues to receive resource subsidy. BADC/BSC cost and pricing should reflect true cost of production including capital and full operational costs in the production of TLS.

Policy 2: Remove the implementation bottlenecks hindering the capacity of research institutes in increasing production of breeder seeds by establishing Breeder Seed Production Units at BARI, BRRI, BJRI, BINA, and Ag-Universities involved in developing new varieties, and providing adequate funds and additional technical staff.

Advantages: Supply of breeder seeds will increase to support increased production of foundation and truthfully labeled seeds.

Limitations: Research objectivity and forward-looking innovation may be compromised unless seed production program is separated from research operations.

Policy 3: Strengthen SCA as an independent body having its own manpower and service cadre to effectively implement its mandate of seed quality control and monitoring. Ensure close collaboration of SCA with MOA, BADC/BSC, DAE, local government (LG) and the private sector to streamline variety testing, seed testing, truthful labeling and market monitoring.

Advantages: Quality control of FS and TLS can be ensured thereby opening up the possibility of 15-20% increase in crop yield, in the foreseeable future. In addition, SCA will emerge as an invaluable information clearing house on all aspects of seeds.

Limitations: Lack of trained manpower will be a challenge to sustaining SCA as a lean, efficient and rapid response body. Staff trained in seed certification and transferred to DAE will need to be brought back and additional training organized for all SCA staff.

²³To increase seed supply, private sector seed agencies will be allowed to market their “truthfully labeled seeds” subject to close monitoring by SCA of the entire seed labeling and certifying process.

²⁴In certain cases, value added tax (VAT) on seed imports was eliminated and customs duty reduced from 35% to 5%.

Policy 4: Allocate adequate resources to ARIs, SCA, BADC/BSC and DAE to impart training to seed producers, farmers, importers, and dealers on production, processing, and storage of quality seeds. (Competent PS organizations and NGOs may be subcontracted to carry out part of the work).

Advantages: Special emphasis on quality control and preservation will increase supply of good quality seeds.

Limitations: Training capacity of PS and NGO may be limited requiring caution in the selection of partner PS and NGOs.

Policy 5: Ensure that BADC/BSC gradually increases rice seed production to reach 20% coverage of total requirements. Increase production of seeds of other high value crops, and establish Seed Sale Centre of BADC/BSC at Upazila.

Advantages: Good quality seed supply will be enhanced and replacement rate of rice seed will reach well above the current 5% level since farmers will have easy access to BADC seeds.

Limitations: It may be difficult for BADC/BSC to achieve 20% coverage over the short run and sustain it over the long-term unless steps are taken to (i) enhance capacity to produce foundation seeds in its own farm and truthfully labeled seeds through contract farmers, (ii) establish new seed processing centres, and (iii) build seed stores including DAE seed stores at Union level. Nonetheless, over the long-term, BADC/BSC share should actually start to decline, as the private sector becomes more efficient.

Policy 6: Ensure supply of foundation seeds produced by BADC/BSC to duly registered private seed producers; and supply breeder seeds produced by ARIs to BADC/BSC and duly registered seed producers in the private sector.

Advantages: Supply of FS and TLS will increase due to involvement of PS and NGOs. Seed market will become more competitive.

Limitations: Quality control and monitoring may be difficult for SCA due to expansion of its sphere of activity. A re-organized and strengthened SCA (as described in policy 3) will be needed to perform the function.

Medium Term Priority

Policy 7. Encourage establishment of R&D facilities for production of quality seeds in the private sector by providing tax holiday and other appropriate incentives.

Advantage: Supply of quality seeds will increase rapidly, resulting in increased agricultural production.

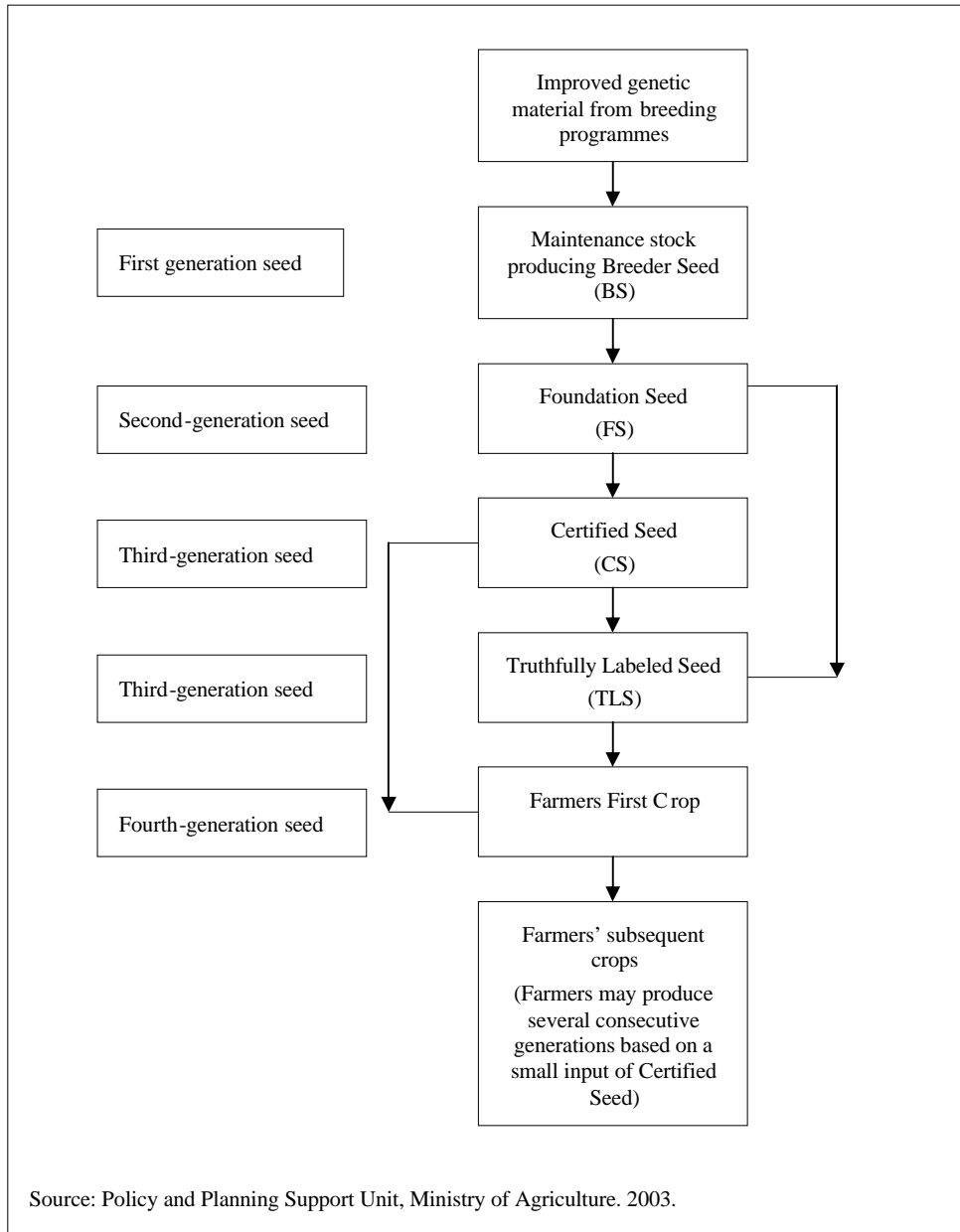
Limitation: Political commitment will be essential.

Policy 8. Empower BSC and LG to assist seed producers in obtaining financing from Banks, NGOs and other sources; establish a Seed Development Fund (SDF) at MOA with initial capital of Taka 25 crores to provide financing to farmer seed producers and small scale seed enterprises.

Advantages: Growth of a competitive seed industry and a seed market will be facilitated.

Limitations: Administering the Fund may be problematic and may lead to abuse in the absence of close monitoring.

Figure 1. Seed Multiplication Diagram



CHAPTER 3

Production/Import, Pricing and Marketing of Fertilizer

A. Background/Overview

1. With one of the highest densities of population, the lowest national resource base and almost perennial recurrence of natural calamities, Bangladesh is conditioned to remain agricultural for quite sometime, because alternative opportunities for gainful employment are limited by prohibitive cost of capital. The development efforts have been primarily focused on attaining food self-sufficiency through vertical yield increase due to scarcity of land and other natural resources. In the agriculture sector, the government is making serious efforts for increasing food grain production to meet the needs of a growing population. The critical role of fertilizer in achieving higher yields was recognized and the government identified promotion of fertilizer use as the key element of its agricultural development policies. The landmass of Bangladesh is broadly grouped into Flood plains (80%), Terraces (12%), and Hills (8%). Most of the soils are low in fertility due to removal of plant nutrients. For the present level of production of food crops about 1.0 million tons of nutrient (N, P, K, S) are annually removed from the soil (Fertilizer Guide, 1997, BARC). About 65% of the net cultivable area has organic matter content less than the critical minimum. As a result, fertilizer application is essential for sustainable crop production.

Growth of Fertilizer Consumption

2. Chemical fertilizers were introduced in Bangladesh in the 1950's. But its use actually began to expand rapidly after 1971. Data on fertilizer use by type for the last decade are shown in table 3. Urea, TSP, DAP, SSP, and MP are the major fertilizers used in Bangladesh. In 2002-2003, Urea constituted 71%, TSP 10%, SSP 4%, DAP 4%, and MP 9% of the total fertilizer use. Zinc Sulphate, Ammonium Sulphate and Gypsum accounted for the rest. Application of these fertilizers is poorly balanced and significantly below the recommended dosage.

Table 3. Fertilizer sales by Product and Year from 1989-90 to 2002-2003 (Metric ton)

Year	Urea	TSP	SSP	DAP	MOP	Gypsum	Zinc	Asp
1989-90	1,369,237	479,767	718	-	118,663	67,808	5,180	1,785
1990-91	1,323,397	514,761	12,120	-	149,761	101,782	2,743	2,763
1991-92	1,533,481	456,672	36,201		137,135	115,334	3,805	4,797
1992-93	1,547,407	407,002	119,828	2,010	126,083	108,140	722	4,992
1993-94	1,578,955	234,185	170,608	28,675	103,875	86,051	5,200	10,036
1994-95	1,748,459	122,947	533,485	1,837	154,240	77,161		2,491
1995-96	2,045,535	111,095	596,881	-	155,881	103,577	1,029	8,692
1996-97	2,119,883	72,629	525,285	-	219,302	86,611	1,161	11,692
1997-98	1,872,000	62,400	473,300	6,800	1,93,500	107,100	700	-
1998-99	1,909,000	170,000	363,000	39,000	212,000	128,000	200	-
1999-2000	2,151,233	259,263	237,201	109,171	239,464	189,398	1,170	26,003
2000-01	2,109,725	399,400	139,000	90,000	124,000	102,000	3,000	10,200
2001-02	2,251,892	341,000	123,000	87,677	247,920	61,821	-	-
2002-03	2,239,236	328,000	129,722	118,471	278,000	39,190	--	--

Source: Ministry of Agriculture, Monthly Report FDI-II and ATDP/IFDC, Bangladesh Fertilizer Association (BFA) and Bangladesh Chemical Industries Corporation (BCIC).

Domestic production

3. Natural gas provides the feedstock for Urea production. Currently, Bangladesh Chemical Industries Corporation (BCIC) is responsible for operation of all fertilizer plants in the country. At present, the country has facilities to produce Urea, TSP, SSP and ASP. Bangladesh currently has eight fertilizer plants. Six plants produce about 2.0 million metric tons of Urea, which normally meets

domestic requirement (Table 4). Excess requirements of Urea in some years are imported. Bangladesh also produces about 65,000 metric tons (15%) of TSP and around 135,000 metric tons of SSP; and all MP/DAP are imported.

Table 4. Fertilizer Production during 1991-1992 To 2002-2003 (million tons)

Year	Urea Production	TSP Production	SSP Production
1991-92	1641000	90800	44700
1992-93	2009000	48200	111800
1993-94	2184000	68300	108400
1994-95	1976000	76000	81600
1995-96	2134000	27500	79500
1996-97	1638000	31700	100150
1997-98	1883000	49700	100500
1998-99	1607000	58600	122000
1999-00	1704000	65000	127000
2000-01	1883000	68000	120000
2001-02	1546000	65600	136400
2002-03	2057000	65000	135500

Source: Ministry of Agriculture and Bangladesh Chemical Industries Corporation 2004 .

Import

4. Virtually all fertilizer imports in Bangladesh were financed with grants, bilateral assistance and concessional loans from over a dozen major donors and lenders until 1991–1992. With the elimination of subsidy and induction of private sector in fertilizer imports in 1992, GOB allowed importers access to the cash foreign exchange to import fertilizer.

B. Constraints/Issues

5. **Depletion of soil nutrient:** Besides major elements (NPK), deficiency in micronutrient like zinc, sulphur and boron, and low organic matter are becoming evident in increasing areas of cultivated land.

6. **Lack of Awareness Program:** Farmers knowledge on the use of balanced and mixed fertilizer is very limited. Effective awareness program to mitigate this deficiency is lacking.

7. **Demand assessment:** Realistic assessment of seasonal and monthly demand of fertilizer is not properly done. Fertilizer demand does not follow a rigid pattern. Demand in a specific crop season or month will vary due to a variety of factors such as early/late planting, early/late rainfall, floods, drought, ground moisture condition, and prices of farm produce.

8. **Farmers' inability to buy fertilizer:** Credit is not available to farmers, interest rates are too high, and lending systems are complicated. Obtaining credit is a hassle because of bureaucracy and distance.

9. **Crop/Fertilizer Price Ratio:** Farmers do not make enough from growing a crop. There is no market to sell excess production. Crop prices are low; fertilizer prices are high (Annex 6).
10. **Risk:** Farmers face risk of crop failure due to flood or drought. Even in the case of normal crop, farmers do not get fair return to his investment (Annex 8). Farming has become a risky enterprise.
11. **Imbalanced use of fertilizer:** Fertilizer use in the country is highly imbalanced with lower intensity of phosphates and potash in particular. This is due to faster rise in price of TSP, DAP, MOP, NPKS relative to Urea. The imbalanced use of fertilizer has adversely affected soil fertility and crop productivity (Annex 9) as well as causing resource conservation problem.
12. **Inefficient use of Urea:** Farmers are not aware of appropriate use of Urea fertilizer. Deep placement of Urea Super Granule (USG) is an efficient method of application of Urea. Evidently there is lack of attention to USG application.
13. **Lack of due attention to micronutrient use:** Deficiency of micronutrients limits the response of major nutrients (NPK). Non-use or limited use of micronutrients adversely affects crop production.
14. **Deficiency of organic matter:** Lack of targeted program for bio-fertilizer production, green manuring and compost making is limiting the use of these organic manures.
15. **Quality control:** The regulatory mechanism and its enforcement to ensure sale of quality fertilizer and to deal with sub-standard product is inadequate.
16. **One sided dealer agreement:** All the terms and conditions are in favor of BCIC. Dealers have no recourse on the agreement.
17. **Urea allotment:** Allotment of Urea is not always based on actual requirements. As a result, it does not become economic for the dealers to lift and distribute the allotted quantity of Urea.
18. **Restricted sales:** Sales of Urea fertilizer are restricted within a particular Upazila. This makes it difficult to meet the shortage occurs in that Upazila, even if there is surplus in the neighboring Upazila.
19. **Underweight bag:** Underweight bag, sub-standard jute bag, and improper quality of inner liner supplied by BCIC create genuine sales problem for the dealers, particularly due to loss of both quantity and quality of Urea.
20. **Restriction on use of PP bag:** TSP factory is allowed to use local PP bag but the importers are not allowed to use locally produced PP bag which is cheaper, durable, and reusable.
21. **Administrative interference:** Administrative interference in fertilizer distribution by different agencies in addition to DAE often contributes to supply inefficiency.
22. **Selection of wholesalers:** Selection of wholesalers (who are not regular dealer and also not in the fertilizer trade) by influential quarter at the district level during peak period and the dealers being forced to sell fertilizer at a fixed price is undesirable as the dealers cannot serve their own regular customer/network.
23. **Factory command area:** Problem arises from restricted procurement of domestic fertilizer within the command area. Factory command area is sometimes selected/fixed by the BCIC without considering the communication system, transport cost, and other associated cost creating anomalies in the system.
24. **Security deposit:** Permanent security deposit of Taka two hundred thousand imposed on the dealers is considered too high, and the dealers tend to recover the loss of interest accrued on it from the sale price of fertilizer.
25. **Lean seasons:** Dealers sometimes incur financial loss because they have to purchase Urea fertilizer during lean seasons when the market demand is low.

C. Review of Current Policy

26. During the 1950s, fertilizer distribution was entirely with the Directorate of Agriculture. BADC was established in 1961. The Corporation was made officially responsible for fertilizer procurement, transportation and distribution since its creation. BADC introduced limited commercial practices in fertilizer marketing known as “Old Marketing System” (OMS). Under the OMS, BADC remained the sole procurer and distributor of fertilizer using a limited number of retail dealers at the union level (the lowest local Administrative Unit), limited wholesaling at the Thana level through its own stores and 97 Thana Central Co-operative Associations (TCCA). An estimated 75% of fertilizers were sold through 423 Thana Sale Centres (TSC) and 25% through 97 TCCAs. Retail dealers/TCCAs received commissions to cover transportation, storage, other incidental cost and profit margin. Under the OMS, BADC’s marketing and distribution costs escalated. The system gradually degenerated. With increased sales, changes in the distribution system became necessary. Fertilizer market reform was initiated in mid-1970s reversing fertilizer marketing from a total public sector monopoly to a largely competitive free marketing system known as “New Marketing System” (NMS) to facilitate continued growth of sales. The New Marketing System (NMS) consisted of the following features:

- Instead of operating 423 Thana Sale Centers, BADC would wholesale fertilizers from 75 strategically-located commercial centres known as Primary Distribution Points (PDPs);
- Movement of fertilizer below PDP would be left to private wholesalers/retailers. BADC would continue with Thana Sale Centres (TSCs) in remote and inaccessible areas only;
- Restrictions on number of dealers be withdrawn to allow free competition;
- Dealers be allowed to move fertilizer from one place to another in response to market demand;
- Raising dealer’s commission to encourage large volume of sales.

Price Decontrol

27. By October 1982, farm-level prices were decontrolled first in Chittagong Division where private dealers were handling 75%-85% of all fertilizers sold to the farmers and then by April 1, 1983, retail prices were decontrolled countrywide. As a result, an estimated 50,000 private retailers with no requirements to licensing, no control of prices and no restrictions on movement completely replaced BADC’s retail trade of fertilizers.

Privatization of Sale of Fertilizer

28. With the decontrol of price and withdrawal of restriction from retail business, BADC’s distribution was gradually confined to some 75 PDP’s. By July 1985, BADC closed almost all 423 TSCs. By mid 1988, 8,000 wholesalers and dealers lifted 97% of the total quantity sold from PDPs.

Introduction of Transportation Discount Point

29. As the Wholesalers/Distributors gained experiences in lifting fertilizer from PDPs and move them to key sale centers, the Government allowed them to lift large volumes from 6 designated Transit Distribution Centres known as Transportation Discount Point (TDP). The distributors were given price discounts smaller than BADC’s transport costs from such Centres to the PDPs that led to a net savings to GOB.

Private Sector Lifting from Factory/Port Ends

30. Government allowed direct sales of Urea from all five factories beginning March 14, 1989. The distributors responded enthusiastically and started lifting Urea massively. The government also allowed the distributors to lift TSP and MP from Port/Factory.

Privatization of Import

31. Impressed by their spectacular performance in lifting fertilizers from port/factory ends, the Government excluded fertilizers from restricted list of imports and allowed private sector to import

fertilizer. The performance of the private sector importers in respect of handling fertilizer imports was satisfactory. Subsidy from the fertilizer was withdrawn completely in December 1992 and importation and distribution of fertilizer was made open. Potential gains received through the private sector participation in fertilizer importation are: (i) lower procurement cost; (ii) lower internal handling and movement cost; (iii) Reduced Government cost; (iv) improved product availability in all season; (v) improved extended services to farmers using fertilizers; and (vi) customer service options.

Reversal of Urea Marketing Policy: Current System

32. Any system when adopted needs a gestation period for institutionalization and for continued and uninterrupted operation. However, the open market scenario in Bangladesh for fertilizer, in particular for domestically produced Urea experienced a setback in 1995. After successful running the operation for a few years, Bangladesh suddenly faced Urea crisis owing to several reasons including lack of monitoring, export of urea without considering domestic demand. Government at this point decided to bring the market under their direct control to meet the crisis situation, which brought back the current, controlled Urea marketing and distribution system.

New Agricultural Policy: Fertilizer Policy

33. The 1999 NAP focused on the use of Urea super granular (USG) to check excessive use of Urea, application of rules and procedures to ensure good quality fertilizers at Farmers' level and training for balanced use of fertilizer. These have been slow in implementation particularly very little progress has been made with increasing the use of organic manure and bio-fertilizer. USG is being promoted by DAE and NGOs. With poor quality control system not much has been achieved in terms of ensuring that fertilizer harmful to the environment will be banned. While private sector is promoted, the public sector reserved the right to import if required. Monitoring task was left to district committees, which is working well. Fertilizer buffer stock system has been continued. DAP is supposed to be encouraged, but its share is still low. NAP stipulated strengthening of Soil Resources Development Institute (SRDI), starting soil testing program and continuing the use of 'Soil Health Card'. The program has already been initiated. The coverage is still small due to lack of manpower and training. The GOB has eliminated VAT on rock phosphate and phosphoric acid.

D. Policies for the Future

34. The Agriculture Sector Review Team recommends the following immediate and medium term policy measures for consideration of the Government. These measures are designed to address key constraints in the fertilizer sector thereby contributing to sustained increase in land and labor productivity in agriculture, promote concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1. Introduce resource conservation subsidy up to a maximum of 30-35% per 50 kg bag to imported TSP/DAP and MOP if their landed cost rises above Taka 450 and Taka 350 per 50kg bag respectively. Extend the resource conservation subsidy also to the available stocks of TSP/DAP and MP in the country and in the pipeline in order to keep the supply of imported products steady. Alternatively, give subsidy to imported TSP, DAP and MOP up to a maximum of 30-35% per 50kg bag if average world prices (CIF) rise more than 10% above three year moving average. Import fertilizer from multiple sources in stead of one single source to avoid artificial crisis; and determine the rate of subsidy based on procurement/supply source, distance, freight and quality of the product and gradually increase the price of Urea.

Advantages: With aggressive farmer education during the subsidy period, this environment friendly measure will contribute to balanced use of urea, phosphate and potash thereby reversing the soil degradation (imbalance of soil nutrient) process while raising paddy yield by 10-20%. Cost of subsidy will be more than offset by incremental value of production. In importing fertilizer, a variable rate of

subsidy will reduce dependence on one source, minimize risk, increase competition and ensure steady supply.

Limitations: *Estimation of excess landed cost and delivery to desired destination at target price will have to be closely monitored by the National Fertilizer Monitoring Committee. The estimated annual fiscal burden (of about Taka 290 crore s if estimated excess landed cost is Taka 200 per 50kg bag and total consumption of TSP/DAP and MOP is 724,000 tons same as in 2002/03) would have to be financed. Farmer education may lag behind. Once introduced it is difficult to withdraw subsidy because of interest group pressure. Therefore, planned withdrawal of subsidy has to be firmly and carefully executed in order to avoid disruption in supply, sudden price increase and consequent negative impact on production.*

Policy 2. Ensure timely supply of fertilizer by giving priority to discharging fertilizer cargo of the importers and allowing the use of local PP bag, while monitoring importer activities for possible supply/price collusion. Import and store limited quantity of TSP/DAP and MP on government account for distribution and sale only at times of supply stress due to international price rise and confirmed evidence of collusion among importers adversely affecting supply and price of fertilizer.

Advantages: *Limited import and distribution of TSP and MP by BCIC will ensure timely fertilizer availability and help market stabilization.*

Limitations: *It may take time for BCIC to fully gear up to this task. Because import is a time consuming activity, detection of an impending supply crisis would require close monitoring of both international and domestic market.*

Policy 3. Ensure that District Fertilizer Monitoring Committee and DAE with appropriately trained staff monitor fertilizer demand and supply, farm level prices and quality, in collaboration with representatives of designated quality control laboratories, Bangladesh Fertilizer Association and farmer representatives; review demand projection before each major crop season and the supply program modified accordingly; limit arrival report of Urea fertilizer to DAE; and hold regular consultations with traders and consumers.

Advantages: *Farmers will receive quality fertilizer (free from adulteration) in standardized bags containing declared quantity (50kg instead of frequent 45 to 48kg as reported from the field).*

Limitations: *Quality control cannot be effectively implemented without capacity building and public/private partnership. Putting the institutional mechanism for quality control in place will require time and strong administrative commitment backed by resource appropriation. The challenge would be to set up a regular system with back-up laboratory facilities and legal cover for enforcing quality control. Problem may arise if the set up is abused to harass traders.*

Policy 4. Increase Buffer stock depots for Urea, especially to cover remote areas. These depots will sell fertilizer to dealers and retain a pre-designated minimum stock.

Advantages: *Additional buffer stock will improve timely availability of adequate quantity of Urea at various production locations, increase competition and contribute to supply and price stabilization.*

Limitations: *Fertilizer monitoring responsibility will increase and the monitoring system will require further strengthening.*

Policy 5. Reduce price differential between mill gate price and buffer stock depot price of Urea and raise the mill gate price by Taka 10 per bag.

Advantages: *Fertilizer price equalization will improve use of Urea from buffer stock and encourage farmers to use balanced dosage of fertilizers.*

Limitations: *Buffer stock godown will need improvement to avoid caking of Urea if held longer than six months.*

Medium Term Priority

Policy 6. Amend Fertilizer (Control) Order 1999 under Essential Commodities Act 1956 to improve regulation of imported and domestically produced fertilizer with regard to quality and product specification and formulate guidelines to implement the Fertilizer Control Order properly and review and rationalize the role of different actors. Strengthen the analytical laboratories, especially the newly built BADC Laboratories for fertilizer quality testing.

Advantages: Fertilizer market will function better as farmers will get quality fertilizer.

Limitations: Amendment of the Order may get bogged down in procedural delays.

Policy 7. Review and rationalize the existing Urea distribution system together with reconsideration of the present system of restricted number of dealers, restriction of Urea distribution within Upazila, fixed quota system and equal allocation to all dealers in an Upazila, based on location-specific assessment so that Urea market can function smoothly on a competitive basis ensuring supply to all consumption points in accordance with demand.

Advantages: Allocation of fertilizer according to estimated demand will improve location specific fertilizer supply, as dealers would be in a better position to respond to market demand.

Limitations: May create artificial location specific scarcity due to unethical conduct of traders.

Policy 8. Over longer term, encourage domestic production and the use of high nutrient content product, such as DAP, NPKS, and bio-fertilizer, following IPNS, if necessary through subsidy.

Advantages: Likely to result in a saving for the country as cost per unit of nutrient including transport cost is lower. Balanced use of fertilizer will be promoted.

Limitations: Supply of high nutrient content product may be a problem.

Policy 9. Take appropriate measures to prevent/check smuggling of fertilizer in neighboring countries.

Advantages: Local farmers will get the benefit of getting the desired fertilizers at the right time, price, and quality.

Limitations: With the porous border, it will be extremely difficult to prevent smuggling.

Policy 10. Recognize local production of Bio, Organic and Mixed Fertilizer as Agricultural Industry in order to enable the farmers to use these fertilizers at competitive price.

Advantages: Use of balanced fertilizer will be increased and soil health will be improved.

Limitations: It may take time for entrepreneur to come forward to setup industry because it is a time consuming activity.

CHAPTER 4

Land and Its Competing Use

A. BACKGROUND / OVERVIEW

1. “Land is like gold in Bangladesh”.²⁵ A total land area of 144,000 sq. km has a population of about 140 million. Of the total land area of 12 million hectares besides homesteads, urban and riverine areas, the net cultivable land is 9.09 million hectares. Per capita cultivable land is one of the lowest in the world (about 0.08 ha). About 84% of the population live in rural area and are directly or indirectly engaged in a wide range of agricultural activities.²⁶ The pressure on the land is extremely high. With increasing population growth (current rate of 1.8%), urbanization, infrastructure expansion coupled with riverbank erosion, the rate of loss of arable land is alarming (82,000 ha a year²⁷).
2. Continuous intensive use of land (cropping intensity >180) for cultivation of HYV crops has intensified monoculture and loss of soil fertility. At the same time water bodies, forestlands and biodiversity are on the decline; shrimp culture is replacing crop cultivation in the coastal areas; and fallow land is disappearing.
3. The uniquely flat delta landscape of Bangladesh (except the hilly areas of the Sylhet region in northeast and Chittagong Hill Tracts in southeast) is criss-crossed by a very high density of river systems (700 rivers with a total length of 221,555 km)²⁸. The extensive inland water system of the country (62.8 km per 1,000sq.km land area)²⁹ has, in recent decades, been constrained as a result of silting up of riverbeds hindering navigation.
4. Bangladesh has the highest density of road network (7.6 km per 100 sq. km) as compared to India (one km), China (2.7 km) and Pakistan (4.8 km). But the density of paved road is estimated at about 29 km per 1000 sq. km, less than half of the average of Asia, and only one tenth of India.³⁰ Most of the rural roads are unusable by automobiles. Although the density of railroad in Bangladesh is higher than most Asian countries (except India), Bangladesh railway is grossly inefficient. Inefficient road infrastructure is a major constraint for marketing of agricultural produces and works as one of the main obstacles to rural development.
5. Based on topography, the Bangladesh lands are classified as high, medium high, low, medium low and very low lands that together constitute 85% of the total land area. The urban areas, riverine areas and homestead lands constitute the remaining 15% (Table 5).
6. Agricultural lands can be grouped into five categories (Category I - Very Good, Category II – Good, Category III – Moderate, Category IV – Poor and Category V – Very Poor).³¹ The distribution of land area under these categories is shown in Table 6.
7. Bangladesh has been divided into 30 agro-ecological zones. However, based on physiographic characteristics, the land types are broadly classified into Hill (12%), Terrace (8%) and Floodplain (80%) areas.³²
8. Hill soils are strongly acidic and low in moisture holding capacity. These lands are either under forest, scrub grassland, or, *Jhum* (slash and burn) cultivation where rice is intermixed with several

²⁵ Gain, P. 1998. Bangladesh: Land, Forest and Forest People. Dhaka: Society for Environment and Human Development (SEHD).

²⁶ MoA. 1999. The National Agricultural Policy. *Ibid.*

²⁷ Government of Bangladesh, Bangladesh Bureau of Statistics. 1996. Agriculture Census.

²⁸ Nazem, N. I. And K. M. Elahi. 1990. Impacts of Riverbank Erosion on Land Settlements in Bangladesh. Proceedings of a Seminar on People and Environment in Bangladesh, Dhaka, February 1990. UNDP/UNFPA.

²⁹ *Ibid.*

³⁰ Khan, A. A. 1993. Freshwater Wetlands in Bangladesh: Opportunities and Options, in Nishat et al. (Eds). Freshwater Wetlands in Bangladesh. IUCN, Gland, Switzerland.

³¹ MoA/DANIDA, Integrated Agriculture Development Plan.

³² Government of Bangladesh, Ministry of Agriculture, BARC. 1983. Agriculture in Bangladesh.

other crops (such as cotton, maize, vegetables, pulses and oilseeds. Some lands are under cultivation of tea, rubber, pineapple and ginger).

9. Terrace soils have silt topsoil with compact plough pan and are strongly acidic and low in moisture holding capacity. Floodplain soils are silt clay to clay in basins, silt loam to silt clay loam on intermediate position, and permeable sandy loam on the highest part.³³ Brown terrace and highland floodplain soils are traditionally used for tree crops, sugarcane or upland rice or mesta followed by early *rabi* crops. Deep and shallow gray terrace soils are used for transplanted *aman* rice, or *aus* rice followed by *aman* rice.

10. The traditional crops on medium highlands are transplanted *aman* rice, *aus* rice or jute followed by transplanted *aman* rice while medium lowlands (moderately flooded) are traditionally used for *aus*, deep-water *aman* or jute, followed by a wide range of *rabi* crops.

11. Lowlands (deeply flooded lands) are either used for deep-water *aman* rice where the soils drain early enough in the dry season. Bottomland (perennially wet) soils are traditionally used for *boro* rice or left under swamp grassland or mangrove forest.

12. However, with the introduction of HYV rice and expansion of irrigation facilities, *boro* rice has taken over the traditional crops during the dry season in most of the land types.

13. Apart from the hilly areas and saline coastal region, the two other important fragile eco-systems are the *char* lands and the *haor* areas. *Char* lands are formed as a result of sediment deposits (usually coarse sands) in flooded areas and usually have poor soil quality. Hardly any crop grows in *char* lands unless the soil is improved with the addition of organic matter. Farmers often grow green manuring crops to improve the soil quality. Crop cultivation becomes possible when the water recedes from these lands during the dry season. Some tuber crops, like sweet potato are often the starter crops in such areas. The crops of these low lying areas are subject to flood hazards. Research attention is needed for *char* lands with a view to improving the soil quality and developing remunerative cropping patterns avoiding flood hazards.

14. *Hoars* are perennial water bodies and often have very deep water. Parts of Netrokona, Kishoreganj and greater Sylhet Districts constitute the major *haor* areas of Bangladesh. These *haors* used to be rich in fisheries resources in the past. Adjoining shallow areas of *haors* have traditionally been used for *boro* rice as well as *aus* rice cultivation. Cultivation of *boro* rice has expanded substantially these days. Tree species like *koroch* and *hizol*, that can withstand standing water, survived well in these areas and provide sources of fuel to the people living in the surrounding areas. Unfortunately, often crops are damaged due to on-rush of flash floods from the hilly areas, upstream in the Meghalaya State of India. Fisheries and tree resources of *haor* areas have been reduced drastically in recent times due to over exploitation. Conservation programs and research initiatives are warranted to bring back the *haors* to their full potential.

B. Constraints/Issues

15. Fragmentation of land: The traditional inheritance law has promoted fragmentation of land. There were some 12 million plots in 1990s.³⁴ These have apparently been fragmented further. Land record and registration systems are old-fashioned, cumbersome and often disputable in terms of ownership and valuation. Farmers usually own very small plots scattered in a Mouza that affects agricultural operation management-wise as well as time- and energy-wise. Fragmentation of lands into small plots also hinders commercial approach to farming.

16. Land Degradation: Land degradation results from (a) natural causes (erosion in steep slopes, high intensity of rains, water logging, leaching in humid region, drought in dry regions), (b) direct causes (deforestation, unsustainable cultivation practices, intensive cultivation of HYV crops, unbalanced fertilizer use, deficiencies due to negative nutrient budgets, improper crop rotation, etc.) and (c) socio-

³³ *Ibid.*

³⁴ Gain, P. 2002. Bangladesh Environment Facing the 21st Century (2nd Edition). Dhaka: Society for Environment and Human Development, Lalmatia, Dhaka. Pp. 1 -25.

economic causes (land shortage, insecure tenancy, overexploitation, etc.)³⁵ A summary of land degradation due to different causes and their extent in terms of land area is given in Table 7. The common types of land degradation are the following.

17. Soil erosion: This causes various forms of erosion including sheet, reel and gully erosion and covers about 25% of the agricultural land in Bangladesh. Silt erosion is particularly heavy in hilly areas of Chittagong Hill Tracts, Moulavibazar and Sylhet districts.³⁶ The Kaptai Hydroelectric Project pushed more than 25,000 tribal families from valleys to steeper hills leading to, among other things, heavy erosion of soils from hill slopes. Leasing lands in hilly areas of Sylhet for pineapple cultivation intensified sheet and reel erosion, turning the lands unfit for crop production, both uphill in slopes and downhill in valleys. Settlement of farmers from plain lands to hilly areas, with no experience in hill farming, led to cultivation practices that caused massive erosion of hillsides.³⁷ Also government owned rubber plantation is “guilty” of allowing heavy erosion in their estates during monsoon rains,³⁸ mainly due to lack of maintenance of bench terraces and removal of ground cover.

18. Soil Salinity: Of the 2.85 million hectares of coastal areas (about 30% of the total cultivated land), 0.87 million hectare is saline. Due to man made disturbances in water flow upstream in rivers, the salinity problem has exacerbated in recent times. The Sundarban ecosystem is seriously threatened due partly to increase on salinity level and salinity intrusion, and partly due to chemical pollution as well as wanton destruction of floral populations. Also with the expansion of export oriented shrimp cultivation, rice shrimp mixed culture has been replaced by shrimp monoculture and the entire agro-ecological zone and socio-economic conditions of small farmers of the region are now threatened.

19. Water logging: Nearly 30% of the net cultivated area was brought under Flood Control and Drainage (FCD) Projects. Also in a number of Flood Control, Drainage and Irrigation (FCDI) Projects lands were perennially waterlogged. Zinc and sulphur deficiency has become widespread especially in areas of continuous rice cultivation where lands remain wet for most parts of the year.³⁹

20. Sedimentation: Wanton destruction in upstream forests, inappropriate cultivation practices and low organic matter content in soils made soils more vulnerable to erosion that, in turn, led to soil sedimentation downstream on riverbeds, lakes, and ponds and inundated floodplains. An estimated 24 billion tons of sediments are deposited annually in riverbeds of the country.⁴⁰ This decreased carrying capacity of rivers, increased flood hazards and navigation problems and the coarse to various grades of sands deposited in adjoining flooded lands degraded agricultural soils. The other impact of sedimentation was the reduction of surface water area affecting fisheries, reduction in the availability of water for irrigation and domestic uses.

21. Riverbank erosion: Bangladesh Bureau of Statistics reported that there are some 700 rivers in the country stretching a length of 221,555 km. Most of the rivers are meandering in nature and their banks, made of deltaic alluvial soils, are highly vulnerable to erosion. Riverbank erosion is severe in 35 *Thanas*. About 1,305 sq. km is washed away annually affecting about one million people with their homesteads and agricultural lands, often with standing crops.⁴¹ It is more devastating than flood or fire hazards, leaving nothing behind.

22. Deforestation: The inland tropical forest of Bangladesh was once a continuation of the Tarai Forest in southern Nepal. The forest destroyed during colonization by the Aryans.⁴² Parts of which remained in Madhupur/Bhawal forests, were cleared during World War II and again in recent times by unscrupulous timber traders in connivance with government forest officials. The forest area reduced

³⁵ Government of Bangladesh, Ministry of Agriculture, BAR C, 1999. Land Degradation Situations in Bangladesh. Soils Division, Bangladesh Agricultural Research Council, Dhaka.

³⁶ MOA/DANIDA. Forestal – Soil and Land Use Survey of Chittagong Hill Tracts. Vol. 2(3).

³⁷ FAO, 1992.

³⁸ Government of Bangladesh, Report of the Task Forces on Bangladesh Development Strategies for the 1990s. Environment Policy. Vol. 4, pp. 84.

³⁹ Zaman, S. M. H. Conservation cropping under rain -fed conditions. Mimeographed.

⁴⁰ Nazem, N.I. and K.M. Elahi. 1990. Impacts of riverbank erosion, *op.cit.*

⁴¹ *ibid.*

⁴² Zaman, S. M. H. 1991. Conservation cropping under rain -fed conditions. Mimeographed.

from about 20% in 1960 to only 6% now.⁴³ Annual deforestation is estimated at about 0.3 million hectares and the country is losing about 3% of its remaining forest areas. Such a heavy deforestation, both in plains and hilly areas, contributed to land degradation through removal of the sources of organic matter as well as through soil erosion. In addition, shortage of fuel and timber also led to wanton denudation of homestead trees, aggravating the problem further.

23. Depletion of soil organic matter: It is widely held that the declining land productivity in Bangladesh is the result of depletion of soil organic matter caused by high cropping intensity⁴⁴ (>180). Most soils in Bangladesh have organic matter less than 1.7%, some have even less than 1% against a good soil which should have organic matter content more than 3.5%.⁴⁵ In Bangladesh crop residues are often used as fuel and fodder and not returned to the soil. Cow dung is also widely used as fuel in rural areas. Such a situation has resulted in the decrease of soil organic matter content. The average organic matter content in top soils (highland and medium highland) declined by 20-46%, from about 2% to about 1% over the past 20 years of intensive cultivation.⁴⁶

24. Deficiencies of major- and micronutrients in soils: Nutrient uptake by HYV is greater than local varieties. Increased cropping intensity, especially with HYV crops, has led to negative balance of major nutrients nitrogen (N), phosphorus (P), potassium (K), sulphur (S) and magnesium (Mg). The net removal of N, P, K and S in areas of intensive cultivation ranges from 180 to 250 kg per hectare per year.⁴⁷ Most soils under highland and medium highland areas are low in fertility level where especially N, P, K and S are deficient. Deficiencies in magnesium (Mg), Zinc (Z), boron (B) and molybdenum (Mo) have also been detected in increasing areas.⁴⁸ These areas of low soil fertility comprise about 60% of the total cultivable land of the country.⁴⁹

25. Soil toxicity: Soil toxicity results from indiscriminate uses of agro-chemicals and industrial wastes. For examples, toxicity results from pesticides, nitrates and nitrides (from nitrogenous fertilizers), discharges from liquid effluents and solid wastes (from urea fertilizer factories leading to ammonia concentration), chromium, cadmium, lead and other heavy metals (from fertilizer plants, tanneries, pharmaceutical and paint industries), mercury (from chlor alkali plants), phenols (from pulp and paper industries), polyethylene (from plastic industries)⁵⁰, etc. All phosphate ores contain traces of uranium; the threshold level of cadmium in fertilizer products is estimated at 48 mg/kg of P₂O₅.⁵¹ Often substandard phosphatic and zinc fertilizer are applied add heavy metals like cadmium and lead to the soil. Surface run off and leaching of fertilizers and pesticides contaminate water bodies also.

26. Acidification: Most topsoil in cultivated or deforested areas become s acidified to variable extent. Very severe form of acidification was reported in about 62000 ha of acid sulphate soils of the coastal region where drainage improvement revealed acidity ranging from pH 2 to pH 4 along with aluminum toxicity.⁵² Intense acidification has also been reported in Sylhet Basin, lower Atrai Basin and in valleys of Madhupur and the Barind tracts.

27. Ferrolyzation: Ferrolysis is a process of degradation of silicate mineral under alternate oxidation and reduction. The process of ferrolyzation has been reported in wetlands of Madhupur and the Barind Tracts and also in acidic soils of Old Floodplains.

⁴³ Government of Bangladesh, BARC. 1995. Bangladesh Country Report for International Conference and Programme for Plant Genetic Resources (ICPPGR), BARC, Dhaka.

⁴⁴ BARC. 1999. Land Degradation Situations in Bangladesh. *Op.cit.*

⁴⁵ *ibid.*

⁴⁶ Miah, M. M. U., A.K.M. Habibullah and S. D. Gupta. 1993. Depletion trend of potassium in Bangladesh soil and its management for maximizing crop production. Bangladesh Journal of Scientific Research, Res. Vol. 14(1): pp 35-42.

⁴⁷ Karim, Z, M.M.U. Miah and S. Razia. 1994. Fertilizer in national economy and sustainable environmental development. Asia Pacific Jour. Env. Dev. Vol. 2. Pp 48-67.

⁴⁸ Miah, M. M. U, K. M. Hossain and A. K. M. Habibullah. 1992. Boron deficiency in cereals and vegetables in some soils of Bangladesh. Proc. Int. Congr. Conf Comm IV, International Society of Soil Science. Dhaka, Dec. 1-3, 1992.

⁴⁹ BARC. 1999. Land Degradation Situations in Bangladesh. *Op.cit.*

⁵⁰ Zaman, S. M. H. 1991. Conservation cropping under rain-fed conditions. Mimeographed.

⁵¹ BARC. 1999. Land Degradation Situations in Bangladesh. *Op.cit.*

⁵² *Ibid.*

28. Pan Formation: In areas where transplanted *aman* rice is grown year after year using country plough, about 3-5 cm firm ploughpan have formed just below the plough layer. This firm pan restricts proliferation of plant roots and utilization of sub-soil nutrients by the growing crops. Such ploughpans have been reported in 2.3 million hectares of the basins of Tista, Ganges, Brhamaputra, Meghna and in the Barind Tracts.

29. *Char* lands and *haor* areas: The total *char* lands are estimated to cover 0.52 million hectares of which 0.19 million hectares are currently cultivable. Farmers sometimes grow green manuring crops to improve them soil. Research attention is needed to improve these *char* lands within the shortest possible time and also for developing cropping patters that could avoid submergence of crops during floods in these low lying areas.

30. In *haor* areas, flash floods from the hilly areas frequently damage the crops grown. The floral population, especially trees resistant to water logging, has been drastically reduced in recent times. Hardly any research has been undertaken with a view to exploiting these lands and water resources to their full potentials.

C. Review of Current Policy

31. There was no land policy guideline in Bangladesh till the introduction of National Agricultural Policy (NAP) in 1999. The National Land Use Policy adopted in 2001 followed this.

The National Agricultural Policy (NAP) on Land

32. The salient features of National Agricultural Policy (NAP) on land stipulate that SRDI will develop land-zoning program for land use. It appears that this may create conflicts with the Land Ministry that controls issues related to land. Therefore, SRDI will need to work with the Land Ministry. NAP also says that measures will be taken to halt the trend of alienation of agricultural land in favour of non-agricultural purposes. The issue is complex. A strong political commitment and open dialogues with stakeholders would be warranted for developing a consensus on the issue. However, there is an urgent need for a clear guidance on conversion of agricultural land to non-agricultural use, which is taking place at an alarming rate. NAP includes bottom-up planning of land use at the *Mouza* or village level through people's participation. The planning for judicial use of land is yet to be institutionalized. However, NAEP encourages bottom up planning for agricultural extension, which may be linked to land use through development of profitable (but sustainable) cropping patterns for different AEZs. Farming systems research for each AEZ will have to be strengthened for the purpose.

33. The NAP does not specifically address the issue of riverbank erosion. About 1.7 million hectares of flood plain areas are prone to riverbank erosion, about a million people are affected every year and many of them become destitute. This is a chronic problem. There should be serious attempts to reduce riverbank erosion through research on river taming.

The National Land Use Policy

34. The salient features of the National Land Use Policy are:

- Halt the present alarming rate of conversion of agricultural land to non-agricultural purposes.
- Prepare of guidelines for maximum land utilization based on agro-ecological characteristics.
- Discourage acquisition of agricultural land for urbanization or for other development projects.
- Reduce environmental pollution and degradation of land, water and air and promote environmentally friendly activities in agricultural development.

35. Fertile agricultural land is going out of cultivation for private construction, house building, brickfield and other uses. It appears that hardly any progress has been made up till now for implementing the Land Use Policy. The issues involved are no doubt complex and would warrant joint efforts by concerned Ministries (Land, Agriculture, Livestock and Fisheries, Environment and Forestry, Local Government, Communication, and Industries) and organizations involved in the use of land and protection of the environment. In a land hungry country like Bangladesh, the matter deserves

urgent attention and a total political commitment is essential to save prime agricultural lands from going out of cultivation. For this, an implementation plan for land use policy needs to be developed with all seriousness.

D. Policies for the Future

36. The Agriculture Sector Review Team recommends the following immediate, medium term and long-term measures for consideration of stakeholders. These measures are designed to address key constraints of the land sector thereby contributing to sustained increase in land and labor productivity in agriculture, promote concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of a subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1. Develop a land policy focusing on land zoning, land utilization plan, and investment plan for land development (leveling, flood control, water logging, siltation of waterbeds and salinization, afforestation and preservation of biodiversity, improved utilization of cultivable land including *khas* land currently not in use).

Advantages: Protect suitable agricultural land areas and contribute to efficient utilization of the scarcest resource of the country. This will also contribute to land and forest conservation.

Limitations: Land zoning has to be carried out in a transparent way for which mechanism is lacking. Require strong commitment from all stakeholders, which is difficult given conflicting interests.

Policy 2. Initiate the preparation of AEZ-based land development plan by Upazila taking into consideration sustainable but most profitable cropping patterns; establish a Parliamentary Committee for earmarking agricultural land that must be protected; and form a multidisciplinary committee of experts including local people and environmentalists to develop plans for use of land for agricultural and non-agricultural purposes through open debates for finalizing the recommendations before sending it to the Parliamentary Committee.

Advantages: Will protect productive agricultural land and will ensure sustainable land use.

Limitations: Implementation will be demanding in terms of manpower and financial resources and in arriving at a general consensus among conflicting groups.

Medium Term Priority

Policy 3. Give priority attention to expedite streamlining of land records and land registration on the basis of appropriate market valuation.

Advantages: Will help development of competitive land market and facilitate use of land records as collateral for credit.

Limitations: Very cumbersome and sensitive area and needs cautious approach and careful handling. It cannot be implemented without cooperation of land administration, which is weak and not responsive to new initiatives regarding land.

Policy 4. Take measures to protect fragile ecosystems including coastal, hilly, *haor* and *char* areas; and reconsidering settlement of plain land farmers in hilly areas and undertake projects like rubber or pineapple plantation in such areas.

Advantages: Will protect fragile ecosystems and reduce social tension while encouraging productive and sustainable use of land.

Limitations: Politically very sensitive and will require broad based consensus.

Policy 5. Give serious consideration to long-term impacts of irrigation and drainage projects before undertaking such projects. Meanwhile, adopt measures against water logging in Flood Control and Drainage (FCD) and Flood Control, Drainage and Irrigation (FCDI) Projects.

Advantages: Reduce loss of land and productivity of land due to water logging and/or salinity.

Limitations: This requires inter-ministerial coordination, which is lacking.

Policy 6. Undertake a program for dredging of rivers, canals and haor basins in order to reduce flood hazards and deterioration of land quality due to sedimentation; and also initiate research on taming river flows and riverbank erosion.

Advantages: Reduce flood hazards and halt land degradation and land loss.

Limitations: Very expensive and past experience is mixed. Research will require appropriate skills, which is not available.

Policy 7. Strengthen the program for conservation of biodiversity, identification of plants suitable for different AEZs, and mass awareness drives on tree plantation; and also continue moratorium on forest clearance until such time adequate forest area is restored in the country.

Advantages: Protect land and forests and preserve plant genetic resources of the country. It will comply with Convention on Biological Diversity (CBD).

Limitations: Difficult to implement due to conflicting interests.

Table 5. Land Types, Areas and their Proportions of the Total Land Area

Land types	Areas (ha)	Proportion (%)
Highland	4,199,952	29
Medium Highland 1	5,039,724	35
Medium Highland2		
Medium Lowland	1,771,102	12
Lowland	1,101,560	8
Very Lowland	193,243	1
Total Land Area	12,305,581	85
River, Urban, Homesteads, et c.	2,178,045	15
Grand Total	14,483,626	100

Source: BARC. 1999. Land Degradation Situations in Bangladesh, BARC, Dhaka.

Table 6. Categories of Agricultural Lands, their Area and Proportion (%)

Category	Agricultural capability	Area (million ha)	%
I	Very good agricultural land	0.19	2
II	Good agricultural land	4.19	34
III	Moderate agricultural land	4.82	39
IV	Poor agricultural land	1.92	16
V	Very poor agricultural land	1.09	9
Total		12.21	100

Source: BARC. 1999. Land Degradation Situations in Bangladesh, BARC, Dhaka.

Table 7. Extent of Land Degradation due to Different Causes

Causes of land degradation	Area (mha) affected			Total area (mha)
	Light	Moderate	Strong	
1. Soil erosion	0.1	0.3	1.3	1.7
2. Riverbank erosion	-	1.7	-	1.7
3. Soil fertility decline	3.8	4.2	-	8.0
4. Phosphorus deficiency (for HYV rice)	5.3	3.2	-	8.5
5. Phosphorus deficiency (for upland crops)	3.1	2.5	-	5.6
6. Potassium deficiency (for HYV rice)	4.0	3.4	-	7.4
7. Potassium deficiency (for upland crops)	2.1	5.4	-	7.5
8. Sulphur deficiency (for HYV rice)	4.4	3.3	-	7.7
9. Sulphur deficiency (for upland crops)	4.1	4.6	-	8.7
10. Depletion of soil organic matter	1.94	1.56	4.05	7.55
11. Water logging	0.69	0.008	-	0.698
12. Soil salinity	0.29	0.43	0.12	0.84
13. Pan formation	-	2.82	-	2.82
14. Acidification	-	0.06	-	0.06
15. Deforestation	-	0.3	-	0.3
Sub –total	29.82	33.778	5.47	69.068
16.Active floodplain (degraded)	-	-	-	1.53
17. Barind (degraded)	-	-	-	0.773
Total	-	-	-	71.371

Source: BARC. 1999. Land Degradation Situations in Bangladesh, BARC, Dhaka.

CHAPTER 5

Minor Irrigation

A. Background/Overview

1. Minor irrigation has been the engine of growth of the crop agriculture of Bangladesh. The irrigation command area increased from nearly 1.6 million hectares in 1979 to about 4.4 million hectares in 2001, an annual rate of increase of over 4% (Table 8), which is about 3 times the average for the Asia and Pacific region.

2. At present, minor irrigation accounts for about 90% of the total irrigation command area. The shallow tube wells (STWs) command area comprises of about 56% (Table 8) of the total area under irrigation. The accelerated transformation of rainfed, monsoon-dependent agriculture into irrigated and diversified agriculture helped the country achieve near self-sufficiency in cereals. More importantly, it helped shift the cultivation of paddy into the *Boro* season where risks from natural calamities such as floods are less. This “*Boro* revolution” helped stabilize the supply of grains and contributed significantly to the war against poverty and hunger.

3. At present, the level of irrigation development is in the order of 50%. Accelerated and sustained increase in the irrigation command area is still feasible in the short and medium-terms. There are, however, emerging issues that may constrain the expansion of the irrigation base and preclude the full realization of the potential benefits from irrigation development.

4. The present yields of paddy and other crops are only about half of their potential levels. The irrigation water use efficiency in STW command areas is below 60%. The water productivity is equally low at about 0.3 kg grain per cubic meter of water.

5. The cost of pump irrigation has been estimated at about US\$ 51 per hectare⁵³ per season at present and is projected to increase with increasing cost of operation and maintenance including diesel cost.

6. The present dispensation would like to help the marginalized farmers by modernizing agriculture, making it efficient and responsive to their needs. Modernization, in the context of Bangladesh agriculture, is basically smallholder in nature, dynamic by readily taking advantage of technological innovations, people empowering, efficient and competitive. The accelerated and sustained transformation of high risk, rainfed agriculture into highly productive, irrigated and diversified agriculture is one of the foundations of this modern agriculture. To achieve such transformation will require, among others, that the following host of interrelated issues and problems in irrigation be properly addressed.

B. Constraints/Issues

7. Minor irrigation was initiated nearly four decades back yet till today a practical and long-term minor irrigation policy has not been formulated. Due to lack of adequate repair and maintenance facilities a large number of irrigation equipment, especially DTW's have become non-operational. Due to lowering of the ground water table capacity utilization of the irrigation equipment is being significantly reduced.

8. In case the ground water level falls below the limit of the suction mode pumps the farmers shall have to invest on force mode pumps, which is financially unattractive. Therefore, investment in minor irrigation will cease in such locations.

9. Due to suspension of spacing requirement (Ground Water Management Regulation 1987) optimum utilization of ground water is being impeded. Shallow tube wells are being installed in the DTW command areas there by reducing the DTW command area and vice-versa.

10. The farm gate output price of major irrigated crops like paddy and wheat has not increased with the rate of increase of cost of production reducing profit at the farm level. If this trend continues irrigated cereal production will become unattractive unless some form of subsidy is provided or diffusion of yield augmenting technology is accelerated.

11. The rate at which minor irrigation has expanded during the last few decades, infrastructure and other facilities do not appear to be sufficient to maintain this growth during the next few decades. In addition, qualitative improvements of irrigation equipment, service delivery and on-farm water management have also become essential.

12. Other challenges for the future are water quality, surface water management, conjunctive water use, technology shift in water management and monitoring of water quality and quantity. These challenges demand changes in the traditional role and mandate of the Irrigation Wing of BADC. BADC has served the purpose for which it was created. With the privatization of pesticide, fertilizer and irrigation equipment BADC's role and mandate has changed. In fact, the name of BADC itself is no longer justified. The need of today to respond to new challenges is different, and it calls for structural reorganization and functional rationalization of the Irrigation Wing. No less important is the energy supply for irrigation, electricity and diesel. Since a vast majority of pumps (85%) are operated by diesel, adequate supply of diesel at right price is essential to support irrigated agriculture. Yet diesel supply and high price problems do occur during peak irrigation season. This year also there was severe shortage of diesel in certain parts of the country. Shortage of diesel coupled with fertilizer shortage can spell disaster for irrigated agriculture.

13. Irrigated agriculture of the country is plagued by low water use efficiency and low water productivity. This situation has been created by faulty well design, drilling and development; improper matching of pump and prime mover, improper operation and maintenance of pump sets, absence of on-farm water management services and the like.

⁵³ Pingali, P.L., Mahboob Hossain and R.V.Gerpacio, Bangladesh Agriculture Under Trade Liberalization, 2001.

C. Review of Current Policy

14. The National Water Policy was approved in 2000 following which the National Water Management Plan was approved in 2004. The policy reiterates support of private development of ground water irrigation along side surface water development where feasible, with major emphasis on increasing irrigation efficiency and water productivity at the same time ensuring equity and social justice.

15. The policy also calls for strengthening appropriate monitoring organizations for tracking ground water recharge, surface and ground water use and changes in surface and ground water quality. The policy stipulates to encourage and promote continued minor irrigation development without affecting drinking water supply and recommends participation of both private and public sector in future ground water development for irrigation, subject to regulation that may be prescribed by the Government from time to time.

16. Improvement of efficiency of resource utilization through conjunctive use of surface and ground water with special attention to strengthen crop diversification has also been advocated in the policy. The policy also calls for strengthening the regulatory system for agricultural chemicals that pollute ground and surface water.

17. Most of the elements of the policy for irrigated agriculture appear to be appropriate which will contribute to balanced irrigation development in the future. However, reopening of public sector involvement in ground water development must be reviewed very carefully. Recommendation of regulation by the Government may in fact impede ground water development.

18. It must be recognized that the accelerated expansion of ground water based irrigation, especially by the STW's were possible due to full privatization and withdrawal of all kinds of regulation. Therefore, introducing any kind of regulation may be counterproductive. A comprehensive review of the minor irrigation will be a prerequisite to evaluate the advantages and disadvantages of regulation before any such consideration is made.

19. Minor irrigation and drinking water supplies may be integrated where feasible. The Rural Development Academy (RDA), Bogra and Barind Multipurpose Development Authority (BMDA) project have done some work along this line with considerable success. Their experience can be utilized in other areas.

20. Detection of arsenic in different parts of the country especially in shallow aquifers, calls for very intense monitoring of the ground water quality, which has been adequately addressed in the policy statement.

D. Policy options

21. There are many policy options for the future. One would be strengthening of on-farm water management preferably through DAE to increase water productivity. Presently, water productivity of the two major crops (rice and wheat) is less than 30% of the recommended value. This will need training of both extension agents and farmers.

22. For increased coverage and relatively trouble free operations all the irrigation pumps should be electrified on a priority basis, say, within a fixed time frame of 10 years with adequate insurance for uninterrupted supply. This is expected to reduce both fixed and operating cost by about 50%.

23. After nearly four decades of minor irrigation development no engine manufacturing plant has been established in the country. Most of the engines are imported from China and according to both dealers and farmers (in Natore during the field visit of the team) they are not of very good quality. Therefore, till the irrigation pumps are electrified government should take appropriate measures (with adequate incentives) for in-country manufacture of engines. At present the country requires more than 100,000 units of engines annually in the irrigation sector alone (including new as well as replacement). This indicates existence of a significant domestic market for engines, which can be exploited by the private sector.

24. Presently, nearly 1 million STWs are being used for irrigation. One of the most serious problems faced by the farmers is the lowering of the ground water table during the month of April and May, which is also the critical period for rice. Some efforts have been made to overcome this problem by using deep-set pumps and lowering the existing pump into shallow pits. But results have not been very encouraging. While visiting farmers in Natore on 17 April, 2004, it was reported that most of STWs in the area went dry and this may adversely affect paddy yield as the crop was in the seed formation stage. Government should promote use of small force-mode pumps and provide adequate subsidy to offset higher cost.
25. As diesel cost is increasing and supply is also becoming unstable during the irrigation season, efforts should be made to convert the diesel engines to CNG/LPG operated engines. At the same time, more CNG/LPG operated engines should be imported/manufactured in the country, if found feasible. A pilot project may precede large-scale introduction.
26. Some shallow aquifers in different parts of the country have already been contaminated by arsenic. Though no visible sign of arsenic has been detected in the food crops, monitoring of ground water quality and quantity (including toxicity from the use of chemicals, e.g., nitrite and arsenic build up in shallow aquifer) will help prevent any future arsenic contamination of the food chain.
27. During the Sector Review Team's trip to the northwestern part of the country, it was observed that some of the farmers were growing high value cash crops, including vegetables; and their number is increasing. Introduction of drip or sprinkler irrigation will significantly benefit these farmers both in water conservation and increased yield. Though the initial cost of these systems is high yet increased costs will be offset by increased production and reduced unit cost of irrigation. Initially farmers will need subsidy. A pilot project may be initiated to evaluate technical and economic feasibility of the systems.
28. A national policy of providing attractive incentive to the farmers growing crops other than paddy during the irrigation season (December- May) may be initiated. This incentive can be in the form of price incentive or any other suitable form. But it must be ensured that the actual target group receives the incentive. This is expected to reduce pumping demand and reduce pressure on ground water and help arrest water table lowering.
29. Of the nearly 1 million irrigation pumps in operation over 80% prime movers are diesel engines. Any disruption in diesel supply can adversely affect crop production. This year, in some areas there was reported shortage of diesel, which was partially overcome by emergency imports. It is, therefore, recommended that the Government formulate appropriate policy to ensure uninterrupted supply at a reasonable price at the farm gate. A time bound subsidy on diesel for irrigation pumps may be considered.
30. During the field visit both farmers and dealers indicated that the Chinese diesel engines that are now available in the market are not of very good quality and does not last more than 5 years. Japanese engines, which are far superior in quality and used in the early stages of tube well irrigation, can be imported as reconditioned engines. This will need changes in the import policy. These engines are expected to cost less than the engines available in the country and last almost twice as long.
31. Irrigation season usually lasts for 4-5 months. The prime mover can be removed from the pump and used to power other machines. Farmers have already started use of these engines for threshing and transportation. But if these engines are used for power tillers, paddy husking and other operations cost of irrigation will be reduced even further. An effort should be made to promote multiple uses of engines.
32. The concept of micro-credit may be introduced in the purchase of irrigation equipment by the banks. This is expected to encourage land less and marginal farmers to become owners of irrigation equipment which at the moment is the domain of large and influential farmers.
33. Wherever feasible pump irrigation should be integrated with domestic water supply. DTW's are more suitable for this purpose as some of the shallow aquifers in the country have been contaminated

with arsenic. Rural Development Academy (RDA), Bogra and Barind Multipurpose Development Authority (BMDA) Project have successfully tested this technology.

E. Policies for the Future

34. Considering the menu presented above, the Agriculture Sector Review Team recommends the following immediate, medium term and long-term measures for consideration of stakeholders. These measures are designed to address key constraints of the water sector thereby contributing to sustained increase in land and labor productivity in agriculture, promote concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1. Encourage government agencies to formulate and implement surface water augmentation schemes within the purview of the charter of those agencies so that the utilization of surface water for irrigation purposes can be increased substantially.

***Advantages:** Harnessing of surface water will increase irrigation coverage and improve water use efficiency through appropriate cost control and pricing. This will promote conjunctive use of ground and surface water.*

***Limitations:** BWDB has developed limited amount of surface irrigation at high capital and operating cost without much impact. Any similar development of surface water by BWDB is likely to be even more costly.*

Policy 2. Promote replacement of the current centrifugal pumps with more expensive force mode pumps in consideration of the lowering of water table by giving a time bound subsidy to offset higher cost. Encourage local production of these pumps through private sector.

***Advantages:** Introduction of force mode pumps will solve the problem faced with lifting water due to lowering of ground water table in many areas, where about 1 million STWs are being used for irrigation.*

***Limitations:** The proposed measure will have limited long term impact without complementary water conservation measures.*

Policy 3. Restructure BADC with its irrigation and seed wings and rationalize its staffing or transform the irrigation wing of BADC into an autonomous minor irrigation authority under MOA, with the recently redefined functions (Gazette No. DA 1, Nov. 22, 1999).

***Advantages:** MIA as a smaller organization will be more effective and efficient (relevant and cost effective) in responding to new challenges. Monitoring of water quality will help detect and prevent possible future contamination of the food chain.*

***Limitations:** Resistance may come from BADC staff and management as usual.*

Policy 4. Ensure through REB/PDP uninterrupted power supply to electric pumps and design a time bound program to increase the share of electric pumps in total irrigation pumps. Withdraw minimum charge for electricity and introduce electric tariff comparable with the neighboring countries and make it uniform for REB and PDP.

***Advantages:** Assured uninterrupted power supply will increase irrigation coverage, enable trouble free operations and reduce irrigation cost (fixed and operating) by about 50% compared with diesel pumps.*

***Limitations:** In the face of likely overall shortage of power supply in the short run, irrigation will have to compete with other sectors for power.*

Policy 5. Provide 20% subsidy to diesel engine operated pump owners on total diesel cost of operation certified by DAE/LG and/or irrigation groups, which should enable them to reduce price of water by 20% charged to individual farmers.

Advantages: Irrigation cost will be reduced

Limitations: Targeting of diesel subsidy will be problematic without active cooperation of representatives of local government and farmer groups and also in the context of field realities it will be difficult to avoid leakage. This measure will be effective only if policy measures are in place to ensure uninterrupted supply of diesel at farm gate.

Medium Term Priority

Policy 6. Allocate additional resources to strengthen DAE's on-farm water management capacity to expand irrigation and improve its management by adopting, among others, appropriate method of water application instead of present practice of flood irrigation for rice in collaboration with farmers/users' organizations.

Advantages: Water productivity will increase, by as much as 30% for rice and wheat. It will promote water conservation.

Limitations: This measure can be made effective only through training of both farmer and extension agents. However, this will also require alternative weed management technique.

Policy 7. Rationalize water pricing through water charge for surface and ground water irrigation provided by BWDB, and give subsidy for electric connection to irrigation pumps as well as withdraw the minimum monthly charge for the connection, and assure adequate fuel supply for irrigation pumps.

Advantages: Net return to water will move towards greater parity between alternative sources leading to rational use.

Limitations: There is no major limitation

Policy 8. Provide limited time bound subsidy for drip/sprinkler irrigation on a pilot basis to establish conditions for technical and financial viability given its significant potential impact on water use efficiency.

Advantages: Drip/sprinkler irrigation will improve water use efficiency and increase yield of high value crops including vegetable seeds. Increased initial capital costs will be offset by increased production and reduced total cost of irrigation.

Limitations: Likely to benefit mostly medium and rich farmers.

Policy 9. Explore the option of gradual replacement of diesel engines by LPG/CNG (bottled) operated engines as well as manufacturing the same locally on a pilot basis in view of high cost and uncertain supply of diesel during irrigation season.

Advantages: Use of LPG/CNG as fuel for irrigation pumps will ensure uninterrupted irrigation at critical point in crop cycle at lower cost.

Limitations: Total cost of LPG/CNG conversion of diesel run irrigation pumps would have to be carefully worked out before specific action is taken to promote its use.

Policy 10. Introduce the concept of micro-credit for purchasing irrigation equipment to encourage landless and marginal farmers to become owners of irrigation equipment which, at the moment, is the domain of large and influential farmers.

Advantage: Landless and marginal farmers will have easier access to irrigation equipment.

Limitations: Organizing micro-credit program for this purpose may be somewhat difficult.

Table 8. Irrigation by Methods (000 hectares)

Year	LLP	DTW	STW	Total - Tubewell	Canal	Traditional	Total
1979-1980	621.4	180.5	55.1	235.6	122.2	589.9	1569.1
1980-1981	665.8	259.5	99.2	358.7	150.3	464.2	1639.0
1981-1982	704.2	323.4	202.1	525.5	163.3	332.8	1725.8
1982-1983	746.5	390.1	298.7	688.8	160.3	252.4	1848.0
1983-1984	666.7	415.4	303.5	718.9	134.0	400.4	1920.0
1984-1985	680.5	441.2	300.4	741.6	147.5	503.1	2072.7
1985-1986	608.7	358.5	534.5	893.0	163.1	432.9	2097.7
1986-1987	659.6	387.5	521.2	908.7	155.5	475.2	2199.0
1987-1988	527.2	432.3	868.5	1300.8	115.2	404.2	2347.4
1988-1989	657.7	501.9	899.1	1401.0	169.7	509.0	2737.4
1989-1990	657.3	428.1	1045.1	1473.2	177.5	629.3	2937.3
1990-1991	674.8	615.5	1131.1	1746.6	172.9	433.7	3028.0
1991-1992	684.7	656.0	1293.4	1949.4	170.6	425.9	3230.6
1992-1993	686.2	645.4	1337.7	1983.1	158.8	425.8	3253.9
1993-1994	627.6	693.7	1431.1	2124.8	154.9	382.5	3289.8
1994-1995	656.9	667.9	1572.9	2240.8	159.2	372.8	3429.8
1995-1996	677.5	676.8	1680.0	2356.8	154.0	365.6	3553.9
1996-1997	570.3	475.4	2104.1	2579.6	155.8	362.6	3668.3
1997-1998	621.7	464.9	2181.9	2646.8	162.7	338.3	3769.5
1998-1999	668.8	661.9	2111.7	2773.7	167.1	330.2	3939.8
1999-2000	741.8	664.1	2290.9	2955.1	172.4	317.3	4186.6
2000-2001	756.8	693.7	2467.4	3161.1	177.3	324.6	4419.7

Source: BBS as quote in, Handbook of Agricultural Statistics, *op.cit.* Table 4.03.

CHAPTER 6

Mechanization

A. Background/Overview

1. The then Government of East Pakistan introduced Power Tillers and Power Pumps in the late 1960s as a part of 'Green Revolution' activities. The Government of Bangladesh allowed continued import of farm machinery since independence to help mechanize farming activities.
2. The Ministry of Agriculture formed an 'Agricultural Machinery Standardization Committee' for testing and standardization of farm machines (mainly tractors, power tillers, pumps and sprayers) so that only high quality standardized equipment suitable for using and maintaining in Bangladesh condition are imported and used in the country.
3. The GOB abolished standardization requirements in 1988 and made the market open for import of agricultural machines (especially power tillers and pumps) at a nominal tariff following a devastating flood and loss of a large population of draught animal. A large number of power tillers and power pumps are imported every year, mainly from China, to meet the local demand.
4. Decreasing number of draught animals, shortening of time available for land preparation and harvesting due to increased cropping intensity, shortage of labor at peak periods, and increasing demand for irrigation are creating increasing demands for appropriate farm machinery.⁵⁴ Mechanization of certain operations like land preparation bring in high return than traditional draught power (Table 9).

Table 9. Impact of Mechanization on Yield and Returns in Rice Cultivation

	Draught Animal	Power Tiller	Both
Aman Rice			
Yield (kg/ha)	5307	5385	5483
Gross return (Tk/ha)	38635	39202	39916
Net return (Tk/ha)	8774	12785	12641
BCR (undiscounted)	1.29	1.48	1.46
Boro Rice			
Yield (kg/ha)	3540	3580	3530
Gross return (Tk/ha)	26373	26671	26298
Net return (Tk/ha)	12373	13746	13388
BCR (undiscounted)	1.88	2.06	2.04

Source: David Barton (2000). Options for farm power use in primary cultivation on small farms: summary of main findings. Proceedings (Vol. 1) of the workshop held on 23-24 July 2000 at BAU, Mymensingh.

5. Engagement of increasing number of people for operating, servicing, trading and fabricating simple agricultural machinery, tools, and accessories is creating alternate livelihood opportunities and contributing to non-farm economy in rural areas though machines have reduced human labor requirement for land preparation.⁵⁵
6. National Agricultural Policy of 1999 briefly states that: a) needs for farm machines in the different zones will be assessed and publicized to attract private sector, b) deficit of animal draught power will be supplemented by mechanization while animal will continue to be used in many areas, c) import of

⁵⁴ Alam, Shamsul. 2000. A Study on Farm Mechanization and Labor Demand in Crop Production Activities in Bangladesh, Bangladesh Agricultural Research Council (BARC), and Hamid, Abdul and Abdul Baqui, Multiple Use of Power Tiller in Bangladesh: A case Study, Bangladesh Agricultural Research Council (BARC).

⁵⁵ Barton, David. 2000. Options for Farm Power Use in Primary Cultivation on Small Farms: Summary of Main Findings. Journal of Agricultural Machinery and Mechanization, 4(1): pp 1 -4.

machines and raw materials needed for local fabrication will enjoy tax relief, d) credit will be made available to both users and traders to help mechanization and e) formation of user groups/cooperatives will be encouraged for owning or leasing agricultural machinery.

7. The policy statements mentioned above have not yet been put into effect; besides allowing import of agricultural machinery at no or low tariff. There is no national policy guideline in respect of agricultural machinery in Bangladesh.

8. An estimated 350,000-400,000 power tillers are in operation along with about 5,000 four-wheel tractors. Bogra and North Bengal in general, greater Comilla, greater Dhaka and Tangail lead in use of power driven machines. These machines (costing about 52,000 Taka each for the Chinese brand power tillers) are owned mostly by large farmers and/or available on custom hiring basis.

9. Manually operated grain threshers (numbering over 200,000), including close-drum thresher (safe for eye), along with a few power operated ones (estimated number: 12000-15000) are also in widespread use. These are all made in Bangladesh by local manufacturers. The manually operated low cost machines (Tk 1,200 to 2,500) are generally owned by individual farmers while the power driven ones (Tk 15,000 to 25,000) are hired.

10. Low lift power pumps and mechanized shallow tube-wells (nearly a million) are also in widespread use. These are also popular custom hiring items.

11. Other mechanical equipment in use includes seeders, seed-cum-fertilizer applicators, manual weeders, hand-held and knapsack type sprayers and various hand tools.

12. Some mechanical grain dryers, sugarcane crushers, solar vegetable and fish dryers (not widely used), BARI-developed corn shellers, and others are also in use, and these are gaining popularity. Only a few machines for harvesting rice and wheat are available. Machines for transplanting rice (e.g., Drum Seeder) seedlings are mostly on trial, so are equipment for corn shelling. Only few low cost and effective drying systems for grains and other farm produces are in use. Rubber-roll hullers of small capacity suitable for small scale rice mills and itinerant rice hulling vendors to replace the inefficient and obsolete 'Engelberg' type steel hulling machines. (Large size rubber-roll hullers are being imported now a day for use at relatively larger rice mills). Illustrative prices of selected machines are presented in Table 10.

Table 10. Local Price Range of Common Agricultural Machinery 2004

Item	Price range (Taka)
Power Tillers	50,000 – 55,000
Locally made Power Tillers (6-8.5 HP)	40,000 – 43,000
Tractors (25 H.P.)	300,000 – 500,000
Low Lift Pump (with diesel engine)	5,000 – 8,000
Manual Thresher	1,200 – 2,500
Power Thresher	12,000 – 25,000
Locally made Power Thresher (8-12 HP)	18,000 – 35,000
Locally made Batch Rice Drier (8.5 HP)	160,000 – 250,000
Locally made Forage Chopper	15,000 – 20,000
Reaper (self-propelled)	42,000 – 90,000
Manual Fertilizer Applicator	1,800 – 2,000
Shallow Tube Well (with engine)	15,000 – 20,000
Insecticide Sprayer (knapsack type, manual)	1,800 – 2,800
Winnowers with 4 HP engines	13,000 – 15,000
Manual Fertilizer Applicator (knapsack type)	1,800 – 2,000
Potato Grader with electric motor	30,000 – 35,000
Low Lift Pump (with diesel engine)	6,000 – 8,000
Shallow Tube Well (with engine)	15,000 – 20,000
Insecticide Sprayer (Knapsack type, manual)	1,800 – 2,800
Manual Weeders	400 – 500

Source: Data collected by the Agriculture Sector Review Team from dealers and users during field mission.

B. Constraints/Issues

13. Key constraints to utilization of agricultural machines are highlighted below:

- Lack of knowledge and skill for efficient use, proper maintenance and repair of machinery at all levels of users, artisans and traders.
- Absence of any public sector agricultural extension activity involving farm machinery or mechanization.
- Poor quality of fuel and lubricating oil available in the village areas.
- Scarcity of proper spare parts, replaceable tools and accessories and adequate after-sales services.
- Poor quality of many imported as well as locally fabricated machines. (The useful life of agricultural machines, including the relatively cheap power tillers imported from China, is very low due to this and other factors mentioned above.)
- Low tariff on imported machines and high tariff on materials for local fabrication (especially carbon steel).
- Absence of product standards and quality certification (for both imported and locally made items) for helping traders and users to make informed choices.
- Absence of adequate design and fabrication guidelines, technical facilities and credit sources for local manufacturers.
- Lack of communal threshing floors often impedes the use of threshing machines near the harvest areas especially in the *haor* regions of Bangladesh.

C. Review of Current Policy

14. There is no explicit set of actions to guide the nature and extent or to set goals of agricultural mechanization in Bangladesh.

15. Except for making import of machines at low tariff (Appendix 2) easy, other items mentioned in the 1999 Agricultural Policy, especially encouraging local manufacturing, have not enjoyed any follow up action.

16. The current policy ignores the necessity of training the users, traders and service providers to maximize the benefits of mechanization.

17. The current policy also ignores the machinery for essential post harvest operations (e.g. parboiling and milling of rice) wherein significant economic losses occur.

D. Policies for the Future

18. The Agriculture Sector Review Team recommends the following immediate and medium term policies for consideration of the Government. These policies are designed to address key constraints of mechanization thereby contributing to sustained increase in land and labor productivity in agriculture, promoting concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1: Increase mechanization capacity and efficiency through training, demonstration and advisory programs for farmers and Union level mechanics/artisans to enhance their skills in operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Give the

responsibility and needed facilities and funds for these activities to DAE; introduce agriculture based vocational education/training in collaboration with ARIs, Universities, NGOs and private sector. Simultaneously, encourage formation of farmer/user groups (for owning, operating, maintaining and custom hiring of agricultural machines and equipment) through DAE and collaborating NGOs/private sector entities.

Advantages: *Skilled farmers and Union level mechanics/artisans will be available for operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Farmer groups will help increase availability of equipment for custom hiring for small farmers and also advance non-farm rural economy.*

Limitations: *Initially, it may be difficult to find adequate number of suitable trainers. Formation of coherent groups may also take time.*

Policy 2: Formulate a comprehensive agricultural mechanization policy, and establish a high level 'Agricultural Mechanization Advisory Committee' chaired by the Minister of Agriculture, with representation from all stakeholders to advise the government on agricultural mechanization issues and policies.

Advantages: *This will provide technical support and guidance to the government in accelerating agricultural mechanization in the right course.*

Limitations: *Little will be achieved if competent experts and persons, with high reputation in this field are included in the committee and due importance is given to the advice of the committee.*

Policy 3: Provide adequate funds for priority research, development and extension works to capable institutions including selected ARIs and Universities on a competitive basis. (Private sector may also share R&D cost or pay royalties in exchange of patent or marketing rights.)

Advantages: *Competitive funding for development of appropriate machinery and solving mechanization problems will stimulate activities to the advantage of the farmers as well as the nascent agri-machinery industry.*

Limitations: *Judicious allocation of funds, avoidance of duplication and close monitoring of activities by the funding authority will be needed.*

Policy 4: Review and rationalize the current tariff rates affecting import of agricultural machines and spare parts and the raw materials needed to manufacture those locally so that local manufacturers feel encouraged to work on competitive basis.

Advantages: *This will provide local manufacturers and workshop owners a level field to compete with imported items.*

Limitations: *Possible misuse of tariff structure for non-manufacturing activities will need close control.*

Policy 5: Join the ESCAP-established 'Asia Pacific Centre for Agricultural Engineering and Machinery (APCAEM)',⁵⁶

Advantages: *Joining APCAEM will enable Bangladesh to take advantage of agricultural machinery development works in other developing countries in the region. The proposed NCAM may act as the local hub for the international network maintained by the APCAEM.*

⁵⁶ Bangladesh was a member of the 'Regional Network for Agricultural Machinery (RNAM)', predecessor to 'APCAEM', for some time in the past.

Limitations: *Appropriate finance will have to be committed to get full benefit of the network through related local programs.*

Medium Term Priority

Policy 6: Establish a ‘National Centre for Agricultural Machinery (NCAM)’ using existing facilities available in the system for development, testing and evaluation of farm machinery, with technical facilities to serve the needs of the public and private sectors. Encourage the engineering divisions of research institutes, the Universities and the private industries to collaborate with and utilise this national centre.

Advantages: *The proposed NCAM will help identification and adaptation of suitable agricultural machinery in addition to providing testing services to the developers of machinery in Bangladesh. A market for agricultural machinery will be developed. Private sector may share R&D and testing costs or pay royalties in exchange of patent or marketing rights. This Centre will facilitate collaboration with the engineering divisions at the NARS Institutes, the Universities and the private sector as seen in similar establishments of other developing countries. The existing facilities at other institutes and BAU may also be upgraded to serve as regional agricultural machinery centres.*

Limitations: *The national centre will need adequate operating funds to be effective. Fund use will have to be closely monitored with time bound output assessment. Effectiveness will depend upon the availability of technical facilities and the quality of staff in charge, their autonomy and accountability.*

Policy 7: Provide support to local manufacture of agricultural machines (small sized diesel/ petrol/ CNG/LPG engines, power tillers, pumps, reapers, etc.), accessories and spare parts by encouraging and inducing the private sector, including joint venture enterprises involving established world-class firms, through credit, tax relief, industrial estate facilities and other effective incentives.

Advantages: *This will reduce dependence on foreign machines and fuels, create employment, help growth of economy and assure availability of machines and spare parts to locally meet the needs of the farmers.*

Limitations: *Comparative economic advantages and availability of needed capital and availability of willing collaborators for joint venture are to be assessed carefully. This policy must also be dovetailed with the industrial and energy-related policies of the country.*

Policy 8: Replace the inefficient and obsolete steel hullers with rubber-roll for proper parboiling and milling of rice to reduce milling loss (2-4%); and establish a separate standard for low cost, low pressure and safe steam boilers suitable for small scale rice mills by amending the existing ‘Boiler Act of 1923’.

Advantages: *Rubber-roll hullers will reduce milling loss by 2 to 4%; improve the recovery of valuable rice bran; and generally assure quality of milled rice. Safe low-pressure boilers will eliminate hazards of often fatal accidents in small rice mills, assure quality of parboiling, reduce wastage of fuel and generally improve the gradation of rice.*

Limitations: *This will require training and motivation of small scale rice mill owners and operators; some essential R&D works and inter-ministry collaboration will also be necessary.*

Policy 9: Construct and lease out community threshing floors in haor areas.

Advantages: *This will help farmers use threshing machines in haor areas for quick threshing and also provide temporary collecting and stacking space for harvested crop and save it from flash floods.*

Limitations: *Ownership and management of such publicly funded community threshing floors may be a problem.*

Appendix 2 Customs Duty on Agricultural Equipment, Spare Parts and Production Materials

Heading No. 1: Ag. equipment and Machines		Duty (%)	2004 Duty (%)	VAT
87.01	Tractors	2.5	Nil	Nil
84.32	Power Tillers	Nil	Nil	Nil
87.16.39	Semi Trailers for Agriculture	CBU 45% CKD 15%	7.5	15
84.37	Rice huller without motor	2.5	15	15
8424.81.10	Agricultural sprayers	Nil	7.5	Nil
8400.90.00	Diesel engine 3 hp to 45 hp	Nil	Nil	15
84.07	Gasoline spark ignition engines	22.5	25 (SD=250%)	15
84.13	Low lift, shallow tube well, deep tube wells pumps	Nil	Nil	15
84.33	Harvesting and threshing machinery	2.5	Nil	15
84.324	Milking and dairy machinery	7.5	Nil	15
84.37	Machinery for checking, sorting and grading seed	2.5	Nil	15
Heading No. 2: Spare parts of Agricultural Machineries				
4011.91.10	Tractor tires	2.5	7.5	15
84.32.90.10	Spare parts for power tiller	15	7.5	15
4013.90.20	Tractor inner tubes	2.5	15	15
87.08	Tractor parts	Variable 15-30	15-30	15
40.10	Fan belts size A to D section	45	25	15
4011.91.10	Power tiller tires	15	7.5	15
84.37.90.00	Rice huller parts	7.5	15	15
84.82	Ball bearings	30	25	15
84.09	Piston with pin	30	7.5	15
84.09	Cylinder heads	30	7.5	15
84.09	Cylinder blocks	30	7.5	15
84.09	Valves Inlet-exhaust	30	7.5	15
84.09	Connecting rods	30	7.5	15
84.13	Oil pumps	30	7.5	15
Heading No. 3: Some Raw materials needed in production of agri-machinery				
7210.12.00	M.S sheets and plates	30	15	15
7213.99.00	Bars and rods of high carbon steel 0.6%	15	7.5	15
7214.99.00	Bars and rods of medium carbon steel 0.25% - 0.6%	30	7.5	15
72.16	Angles, shapes and sections of iron or non -alloy steel	45	7.5	15
7217.10.00	Wire of iron or non-alloy steel with 0.6% or more carbon	15	25	15
7227.10.00	Bars and rods of high speed steel	30	15	15
72.28	Other bars and rods of other alloy steel, various section	30	15	15
72.14	Mild steel rods and bars 16 mm and above	45	7.5	15
72.04	Re-rollable scrap	15	7.5	Nil
72.04	Scrap vessels	7.5	7.5	Nil

Source: Agricultural Machinery Manufacturers' Association of Bangladesh, 2004.

CHAPTER 7

Marketing and Agribusiness

A. Background/Overview

1. The marketing of surplus produce in the peak period faces problems due to insufficient agripreneurial development in the country to undertake agro-processing and marketing. Bangladesh suffers from serious lack of information on agro-processing and marketing thereby limiting the reach of potential investors. There is no institution, public or private to fill this gap. This requires priority attention, particularly when many farmers are engaged in diversifying production as per government policies.
2. The private sector agribusiness is just evolving. Many of these enterprises have developed contract farming of cereals, fruits, vegetables, pulses, oilseeds and others. Several companies are involved with a relatively short history. Some have emerged as important success stories which could develop into commercial/industrial agriculture in Bangladesh provided impediments are removed.
3. The agricultural marketing chain is highly fragmented. Many actors like local collectors, local traders, local market *aratars* and their agents, urban wholesalers and their commission agents, rural and urban retailers constitute the important component of the marketing system. The wholesalers and their agents mainly determine the market price of fresh produces. This is the most popular and common marketing structure. It is estimated that in the process of marketing, as much as 10-40% of the produce is lost due to mishandling, improper packing and transportation. Market price is determined by the marginal cost of supply and demand. The wholesalers are able to pass on the entire cost partly to farmers in terms of lower farm gate prices and to consumers in terms of higher whole sale prices than what would have been the outcome had the farmers been able to sell their produces directly to consumers. This partially explains the large differential between farm gate price and wholesale/retail price as observed in the market. The more elastic is the demand, the higher would be the farmgate-wholesale price differential.
4. There are other factors that determine the price farmers actually receive for their produce. Non-availability of market information at farmer's level, lack of infrastructure, inefficient and ineffective market management tends to discourage the farmers to go to the market. They appear to be comfortable selling their produces (especially the perishable ones) from their farms or homes to the traders without much bargaining/negotiation over the price paid in order simply to avoid market risks. Nonetheless, the middlemen serve an extremely useful purpose. But for them, produce will be lying in and around the village markets looking for buyers from outside and eventually surplus usually dry up and the prospect of commercialization is nipped in the bud.
5. Traditionally, the rice market has operated well. It is said to be near perfect with narrow bands for arbitrage unlike other commodities. A study by the Department of Agricultural Marketing (DAM) analyzed the cost of marketing⁵⁷ and concluded that for the five spices in general, the producers get about 65% of the consumers price and the rest 35% is shared by traders (5%) wholesalers/ *aratars* (20%) and retailers (10%). The total marketing cost was established at 12% (3% by producers, 3% by traders, 4% wholesalers and 2% by retailers). These statistics are encouraging but do not reflect the real situation in the field for high-risk fresh produce like tomato as discovered by the Agriculture Sector Review Team during recent field trips to different parts of Bangladesh. Obviously there are hidden barriers to entry into the market, which does not allow the marketing margins of non-rice agriculture to come down. There are associations/cartels on the buyers and transporters side but not much on the sellers' side, especially for smallholders. Some would say a total institutional change in favor of the farmers is needed to empower the farmer associations/cooperatives for marketing their produces, with bargaining power.

⁵⁷ "Study of the spices of Bangladesh: Constraints and Potentials", CDP, DAM, August 1998.

6. The pattern of agricultural markets in Bangladesh consists of the following:

Primary Rural Markets: This market is composed of farmers and small retail traders having few permanent shops. This market operates usually twice in a week.

Rural Assembly Markets: Traders from distant places gather in these markets with a view to collecting marketable surplus. Because of the presence of sizeable number of traders commercial trading takes place in these markets. Significant number of permanent shops i.e., “Mokam” and processors are found in these markets. Presence of Commission agents, Banks and easy transport system make these markets more useful to the operators. This type of market operates twice or every working days of the week.

Secondary Markets: This market is large and composed of traders who operate nationally. Commission agents, *jothdars*, wholesalers, processors, exporters are all active in this market. Normally, such markets are easily accessible by various means of transport. With large number of permanent shops and service institutions, this market operates on all working days.

Urban Wholesale Markets: These are specialized markets operating in a particular line of products (e.g., rice, vegetable, and fruits). These markets bridge the gap between distant wholesalers and large number of retailers. Commission agents called *arathdars* are rendering such services in these markets.

Urban Retail Markets: In these markets, consumers collect their necessary items. The retailers present variety of items in these markets to meet the daily necessities of the consumers.

7. Steps need to be taken to improve workings of markets in Bangladesh to foster competition and eliminate rent-seeking margins. In this context, market regulations and leasing procedures and price fixing mechanisms need to be streamlined and stakeholders (includes farmers, NGOs, LG, shopkeepers, vendors, traders and consumers) participation in the management of market centers need to be ensured through consultative forum at the local level. Trend of absentee landowners are increasing in many areas, which result in contract leasing among the landless or small farmers (0.5 - 2.5 acres). Although horticultural crops cultivation is 3-4 times profitable than rice, subsistence farmers are reluctant to grow highly perishable crops because of the risk involved in marketing (Annex 8). Therefore, within the markets themselves measures could be introduced to assist farmer-sellers better manage the market risks. For example, the Shoshyo Gudam Rin Prokolpo (SHOGARIP) for cereals could be extended allowing farmers avoid distress sale during and after harvest. The Department of Agricultural Marketing (DAM) has taken an important initiative in renting 77 Godowns of 250 metric tons each in 36 districts from the Local Government Engineering Department (LGED) and developing good organization and management with the participation of the growers. There is also a need for gradual transition of market hierarchy and balanced spatial distribution and stronger linkages between different levels of markets. Major urban and peri urban centers tend to be over served by all types of markets. Due to market risks and economies of scale, urban markets have developed faster than rural markets, which tend to be scattered. All rural markets do not have equal access to urban markets; links are tenuous, more so when one considers the supermarkets and upscale restaurants that are coming up in increasing numbers in many cities. The establishments require regular and timely supply of quality products.

8. As regards export only a modest amount, 12,799 metric tons was exported in 2001-2002, down from 23,597 tons exported in 1997-1998 (Table 11). The narrow band of products is sent to few ethnic markets (Tables 12 and 13). It is a long way from here to the supermarket chains in Europe and the US that need quality products. The responsible public body, the Bangladesh Standard and Testing Institute (BSTI) has had limited impact on quality control. Bangladesh imports USD250-300 million worth of processed food mostly dairy products, vegetable oils, pulses, spices, fruits and nuts, cereal and cereal products. Industry experts' view is that exports of fresh as well as processed/semi-processed agricultural products could be increased significantly, if appropriate strategy for export promotion were developed. Thailand, Bhutan, India, and the Philippines among other countries, which produce agricultural commodities similar to Bangladesh, has developed aggressive export policies and are exporting products to many developed countries.

9. With the agreement of WTO and other bilateral agreements between developing countries, there are very good prospects for exporting fresh, processed or semi-processed products, cereal, horticultural crops, fish, meat, milk, poultry, flowers and ornamental plants, seeds, and medicinal and aromatic plants. Bangladesh being a LDC country is exempted from reduction commitment on tariffs, export subsidies and domestic support to agriculture. To exploit external linkages, action need to be taken to promote agricultural technology transfer and market research, develop infrastructure and create policy environment to support the agro-processing sector, which clearly holds the key to success. Measures need to be taken to avail opportunities along several directions namely, geographically (fast growing import markets), horizontally (increasing the spread of export commodities), and vertically (increasing value addition of export commodities). The agreement on Sanitary and Phytosanitary (SPS) measures has implications for Bangladesh's exports of frozen food, dried fish, tea, vegetables and other food products. Steps to harmonize SPS need to be implemented and Technical Barrier to Trade (TBRT) measures with international standards removed. The application of Good Agricultural practices (GAP), Good Veterinary Practices (GVP), Good Health and Manufacturing Practices (GHMP) and adoption of quality assurance system has to be encouraged to boost agricultural exports.

10. The adoption of good business practices and adherence to international norms would assist in consolidating trade with traditional markets, open new opportunities and attract premium prices by ensuring consistency of safety and compositional quality of agricultural products. Bangladesh is still dependent on ethnic markets primarily in UK and the Middle East, which are not viable over longer term. Urgent interventions are required to explore western super market demand. Strategies need to be articulated to explore such possibilities keeping in view WTO implications in exporting horticultural produces. A comprehensive 'Agribusiness Policy' and a competent institution to promote agricultural exports are overdue. Donor financed projects like Northwest Crop Diversification Project (NCDP), Agribusiness Development Project (ADP), Agro-based Industries and Technology Development Project (ATDP-II), South Asia Enterprises Development Facilitates (SEDF) are working in this area. The activities of these projects need to be coordinated to avoid duplication and achieve economies of scale.

B. Constraints/Issues

11. **Policy constraints:** Markets are operated under a centralized management system through the Agricultural Markets Produce Regulation Act of 1964 (amended 1985). This Act, as implemented, manages the operation of the markets rather than regulating the management of the markets. The Act refers to one single market in one single city, whereas the Act is supposed to be the Governing legislation covering all aspects of marketing in Bangladesh. Only 392 markets are notified under this Act. In these markets the Govt. authority are responsible to give license to the traders and fixing the market charges. It does not outline a self-governing management system; provide guidelines for proper conduct of the operations; adherence to particular standards of operation; and the food safety and quality control mechanisms. Market participants have no role in the management of the markets. Even the existing Act, good or bad, is not properly enforced. The Government is more interested in revenue collection rather than treating the market as centre for economic growth and service. Lessees are interested only in collecting market charges and not in organizing and maintaining the market. High toll (market charges) collection inhibits the growers to go and sell their produces in the market. The Gazette Notification (6th volume) published on 22 September 1994 by DAM on market charges is not followed. Revenue collected is rarely returned to the market for infrastructure development.

12. **Institutional constraints:** There are many institutional constraints in the marketing system. In terms of physical markets, there are problems of multiple ownership and control of the land on which the market is built. Market infrastructure development, market operations and market revenue collection system are all beset with problems. There is no coordination among these operations. All operate independently and usually without any consideration of competing interests. Market management is weak, and the role of government organizations (including DAM, DMAC and Parishads at different levels) is merely revenue collection. The government organizations have legislative control only over 392 notified markets. This is only 2.38% of all markets in Bangladesh.

Private sector organizations also have institutional problems. Individual firms have top down approach to management that stifles innovation, while industry associations rely heavily on political patronage and availability of a strong motivational leader.

13. Infrastructural constraints: Infrastructural constraints are few, but chronic. Markets are congested and developed in an unplanned manner. Most markets lack basic support facilities such as godowns, cold or cool storage, portable water, drainage, and vehicle access for loading and unloading. Storage facilities for food grains, fishes and potatoes are relatively better developed, but for perishable high value horticultural crops (vegetables, fruits and spices), storage facilities are lacking. Multipurpose cold storage, cool chain management and others are very new ideas in Bangladesh. However, small scale cold storage facilities of perhaps 20-40 tons within a market are sufficient for day to day operations and could be built with minimal cost by insulating the existing building and installing the appropriate refrigeration. Most of these facilities could be created with appropriate use of the collected market revenues. There are around 14,000 (according to the latest survey of dam) markets in the country. The markets, located in the rural or semi-urban areas are mostly in poor condition having limited logistics, infrastructural, management and institutional facilities. Roads especially the link and approach roads of the rural markets are not in good condition. Road transportation has relatively improved, but the cost is very high which, in turn, raises the product price.

14. Human resource constraints: There is dearth of human resources having skills and experience in market management and agribusiness management. The weak performance of the management committee is partly due to lack of experience and management skills. Most of those who are involved in market management have limited management background. No one has modern market management skills, including GO-NGO staff.

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

16. Quality control: Most of the markets are not following the standard weights and measures, determined by BSTI (Bangladesh Standard and Testing Institutes). Different weights and measures are used and the growers are cheated. The established monitoring system is not working properly. There is no standard grading system for different products used in rural markets. Sorting and grading system is outdated.

17. Other constraints: *Poor post harvest handling.* Post-harvest loss is as high as 35% in perishable items. This is the most important area where much improvement is required. Farmers and traders do not have knowledge about pre-cooling to minimize field heat, scientific packaging and proper handling in transporting their produces. Fresh produces for domestic and international market are generally packed in bamboo baskets, gunny bags and used cartoons. Importance of pack size, weight and packing material is always ignored. The pack-size varies from 10-50 kg, based on the nature of the produce and packing material. Improper sorting and grading is also a great problem observed during field visit. *Lack of credit for marketing and agribusiness.* NGOs and banks are not concerned about marketing loan. Only the landless/hard core poor are targeted by NGOs. Bank formalities are very complicated and time consuming. The small and medium level farmers (0.5 – 3.00 acres) remain away from banks. They seek loan mostly from local money lenders with high interest rate. Banking system and the process for securing financial facilities for agribusiness is also difficult.

18. Underdevelopment of the agribusiness sector: Some private companies have been processing fruits and vegetables but they have not been able to make any breakthrough in meeting the domestic and export demands. Fruits and vegetables processing involves post harvest handling (pre-cooling, washing, grading, treating, storage) dehydration, pickling, and other special activities like packaging which are not well known to the small agripreneurs. Post harvest and processing loss is very high. Cool chain facilities are not developed yet, excepting one or two examples. Non-availability of

appropriate processing technologies is a major problem. Contract farming for assured supply of quality agricultural produces for agro-processing and supply chain management system has not developed. Value chains linkages among farmers, traders, processors and service providers, and management and coordination of these entities are almost absent. There is very little understanding and capacity of the agribusiness entrepreneurs to turn the comparative advantage into competitive strength. Easy movement of products often becomes difficult due to political and social unrest. There is also lack of skilled human resources in this sector (a private university has already opened MBA course in agribusiness which is quite expensive). There is very limited attempt to encourage agribusiness education in both the public and private universities. A comprehensive 'Agribusiness Policy' "to provide necessary supports to the private sectors is overdue. Quality control and certification is a major constraint in marketing Bangladesh products in both the domestic and international markets. There is total absence of coordination between agro-technologists, investors/bankers and agro-entrepreneurs.

C. Review of Current Policy

19. Current policy does not reflect emerging need for market research and intelligence and the need for agricultural producers to be linked to the global market. Steps identified in the 'National Agriculture Policy' (sub-clause 11.1) were not followed. Government has to do more in developing the agricultural marketing system to ensure fair benefits for the growers and the consumers. Reorganizing and strengthening of DAM and establishing "Krishi Mulla Kamishan" (Agriculture Price Commission) were not pursued vigorously as envisaged in the current policy.

20. Programs identified in the 'National Agriculture Policy' sub-clause 11.2 mostly remain to be implemented. These programs include:

- Storing of harvested agro produces (only cereals and potato) in the favorable environment throughout the year.
- Establishment of multipurpose cold storage for fresh horticultural produces.
- Promotion of demand and supply of agro produces through the development of transportation facilities (some progress has been made, but much more needs to be done).
- Reduction of post harvest losses and agro-processing (received little attention despite the fact that there is serious lack of information in this area and that agricultural growth prospect will be truncated without substantial investments in post harvest management including processing).
- Sorting, grading, packaging and quality control of the agricultural produces for domestic and international market (partially achieved by reducing bank interest but awareness building, filling the information gap, and developing skilled human resources still lag behind).
- Hat/bazaars and associated infrastructures for smooth and effective marketing (not developed adequately).

21. Bangladesh falls short of the accepted norm of one market for every 4000 farmers. Dissemination of market information to the growers, traders and consumers is weak due to total lack of attention to this critical element of marketing. Information support to the consumers/users, businessmen and processors on latest production and processing technologies is still lacking. Assistance in developing marketing database is all but non-existent. The Agricultural Commodities Produce Markets Regulation Act, 1964 (Revised in 1985) has been amended recently but it is not in force, and the amendment is not complete. Steps for developing contract-farming linkages between the growers and the enterprises, traders, exporters and processors have made some progress. Several private enterprises/companies have initiated contract farming. The concept of self-help cooperative marketing system has been tested in a project with rice seed marketing. Assurance of reasonable prices to the growers by strengthening the procurement system of agro produces during post harvest glut or crop

loss and maintenance of steady prices of agro produces in the market through provision of output price support has not been followed through.

D. Policies for the Future

22. The Agriculture Sector Review Team recommends the following immediate and medium term policy measures for consideration of the Government. These measures are designed to address key constraints of the marketing sector thereby contributing to sustained increase in land and labor productivity in agriculture, promote concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1. Establish an Expert Committee to review periodically the competitive strength of Bangladesh agriculture in domestic and international market and recommend appropriate policies, including the possibility of establishing Agro-Export Processing Zones, in the context of globalization and trade liberalization.

Advantages: This will augment the current efforts of the Government to facilitate agricultural exports.

Limitations: The proposed Expert Committee must have a standing budget for technical and operational support to carry out its mandate.

Policy 2. Establish a separate ‘Centre for Agricultural Market Research, Intelligence and Information’ by restructuring and renaming DAM with additional facilities and trained manpower.

Advantages: Market intelligence gathering and dissemination and analysis of market prospect will immensely improve.

Limitations: Availability of trained manpower will be a problem at the initial stage, particularly if the incentive structure is not made appropriate.

Policy 3. Amend the 2002 ‘Market Management and Leasing Policy’ to remove barriers to competition and market expansion; and further amend the ‘Agricultural Markets Produce Regulation Act of 1964’ to cover all aspects of marketing, including outlining of the composition of the Management Committee, powers of inspectors, appeals and review process, disposal of produce unfit for consumption and mechanisms to create by laws.

Advantages: Appropriate amendment of the 2002 ‘Market Management and Leasing Policy’ will ensure participation of stakeholders, NGOs and local government with autonomy in the organization and management of the markets. The amended Act of 1964 will be a governing legislation covering all aspects of marketing in Bangladesh.

Limitations: The amendment process could become cumbersome if not managed well. Firm commitment will be required to implement the Act.

Policy 4: Increase investment in market infrastructure (decentralized wholesale markets, growers’ markets and retail markets as well as municipal and local assembly markets) and arrange technical assistance and credit for improving preservation, packaging and transportation of non-perishable goods.

Advantages: With improved market infrastructure, product wastage will be reduced, net marketing margin will increase and return to farmers will go up.

Limitations: Quality control will remain a challenge, which has to be responsive to market demand.

Policy 5. Initiate through DAE and NGOs formation of Farmer-managed Marketing Associations for pulses, oilseeds, and horticultural fresh and processed products from home scale processors.

Advantages: Product marketing and net returns to producers will increase. The partnership between DAE and NGOs will be strengthened.

Limitations: Cooperatives have not always worked well in the past. Training and supervision will remain a key element in the foreseeable future.

Policy 6. Formulate a comprehensive 'Agribusiness Policy' in collaboration with the private sector, covering production, processing and preservation, quality control and product standardization, market development (domestic and foreign), and values chains linkages and management.

Advantage: A comprehensive 'Agribusiness Policy' will facilitate development of agro-processing industries and removal of barriers that hinder market development and competition.

Limitation: Implementation of the policy without undue public sector interference will be of crucial importance.

Medium Term Priority

Policy 7. Establish an 'Agribusiness Development Fund', with appropriate financing system to provide flexible financing to promote agro-processing, packaging, and transportation (including refrigerated van) to feed the domestic and international market.

Advantages: By meeting the financing needs of small agro-processors and traders this fund will help improve processing and marketing of agricultural produce.

Limitations: The fund could at most play a catalytic role. Management of the fund will have to be transparent and accountable.

Policy 8. Test pilot scale Grain banks/Insurance schemes for agricultural products; and provide support to expand the ongoing SHOGARIP initiative of DAM in other potential districts.

Advantages: Crop insurance schemes will mitigate market risks.

Limitations: Crop insurance is inherently difficult to manage. Both grain banks and insurance require farmer cooperation, management and understanding. Training has to play an important role.

Policy 9. Improve rural credit by exploring alternative options such as (i) establishment for rural banks and branches; (ii) increasing the reaches of and accessibility to BKB resources; and (iii) establishing a 'Small Farmer Development Fund'.

Advantages: Improve credit delivery to small farmers and agripreneurs (over 40% of rural households) who are otherwise left out of micro credit/BKB/other public and private agencies resources loop.

Limitations: Agricultural activities are inherently risky. Production and market risks will have to be managed to underwrite lending to small farmers and agripreneurs.

Policy 10: Encourage establishment of multipurpose mini cold storage and use of plastic crates for handling, processing and preservation of fruits and vegetables by providing incentives through reduced tariff for imported materials and provision of credit to the entrepreneurs.

Advantages: Stream of continued supply of raw materials to processing industry will be ensured. Markets for perishable agricultural products will also be assured.

Limitations: An active and efficient produce marketing network will be essential.

Policy 11: Strengthen BSTI with the help of the Ministry of Commerce and in collaboration with internationally accepted private certifying agencies with additional capacity for quality certification of agricultural products (fresh and processed) for domestic and international market (compliance with all internationally recognized norms including phytosanitary conditions).

Advantages: Improved quality control will facilitate agricultural export while regulating import quality as well as improve quality of domestic products.

Limitation: Quality control will remain a challenge, which has to be responsive to market demand.

Table 11. Annual Exports of Vegetables and Fruits (Metric Ton) with C&F Prices (1992/93 to 2001/02)

Year	Vegetables		Fruits	
	Amount of Exports (Metric Ton)	Average Price (US\$/Ton)	Amount of Exports (Metric Ton)	Average Price (US\$/Ton)
1992-93	8042	1002	1249	1050
1993-94	7415	1095	1007	1311
1994-95	8270	1051	1365	1436
1995-96	12932	1122	2278	1497
1996-97	20449	1218	385	1482
1997-98	23597	1376	7	1466
1998-99	13106	1349	13	1538
1999-00	10270	1363	*	-
2000-01	9509	1345	*	-
2001-02	12799	1201	*	-

Note: * Means Negligible Amount

Source: Export Promotion Bureau, Monthly Export Statistics, Different Issues.

Table 12. List of Major Vegetables Exported in 2002

Name of vegetables	Percent of total exports
Yard long Bean (Barbati)	16.0
Taro tuber	12.19
Stolon of Taro (Pani Kachu)	11.12
Teasle gourd (Kakrol)	10.00
Bitter gourd (Korolla)	8.10
Bottle gourd (Lau)	8.10
Ridge gourd (Jhinga)	7.20
Palwal (Potal)	5.30
White gourd (Chalkumra)	5.30
Others	16.68

Source: Field Survey of Eleven Vegetables Exporters of Dhaka City in Oct -Nov. 2002.

Table 13. Categories of Vegetables Exported in Different Countries (1995/96 to 2000-01)

Year	Vegetables (fresh or chilled, code - 070990)				Leeks & other alliaceous vegetables, fresh or chilled (code-070390)				Mixture of vegetables and fruits of the genus capsicum (Code-07110)			
	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th	1 st	2 nd	3 rd	4 th
1995-96	UK	S.Arabia	UAE	USA	Qatar	USA	Kuwait	Oman	UK	-	-	-
1996-97	UK	S.Arabia	Kuwait	Canada	Kuwait	Qatar	UAE	Oman	Canada	USA	DPR Korea	-
1997-98	UK	S.Arabia	Bahrain	Kuwait	Kuwait	Qatar	UAE	Bahrain	DPR Korea	USA	UK	-
1998-99	UK	S.Arabia	Kuwait	Germany	Qatar	UAE	Kuwait	Oman	India	-	-	-
1999-00	UK	S.Arabia	Kuwait	Bahrain	Qatar	Kuwait	Bahrain	UAE	Belgium	-	-	-
2000-01	UK	S.Arabia	Kuwait	Bahrain	Qatar	Bahrain	Kuwait	UAE	Bahrain	Finland	Finland	Singapore

CHAPTER 8

Agricultural Research

A. Background/Overview

1. In 1950s, increasing population pressure, widespread poverty, chronic food shortages, and attendant economic uncertainties and social upheavals stimulated the thinking of national leaders for restructuring the agricultural services. Beginning early 1950s, Bangladesh transformed the Department of Agriculture into Department of Agriculture (Research and Education), Department of Agriculture (Extension and Management), Bangladesh Jute Research Institute (BJRI) and Bangladesh Agricultural Development Corporation (BADC). Introduction of IR8 from IRRI in mid 1960s and its miraculous performance triggered further transformation of the Department of Agriculture (Research and Education) into semi-autonomous Bangladesh Rice Research Institute (BRRI) and Bangladesh Agricultural Research Institute (BARI) in the 1970s. Subsequently, in the same period, Bangladesh Institute of Nuclear Agriculture (BINA) and Bangladesh Sugarcane Research Institute (BSRI) were established. Bangladesh Agricultural Research Council (BARC) was also created as an apex body to consolidate, guide and coordinate the national agricultural research efforts. Linkage was established with the International Agricultural Research Centers (IARC), especially with International Rice Research Institute (IRRI), International Center for Wheat Improvement (CIMMYT), International Potato Research Center (CIP) and International Center for Research in Semi Arid Tropics (ICRISAT). BINA has established linkage with the International Atomic Energy Agency. The success of rice and wheat research prompted further expansion of the network of research stations and facilities. Research staff also increased significantly. At its height, the National Agricultural Research System (NARS) was composed of about 1700 scientists in 1991; now the staff strength has declined to 1400. Innovative farming systems research (FSR) approach was introduced to involve farmers in testing, selecting and disseminating relevant technologies. The purpose was to facilitate convergence of research, extension and farmers in the field.

2. This intensive effort to organize agricultural research contributed significantly to agricultural growth. The largest contribution was made by the Bangladesh Rice Research Institute (BRRI) and the Bangladesh Agricultural Research Institute (BARI). BRRI has released 43 high yielding rice varieties, including one hybrid. BARI has released 228 high yielding varieties of various crops, including 21 wheat varieties and 32 potato varieties (table 2). BARI has also released 41 vegetable and 11 spices varieties; some of these are suitable for cultivation in summer season. This technological change coupled with market forces has revolutionized agricultural production. From a relatively stagnant sector, Bangladesh agriculture emerged as a dynamic sector during the Green Revolution period. Growth of institutional infrastructure, technological change, positive shift in public policy and market forces together stimulated rapid growth in agriculture. Rice production increased from 11.7 million tons in 1974 to 23 million tons by the year 2000; and wheat production from 0.11 million tons in 1974 to 1.8 million tons in 2000. Production of vegetables has also increased from 0.7 million tons to 1.4 million tons, and production of potato has increased from 0.7 million tons to 3.4 million tons over the last two decades (MOA, 2004). The country, once believed to be incapable of feeding itself, virtually reached near self-sufficiency in food grain by the end of 1990s from the technologies developed by the public research system.

3. Despite this commendable achievement, the shortfall in non-cereal crops, such as pulses, oilseeds, vegetables and fruits has become a chronic threat. The output levels of these crops have

either remained static or declined in absolute terms. HYV rice yield has also slowed, showing sign of stagnation or even decline in some cases. From this angle alone, the achievement of the NARS has remained substantially short of what might have been otherwise expected. The key problems appear to be associated with limited operating funds, inappropriate incentive structure, erosion of scientific skills, and serious institutional and management constraints.

Table 14. Varieties Released by and in the Pipeline of Different Research Institutes (number)

Institute	Crops	Varieties Released	Varieties in the pipeline
BRRRI	Rice	43	4
	Agricultural machinery	11	
BARI	Wheat	21	5
	Potato	32	4
	Vegetables	41	36
	Fruits	32	5
	Flower	3	5
	Pulses	25	4
	Oilseeds	30	8
	Spices	11	5
	Agricultural machinery	11	
Bina	Rice	6	2
	Pulses	13	0
	Oilseeds	10	6
	Jute	2	4
	Tomato	3	2
BJRI	Jute	36	3
BSRI	Sugarcane	31	4
BAU	Crops and Horticulture	22	
	Livestock	22	
	Fisheries	14	
	Agricultural Engineering and Food Engineering	13	
	Socioeconomic	1	

Source: Agricultural Challenge and Opportunities in the 21st Century, MOA (2004), BRRRI, BARI, BINA and BAU.

B. Constraints/Issues

4. Agricultural research in 1970s started from a low technology base. It was relatively easier to make quick technological breakthrough from a low base, with extended facilities and adequate investments. That stage is over. Realizable yield potential of high yielding varieties of rice and wheat has now reached the peak; further increase of yield ceiling is not going to be easy with traditional research approach and declining investments in research. Moreover, a set of second generation problems has surfaced. Intensive use of seed-fertilizer-irrigation technology along with pesticide use phenomenally increased agricultural production, but at the same time it has resulted in decline in soil fertility due to nutrient mining and ground water depletion, increased incidence of pests accompanied by soil salinity and erosion of agro-biodiversity. Arsenic contamination of underground drinking water has appeared as a health hazard. Ecological problem has become a serious threat. Cultivated land is also shrinking and agriculture is being pushed into marginal and vulnerable areas due to population growth, rapid urbanization, growth of small industries, expansion of infrastructures, roads and highways, and rural and urban

markets. Bangladesh agriculture today faces new challenges not only because of changes that are internal to the country, but also because of changes in global and regional trade regimes and the IPR regimes. Agriculture is no more a mere domestic affair, it is a commercially competitive sector exposed to the global market.

5. In this scenario, the priority of research needs to be carefully selected to address the second-generation problems i.e. reducing the yield gap between research and farmer's field and further increasing production per unit area, which is still critical for alleviation of poverty. It is equally critical to intensify research on processing and product diversification for value addition to increase incomes, reduce the level of malnutrition, satisfy consumer needs, and enter into competitive export market. In the new environment, the need is to develop technology that would improve land and labor productivity, and soil fertility and water use efficiency, leading to conservation of natural resources. Research also has to respond to the challenges resulting from market liberalization by improving the quality of both primary and secondary agricultural products to remain competitive in the market. It is overdue to shift research focus from supply-driven to demand-driven research, where market forces will dictate the research portfolio.

6. Agricultural problems are more complex now than in the Green Revolution period. The technology market has also become highly competitive. It will not be easy to achieve further technological gains without having stronger institutions, new facilities, collective efforts, high scientific skills, and more investments to exploit frontier science such as biotechnology and information technology. Research orientation and program priorities need to sharply focus on problems that would satisfy market needs and increase incomes of the farmers.

7. A number of reviews of the agricultural research system have been conducted since 1970s. These reviews reveal that the Bangladesh agricultural research system not only has serious management problems, but also lacks certain capacities that are indispensable for making a research system function more effectively and efficiently. The constraints stem from inappropriate system design and management practices. The recommendations of these reviews were not taken seriously, and limited efforts were made to implement the recommendations in order to remove the constraints impeding the effectiveness of the research system. These constraints relate to human resource management, funding and organizational setting and management system.

Human resource constraints

8. Quality scientific staff is the heart and soul of research. All Research Institutes are currently constrained by limited number of quality staff, which is hindering self-sustained growth in technological innovation. About 300 top and skilled scientists have left the research system due mainly to poor human resource management policy and inadequate incentive structure. With current low remuneration package and absence of an incentive scheme, the institutes could neither attract nor retain good quality scientists. Those who are still in the research system are frustrated and looking for opportunities to leave the system. Turn over of good scientists is not unusual, but there must be provision for continued lateral entry of competent scientific talents at different levels, if research excellence is to be maintained. The recruitment and promotion system is rarely based on merit; it is based on seniority and external influence. This is incompatible for the development of a pool of scientific talents and is discouraging for quality scientific research. The Heads of the Institutes feel considerable external pressure in matters of recruitment and promotion. They are unable to exercise whatever limited authority is delegated to them. Furthermore, opportunities for training and retraining of staff, particularly in new areas of science like biotechnology and information technology are limited. There is also external influence on the process of selecting candidates for foreign training. The Institutes have no authority to approve and issue orders for training even of a lower level scientist. Scientific freedom is limited. More

surprising is the fact that more than 90% of the leadership positions are manned year after year by in-charge officials (CSO in-charge, Director in-charge, DG in-charge).

Funding constraints

9. Declining investment in agricultural research has retarded research progress. Inadequate operating fund has stifled new research initiatives. Public expenditure in agricultural research during 1984-1990 was 4.73% of the total budget of agriculture, which dropped to 3.84% in 2000-2001 (Table 2.2). Financing of research varies from 0.2 – 0.3% approx. of agricultural GDP, which should be at least 1%. Currently, about 20% of the total budget allocated to research is spent for experiments (Table 15), whereas a minimum of 40% of the total budget is required to be allocated to research expenditure. On-farm participatory research is especially handicapped due to inadequate budget provision. Allocation of revenue budget mainly covers staff salaries and consumables in limited quantity. Entire research operating funds come from development budget through specific projects. The institutes are unable to take new research initiatives without development projects. It is a major disincentive to scientific research. Research fund should come from revenue budget as ‘block grant’. Agricultural research has all along been supported by donor funds through development projects. When donor projects end, fund constraints affect continuity of research. This also results in loss of trained scientists as they loose their job on expiry of the project. Some major donors have withdrawn their support for agricultural research since early 1990s. This has caused serious dislocation/disruption of programs in some of the Research Institutes. It was stipulated that upon their withdrawal, the government would step in and provide funds without interruption. This has not happened.

Table 15. Share of Research Expenditure (%) of Total Budget of BARI (million Taka)

Fiscal Year	Total Budget (Million Taka)	Pay&Allowances (%)	Overhead (%)	Capital Expenditure (%)	Research Expenditure (%)
1993-1994	283.53	52.76	5.66	28.97	10.62
1994-1995	417.21	40.16	9.88	31.27	18.69
1995-1996	415.73	40.62	8.62	28.68	17.81
1996-1997	441.39	40.35	8.60	30.09	17.93
1997-1998	442.74	43.34	9.63	23.78	22.61
1998-1999	475.33	43.77	8.30	28.09	19.84
1999-2000	625.30	34.26	5.64	38.62	21.48
2000-2001	536.87	39.85	5.64	25.48	26.97
2001-2002	525.90	39.93	6.77	28.04	24.91
2002-2003	536.70	40.58	7.67	15.05	28.37

Source: Bangladesh Agriculture Research Institute, Accounts Division.

10. Management of funds, particularly donor funds, sometimes creates unnecessary hindrance in implementing projects. BARC and the Research Institutes have not formulated their own financial rules as per provision of the Acts to establish transparent financial management systems.

Institutional and management constraints

11. The infrastructure and scientific staff of the Research Institutes have expanded without undergoing any transformation at any stage since the creation of these institutes. Expansion did not take place based on changing context and new demand for scientific knowledge and technologies. The context of agricultural research has changed, but the system has not been adjusted accordingly. Careful review has never been conducted since the creation of the research system to examine whether agricultural research with the existing organizational setting and

research orientation can meet the new challenges, and ensure efficiency and relevance of research services. Institutional structure and organization that were created during the sixties and seventies were primarily tailored to work on the development of seed-fertilizer-irrigation technologies, and associated problems by consolidating the limited and scattered resources and human capital. The appropriateness of this research system in addressing today's complex problems that characterize crop and natural resource management has not been examined. The system is still not free from the strict government civil service rules and regulations that are highly incompatible with what is needed to do science. Professionalism and scientific culture has eroded. Institutional and management constraints have seriously affected research quality.

12. Some Institutes still have overlapping mandates that call for rationalization for better utilization of scarce resources and focusing on priority research areas within their mandates. The relationship of BARC and ARIs remained unclear even after 1996 amendment of the BARC Act. Functions given to BARC are too many and not clearly focused. In the absence of uniform service rules for the research system, inter-institutional movement of scientists and research leaders is restricted. This, in particular, has created leadership crisis across the system and a deep sense of dissatisfaction among the potential research leaders. In some cases, this has led to failures in properly organizing and directing research programs.

13. The practice of making budgetary allocation to ARIs without direct involvement of BARC has negative impact on the coordinating role of the Council. In fact, ARIs prepare their own research budgets and secure allocations directly from the Ministry of Finance. The mechanisms for allocating research resources within the NARS are not always transparent⁵⁸. It has not been possible for BARC to bring the disparate institutes under a uniform financial system without the corresponding changes in the Acts of ARIs in harmony with the Act of BARC.

Research management constraints

14. The administrative and financial power and authority given to the Director Generals has not been delegated down the line of command. The Directors, Heads of Research Stations and Divisions, and Program Leaders are given the functional responsibilities, but not the administrative and financial powers to act. The scientists go to the Director/ Program Leaders for technical decisions, but for financial decisions they are required to go to the Director General. This dual control is the key problem of management

15. Research planning process is an important issue, where improvement has been minimal even after the implementation of Agriculture Research Management Project (ARMP), which was designed to improve the research management systems. Research planning and priority setting process has not been institutionalized. As a result, research agenda drawn is not, in many cases, focused on priority needs. Research planning has often been inconsistent with national research priorities, farmers' needs, and prevailing socio-economic environment. Research initiatives have limited focus on processing and product development, quality improvement, biotechnology, and on generating stress tolerant technologies for the marginal and vulnerable areas. A large group of staff from different Research Institutes was trained in management information system (MIS) for agricultural research. It is reported that steps have been taken to implement MIS, but the evidence does not show that it has been institutionalized across the research system. Some progress has been made in computerizing personnel and publication data, but little has been done to computerize research programs and create technology data base. Financial management system is reported to have been developed, but could not be put into operation in absence of qualified personnel.

⁵⁸ Huda, A.T.M.S. Integrated Agricultural Development Plan (IADP), MoA, GoB. 2003.

16. Public sector research organizations form an important component of agricultural R&D system. But the changing environment in which the institutes operate demands adjustments in their structure and roles. There is a need to develop effective partnerships and linkages with universities, private sector and NGOs. Commercial enterprises, NGOs, universities and public sector research organizations are real and definable entities of innovation systems. A focus on only one or group of public or private sector institutions will not necessarily guarantee impacts on production and sustainable resource use. New ways and mechanisms need to be established to facilitate agricultural innovation that impacts positively on the poor and contributes to sustainable development.

17. Some institutes are working in partnership with the private sector and NGOs through specifically designed donor projects, but no institute has taken the lead to build partnership with NGOs and the private sector as a regular process in research planning and implementation. Research-extension-farmer linkage remains weak as before. This weakness serves to limit realization of the full potentials of new technology. The Technology Transfer and Monitoring Unit (TTMU) of BARC, which was established to facilitate this linkage, have been further weakened. It is almost non-functional due to lack of human and financial resources.

C. Review of Current Policy

18. The current agricultural research policy as defined in the 1999 National Agricultural Policy (NAP) calls for:

- Strengthening the national agricultural research system to undertake adaptive and applied research, including research on marketing and social and economic aspects in order to determine the economic importance of crop production.
- Improving and strengthening coordination of national research efforts through periodic evaluation.
- Giving priorities to:
 - development of low-cost technologies for marginal, small and medium farmers including women;
 - development of stress tolerant varieties;
 - development of fertilizer application methods that are harmless for soil, environment and health;
 - IPM package;
 - reduction of crops losses;
 - preservation and development of land productivity;
 - preservation of existing biodiversity of different crops;
 - quality improvement;
 - processing and preservation;
 - price and marketing research.

19. Efforts to strengthen the national agricultural research system were half-hearted. A major stride is needed to look at the system holistically in the context of globalization and market liberalization, and introduce institutional and management changes that will enhance the capacity and improve the efficiency of the system to face the new challenges, resulting from changes in the internal and external environment.

20. The policy objective to coordinate and monitor the national agricultural research efforts through BARC remains weak as ever. Scheduled reviews of research institutes and programs have not been undertaken on a regular basis, undermining the requirements of scientific

accountability of the research system. The capacity of BARC has not been raised to undertake this initiative. BARC is weaker than the Research Institutes in terms of institutional capacity and human skills. The International Service for National Agricultural Research (ISNAR) conducted a review in 1991 and recommended measures to improve institutional and research planning capacity of BARC. This was followed by another review conducted by a National Committee in 1995. Winrock International Institute for Agricultural Development undertook the latest review in 2001. Most of the recommendations of the two Committees were not implemented. Three major projects funded by USAID and the World Bank from early 1980s to late 1990s were implemented to remove institutional and management deficiencies, and strengthen and improve research management capacity of NARS. Achievements of these projects are limited.

D. Policies for the Future

21. Agricultural research of the future has to move from the centralized research approach to a decentralized approach by de-concentrating applied and adaptive research activities at the headquarters. The headquarters should be the center for strategic and frontier research. Primary center for applied and adaptive research should be the regional and sub-regional research stations to directly deal with site-specific problems, particularly of the marginal and vulnerable areas. There is a growing feeling that well developed decentralized system of applied and adaptive research linked to a dynamic extension system, and skilled farmers and agribusiness might improve the relevance and efficiency of research and enhance wider adoption of technologies.

22. Public research institutions are no longer the only source of innovation. A large share of the innovations in the agriculture sector is now originating from other sources. Many actors in the private sector have entered into agricultural R&D. The role of Universities, NGOs, and farmer organizations are expanding. Innovations can now be generated in networks, where the farmers and people from different organizations, different disciplines, and different professions meet. Combining collective wisdom and knowledge of potential actors, with hands-on-experience, is becoming a new way of generating innovation. These developments have changed the context of agricultural research.

23. In light of the analysis presented above, the Agriculture Sector Review Team recommends the following immediate and medium term policy measures for consideration of the Government. These measures are designed to address key constraints of the research sector thereby contributing to sustained increase in land and labor productivity in agriculture, promote concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated, with advantages and limitations.

Immediate Priority

Policy 1. Initiate institutional reform and enactment of a unified legislation for the semiautonomous research institutes, providing administrative and financial autonomy and introduce unified autonomous agricultural research service with a built in incentive structure to stem the exodus of highly trained scientists and to improve the efficiency and effectiveness of research.

Advantages: Research profile will go up, relevant research output will improve, and capable scientists will be willing to come and stay with research.

Limitations: Understanding and accommodation by all stakeholders will be required to bring the desired changes.

Policy 2. Increase research budget by 1% of agricultural GDP and provide 'Block Grant' to finance operational expenses of research, including biotechnology; and establish an 'Agricultural

Research and Development Fund' financed by public and private resources, specifically for competitive funding for technology generation and service delivery and to foster public-private partnership.

Advantages: With more resources available for new research initiatives, continuous flow of new technology could be expected.

Limitations: Effective use of research funds will require client orientation and participatory mechanism for determining research priorities, the tradition for which is lacking.

Policy 3. Undertake a comprehensive human resource development program for building a pool of scientists in different disciplines, including frontier science for progressive and sustainable agricultural research.

Advantages: Scientists with new knowledge and advanced skills will be available for research in new areas of science, and the contribution of research is more likely to be enhanced.

Limitations: Government commitments and availability of funds.

Policy 4. Improve and institutionalize research management (PM&E), human resource management, and financial and information management systems.

Advantages: Efficiency and effectiveness of the research system will be enhanced.

Limitations: Availability of funds and skilled personnel

Policy 5. Institutionalize research-extension-farmer/users linkages and participatory on-farm research at all levels through interactive fora and continuous exchange of information.

Advantages: Research output will be responsive to the needs of farmers and extension staff will be better placed for disseminating new technology.

Limitations: The problem of inter-institutional coordination and funding will have to be solved.

Policy 6. Direct research attention to land, labor, and resource conserving technologies, and product development and quality improvement, especially of those crops having comparative advantage in domestic and international market.

Advantages: Productivity increase and resource conservation will contribute domestic food security, and to achieve commercialization and competitiveness in international market.

Limitations: New research skills and willingness to change research approach will be required.

Policy 7. Formulate a comprehensive biotechnology policy and regulatory framework and build capacity for GMO testing and food safety protection; and make adequate provision for training and retraining of professionals, especially in new areas such as processing and biotechnology.

Advantages: Policy and regulatory framework will allow Bangladesh to take advantage of the new frontiers of possibilities without undue risk.

Limitations: Socially very sensitive area, which needs public education, debate and understanding of all relevant issues so that an informed consensus can be reached.

Medium Term Priority

Policy 8. Strengthen the regional and sub-regional research stations and laboratories to undertake applied and adaptive research for addressing local problems locally.

Advantages: Technology generated under local environment will be more appropriate and suitable for local agro-climatic and socio-economic conditions.

Limitations: Funding will have to be ensured.

CHAPTER 9

Agricultural Extension

A. Background/Overview

1. The agricultural extension system in Bangladesh has apparently undergone more summersaults than in most other countries. Though the formal recognition of the need for educating farmers in the adoption of improved technologies got a footing in the early part of the 20th Century, the emphasis was initially on offsetting famine situations. The initial focus concentrated more on advising farmers in the use of seeds and fertilizers.
2. The East Pakistan Directorate of Agriculture was created in 1950 for field level extension services. During the 1960s, the Comilla Model of farmers' Cooperatives was introduced. Simultaneously, the Agricultural Development Corporation was created. With the introduction of green revolution technologies, the corporation took over sales of seeds and fertilizers and started providing irrigation facilities to farmers.
3. In 1950s, the Directorate of Agriculture was bifurcated into (a) Directorate of Agricultural (Extension and Management) and (b) Directorate of Agricultural (Research and Education). In 1970s, semiautonomous agricultural Research Institutes were established⁵⁹, and apparently as a corollary, as many as six directorates of extension services were created out of DAEM based on commodities and/or discipline⁶⁰.
4. These directorates approached the same farmers separately and with different messages. Farmers became confused and the overhead costs soared. The six directorates were again merged in 1982 to form the Department of Agricultural Extension (DAE).
5. The conventional extension approach started in the British colonial period and was based on 'motivation, training and demonstration'. It was the larger farmers, who grew export crops for the colonizers' metropolis, received most of the attention.⁶¹
6. In the post-colonial period, the extension services that were introduced by the colonial powers were generally the models in the developing countries. The 'top-down' systems, that served the interests first of the colonial rulers and then of the nation state were retained. The systems precluded farmers from any decision-making role. The approach failed more often than it succeeded.⁶²
7. In Bangladesh, the major weakness of the system can be summarized as follows:
 - Lack of effective linkage between research and extension.
 - Inadequate in-service training to extension personnel.
 - Assignment of non-extension jobs to extension workers.
 - Absence of planned schedule of work for the field level extension workers.

⁵⁹ BARI, BRRI, BJRI, BARC.

⁶⁰ DAJP - Directorate of Agriculture (Jute Production); DAPP - Directorate of Agriculture (Plant Protection); HDB – Horticulture Development Board; TDB – Tobacco Development Board; SCA – Seed Certification Agency; CERDI – Central Extension Resources Development Institute

⁶¹ Arnon, I. 1989. Agricultural Research and Technology Transfer. Elsevier Applied Science Publisher Ltd. Essex, England.

⁶² Buer E., V. Hoffman and P. Keller. 1998. Agricultural extension down the ages. Agriculture + Rural Development. 5(1). DLG-Verlags-GmbH, Germany. pp. 3-6.

- At the Block level, the Block Supervisor had to cater for a large number of farm families (1000 – 2000).⁶³
- The physical facilities (working office, housing, transport) of the field worker were either inadequate or absent.⁶⁴
- In field activities, mostly concentrated in demonstrations, farmers seldom had any say on the planning or decision-making of these demonstrations.
- Conditions under which these demonstrations were conducted often differed from the farmers' own situations.
- Demonstrations were not always evaluated to see if they actually induced farmers to adopt the concerned technology or skill.⁶⁵
- Feedback mechanism from extension to research was weak.
- Lack of supervision and monitoring.
- Lack of accountability.
- Inadequate female extension workers and their limited field posting.

8. The green revolution technologies of the 1960s brought significant increases of rice and wheat yields in parts of Asia. Based on the success, the Training and Visit (T&V) System was introduced and promoted in late 1970s by the World Bank. The system envisaged a rise in agricultural production through continuous dissemination of messages to farmers.⁶⁶ It stressed on improving agricultural management practices.⁶⁷

9. The system focused on contact farmers who were envisaged to pass on information of improved agricultural practices to other farmers. It continued up to the end of 1980s. By then it became clear that the system not only failed to be effective, it was fraught with some inherent problems. These included:

- The system was too rigid, top-down and expensive.
- Farmers' participation in decision-making was missing.
- Field demonstration was neglected in favor of carrying messages to farmers.
- It gave attention to contact (elite) farmers. Needs of resource poor farmers were not given attention to and the impact, if any, remained confined to contact farmers.
- The linkage between research and extension did not improve as was envisaged under the system.

⁶³ Kibria, A. K. M. A. 1988. Transfer of Technology (TOT) Systems in Bangladesh, Agriculture Sector. Proc. of Workshop on Transfer of Technology (TOT) Systems in Agriculture in SAARC Countries. Dhaka, Bangladesh. Pp. 3-21. BARC. Bangladesh.

⁶⁴ *Ibid.*

⁶⁵ Milki, A. K. M. G. 1992. Extension and training for vegetable development. In: Vegetable Production and Marketing. Proc. National Review and Planning Workshop. January 26-29, 1992. BARI, Joydevpur, Gazipur. Bangladesh. pp. 231-234.

⁶⁶ Banor, D. and J. Q. Harrison. 1977. Agricultural Extension: Training and Visit System. The World Bank. Washington D.C.

⁶⁷ Better land preparation, improved seedbed and nursery maintenance, use of good seed, seed treatment, timely field operations, proper spacing of plants (Banor & Harrison loc cit).

B. Constraints/Issues

Blue print agriculture and ecological problems

10. Agricultural research and extension, particularly with green revolution technologies, triggered the so-called blueprint or industrial agriculture. In other words, the crop field environment had to be adapted or modified, through the use of external inputs, to the needs of technologies developed 'within the walls of research institutes' and under the so-called 'ideal conditions'. The need was to develop technologies suited to local environment. The consequence was not only overexploitation of natural resource bases (soil, water, energy resources) but also disappearance of agro-biodiversity.

Participatory technology development and extension

11. The current school of thought puts emphasis on participatory technology development and extension where the farmer works with the research and extension worker as a partner and plays a decision-making role from the planning stage to the stage of technology adoption. Farmers have been innovative ever since agriculture began some 10,000 years ago. Agriculture as a science is hardly 200 years old. The advent of scientific agriculture relegated the farmer to the background, at the receiving end of what is being developed in and transferred from the formal sector. The result was, the farmer lost his/her morale as innovator and became dependent on the formal sector. Participatory research and development aims to bring back the farmer to the decision-making process.

12. Participatory approaches in research and extension provide the opportunity to marry the best of the scientists' knowledge and practices with traditional knowledge and practices of the farmers. Such an approach has the best possible chance to generate technologies that would suit the local environment, and would not demand major restructuring of the existing farming systems to suit the needs of new technologies developed in research institutes and to the detriment of resource bases. Furthermore, technologies developed through participatory approaches are likely to be spontaneously adopted by the farmers because farmers are partners of the process.

13. The key question is participatory research and extension with whom? If only the so-called progressive farmers are chosen as partners, they are likely to contribute to more uneven development and more polarization of resources in the hands of a few.

Addressing equity and ecological problems

14. How would participatory technology development and extension help address ecological problems and at the same time ensure equity? Ecological security cannot be thought of without considering an ecological area. The individual farm household focus in extension, followed till the time of T&V system, has not been adequate in taking care of ecological issues. Similarly, equity cannot be ensured without taking an entire community into consideration. Perhaps, the simplest possible answer to address ecological security of the farm and the economic well being of the farming community would be a holistic village development approach, taking into consideration not only technological aspects but also human, material and other biological resources.⁶⁸ To be successful, the holistic village development approach must, of course, be participatory involving all or as many village farmers as possible with a team of multidisciplinary specialists.

⁶⁸ Hossain, M. G. 1997. Participatory plant breeding – a way for empowering farming communities in on-farm conservation and innovation. in Plant Genetic Resources – Bangladesh Perspectives. Proceedings of National Workshop on Plant Genetic Resources. August 1997. BARC, Dhaka. NCPGR/BARC/IPGRI. pp. 189-195.

Group approach in extension

15. The above calls for a well thought out group approach in technology development and transfer involving different categories of farmers including women, young people, ethnic minority groups, etc. This means targeted participatory approach with different groups of farmers ensuring access to resources, market opportunities, infrastructure, etc. However, instead of grouping farmers as large, small, etc., it would be more appropriate to group them into 'high access' and 'low access' farmers recognizing that farmers have different access problems to resources as land, water, credit, inputs, markets, and advisory services.⁶⁹.

C. Review of Current Policy

16. Agricultural extension, which has been seen as a public good and run by the State, is now passing through a transition. Several reasons can be discerned for this transition.⁷⁰ First, there is a decline in the fund available for the public extension service. Second, NGOs and the private sector are coming up with services for farmers. Third, the role of the third sector (farmers'/professional organizations) is getting focus in technology transfer so that users of technology can take on responsibility in technology innovation and extension. Fourth, the role of the public sector is being seen more concentrated on policy framing and regulatory activities.

17. In the developing world, however, "Significant policy, legal, organizational and managerial changes must be implemented as part of any concept that shifts responsibility away from the public sector. Change is necessary, but unless clear strategies are developed that are gradual and multi-dimensional resource poor farmers will remain poorly served."⁷¹

18. Since the beginning of 1990s, the DAE has been looking for an appropriate extension approach suited to the farming communities of the country that are characterized, in the main, by resource poor farmers. The World Bank/DFID supported Agricultural Support Services Project (ASSP) that replaced the T&V System in 1992 emphasized the following:

- The basic unit of agricultural production is the rural household and its farm where various activities are performed. The extension staff, therefore, needs to take a "whole farm system" into account in extension.
- Homestead, storage, processing are important parts of the production system. As women are responsible for much of these activities, both men and women should have access to extension services.
- Resources and circumstances of farmers vary. Larger farmers have different possibilities for developing their farms than the small and resource poor farmers. Therefore, the extension staff should be aware of the variation and provide appropriate information and services to all categories of farmers based on their needs and circumstances.

⁶⁹ Rolling, N. 1982. Alternative approaches in extension, in G. E. Jones and M. J. Rolls. (Eds.) Progress in Rural Extension and Community Development. New York: John Wiley & Sons, Chichester. Pp. 97-115.

⁷⁰ See (a) Rivera W. M. and D. J. Gustaffson 1991. (Eds.) Agricultural Extension: A worldwide institutional evolution and forces for change. Amsterdam: Elsevier; (b) Farrington, J. 1994. Public sector agriculture extension: Is there a life after structural adjustment. ODI Natural Resources Perspectives. No. 2, November 1994; (c) Garforth, C. 1997. Global trends and future options in agricultural extension. Proceedings of Second National Workshop on New Agricultural Extension Policy Implementation. ASSP/DAE/ MoA, Government of Bangladesh. Dhaka; (d) Buer et al. 1998. *op. cit.*; (e) Kidd, A., J Lammers and V. Hoffman. 1998. Towards pluralism in agricultural extension – a growing challenge to public and private sectors. Agricultural + Rural Development. Vol. 5(1). Pub. DLG-Verlags-GmbH, Germany. pp. 7-10. (f) Rolling, N. and A. Groot 1998. Contemplating alternatives – A comparative framework for thinking about extension. Agricultural + Rural Development. Vol. 5(1). Pub. DLG-Verlags-GmbH, Germany. pp. 11-13.

⁷¹ Kidd et al. *op.ct.*

- Farmers adopt technologies and farming practices that benefit them. Often the extension staff encourages farmers to adopt changes that may meet the strategic agricultural needs of the country but not essentially meet the immediate needs of farmers.

19. Based on these considerations, the ASSP developed five principles for extension/technology transfer:

Responsiveness to farmers needs: This requires comprehensive Farmers Information Needs Assessments (FINA). The assessment records would be used to develop extension plans in Upazila and Districts.

Working with Groups: This would increase contacts with greater number of farmers (than was the case with individual contact farmers).

Decentralized extension planning: Upazila and District Offices develop their own extension plans while the DAE headquarters would concentrate on monitoring and supervision functions.

Targeting all categories of farmers: Extension plans are carefully targeted to all categories of farmers (big, small, marginal, landless, and also young and female farmers).

Using a range of extension methods: Methods include not only training, visits and demonstrations but also group meetings, motivational tours to research institutes and other localities, printed material, folk media like songs and drama, etc.⁷²

20. The achievements of ASSP can be summarized as follows:

- Introduction of a New Agricultural Extension Policy (NAEP) in 1996 based on the principles outlined above.
- Establishment of linkages among related agencies involved in rural development (departments dealing with crops, livestock, fisheries forestry, parastatals, NGOs, and the private sector).
- Decentralized bottom-up demand led extension planning.
- Partnership of government departments and NGOs.
- Establishment of monitoring and evaluation system.

21. These were significant achievements that opened up avenues for participatory, situation based technology development and extension that can mobilize local creativity, energy and experience and capitalize on diversity. The project ended in June 1999.

22. Agricultural Services Reform and Innovation Project (ASIRP) was a follow up project from July 1999 to February 2003. The project focused, among other things, on the following:

- Improving the quality of FINA and translating FINA findings into locally appropriate and relevant extension messages.
- Improving group approaches to establish strong linkage with farmers' groups and their parent bodies and to ensure tangible benefits to the groups.
- Strengthening research-extension linkages to ensure that problems identified at the field level are placed on research agenda and the solutions found are placed within the mainstream extension messages.

⁷² Government of Bangladesh, Ministry of Agriculture. 1995. Agricultural Extension Manual.

- Improving Upazila planning and implementation through involvement of all extension service providers to develop collaborative projects and integrating various extension services (crops, livestock, fisheries, water, and infrastructure) through multidisciplinary extension services.
- Effective monitoring and evaluation (M&E) procedures developed during ASSP.

23. Achievements of ASIRP:

DAE is somewhat better organized and exhibits greater decentralized decision-making for extension with Upazila level extension planning. There has been modest improvement in research extension linkage and farmer feed back. On group approach in extension, DAE still needs to institutionalize the process widely.

D. Policies for the future

24. In light of the analysis presented above, the Agriculture Sector Review Team recommends the following immediate, medium term and long-term measures for consideration of stakeholders. These measures are designed to address key constraints of the extension services thereby contributing to sustained increase in land and labor productivity in agriculture, promote concomitant investments and mitigate natural disaster and market related risks thus facilitating the transformation of subsistence agriculture to industrial/commercial agriculture. Against this backdrop, individual policies are stated together with their respective advantages and limitations.

Immediate Priority

Policy 1: Reorganize the extension service as a bottom-up institution centred on the concept of ‘Specialized Agricultural Service Centres’ (SASC) at the Upazila level, and one stop extension service at the Union level.

Advantages: This should reinforce the approach already enunciated in NAEP. Farmers will receive specialist attention at one place.

Limitations: Trained personnel may not be available in the near future to fill all positions. Retraining and relocation of some current staff will be necessary.

Policy 2. Develop a comprehensive training program for the farmers, input dealers, seed producers and the field technicians (BS) at the Upazila level.

Advantages: This will improve the knowledge and skills of the farmers, input dealers and the field technicians leading to improved agricultural production.

Limitations: Availability of resource persons and funding may become a problem.

Policy 3: Adopt community (village) or group based extension and training system to develop group farming for commercialization of agriculture and conservation of resources.

Advantages: Group-based extension and training system will enhance commercialization of agriculture, facilitate conservation of resources, and benefit all categories of farmers including small and marginal farmers.

Limitations: Group-based extension and training will call for close collaboration between DAE, NGOs and farmer communities, and will empower farmers which are easier said than done in Bangladesh socioeconomic context.

Policy 4: Establish a permanent ‘Advisory Committee on Agricultural Research and Extension’, linking with grassroot level organizations (for feedback to the advisory committee), to undertake periodic review of key issues affecting the development of the sector in order to facilitate revision and updating of policies as may be required under changing circumstances.

Advantages: Facilitate revision and updating of policies for adoption as required in changing circumstances.

Limitations: The Committee may not be effective if it is not given resources and a clear mandate.

Medium Term Priority

Policy 5: Reactivate ATIs and CERDI for professional training, including BS and training of trainers.

Advantages: Full utilization of currently underutilized/unutilized training facilities at ATIs and CERDI will ensure skilled human resource development for the extension service.

Limitations: Availability of resource persons and funding may become a problem.

Policy 6: Strengthen Agricultural Information Service (AIS) linking with the public mass media (radio, television, newspapers, etc.) for speedy dissemination of extension messages and essential information related to agriculture.

Advantages: This will immensely assist farmers in getting up-to-date information on new technology and related issues.

Limitations: Securing time and space in radio and television channels for the program may not be easy.

Policy 7. Build soil testing capacity at Upazila level, and strengthen the soil testing facilities and advisory services at SRDI laboratories by providing more funds for equipment, manpower and materials.

Advantages: This will provide direct support to farmers in determining their soil fertility status and use fertilizers accordingly to maintain soil productivity.

Limitations: Training of DAE field staff in simple field soil testing methods will be essential.

CHAPTER 10

SUMMARY OF RECOMMENDED POLICY STATEMENTS

Policy	Advantage	Limitations
Seed		
Immediate Priority		
1. Restructure BADC with its Seed and Irrigation Wings and rationalize its staffing or transform the Seed Wing of BADC into Bangladesh Seed Corporation (BSC), with the function defined in line with the current Seed Policy of the Government, which gives BADC the full responsibility of producing Foundation Seeds as public good. BADC/BSC will continue production and distribution of Truthfully Labeled Seeds until the private sector takes it over fully, and sell TLS at market rate to create level playing field for the private seed producers. Expand processing and storage facilities of BADC/BSC to increase its seed production capacity; and share the facilities with the private seed producers, where possible, on lease or rent at market rate.	BSC will be able to augment seed production and distribution through catalyzing and facilitating growth of the PS and NGOs. BSC will be the single most public-cum-private enterprise ensuring seed security of the country.	Competitive efficiency and growth of private seed sector may not be achieved if BSC continues to receive resource subsidy for TLS. BSC cost and pricing should reflect true cost of TLS production including Capital and full operational costs.
2. Remove the implementation bottlenecks hindering the capacity of research institutes in increasing production of Breeder Seeds by establishing Breeder Seed Production Units at BARI, BRRI, BJRI, BINA and Ag-Universities involved in developing new varieties, and providing adequate funds and additional staff.	Supply of Breeder Seeds will increase leading to increase in production of foundation and truthfully labeled seeds..	Research objectivity and forward-looking innovation may be compromised unless the seed production program is not separated from research operations.
3. Strengthen SCA as an independent body having its own manpower and service cadre to effectively implement its mandate of seed quality control and monitoring. Ensure close collaboration of SCA with MOA, BADC/BSC, DAE, LG and the private sector to streamline varietal testing, seed testing, Truthful Labeling and market monitoring.	Supply of good quality seed will increase thereby opening up the possibility of 15%-20% increase in crop yield. SCA will emerge as an invaluable information clearing house on all aspects of seeds.	Lack of trained manpower will be a challenge to sustaining SCA as a lean, efficient and rapid response body. Staff trained in seed certification and transferred to DAE should be brought back, and additional training should be organized for all SCA staff.
4. Allocate adequate resources to ARIs, SCA, BADC/BSC and DAE to impart training to seed producers, farmers, importers and dealers on production, processing and storage of quality seed. (Competent private sector organizations and NGOs could be contracted to do the same).	Special emphasis on quality control and preservation will increase supply of good quality seeds.	Training capacity of NGO may be limited requiring caution in the selection of partner NGOs.
5. Ensure that BADC/BSC gradually increases rice seed production to reach 20% coverage of total requirement; and increase production of seeds of other high value crops.	Good quality seed supply will be enhanced and replacement rate of rice seed will rise well above the current 5%.	It may be difficult for BSC to achieve 20% coverage over the short run and sustain it over the long-term unless steps are taken to (i) enhance capacity to produce foundation seeds in its own farm and truthfully labeled seeds through contract farmers, (ii) establish new seed processing centres, and (iii) build seed stores including DAE seed stores at

Policy	Advantage	Limitations
		Union level. Nonetheless, over the long-term, BSC share should actually start to decline, as the private sector becomes more efficient.
6. Ensure supply of foundation seeds produced by BSC to private seed producing concerns; and supply of breeder seeds produced by ARIs to BSC and the competent private seed producers and NGOs.	Supply of foundation seed and truthfully labeled seed will increase due to involvement of PS and NGOs. Seed market will become more competitive.	Quality control and monitoring may be difficult for SCA due to expansion of its sphere of activity. A re-organized and strengthened SCA (as described in policy 3, below) will be needed to manage the issue.
Medium Term Priority		
7. Encourage establishment of R&D facilities for production of quality seeds in the private sector by providing tax holiday and other appropriate incentives	Supply of quality seeds will increase rapidly, resulting in enhanced agricultural production.	Political commitment will be essential
8. Empower BSC and LG to assist seed producers in obtaining financing from banks, NGOs and other sources; and establish a Seed Development Fund (SDF) at MOA with initial capital of taka 25 crores to provide financing to farmer seed producers and small scale seed enterprises.	Growth of a competitive seed industry and a seed market will be facilitated.	Administering the Fund may be problematic and may lead to abuse in the absence of close monitoring.
Fertilizer		
Immediate Priority		
1. Introduce resource conservation subsidy up to a maximum of 30-35% per 50kg bag to imported TSP, DAP and MOP if their landed cost rises above Taka 450 and Taka 350 per 50kg bag respectively; and extend this also to the available stock of TSP, DAP and MP in the country and in the pipeline in order to keep both the demand and supply of these products steady. Alternatively give subsidy to imported TSP, DAP and MP up to a maximum of 30-35% per 50kg bag if average world prices (CIF) rise more than 10% above three year moving average. Import fertilizer from multiple sources in stead of one single source to avoid artificial crisis; and determine the rate of subsidy based on procurement/supply source, distance, freight and quality of the product. Gradually increase the price of Urea.	With aggressive farmer education during the subsidy period, this environment friendly measure will contribute to balanced use of urea, phosphate and potash thereby reversing the soil degradation (imbalance of soil nutrient) process, while raising paddy yield by 10-20%. Cost of subsidy will be more than offset by incremental value of production. In importing fertilizer, a variable rate of subsidy will reduce dependence on one source, minimize risk, increase competition and ensure steady supply.	Estimation of excess landed cost and delivery to desired destination at target price will have to be closely monitored by the National Fertilizer Monitoring Committee. The estimated annual fiscal burden (of about Taka 260 crores if estimated excess landed cost is Taka 200 per 50kg bag and total consumption of TSP/DAP and MOP is 650,000 tons same as in 2002/03) would have to be financed. Farmer education may lag behind. Once introduced it is difficult to withdraw subsidy because of interest group pressure. Therefore, planned withdrawal of subsidy has to be firmly and carefully executed in order to avoid disruption in supply, sudden price increase and consequent negative impact on production.
2. Ensure timely supply of fertilizer by giving priority to discharging fertilizer cargo of the importers and allowing the use of local PP bag, while monitoring importer activities for possible supply/price collusion. Import and store limited quantity of TSP/DAP and MP on	Limited import and distribution of TSP and MP by BCIC will ensure timely fertilizer availability and help market stabilization.	It may take time for BCIC to fully gear up to this task. Because import is a time consuming activity, detection of an impending supply crisis would require close monitoring of both international and

Policy	Advantage	Limitations
government account for distribution and sale only at times of supply stress due to international price rise and confirmed evidence of collusion among importers adversely affecting supply and price of fertilizer.		domestic market.
3. Ensure that District Fertilizer Monitoring Committee and DAE with appropriately trained staff monitor fertilizer demand and supply, farm level prices and quality in collaboration with representatives of designated quality control laboratories, Bangladesh Fertilizer Association and farmer representatives; review demand projection before each major crop season and the supply program modified accordingly; limit arrival report of Urea fertilizer to DAE; and hold regular consultations with traders and consumers.	Farmers will receive quantity of quality fertilizer (free from adulteration) in standardized bags containing declared quantity (50kg instead of frequent 45kg as reported from the field).	Quality control cannot be effectively implemented without capacity building and public/private partnership. Putting the institutional mechanism for quality control in place will require time and strong administrative commitment backed by resource appropriation. The challenge would be to set up a regular system with back-up laboratory facilities and legal cover for enforcing quality control. Problem may arise if the set up is abused to harass traders.
4. Increase buffer stock depots for Urea especially to cover remote areas. These depots will sell fertilizer to dealers and retain a pre-designated minimum stock.	Additional buffer stock will improve timely availability of adequate quantity of Urea at various production locations, increase competition and contribute to supply and price stabilization.	Fertilizer monitoring responsibility will increase and the monitoring system will further strengthening.
5. Reduce price differential between mill gate price and buffer stock depot price of Urea, and raise the mill gate price by Taka 10 per bag.	Fertilizer price equalization will improve use of Urea from buffer stock.	Buffer stock godown will need improvement to avoid caking of Urea if held longer than six months.
Medium Term Priority		
6. Amend the Fertilizer (Control) Order 1999 under Essential Commodities Act 1956 to improve regulation of imported and domestically produced fertilizer with regard to quality and product specification and formulate guidelines to implement the Fertilizer Control Order properly and review and rationalize the role of different actors. Strengthen the analytical laboratories, especially the newly built BADC Laboratories for fertilizer quality testing.	Fertilizer market will function better as farmers will get quality fertilizer.	Amendment of the Order may get bogged down in procedural delays.
7. Review and rationalize the existing Urea distribution system together with reconsideration of the present system of restricted number of dealers, restriction of Urea distribution within Upazila, fixed quota system and equal allocation to all dealers in an Upazila, based on location-specific assessment so that Urea market can function smoothly on a competitive basis ensuring supply to all consumption points in accordance with demand.	Allocation of fertilizer according to estimated demand will improve location specific fertilizer supply, as dealers would be in a better position to respond to market demand.	May create artificial location specific scarcity due to unethical conduct of traders.
8. Over longer term, encourage domestic production and the use of high nutrient content product such as DAP, NPKS, and bio-fertilizer, following IPNS, if necessary through subsidy.	Likely to result in a saving for the country as cost per unit of nutrient including transport cost is lower. Balanced use of fertilizer will be promoted.	Supply of high nutrient content product may be a problem.

Policy	Advantage	Limitations
9. Take appropriate measures to prevent/check smuggling of fertilizer in neighboring countries.	Local farmers will get the benefit of getting the desired fertilizers at the right time, price, and quality.	With the porous border, it will be extremely difficult to prevent smuggling.
10. Recognize local production of bio, organic and mixed fertilizer as agricultural industry in order to enable the farmers to use these fertilizers at a competitive price.	Use of balanced fertilizer will be increased and soil health will be improved.	It may take time for entrepreneur to come forward to setup industry. Because is a time consuming activity.
Land		
Immediate Priority		
1. Develop a land policy focusing on land zoning, land utilization plan, and investment plan for land development (leveling, flood control, water logging, siltation of waterbeds and salinization, afforestation and preservation of biodiversity, improved utilization of cultivable land including khas land currently not in use).	Protect suitable agricultural land areas and contribute to efficient utilization of the scarcest resource of the country. Will contribute to land and forest conservation.	Land zoning has to be carried out in a transparent way for which mechanism is lacking. Require strong commitment from all stakeholders, which is difficult given conflicting interests.
2. Initiate the preparation of AEZ-based land development plan by Upazila taking into consideration sustainable but most profitable cropping patterns; establish a Parliamentary Committee for earmarking agricultural land that must be protected; and form a multidisciplinary committee of experts including local people and environmentalists for use of land for agricultural and non-agricultural purposes; and hold open debates for finalizing recommendations before sending it to the Parliamentary Committee.	Will protect productive agricultural land and will ensure sustainable land use.	Implementation will be demanding in terms of manpower and financial resources and in arriving at a general consensus among conflicting groups.
Medium Term Priority		
3. Give priority attention to streamlining land records and land registration on the basis of appropriate market valuation.	Will help development of competitive land market and facilitate use of land records as collateral for credit.	Very cumbersome and sensitive area and needs cautious approach and careful handling. It cannot be implemented without cooperation of land administration, which is weak and not responsive to new initiatives regarding land.
4. Take measures to protect fragile ecosystems including coastal, hilly, <i>haor</i> and <i>char</i> areas. Reconsider settlement of plain land farmers in hilly areas and undertake projects like rubber or pineapple plantation in such areas.	Will protect fragile ecosystems and reduce social tension while encouraging productive and sustainable use of land.	Politically very sensitive and will require broad based consensus.
5. Give serious consideration to long term impacts of irrigation and drainage projects before such projects are undertaken. Meanwhile, take measures against water logging in Flood Control and Drainage (FCD) and Flood Control, Drainage and Irrigation (FCDI) Projects.	Reduce loss of land and productivity of land due to water logging and/or salinity.	This requires inter-ministerial coordination, which is lacking.
6. Undertake a program for dredging of rivers, canals and haor basins in order to reduce flood hazards and deterioration of land quality due to sedimentation; and also initiate research on taming river flows and riverbank erosion.	Reduce flood hazards and halt land degradation and land loss.	Very expensive and past experience is mixed. Research will require appropriate skills, which is not available.

Policy	Advantage	Limitations
7. Strengthen the program for conservation of biodiversity, identification of plants suitable for different AEZs, and mass awareness drives on tree plantation; and continue moratorium on forest clearance until such time adequate forest area is restored.	Protect land and forests and preserve plant genetic resources of the country. It will comply with Convention on Biological Diversity (CBD).	Difficult to implement due to conflicting interests.
Minor Irrigation		
Immediate Priority		
1. Encourage government agencies to formulate and implement surface water augmentation schemes within the purview of the charter of those agencies so that the utilization of surface water for irrigation purposes can be increased substantially.	Harnessing of surface water will increase irrigation coverage and improve water use efficiency through appropriate cost control and pricing. This will promote conjunctive use of ground and surface water.	BWDB has developed limited amount of surface irrigation at high capital and operating cost without much impact. Any similar development of surface water by BWDB is likely to be even more costly.
2. Promote replacement of the current centrifugal pumps with more expensive force mode pumps in many areas by giving a time bound subsidy to offset higher cost. Encourage local production of these pumps through private sector.	Introduction of force mode pumps will solve the problem faced with lifting water due to lowering of ground water table in many areas, where about 1 million STWs are being used for irrigation.	The proposed measure will have limited long term impact without complementary water conservation measures.
3. Restructure BADC with its Irrigation and Seed Wings and rationalize its staffing or transform the Irrigation Wing of BADC into an autonomous Minor Irrigation Authority under MOA, with the recently redefined functions (Gazette No. DA 1, Nov. 22, 1999).	MIA as a smaller organization will be more effective and efficient (relevant and cost effective) in responding to new challenges. Monitoring of water quality will help detect and prevent possible future contamination of the food chain.	Resistance may come from BADC staff and management as usual.
4. Ensure through REB/PDB uninterrupted power supply to electric pumps and design a time bound program to increase the share of electric pump in total irrigation pumps. Withdraw minimum charge for electricity and introduce electric tariff comparable with the neighboring countries and make it uniform for REB and PDP.	Assured uninterrupted power supply will increase irrigation coverage, enable trouble free operations and reduce irrigation cost (fixed and operating) by about 50% compared with diesel pumps.	In the face of likely overall shortage of power supply in the short run, irrigation will have to compete with other sectors for power.
5. Provide 20% subsidy to diesel engine operated pump owners on total diesel cost of operation certified by DAE/LG and/or irrigation groups, which should enable them to reduce price of water by 20% charged to individual farmers.	Irrigation cost will be reduced.	Targeting of diesel subsidy will be problematic without active cooperation of representatives of local government and farmer groups and also in the context of field realities it will be difficult to avoid leakage. This measure will be effective only if policy measures are in place to ensure uninterrupted supply of diesel at farm gate.

Policy	Advantage	Limitations
Medium Term Priority		
6. Allocate additional resources to strengthen DAE's on farm water management capacity to expand irrigation and improve its management by adopting, among others, alternate drying and wetting method of water application instead of present practice of flooded irrigation for rice in collaboration with farmers/users' organizations.	Water productivity will increase, by as much as 30% for rice and wheat. It will promote water conservation.	This measure can be made effective only through training of both farmer and extension agents. However, this may also require alternative weed management technique.
7. Rationalize water pricing through water charge for surface and ground water irrigation provided by BWDB, and give subsidy for electric connection to irrigation pumps as well as withdraw the minimum monthly charge for the connection, and assure adequate fuel supply for irrigation pumps.	Net return to water will move towards greater parity between alternative sources leading to rational use.	There is no major limitation.
8. Provide limited time bound subsidy for drip/sprinkler irrigation on a pilot basis to establish conditions for technical and financial viability given its significant potential impact on water use efficiency.	Drip/sprinkler irrigation will improve water use efficiency and increase yield of high value crops including vegetable seeds. Increased initial capital costs will be offset by increased production and reduced total cost of irrigation.	Likely to benefit mostly medium and rich farmers.
9. Explore the option of gradual replacement of diesel engines with LPG/CNG (bottled) operated engines as well as manufacturing the same locally on a pilot basis in view of high cost and uncertain supply of diesel during irrigation season.	Use of LPG/CNG as fuel for irrigation pumps will ensure uninterrupted irrigation at critical point in crop cycle at lower cost.	Total cost of LPG/CNG conversion of diesel run irrigation pumps would have to be carefully worked out before specific action is taken to promote its use.
10. Introduce the concept of micro-credit for purchasing irrigation equipment to encourage landless and marginal farmers to become owners of irrigation equipment which, at the moment, is the domain of large and influential farmers.	Landless and marginal farmers will have easier access to irrigation equipment.	Organizing micro-credit program for this purpose may be somewhat difficult.
Mechanization		
Immediate Priority		
1. Increase mechanization capacity and efficiency through training, demonstration and advisory programs for farmers and Union level mechanics/artisans to enhance their skills in operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Give the responsibility and needed facilities and funds for these activities to DAE; introduce agriculture based vocational education/training in collaboration with ARIs, Universities, NGOs and private sector. Simultaneously, encourage formation of farmer/user groups (for owning, operating, maintaining and custom hiring of agricultural machines and equipment) through DAE and collaborating NGOs/private sector entities.	Skilled farmers and Union level mechanics/artisans will be available for operating, maintaining and repairing power tillers, pumps and other common agricultural machines. Farmer groups will help increase availability of equipment for custom hiring for small farmers and also advance non-farm rural economy.	Initially, it may be difficult to find adequate number of suitable trainers. Formation of coherent groups may also take time.

Policy	Advantage	Limitations
2. Formulate a comprehensive agricultural mechanization policy, and establish a high level 'Agricultural Mechanization Advisory Committee' chaired by the Minister of Agriculture, with representation from all stakeholders to advise the government on agricultural mechanization issues and policies.	This will provide technical support and guidance to the government in accelerating agric. mechanization in the right course.	Little will be achieved if competent experts and persons, with high reputation in this field are included in the committee and due importance is given to the advice of the committee.
3. Provide adequate funds for priority research, development and extension works to capable institutions including selected ARIs and Universities on a competitive basis. (Private sector may also share R&D cost or pay royalties in exchange of patent or marketing rights.)	Competitive funding for development of appropriate machinery and solving mechanization problems will stimulate activities to the advantage of the farmers as well as the nascent agri-machinery industry.	Judicious allocation of funds, avoidance of duplication and close monitoring of activities by the funding authority will be needed.
4. Review and rationalize the current tariff rates affecting import of agricultural machines and spare parts and the raw materials needed to manufacture those locally so that local manufacturers feel encouraged to work on competitive basis.	This will provide local manufacturers and workshop owners a level field to compete with imported items.	Possible misuse of tariff structure for non-manufacturing activities will need close control.
5. Join the ESCAP-established 'Asia Pacific Centre for Agricultural Engineering and Machinery (APCAEM).	Joining APCAEM will enable Bangladesh to take advantage of agricultural machinery development works in other developing countries in the region. The proposed NCAM may act as the local hub for the international network maintained by the APCAEM.	Appropriate finance will have to be committed to get full benefit of the network through related local programs.
Medium Term Priority		
6. Establish a 'National Centre for Agricultural Machinery (NCAM)' using existing facilities available in the system for development, testing and evaluation of farm machinery, with technical facilities to serve the needs of the public and private sectors. Encourage the engineering divisions of research institutes, the Universities and the private industries to collaborate with and utilize this national centre.	The proposed NCAM will help identification and adaptation of suitable agricultural machinery in addition to providing testing services to the developers of machinery in Bangladesh. A market for agricultural machinery will be developed. Private sector may share R&D and testing costs or pay royalties in exchange of patent or marketing rights. This Centre will facilitate collaboration with the engineering divisions at the NARS Institutes, the Universities and the private sector as seen in similar	The national centre will need adequate operating funds to be effective. Fund use will have to be closely monitored with time bound output assessment. Effectiveness will depend upon the availability of technical facilities and the quality of staff in charge, their autonomy and accountability.

Policy	Advantage	Limitations
	establishments of other developing countries. The existing facilities at other institutes and BAU may also be upgraded to serve as regional agricultural machinery centres.	
7. Provide support to local manufacture of agricultural machines (small sized diesel/ petrol/ CNG/LPG engines, power tillers, pumps, reapers, etc.), accessories and spare parts by encouraging and inducing the private sector, including joint venture enterprises involving established world-class firms, through credit, tax relief, industrial estate facilities and other effective incentives.	This will reduce dependence on foreign machines and fuels, create employment, help growth of economy and assure availability of machines and spare parts to locally meet the needs of the farmers.	Comparative economic advantages and availability of needed capital and availability of willing collaborators for joint venture are to be assessed carefully. This policy must also to be dovetailed with the industrial and energy-related policies of the country.
8. Replace the inefficient and obsolete steel hullers with rubber-roll for proper parboiling and milling of rice to reduce milling loss (2-4%); and establish a separate standard for low cost, low pressure and safe steam boilers suitable for small scale rice mills by amending the existing 'Boiler Act of 1923'.	Rubber-roll hullers will reduce milling loss by 2 to 4%; improve the recovery of valuable rice bran; and generally assure quality of milled rice. Safe low-pressure boilers will eliminate hazards of often fatal accidents in small rice mills, assure quality of parboiling, reduce wastage of fuel and generally improve the gradation of rice.	This will require training and motivation of small scale rice mill owners and operators; some essential R&D works and inter-ministry collaboration will also be necessary.
9. Construct and lease out community threshing floors in haor areas.	This will help farmers use threshing machines in haor areas for quick threshing and also provide temporary collecting and stacking space for harvested crop and save it from flash floods.	Ownership and management of such publicly funded community threshing floors may be a problem.
Marketing and Agribusiness		
Immediate Priority		
1. Establish an Expert Committee to review periodically the competitive strength of Bangladesh agriculture in domestic and international market and recommend appropriate policies, including the possibility of establishing Agro- Export Processing Zones in various parts of the country, in the context of globalization and trade liberalization.	This will augment current efforts of the Government to facilitate agricultural exports.	The proposed Expert Committee must have a standing budget for technical and operational support to carry out its mandate.
2. Establish a separate 'Centre for Agricultural Market Research, Intelligence and Information' by restructuring and renaming DAM with additional facilities and trained manpower	Market intelligence gathering and dissemination and analysis of market prospect will immensely improve.	Availability of trained manpower will be a problem at the initial stage, particularly if the incentive structure is not made appropriate.

Policy	Advantage	Limitations
3. Amend the 2002 'Market Management and Leasing Policy' to remove barriers to competition and market expansion; and further amend the 'Agricultural Markets Produce Regulation Act of 1964' to cover all aspects of marketing, including outlining of the composition of the Management Committee, powers of inspectors, appeals and review process, disposal of produce unfit for consumption and mechanisms to create by laws.	Appropriate amendment of the 2002 'Market Management and Leasing Policy' will ensure participation of stakeholders, NGOs and local government with autonomy in the organization and management of the markets. The amended Act of 1964 will be a governing legislation covering all aspects of marketing in Bangladesh.	The amendment process could become cumbersome if not managed well. Firm commitment will be required to implement the Act.
4. Increase investment in market infrastructure (decentralized wholesale markets, growers' markets and retail markets as well as municipal and local assembly markets) and arrange for technical assistance and credit for improved preservation, packaging and transportation of non-perishable goods.	With improved market infrastructure, product wastage will be reduced, net marketing margin will increase and return to farmers will go up.	Quality control will remain a challenge, which has to be responsive to market demand.
5. Initiate, through DAE and NGOs, formation of Farmer Managed Marketing Associations for pulses, oil seeds, and horticultural fresh and processed products from home scale processors.	Product marketing and net returns to producers will increase. The partnership between DAE and NGOs will be strengthened.	Training and supervision will remain a key element in the foreseeable future.
6. Formulate a comprehensive 'Agribusiness Policy' in collaboration with the private sector covering production, processing and preservation, quality control and product standardization, and market development (domestic and foreign).	A comprehensive 'Agribusiness Policy' will facilitate development of agro-industries and removal of barriers that hinder market development and competition.	Implementation of the policy without undue public sector interference will be of crucial importance.
Medium Term Priority		
7. Establish an Agribusiness Development Fund, with appropriate financing system to provide flexible financing to promote agro-processing, packaging, and transportation (including refrigerated van) to feed the domestic and international market.	By meeting the financing needs of small agro-processors and traders this fund will help improve processing and marketing of agricultural products.	Management of the fund in terms of transparency and accountability will have to be ensured.
8. Test pilot scale Grain Banks/ Insurance Schemes for agricultural products; and expand the ongoing SHOGARIP initiative of DAM in other potential districts.	Crop insurance schemes will mitigate market risks.	Crop insurance is inherently difficult to manage. Both grain banks and insurance require farmer cooperation, management and understanding. Training has to play an important role.
9. Improve rural credit by exploring alternative options such as (i) establishment for rural banks and branches; (ii) increasing the reaches of and accessibility to BKB resources; and (iii) establishing a 'Small Farmer Development Fund'.	Improve credit delivery to small farmers and agripreneurs (over 40% of rural households) who are otherwise left out of micro	Agricultural activities are inherently risky. Production and market risks will have to be managed to underwrite lending to small farmers and agripreneurs.

Policy	Advantage	Limitations
	credit/BKB/other public and private financing agencies loop.	
10. Encourage establishment of multipurpose mini cold storage and use of plastic crates for handling, processing and preservation of fruits and vegetables by providing incentives through reduced tariff for imported materials and provision of credit to the entrepreneurs.	Stream of continued supply of raw materials to processing industry will be ensured. Markets for perishable agricultural products will also be assured.	An active and efficient produce marketing network will be essential.
11. Strengthen BSTI with the help of the Ministry of Commerce and in collaboration with internationally accepted private certifying agencies with additional capacity for quality certification of agricultural products (fresh and processed) for domestic and international market (compliance with all internationally recognized norms including phytosanitary conditions).	Improved quality control will facilitate agricultural export while regulating import quality as well as improve quality of domestic products.	Quality control will remain a challenge, which has to be responsive to market demand.
Research and Extension		
Immediate Priority		
1. Initiate institutional reform and enactment of a unified legislation for the semiautonomous research institutes, providing administrative and financial autonomy and introduce unified autonomous agricultural research service with a built in incentive structure to stem the exodus of highly trained scientists and to improve the efficiency and effectiveness of research.	Research profile will go up, relevant research output will improve, and capable scientists will be willing to come and stay with research.	Understanding and accommodation by all stakeholders will be required to bring the desired changes.
2. Increase research budget by 1% of agricultural GDP, and provide 'Block Grant' to finance operational expenses of research, including biotechnology; and establish an 'Agricultural Research and Development Fund' financed by public and private resources, specifically for competitive funding of technology generation and service delivery and to foster public private partnership.	With more resources available for new research initiatives, continuous flow of new technology could be expected.	Effective use of research funds will require client orientation and participatory mechanism for determination of research priorities, the tradition for which is lacking.
3. Undertake a comprehensive human resource development program for building a pool of scientists in different disciplines, including frontier science for progressive and sustainable agricultural research.	Scientists with new knowledge and advanced skills will be available for research in new areas of science, and the contribution of research is more likely to be enhanced.	Government commitments and availability of funds
4. Improve and institutionalize research management (PM&E), human resource management, and financial and information management systems.	Efficiency and effectiveness of the research system will be enhanced.	Availability of funds and skilled personnel.
5. Institutionalize research-extension-farmer/users linkages and participatory on-farm research at all levels through interactive fora and continuous exchange of information.	Research output will be responsive to needs of farmers and extension will be better placed in	The problem of inter-institutional coordination and funding will have to be solved.

Policy	Advantage	Limitations
	disseminating new technology.	
6. Direct research attention to land, labor, and resource conserving technologies, and product development and quality improvement, especially of those crops having comparative advantage in domestic and international market.	Productivity increase and resource conservation will contribute to domestic food security and to achieve commercialization and competitiveness in international market.	New research skills and willingness to change research approach will be required.
7. Formulate a comprehensive biotechnology policy and regulatory framework and build capacity for GMO testing and food safety protection; and make adequate provision for training and retraining of professionals, especially in new areas such as processing and biotechnology.	Policy and regulatory framework will allow Bangladesh to take advantage of new frontiers of possibilities without undue risk.	Socially very sensitive area, which needs public education, debate and understanding of all relevant issues so that an informed consensus can be reached.
Medium Term Priority		
8. Strengthen the regional and sub-regional research stations and laboratories to undertake applied and adaptive research for addressing local problems locally.	Technology generated under local environment will be more appropriate and suitable for local agro-climatic and socio-economic conditions.	Funding will have to be ensured.
Extension		
Immediate Priority		
1. Reorganize the extension service as a bottom-up institution centred on the concept of 'Specialized Agricultural Service Centres' (ASCS) at the Upazila level, and one stop extension service at the Union level.	This should reinforce the approach already enunciated in NAEP. farmers will receive specialist attention at one place.	Trained personnel may not be available in the near future to fill all positions. Retraining and relocation of some current staff will be necessary.
2. Develop a comprehensive training program for the farmers, input dealers, seed producers and the field technicians (BS) at the Upazila level.	This will improve the knowledge and skills of the farmers, input dealers and the field technicians leading to improved agricultural production.	Availability of resource persons and funding may become a problem.
3. Adopt community (village) or group based extension and training system to develop group farming for commercialization of agriculture and conservation of resources.	Group-based extension and training system will enhance commercialization of agriculture, facilitate conservation of resources, and benefit all categories of farmers including small and marginal farmers.	Group-based extension and training will call for close collaboration between DAE, NGOs and farmer communities, and will empower farmers which are easier said than done in Bangladesh socioeconomic context.
4. Establish a permanent 'Advisory Committee on Agricultural Research and Extension', linking with grassroot level organizations (for feedback to the advisory committee), to undertake periodic review of key issues affecting the development of the sector in order to facilitate revision and	Induce adoption of up to date policies to provide support to the farmers.	The Committee may not be effective if it is not given resources and a clear mandate

Policy	Advantage	Limitations
updating of policies as may be required under changing circumstances.		
Medium Term Priority		
5. Reactivate ATIs and CERDI for professional training, including BS and training of trainers.	Full utilization of currently underutilized/unutilized training facilities at ATIs and CERDI will ensure skilled human resource development for the extension service.	Availability of resource persons and funding may become a problem.
6. Strengthen Agricultural Information Service (AIS) linking with the public mass media (radio, television, newspapers, etc.) for speedy dissemination of extension messages and essential information related to agriculture.	This will immensely assist farmers in getting up-to-date information on new technology and related issues.	Securing time and space in radio and television channels for the program may not be easy.
7. Build soil testing capacity at Upazila level, and strengthen the soil testing facilities and advisory services at SRDI laboratories by providing more funds for equipment, manpower and materials.	This will provide direct support to farmers in determining their soil fertility status and use fertilizers accordingly to maintain soil productivity.	Training of DAE field staff in simple field soil testing methods will be essential.
Sectoral policies and Institutions		
Initiate Preparation of a “revised up-to-date policy”, anchored on a vision for a competitive, commercial and diversified agriculture (inclusive of livestock, forestry and fisheries), which will clearly lay down an effective and transparent framework of governance in the agriculture sector.	This will provide clear guidelines to move forward with a framework of governance. Policies by themselves are not much useful unless implemented successfully and successful implementation requires well functioning institutions and efficient and transparent governance.	Institutional and human resource capability, political will and resources;

CHAPTER 11

Resource Cost

The estimated resource cost of the Actionable Policy Brief is presented in Table 16. Total capital cost is estimated at Taka 18,006 million and recurrent annual cost Taka 2,809.75 million. In capital cost, the bulk is claimed by irrigation, research and marketing while fertilizer subsidy takes the lion's share of recurrent annual budget. Details are given by policy recommendation in Annex 10.

Table 16. Summary Resource Cost of the Actionable Policy Brief (million Taka)

Sub-sector	Capital	Recurrent
Seed	340	12
Fertilizer	100	2,577
Irrigation	6,550	40
Mechanization	50	30.75
Marketing & Credit	7,276	50
Research and Extension	3,670	80
Land	20	20
Total	18,006	2,809.75

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Annex 1. Cost of Production of Rice in India, West Bengal and Bangladesh 2000-2001

Items	Punjab (\$/ha)	West Bengal (\$/ha)	Bangladesh (\$/ha)	Thailand Wet season (\$/ha)	Thailand Dry season (\$/ha)	Vietnam Wet season (\$/ha)	Vietnam Dry season (\$/ha)
Seeds	12.04	16.64	9.93	18.46	25.79	20.03	21.35
Fertilizer & Manure	50.11	39.72	77.20	25.71	57.06	56.91	59.08
Hired labor	80.61	192.14	167.98	30.44	27.33	102.02	104.42
Animal labor	0.25	9.93	14.64				
Machine services	55.30	32.04	7.38	65.71	67.15	42.36	44.40
Insecticide	20.95	4.75	12.94	5.34	24.28	26.52	27.22
Irrigation charges	31.04	18.82	52.95	1.45	17.94	6.98	17.98
Interest on working capital	6.91	6.64	5.80				
Other costs				3.23	4.10	-	-
Total variable cost (\$)	259.23	320.68	348.82	150.34	223.65	254.82	274.45
Yield/paddy (ton/ha)	5.46	3.48	3.92	2.287	4.171	3.678	4.713
Average cost (\$/ton)	47.48	92.15	88.92	65.74	53.62	69.28	58.22
Farmgate price of paddy (\$/ton)	117.11	113.36	136.42	100.23	91.52	103.42	100.95
Wage rate (\$/day)	1.48	0.91	1.23	5.21		1.64	
Fertilizer price at Farmgate (\$/ton)							
Urea	106	106	116	165		170	
TSP	-	-	223				
DAP	203	203	267				
MP	98	98	214				
Electricity (\$/KWH)	0.023	0.013	0.053				
Diesel (\$/liter)	0.454	0.454	0.357				

Note: Surplus of rice supply in Punjab provides the trade competition with Bangladesh. The rice in Bangladesh represents the average of T. Aman (HYV) and Boro (HYV). In the case of Thailand and Vietnam labor cost include imputed value of family labor and interest on working capital was not calculated.

Source: (i) The Indian costs of production are from Report of the Cost of Cultivation Studies, Agriculture Prices Commission, Government of India. (ii) The Bangladesh costs of production data are based on 1997-1998 field survey conducted in Bangladesh by the field project of International Food Policy Research Institute (IFPRI), Washington D.C. The 1997-1998 data on cost of production was updated to 2000-2001 by applying the input prices of 2000-2001 and revising the yield figure slightly to reflect a better production condition in 2000-2001 relative to 1997-1998. (iii) Indian input prices are taken from Ashok Gulati, Subsidy Syndrome in Indian Agriculture, Oxford University Press, 2002. Indian wage data is taken from S. Bhalla, Rural Casual Laborers, wages and poverty, 1983-2000, Jawaharlal Nehru University, 2003. (iv) Thailand and Vietnam data is adapted from Pingali, P.L., Mahboob Hossain and R.V. Gerpacio, Bangladesh Agriculture Under Trade Liberalization, 2001.

Annex 2. Profitability of Agriculture 2003-2004

Crop	Yield (ton/ha)			Total Cost (Taka/ha)		Net Return (Taka/ha)		Benefit/cost ratio			
	Bogra	Parbotipur	Experiment Station (HYV)	Bogra	Parbotipur	Bogra	Parbotipur	Bogra	Parbotipur	Experiment Station (HYV)	Farm Household Survey (1996-1997)
Aus (HYV)	3.33		3.70	16450		3530		1.21			
Aus		1.73	3.70		7904		746		1.16		
Aman (HYV)	3.952		5.00	14598		13066		1.89			1.25
Aman (local)	2.470	2.470	5.00	11016	9880	7509	7410	1.68	1.75		
Boro	5.31	4.94	5.97	24885	21489	9630	13091	1.28	1.61		1.34
Wheat	2.964	1.976	3.3	18426	11115	8250	8645	1.45	1.78	1.81	1.18
Pulses, Mash	1.235			12128		6397		1.53			1.73
Pulses, Masur	0.865			12721		8904		1.70			1.2
Pulses		0.494			7410		9880		1.75		
Oilseeds, Mustard	1.111		1.46	13709		6289		1.46		2.74	1.6
Oilseeds		1.482	1.46		14820		14820		2.00		
Potato (HYV)	16.06		16.50	47128		17112		1.36			
Potato		7.41			44707		29393		1.66	1.69	1.44
Maize	6.916	4.00	7.00	33730	21489	14682	18511	3.30	1.86	1.93	1.37
Aromatic rice	1.383	.939	2.89	11209	9880	4004	5144	1.31	1.52	1.89	
Onion	9.88	4.45	10.58	31898	25441	86662	63559	3.72	3.50	3.10	1.14
Chilli	1.383		11.16	33533		63277		2.89		1.90	2.79
Garlic	6.916	4.45	3.54	43262	30381	95058	103119	3.20	4.39	1.5	1.39
Ginger	11.856	9.88	10.56	109330	45448	127790	102752	2.17	3.26		4.7
Turmeric	13.585	17.784	15.25	66796	25318	41884	63602	1.63	3.51	2.24	3.33
Brinjal	21.74	14.82	32.53	25886	62985	82814	122314	4.20	5.73	2.52	
Okra	11.86	4.20		26824	25688	44336	41512	2.65	2.62		
Country Bean	13.59	4.94	14.39	44954	24453	90946	24947	3.02	2.02	2.06	
Cauliflower	22.23	37.05	29.24	37593	59280	73557	88920	2.96	2.50	2.74	
Tomato	19.76	19.76		37482	34580	120598	163020	4.22	5.71		
Cabbage	25.94	37.05	43.37	48654	59280	29166	88920	1.60	2.50	2.2	
Banana	19.76		16.05	56716		81604		2.44		2.10	
Papaya	29.64	22.23	24.95	60288	21242	28632	89908	1.47	5.23	2.10	
Watermelon	29.64	22.23		22057	13338	96503	75582	5.38	6.67		
Pumpkin	18.525	22.23		18130	13338	55970	97812	4.09	8.33		
Pointed Gourd	14.82	22.23	18.75	28800	13338	74940	97812	3.60	8.33	2.67	
Bitter Gourd	11.12	22.23		22563	13338	33037	97812	2.46	8.33		
Bottle Gourd	17.29			16796		52364		4.12			
Garden Pea	1.68			15388		11492		1.75			
Carrot	11.86	24.70		26577	14573	32723	59527	2.23	5.08		
Sunflower	1.61		1.88	23712		5268		1.22		1.46	
Spinach	19.76	4.94		23613	28899	15907	20501	1.67	1.71		

Source: (a) Data for Bogra and Parbotipur was collected during Agriculture Sector Review Team field mission. (b) Experiment station data is from BARI collected by Northwest Crop Diversification Project. (c) Farm Household Survey data was collected by the Ministry of Agriculture.

Annex 3. Yield Gap Between Farm and Experiment Station Levels (Metric tons of milled rice)

Rice type	National average ¹ 1995-1997			Experiment station	Yield gap ² (%)
	Local variety	HYV	Total	HYV	
Aus	0.87	1.68	1.09	2.30	53.0
Aman	1.22	2.40	1.70	3.10	45.0
Boro	1.55	2.73	2.62	3.70	29.0
Total	1.15	2.51	1.86	3.14	41.0

Note: ¹The national average as well as experiment station yields is weighted average of Aus, Aman and Boro using respective areas as weight.

²Yield is between national average and experiment station (experiment station-national average)/experiment station
Source: Compiled from data provided in Annual reports, 1995, 1997, 2001 and Modern Rice Cultivation, Bangladesh Rice Research Institute, Joydevpur, Dhaka 2001; and (b) national average yields are from Bangladesh Bureau of Statistics, Statistical Yearbook of Bangladesh 2001, Dhaka.

Annex 4. Rough Rice Yield (t/ha) in Experiment Stations and National Average Yield

Season & Variety	Location	Experiment Station	National Average	Yield Gap
Boro BR3	Joydevpur	5.92	4.35	1.57
	Comilla	5.62		1.26
	Habiganj	5.98		1.63
	Barisal	6.10		1.75
	Rajshahi	5.37		1.02
	Rangpur	6.88		2.53
Aman BR11	Joydevpur	6.60	3.21	3.39
	Comilla	5.43		2.22
	Barisal	5.38		2.17
	Rajshahi	4.77		1.56
	Rangpur	5.47		2.26
Aus BR14	Joydevpur	4.2	2.66	1.54
	Comilla	3.9		1.24
	Barisal	4.0		1.34
	Rajshahi	5.28		2.62

Source: Food and Agriculture Organization, Bridging the Rice Yield Gap in the Asia Pacific Region, Rome, 2000.

Annex 5. More Evidence on Yield Difference of Different Crops (metric ton/ha)

Crop	Potential Yield at Research	Yield Available	Demonstration	Farmers Yield	Yield Gap
Aus	9.00	4.00	4.85	3.50	0.50
Aman	9.00	6.75	7.05	4.00	2.75
Boro	9.00	7.00	7.85	4.80	2.20
Wheat	4.00	3.00	3.00	2.12	0.80
Mustard	1.50	1.00	1.00	0.73	0.27
Ground nut	2.20	1.70	1.50	1.26	0.44

Onion	14	10.00	8.00	4.10	3.90
Turmeric	30	22	25	3.10	18.9
Masur	1.65	1.20	1.40	0.75	0.45
Mung	1.17	0.88	0.75	0.68	0.20
Mashkalai	1.50	1.12	1.30	0.76	0.36
Kheshari	1.63	1.21	1.00	0.84	0.79

Source: Hasan, Taufiq, et.al. 2004. "Transfer of Technology: Public and NGO Association", Paper presented in the Consultation of the Field Workers and Technology Fair.

Annex 6. Selected Time Series Indicators of Profitability in Rice 1984-1985 to 2001-2002

Years	Nominal Rice Price (Tk/kg) ¹	Real Rice Price (Tk/kg) ²	Index of Real Rice Price (1984-1985=100)	Index of Real Wage Rate (1984-1985=100) ³	Fertilizer/Rice Price Ratio ⁴	Index of Rice Yield (1984-1985=100) ⁵
1984-1985	7.89	15.97	100.0	100.0		100.0
1985-1986	7.51	13.68	85.7	102.2	0.65	
1986-1987	8.85	14.51	90.9	101.6		
1987-1988	9.37	14.07	88.1	93.8		
1988-1989	9.76	13.65	85.6	85.5		
1989-1990	9.47	12.10	75.8	80.8		
1990-1991	10.69	12.82	80.5	75.0	0.54	
1991-1992	11.03	12.84	80.4	77.4		
1992-1993	9.12	10.59	66.3	81.9		
1993-1994	9.57	10.71	67.1	79.1		
1994-1995	12.19	12.71	79.6	75.6		
1995-1996	11.99	11.99	75.1	76.0	0.79	138
1996-1997	9.79	9.50	59.5	94.5	0.57	
1997-1998	11.48	10.58	66.2	90.0		
1998-1999	13.77	12.12	75.9	92.3		
1999-2000	12.24	10.21	63.9	102.6	0.87	
2000-2001	11.48	9.42	58.9	114.1		
2001-2002	11.96	9.60	60.1	115.0	0.90	162

Note: ¹Coarse rice.

²Nominal price deflated with general price index with 1995-1996 as the base year.

³Nominal wage deflated with general price index with 1995-1996 as the base year.

⁴Fertilizer price is weighted average price at farm level for Urea, TSP and MP. Rice price is from column 2.

⁵Average yield of Aus, Aman and Boro.

Source: Compiled, taking data from

(1) Dorosh, Paul, Carlo Del Ninno, and Quazi Shahabuddin, Food Policy in Bangladesh in 21st Century, Dhaka: University Press Limited, 2004. (2) Retrospect and Prospect of Rice, *op.cit.* (3) Wage data from BRRRI Socio-economic Division.

Annex 7. Comparison of Bangladesh Rice Price with Neighboring Countries 1990-1991 to 2001-2002 (all prices in US\$/ton)

Year	Bangladesh Wholesale	Thailand cif Chittagong (15% broken)	India Darshana cif
1990-1991	298	282	208
1991-1992	286	284	253
1992-1993	233	248	174
1993-1994	240	266	240
1994-1995	302	284	209
1995-1996	293	361	240
1996-1997	231	331	243
1997-1998	269	297	258

1998-1999	265	291	245
1999-2000	227	214	215
2000-2001	205	199	201
2001-2002	210	201	200

Note: The incidental cost for transporting rice from Darshana border to Dhaka and other clearing cost was 6% of cif value in 1998.

Source: Compiled from information in Dorosh et al., *op. cit.*

Annex 8. Estimated Market Risks of Bangladeshi Farmers

Risk	1991	1995	2002	2004
Urea				
Price per 50kg bag				
Ex-factory	189.4-212.0	186.3	244-251	240
Farmgate Maximum (Tk.), March	365.50	358.0	286.0	300
Farmgate Minimum (Tk.), October	241.40	226.0	279.0 (July)	285
% Difference Max/Min	51.48	58.4	2.5	5.3
% Increase of Max (over previous year)	Not available	49.79	1.8	4.9
TSP				
Price per 50kg bag				
Ex-factory				550
Port	216-275	368-400	452-554	
Farmgate Maximum (Tk.)	339.5 (June)	462 (June)	588 (June)	700-800 (April)
Farmgate Minimum (Tk.)	265 (August)	384 (Nov)	506 (March)	500-550
% Difference Max/Min	28.1	20.3	16.2	42.9
% Increase of Max (over previous year)	Not available	11.9	-3.3	36.4
Adulteration/less weight	Yes	yes	yes	yes
MP				
Price per 50kg bag				
Port	166-212.5	283-321	401-410	
Farmgate Maximum (Tk.)	290.5 (May)	408 (Dec)	451.0 (Sept)	600 (April)
Farmgate Minimum (Tk.)	214.8 (July)	339 (Oct)	430.0 (July)	400
% Difference Max/Min	35.2	20.4	4.9	50
% Increase of Max (over previous year)	Not available	-10.4	.04	33.3
Adulteration/less weight	Yes	yes	yes	yes
Seed				
Low germination/mixed	Private sector seed	Private sector seed	Private sector seed	Private sector seed
Average daily wage of agricultural labor (without food) by season (Taka per day)				
Aus/Jute	39.00	42.00	62.00	60-80
Aman	38.00	44.00	68.00	70-90
Boro	45.00	50.00	75.00	90-110
Wheat	38.00	41.00	60.00	
Monthly wholesale prices (Taka/kg)				
Aman paddy HYV (Max/Min/% difference)	9.43/6.94/36	7.81/6.15/27	7.46/6.26/19	7.8/6.4/22
Boro paddy HYV (Max/Min/% difference)	9.19/6.39/44	7.84/6.00/31	7.35/5.69/29	7.45/5.69/31
Wheat (Max/Min/% difference)	5.24/2.4/118	5.28/2.38/118	8.89/8.32/7	9.15/7.53/22
Masur (Max/Min/% difference)	38.7/30.9/25	36.64/35.31/4	37.46/34.71/7	36.9/32.4/14

Potato (Max/Min/% difference)	9.92/4.40/ 25	12.12/5.2/ 133	9.2/4.04/ 128	7.33/4.13/ 77
Onion (Max/Min/% difference)	48.16/11.22/ 329	28.57/6.62/ 331	19.16/8.7/ 120	23.25/8.49/ 174
Garlic (Max/Min/% difference)	53.11/25.76/ 106	42.72/23.07/ 85	27.5/19.72/ 39	40.14/22.7/ 77
Tomato (Max/Min/% difference)				40/2/ 2000

Source: Ministry of Agriculture, Hand Book of Agricultural Statistics, May 2003. Tables 8.04, 8.04a, 8.04b and 8.04c and data collected during field mission.

Annex 9. The Imbalance in the Use of Nitrogenous, Phosphatic and Potashic Fertilizers in Bangladesh

Crops (HYV) Kg/ha	Recommended ¹			Actual ²			Gap (%) ³		
	Urea	TSP ⁴	MP	Urea	TSP ⁴	MP	Urea	TSP	MP
T.Aus	141	101	69	135	28	17	4.26	72.27	75.36
T.Aman	166	101	69	135	30	24	18.67	70.29	65.21
Boro	269	131	121	192	47	37	28.62	64.12	69.42

Note: ¹Recommended dose varies with crops, land types, seasons and soil nutrient status. This average recommended dose for rice was reported in *Adhunik Dhaner Chash*, 1999, Bangladesh Rice Research Institute.

²Actual levels of use are developed from data reported in the 1995/96 Agricultural Census.

³Gap = (Recommended - Actual)/Recommended x 100.

⁴TSP includes equivalent quantities of SSP and DAP.

Annex 10. Resource Cost Implications of the Recommendations

Recommendation	Capital Cost/Onetime Cost (million Taka)	Additional Annual Recurrent Cost (million Taka)	Remarks
Seed			
1. Seed Corporation	70	-	To be run as a commercial enterprise
2. Seed Certification Agency	10	10	More rearrangement within existing cells. But with additional equipment and staff.
3. Training Program for Seed Producers	10	2	
4. Seed Development Fund	250	-	
Sub total	340	12	
Fertilizer			
1. Increase in Buffer Stock Depot	50	5	10 more depots at Taka 50 per depot.
2. Fertilizer subsidy	-	2,500	On 2.3 million tons of Urea increase price by Taka 200/ton and apply subsidy rate of Taka 4,000/ton on TSP/DAP and MP (e.g., .724 million tons in 2002-2003).
3. Subsidy on public import at times of crisis	50	50	Although provided for, hopefully it

Recommendation	Capital Cost/Onetime Cost (million Taka)	Additional Annual Recurrent Cost (million Taka)	Remarks
4. Monitoring of demand, supply and prices	-	20	would not be recurrent.
7. Review of fertilizer distribution system	-	2	
Sub total	100	2,577	
Land development			
1. Soil testing	20	10	
2. Land records/registration	-	-	Perhaps other on going steps are looking into it.
Sub total	20	10	
Water development			
1. Use of force mode pumps	2,500		Time bound subsidy for 500,000 pumps at Taka 5,000 each
2. Transformation of Irrigation Wing of BADC	50	10	
3. Electrification of pumps	1,400	-	0.4 million well at 3,500 each
4. On-farm water management to increase supplemental irrigation and dry and wet type irrigation	-	20	
5. Surface water development	2,500	25	Project oriented development at Taka 500 million/year for 5 years.
6. Drip/Sprinkler Irrigation	50	5	Pilot experiment
7. Development of LPG/CNG machines	50	5	
Sub total	50 6,550	40	
Mechanization			
1. Advisory Committee	-	0.5	
2. Training		20	
3. Regional network		0.25	
4. Agriculture Machine Center	50	10	
Sub total	50	30.75	
Marketing and credit			
1. Permanent Committee to guide commercialization	-	20	
2. National Center for Agrimarket Research and Intelligence and strengthening AM	150	30	
4. Wholesale and growers' market	920	-	In each Upazilla one growers' market and one wholesale market at Taka 1 million each

Recommendation	Capital Cost/Onetime Cost (million Taka)	Additional Annual Recurrent Cost (million Taka)	Remarks
6. Comprehensive marketing policy	10	-	Cost of 30 km in each Upazilla at Taka 50,000/km. Credit fund as well as initial cost.
7. Agribusiness development fund	500	-	
8. Market feeder roads	696	-	
9. Credit seed capital	5,000		
Sub total	7,276	50	
Research and Extension			
1. Agricultural Research Development Fund	1,000	200	Fund to be periodically augmented by Government and other sources.
3. Research –Extension-Farmer linkage	500	200	100 satellite stations at Taka 5 million capital and Taka 0.2 million recurrent annual cost
4. Advisory Committee	50	30	
5. Biotechnology	100	50	
7. Information management	200	50	
8. Agricultural Service Center	1,820	182	464 ASCs at Taka 5 million each less cost of research-extension-farmer linkage satellite
Sub total	3,670	712	
Total	18,006	2,809.75	