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AGRICULTURE SECTOR ANALYSIS

Final Report

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ACRONYMS

ADB	Asian Development Bank
ADP	Annual Development Plan
AMD	Agricultural Marketing Division
ASR	Agricultural Sector Review
AUS	Australia
BADC	Bangladesh Agricultural Development Corp.
BARC	Bangladesh Agriculture Research Council
BARD	Bangladesh Academy for Rural Development
BARI	Bangladesh Agricultural Research Institute
BAU	Bangladesh Agricultural University
BB	Bangladesh Bank
BBS	Bangladesh Bureau of Statistics
BCIC	Bangladesh Chemical Industries Corp.
BDECO	Bangladesh Diesel Engine Company
BDG	Bangladesh Government
BEERI	Bangladesh Educ., Exten., and Res. Institute
BFDC	Bangladesh Fisheries Development Corp.
BFIDC	Bangladesh Forest Industries Dev. Corp.
BFRI	Bangladesh Forest Research Institute
BIDS	Bangladesh Institute for Development Studies
BINA	Bangladesh Institute for Nuclear Agriculture
BIWTA	Bangladesh Inland Water Transport Authority
BIWTC	Bangladesh Inland Water Transport Corporation
BJEC	Bangladesh Jute Export Corporation
BJC	Bangladesh Jute Corporation
BJMC	Bangladesh Jute Mills Corporation
BJRI	Bangladesh Jute Research Institute
BJPUSF	Bangladesh Jatiya Palli Unnayan Samabaya Fed. (Bangladesh National Rural Dev. Co-op. Fed.)
BJSP	Bangladesh Jatiya Samabaya Parishad (Bangladesh National Co-operative Council)
BJSU	Bangladesh Jatiya Samabaya Union (Bangladesh National Co-operative Union)
BLRI	Bangladesh Livestock Research Institute
BKB	Bangladesh Krishi Bank (Agriculture Bank)
BRAC	Bangladesh Rural Advancement Committee
BRDB	Bangladesh Rural Development Board
BRRRI	Bangladesh Rice Research Institute
BRTC	Bangladesh Road Transport Corporation
BS	Block Supervisor

BSB	Bangladesh Shilpa Bank
BSB	Bangladesh Sericulture Board
BSBL	Bangladesh Samabaya Bank Limited
BSCIC	Bangladesh Small and Cottage Ind. Corp.
BSFIC	Bangladesh Sugar and Food Ind. Corp.
BSMC	Bangladesh Sugar Mills Corp.
BSS	Bittaheen Samabaya Samity (Mens' Landless Co-operative)
BTB	Bangladesh Tobacco Board
BTB	Bangladesh Tea Board
BTRI	Bangladesh Tea Research Institute
BWDB	Bangladesh Water Development Board
CDB	Cotton Development Board
CHTDB	Chittagong Hill Tracts Dev. Board
CIDA	Canadian International Dev. Agency
CIP	International Potato Centre
CSD	Central Supply Depot
CY	Calendar Year
DAE	Department of Agr. Exten.
DAEM	Direct. of Agr. Exten. and Mangmt.
DANIDA	Danish International Dev. Agency
DLS	Department of Livestock Serv.
DOF	Department of Fisheries
DOFy	Department of Forestry
DTW	Deep Tubewell
DWA	Department of Women Affairs
EEC	European Economic Community
EP	Essential Priority
ERP	Effective Rate of Protection
ESCAP	Econ. and Soc. Comm. for Asia and the Pacific
FAO	Food and Agricultural Organization
FBS	Female Block Supervisor
FCD	Flood Control and Drainage
FCDI	Flood Control, Drainage and Irrigation
FF	Ford Foundation
FFW	Food for Work
FR	France
FRG	Federal Republic of Germany
FRI	Fisheries Research Institute
FTR	Fisheries Technological Res.

FY	Fiscal Year
GB	Grameen Bank
GDI	Gross Domestic Investment
GDP	Gross Domestic Product
GNP	Gross National Product
GOB	Government of Bangladesh
GTI	Graduate Training Institute
HH	Households
HSC	Higher Secondary Certificate
HYV	High Yielding Variety
IBA	Institute of Business Administration
IBRD	International Bank for Recons. and Dev.
ICOR	Incremental Capital Output Ratio
IDA	International Development Agency
IFAD	Int. Fund for Agricultural Dev.
IFDC	Int. Fertilizer Dev. Corporation
ILO	International Labour Organization
IMF	International Monetary Fund
IMP	Irrigation Management Programme
IOF	Institute of Forestry
IRDP	Integrated Rural Dev. Prog.
IRR	Internal Rate of Return
IRRI	Int. Rice Research Institute
IPSA	Inst. of Postgraduate Studies in Agr.
ISDB	Islamic Development Bank
IV	Improved Variety
IVA	International Value Added
JICA	Japanese Int. Co-operative Agency
KSS	Krishak/Krishi Samabaya Samity (Farmers Co-operative Society)
LCG	Local Consultative Group
LDC	Less Developed Country
LIV	Local Improved Variety
LLP	Low Lift Pump
LRI	Livestoc Research Institute
LSD	Local Supply Depot

LVSD	Livestock and Veterinary Sc. Dep.
MBBS	Mahila Bittaheen Samabaya Samity (Womens' Landless Co-operative)
MLGRD	Ministry of Local Govern. and Rural Dev.
MOA	Ministry of Agriculture
MOE	Ministry of Education
MOF	Ministry of Food
MOFL	Ministry of Fisheries and Livestock
MOJ	Ministry of Jute
MP	Muriate of Potash
MPO	Master Plan Organization
MORA	Ministry of Religious Affairs
MR	Modified Rationing
MS	Mosque Society
MT	Metric Ton
MV	Modern Variety
NARS	National Agr. Research System
NCB	Nationalised Commercial Banks
NES	National Extension Service
NETH	Netherlands
NGO	Non-Government Organization
NMS	New Marketing System
NORAD	Norwegian Agency for Dev. Co-op.
NWP	National Water Plan
OECD	Org. for Econ. Co-op and Dev.
O&M	Operation & Maintenance
ODA	Overseas Development Authority
OMS	Open Market System
PC	Planning Commission
PFDS	Public Food Distribution System
PKC	Patuakhali Krishi College
PPP	Project Plan Proposal
PPW	Plant Protection Wing
RCS	Registrar of Co-op. Societies
RDA	Rural Development Academy
RDO	Rural Development Officer
RDRS	Rangpur Dinajpur Rural Service
RESP	Rural Employment Sector Prog.

RPP	Rural Poor Program
RU	Rajshahi University
SACP	Special Agr. Credit Prog.
SFYP	Second Five Year Plan
SDC	Swiss Development Co-operation
SDF	Saudi Development Fund
SFD	Saudi Fund for Development
SR	Statutory Rationing
SRI	Sugar Research Institute
SRTI	Sugarcane Res. and Training Inst.
STW	Shallow Tubewell
TB	Tea Board
TFYP	Third Five Year Plan
TIP	Thana Irrigation Project
TPI	Tropical Products Institute
TRI	Tea Research Institute
TSP	Triple Super Phosphate
UCCA	Upazila Central Co-op. Assoc.
UCRC	Upazila Employment Resource Center
UFFL	Urea Fertilizer Factory Ltd.
UN	United Nations
UNCDF	United Nations Capital Dev. Fund
UNDP	United Nations Dev. Prog.
USA	United States of America
USAID	United States Agency For Int. Dev.
VGD	Vulnerable Group Development
VGF	Vulnerable Group Feeding
WB	World Bank
WDB	Water Development Board
WES	Wage Earners Scheme
WFP	World Food Programme

EXECUTIVE SUMMARY

1. The Agriculture Sector Analysis(ASA) is one of the resources USAID/D will use in developing its Country Development Strategy Statement for 1990-95. However, the ASA looks well-beyond 1995 in its analysis.
2. A growth paradigm has been developed which has as its components agricultural production, employment, income(demand), poverty alleviation and benefit distribution.
3. The growth of food output has lagged behind population growth during the past three decades. If current trends continue, the gap between food requirement and production will widen dramatically.
4. The rural labor force is predominantly agricultural, and suffers from high under-employment due to seasonality of agricultural activities. The total labor force is expected to grow at a fast rate, and there will be about 19 million net new entrants to the labor force between 1990-2005. For the foreseeable future, accelerated growth in agricultural production will be by far the most important single contributor to employment generation in the Bangladesh economy.
5. With GNP per capita around \$160, Bangladesh is among the five lowest income countries in the world. The distribution of income is also somewhat unequal. The present level of low income, hence purchasing power, may not be able to sustain the required food production momentum.
6. Pervasive poverty and malnutrition are serious problems in the country. Without an efficient distributive policy, greater food production by itself is unlikely to solve hunger problems. Although the country's poverty situation remains serious, recent evidence suggests that some poverty alleviation has taken place during the last few years.
7. The performance of foodgrain subsector, mostly rice, is the primary determinant of the growth in agriculture, and to a large extent the growth of the economy. Foodgrains, account for nearly 80% of labor force requirement in the crop sub-sector, 40% of average household expenditure, 80% of total calorie intake, and about 75% of protein intake. Foodgrain production is also a major determinant of employment and the level of nutrition.

8. Expansion of irrigated area is a precondition for increased crop production. An irrigation-induced technological change (IITC) in foodgrain production, complemented by a price support and stabilization policy, is recommended as the foodgrain production strategy for Bangladesh. The effects of the IITC are measured using a mathematical model. The results, based on a "realistic" irrigation development scenario, indicate that even if the projected foodgrain production can be achieved through the IITC, Bangladesh will still need to import about 2.4 million tons of foodgrains in FY 2005 to meet the 16 ounce per capita per day consumption target. However, if the past foodgrain production trend continues (i.e., if the IITC is not implemented), then the country will need to import about 6.5 million tons of foodgrains in FY 2005.

9. Increased crop production due to IITC will generate about 230 million workdays of additional employment during the FY87-FY95 period. In addition, approximately 58 million workdays will be generated from rice milling. In total, the increased production and rice milling will absorb about 20% of the increase in rural labor force during the period. Additional employment will be created through marketing and distribution of foodgrains and inputs.

10. Due to IITC in foodgrain production, per capita real income will increase by about 12% during FY87-FY95. The total benefits of the IITC will be about 12 billion Taka over the same period. Of this amount, 81% will go to consumers and 19% to producers.

11. The IITC will result in a substantial improvement in the poverty situation and in nutritional status. The proportion of the rural population below the poverty line would decline from 52% in FY86 to 37% in FY95. On the average, the level of calorie intake would increase by 16%.

12. The total investment requirement for irrigation alone during the MPO plan period FY90-FY2005 is about 115 billion Taka (at 1987 prices), or U.S.\$3.8 billion.

13. The Government of Bangladesh will complete its Third Five Year Plan (TFYP) in mid-1990. The Fourth Five Year Plan (FFYP) is being prepared but no information has been released. Indications are, however, that the direction of the FFYP will be the same as the TFYP.

14. The major components of the TFYP were:

- Self-sufficiency in food cereals by 1989/90
- Expansion of employment opportunities
- Land resources conservation
- Stabilization of agricultural output
- Broadening the genetic base of HYVs

15. The TFYP fell well short of its production and employment goals. In fact, the foodgrain gap between production and requirements increased from 1.2 mil.mt in 1985 to 2.5 mil.mt in 1988 and appears to be widening. The gaps for oilseeds, pulses and potatoes also widened considerably during this period. The BDG's policy regarding expansion of small scale irrigation was partly responsible for the gap in foodgrain production.

16. USAID's current Development Assistance (DA) programs are directed at increasing rural agricultural productivity, expanding rural employment, and human resource development. Approximately \$20 million are available annually for DA-assisted projects. However, DA funds are mortgaged until the mid-90s. Any new projects will have to be programmed after that time, or existing projects reprogrammed or terminated early.

17. USAID's PL480 programs provide assistance, primarily in food aid, but development activities are an integral part of these programs. Title II food aid is used in Food for Work projects, mainly rural roads, bridges and culverts. About \$15 million are available annually under this program. Funds received from the sale of foods and commodities imported under the Title III program are used for a number of development activities, including flood control, drainage and irrigation (38% of current funding); roads and bridges (18%); research and extension (15%); rural electrification (10%); pump irrigation (8%); and other activities (11%). Most of the Title III current activities are collaborative projects with other donors. About \$60 million in local currency are available annually from Title III food sales.

18. USAID's FY89 Action Plan focuses on food security through increasing production, more appropriate pricing, and more equitable distribution. The Plan calls for increased yields and cropping intensity, greater crop diversification, efficient distribution of fertilizers; a functional sustainable research system, elimination of subsidies except for the very needy, and foodgrain price stability.

19. Donors, including USAID, provide approximately \$2.0 billion annually in food aid, commodities, and development assistance. The latter accounts for about \$1.1 billion of the total. Development assistance provides almost 80% of the funds for projects in the agriculture sector, 90% for projects in water resources, and 92% for rural development projects. As of FY88, there was a pipeline of \$4.7 billion in donor-aid funds. This figure does not include commodities and food aid which normally clear very quickly. Discussions are underway on ways to accelerate project implementation.

20. The team addressed a number of constraints which it felt were amenable to solution, providing enough resources were applied. The team recommended six priority areas for USAID's consideration. These are:

- Expand irrigated areas, improve irrigation water management techniques, and develop a service support capability for irrigation.

- Improve technology/technology transfer (an expansion of ARPII)

- Increase infrastructure development.

- Human resource development-Higher Education

- Privatization of seed importation, production and distribution

- Full privatization of fertilizer distribution and conversion of the TSP plant into a privately operated blending/mixing plant.

21. A number of other constraints and means of removing them are contained in the Annexes to this report.

I. INTRODUCTION

1.0 USAID is in the process of preparing its Country Development Strategy Statement (CDSS) for the period 1990-1995. This is an important document since it provides the guidelines for USAID's future assistance to Bangladesh. Several teams will be involved in providing background information for the CDSS, including the Agriculture Sector Analysis team which has developed a growth paradigm for the agriculture sector. The paradigm involves identifying the gaps between the existing situation and the potential, looking at feasible ways these constraints might be overcome and developing strategies and programs for USAID to consider. It is recognized that USAID is only one donor among many and, in the agricultural sector, a relatively small one. Consequently, it is important that the programs USAID undertakes have a maximum effect on that particular sub-sector. The analysis that follows attempts to provide the focus USAID needs in developing its strategies and programs for agriculture.

1.1 The main body of this report relies heavily on the major inputs into the ASA- economic analysis, food production, institutional analysis, agribusiness analysis and policy considerations. These are included as annexes to this report and should be referred to for a fuller understanding of the many constraints facing the agriculture sector and the suggested means for overcoming them.

II. GENERALIZED DESCRIPTION OF A PARADIGM 1/

2.0 All countries at one time in their history began as agrarian societies. Some, like Thailand, have grown into dynamic open economies through a progressive program of macro-economic policy, market and trade liberalization, and judicious investment. Others, like India, have relied on government control of markets, maintenance of trade barriers and industrial-led investment policies. Growth has occurred, but has led to the formation of a bi-modal economy, able to produce sophisticated jet fighters and space satellites, yet unable to solve nutritional problems of the landless poor. Others, like Bangladesh are just beginning on the road to growth and structural adjustment.

2.1 These nations differ with respect to cultural, political and economic endowments, yet share a common growth path. All have realized that food availability is critical to political stability, and that failure to provide adequate supplies of basic cereals, which comprise up to 40 to 50 percent of the average citizen's diet, at prices perceived as fair by both producers and consumers, have resulted in serious social disruption.

1/ Excerpted from Martin Hanratty. A Food and Natural Resources Growth Paradigm for Bangladesh. Off. of Tech. Res., Bur. for Asia and the N.E., U.S. Agency for Int. Dev., Washington, D.C., March 17, 1989. Dr. Hanratty worked with the ASA team and prepared this paper while on a two week assignment to Bangladesh in March, 1989.

2.2 The growth process begins with the introduction of new, higher yielding varieties, combined with improvements in rural infrastructure--notably irrigation and roads-- and favorable government price and input policies. In numerous countries throughout the world, these interventions have led to increases in per hectare yields, increased agricultural-based employment and rising per capita incomes. Surpluses generated in agriculture typically have found their way into other sectors through lower food prices, and consequently urban wages, and increases in the demand for manufactured goods and services which further increases incomes.

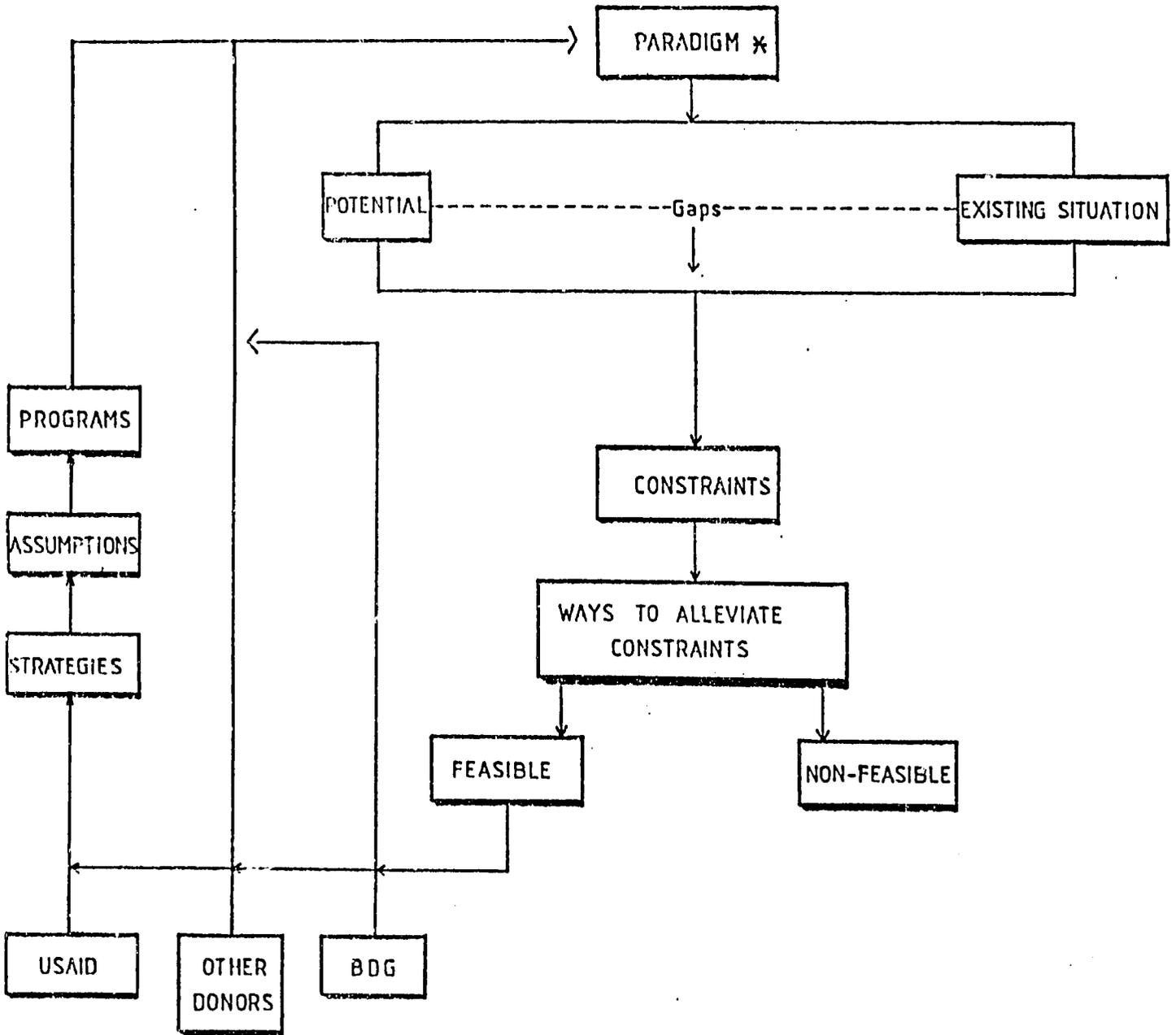
2.3 As agricultural growth continues, yield increases begin to slow and the demand for agricultural labor declines. New entrants into the rural labor force, who are often better educated, tend to look to the industrial and service sectors for employment. Expansion in these sectors caused by growing domestic demand for non-agricultural goods and services lead to increased employment in these sectors, and to declines, first in the rate of growth in the agricultural labor force and then in its relative size, and a decline in the proportion of net national income generated by agricultural sector activities. Increases in rural and urban incomes, which continue to be supported by falling real cereal prices and increased income, lead to shifts in consumer demand away from basic cereals toward increased consumption of high quality protein foods, such as meat, poultry, fish and dairy products and greater dietary reliance on processed rather than bulk agricultural products. During this process the source of growth in agricultural employment shifts from field production to processing, marketing and transportation, initially to meet high value foreign demand and later to service rapidly expanding domestic markets.

2.4 In the initial phases of growth, a country's economy is characterized by incomes below \$250 per person, sluggish growth in Gross Domestic Product, and a heavy reliance on agricultural production as the major source of income growth. At this phase, agriculture usually contributes over 50 percent of GDP, industry between 10 and 20 percent, and the service sector the remainder. Although agriculture is important, productivity remains low and production, the major determinant in national income, employment and nutrition, is barely able to keep pace with population growth, and calorie consumption remains significantly below recommended levels. Reliable access to fertilizer and irrigation water, both essential to improved agricultural productivity, remain limited. The sector continues to absorb labor, but at a rate below the rate of growth in the rural labor supply, and under and unemployment pose serious problems. At this point in a nation's development, solving the food grains productivity problem is of vital concern.

2.5 Unless constraints to increased productivity can be overcome, employment growth will be limited, consumption of higher value agricultural and non-agricultural goods and services will be below required levels and the transfer of excess resources from the agricultural to the industrial and service sectors will not occur.

2.6 The basic components of the paradigm used in this analysis are production, employment, income(demand), poverty alleviation, and benefit distribution(equity) (Fig. 1). The analysis begins with a determination of the actual situation of the components in the paradigm. An analysis is then made of the potential and the gap between the two determined. The question then become, what are the major constraints preventing the agriculture sector from reaching its full potential? These constraints are analyzed, along with an analysis of how the constraints might be removed or alleviated. Those that can be alleviated are further analyzed to determine which of them could be best handled by the BDG, USAID, and other donors, or a combination of the three. In all cases, the BDG will be the sole actor or a partner with USAID and/or other donors in any intervention to improve the components of the paradigm.

2.7 The team has proposed a limited number of interventions that USAID might make during the upcoming CDSS period(See Section VII). This does not mean that other constraints are not important. It is a recognition that USAID cannot do everything and must target its efforts on those interventions where it can make the largest impact on the components of the paradigm with the resources it has to carry them out.



- * Components of Paradigm:
- Production
 - Employment
 - Income (Demand)
 - Poverty Alleviation
 - Benefit distribution

FIGURE 1. PARADIGM FOR AGRICULTURE SECTOR DEVELOPMENT

III. GAP ANALYSIS

Existing Situation

A. Food Demand and Production

3.1 The rate of increase in demand for food can be expressed as a linear function of the rate of growth of population and the rate of growth of per capita real income:

$$D = P_0 + \gamma_0 (Y_0)$$

where D = rate of increase in demand for food per year,
 P_0 = rate of growth of population per year,
 γ_0 = income elasticity of demand for food, and
 Y_0 = rate of increase in per capita real income per year.

Assuming a real GNP growth rate of 4% per year (the average rate achieved over the last five years), and assuming that the income elasticity of demand for food declines as income increases, demand projections are made for foodgrains, oilseeds, pulses, and potatoes through the year 2005.

3.2 The existing food production situation is not satisfactory. The growth of food output has lagged behind population growth during the past three decades. During the 1980's, foodgrain production increased moderately, production of oilseeds remained almost stagnant, while production of pulses declined. If the past production trends continue, then the gap between demand and production will be widened rather sharply (Annex 2A, Figures 3,4,5 and 6).

3.3 The performance of the foodgrain subsector is the primary determinant of the growth in agriculture, and to a large extent the growth of the economy. Crop production, mostly rice, constitutes about two-thirds of total agricultural value added. Foodgrain production accounts for nearly 80% of labor force requirements in the crop sector. Foodgrains account for about 40% of average household expenditure, 80% of total calorie intake, and about 75% of protein intake. Thus, foodgrain production is a major determinant of the level of nutrition.

B. Employment

3.4 Over the last few decades, the economy experienced only modest growth in output but a rapid increase in population and labor force. The rural work force is predominantly agricultural, and suffers from low productivity and high under-employment due to seasonality of agricultural activities. Even in large landowning households, family workers may remain unemployed during slack seasons of the year. However, since the poor cannot afford to remain unemployed, the unemployed rate is rather low. The trends in labor force and employment are shown in Table 1.

Table 1. Trends in Labor Force and Employment
(Millions)

	Census 1961	Census 1974	Census 1984	Labor Force Survey 1983/84	Labor Force Survey 1984/85
Total Labor Force	16.9	21.9	25.9	28.5	29.5
Male	16.1	21.0	24.4	26.0	26.8
Female	0.8	0.9	1.5	2.5	2.7
Rural	15.9	19.8	22.6	24.6	25.4
Urban	1.0	2.1	3.3	3.9	4.1
Employed Population	16.8	31.4	25.3	28.0	29.0
Unemployed Rate (%)	0.4	2.3	2.3	1.8	1.7
Employment in Agriculture	14.2	16.8	15.4	16.4	16.7
Percent Agr. of Total	84.5	78.5	60.1	58.6	57.6

Source: Report on Labor Force Survey: 1984-85, Bangladesh Bureau of Statistics, 1988.

3.5 Agriculture accounted for 47% of GDP and 58% of total employment in FY 85. Foodgrain production accounts for nearly 80% of labor force requirements in the crop sector which, in turn, accounts for two-thirds of employment in agriculture. Accordingly, for the foreseeable future, accelerated growth in agricultural, particularly foodgrain production, will provide the single most important contribution towards generating employment and income. Therefore, the strategy should be to broaden the modern technological base -- an increase in irrigation coverage, expanded cultivation of HYVs of foodgrains, and appropriate policy measures relating to supply of inputs and marketing facilities. As the irrigation - based technology is more labor intensive than the traditional techniques, a large increase in employment is expected to result from the increase in output.

C. Income

3.6 With GNP per capita around \$160, Bangladesh is among the five lowest income countries in the world.

3.7 The distribution of income in Bangladesh is somewhat unequal. In FY 86, the bottom 40% of the households received about 19% of the total income while the top 10% received about 31%. The Gini concentration ratio is estimated at 0.37. The Gini index is the most widely used summary measure of income inequality, which assumes a value between 0 and 1. The more equal the income distribution, the smaller the Gini index.

3.8 Agricultural income is highly unequally distributed; the Gini concentration ratio is estimated at 0.62. This is related mostly to unequal distribution of land ownership, since land is the most important asset determining agricultural income.^{1/}

3.9 A significant increase in food production will require expansion of effective demand to support it. The present level of low income, hence low purchasing power of the bulk of the population, may not be able to sustain the production momentum. Thus, a self-sustaining growth in food production will require income generation and improved income distribution, primarily through efficient employment creation.

D. Poverty and Nutrition

3.10 Pervasive poverty and malnutrition are fundamental and serious problems in the country. Due to inadequate purchasing power of large segments of the population, consumption levels are very low, and their intake of calories falls short of the minimum nutritional requirement.

3.11 Hunger is not primarily a food production problem, but it is mainly a problem of poverty and of access to food supply. Without an efficient distributive policy (i.e., an improved income distribution and/or targeted food distribution), greater food production is, by itself, unlikely to fully solve hunger problems.

3.12 Although the country's poverty situation remains overwhelming, recent evidence suggests that a considerable poverty alleviation has taken place (for methodology and a detail discussion of results, please see Annex 2B). Between FY 82 and FY 86 the proportion of the rural population below the poverty line declined from 72% to 52%. Such a large reduction in rural poverty in the four-year period may be questionable, despite the fact that there have been improvements in some of the poverty indicators. There has been a significant (35%) increase in real wage in agriculture, which constitutes a major portion of income of the rural poor. Moreover, real wage in the small scale rural industry increased by 43% over the period. A World Bank study reports an increase in food availability to the rural poor during the period through substantial progress in the Food-for-Work and the Vulnerable Group Feeding programs.^{2/} In urban areas, however, the

^{1/} Hossain, M., *Nature and Impact of the Green Revolution in Bangladesh*. IFPRI/BIDS, Washington, D.C., 1988.

^{2/} World Bank, *Bangladesh: Promoting Higher Growth and Human Development*. Washington, D.C., 1987.

percentage of poor population registered a slight increase -- from 65% of urban population below the poverty line in FY 82 to 67% in FY 86. Table 2 presents a comparison of calorie intake between rural and urban areas as well as between the period FY 82 and FY 86.

Table 2 A Comparison of Calorie Intake

Percentile of Population (Ranked from Poor to Rich)	Estimated Calorie Consumption as Percent of Minimum Requirement <u>a/</u>			
	FY 82		FY 86	
	Rural	Urban	Rural	Urban
5	48	71	60	70
10	58	76	69	75
20	69	81	82	81
30	76	86	89	86
40	82	89	94	90
50	88	93	99	94
60	95	97	104	98
70	99	102	110	101
80	104	107	119	107
90	114	114	124	111
95	121	117	132	113

Source: Annex 2B, Table 4.

a/ Estimated implicit calorie consumption based on the concept of ability to consume. See Annex 2B for details.

FOODGRAIN PRODUCTION POTENTIALS

3.13 The recent BDG strategy for attaining foodgrain self-sufficiency by the end of the century is as follows:

"Further rapid expansion of rice area (particularly for irrigated Boro) is neither feasible nor desirable, because most of the irrigated land suitable for Boro has already been covered and because expansion of rice coverage would adversely affect the production of other crops. Increased foodgrain production must be attained through;

shifting of land from growing local to HYV rice;

increasing intensity of land use;

increasing yield per unit of land through the increased application of improved inputs; and

improving farm management practices."^{1/}

3.14 The above strategy is not realistic. According to the recent (1988) UNDP/FAO Land Suitability Assessment, and the Master Plan Organization (MPO) reports^{2/}, irrigated Boro rice area can be increased to 6.9 million hectares, of which only 1.9 million hectares (or 28% of potential) is currently achieved. On the other hand, the potential HYV Aman area is limited. Considering the flood depth and land suitability data provided in the MPO report it is estimated that only 2.68 million hectares can be brought under HYV Aman rice without flood control and drainage (FCD) measures. Of this potential area, about 1.5 million hectares require supplemental irrigation for HYV cultivation. However, with FCD, an additional 1.82 million hectares can be brought under HYV Aman rice. Thus, the potential HYV Aman area is about 4.5 million hectares of which only about 26% can be utilized without supplemental irrigation and FCD. In FY 87, HYV Aman area was 1.25 million hectares, with 190 thousand hectares covered by supplemental irrigation.

^{1/} Planning Commission, Bangladesh Agriculture: The Implication of Attempting to Achieve Foodgrain Self-sufficiency by the End of the Century . (Draft). June, 1988.

^{2/} UNDP/FAO, Land Resources Appraisal of Bangladesh for Agricultural Development: Land Suitability Assessment. Tech. Rpt. 6. Rome, 1988.
Master Plan Organization (MPO), National Water Plan. Ministry of Irrigation, Water Development and Flood Control, BDG/UNDP/World Bank, 1986.

3.15 Foodgrain production potentials with maximum available yields with available technology are estimated under three alternative scenarios, and are shown in Figure 2. Technological development through agricultural research can further increase these potentials. The estimates ignore prices, and elasticities of demand and supply, but implications of decreases in competing crops are taken into account, and production of other crops is considered to remain at current levels.

Scenario A: Without any increase in irrigated area from the current level, if farmers use all available HYV technology on all foodgrain crops with optimal levels of input use and management, and if they can achieve the maximum obtainable yields, then production (25.2 million tons) can meet national foodgrain requirements (i.e., 15.5 ounces per capita per day) to the year 1999.

Scenario B: If irrigation is expanded to the limits and all irrigable land is planted to Boro rice (6.9 million hectares), and if the full HYV Aman area can be provided with supplemental irrigation (2.68 million hectares), then foodgrain production (30.8 million tons) can meet requirements to the year 2008.

Scenario C: If currently available HYV technology were applied to all grain crops, the irrigated area were expanded to the limits of water resources, and 50% of all irrigable land is planted to maize and the remaining in Boro rice and wheat, then the agriculture production (37.3 million tons) could meet national foodgrain requirements to the year 2017.

FOODGRAIN PRODUCTION STRATEGY

3.16 Bangladesh enjoys a comparative advantage in production of foodgrains, as suggested by the domestic resource cost (DRC) estimates 1/. Thus, a national goal to increase foodgrain production to meet requirements makes economic sense, and is considered feasible, but obviously calls for a rational production strategy.

3.17 There are two broad sets of policy instruments available to governments for their food and agricultural sector, namely price policies and technology policies. Price policies may include output price support, output price subsidies, input price subsidies, and output price stabilization. Technology oriented policies encompass biochemical (i.e., HYV seed-fertilizer) technology, irrigation and water management,

1/ UNDP, Bangladesh Agriculture Sector Review. **Bangladesh Agriculture: Policies and Performance**. 1989.

and farm power. Bangladesh has a large population, rapid growth in labor force, and limited land base. Therefore, employment-increasing irrigation and biochemical technologies are clearly more appropriate paths of technological change for sustained growth in foodgrain production than labor-saving mechanization. However, anticipating an inadequate supply of draft animals, future growth in foodgrain production may require the use of small power tillers for cultivation. If such a situation occurs, the farmers' adoption of power tillers should be demand-driven. The government policy should be limited to facilitating the private importation and distribution of power tillers.

3.18 A balanced food policy should include both price and technology policies, but there are justifications for giving primacy to an appropriate technology policy. Efficiency-increasing technological change in agriculture allows an increased foodgrain supply at a lower unit cost of production by shifting the production function, without an increase in output price. Thus, incomes of low income people may increase through the employment-augmenting production process without an off-setting effect of rising wage-good price. In contrast, if optimal farm incentives for foodgrain production already exist, government price interventions will result in the loss of economic efficiency. An increase in relative agricultural prices (through price support or input subsidy) increases supply along the production function which is subject to a diminishing return. Such an increase in production is, by definition, at an increasing real cost in resources and shifts the distribution of income against low-income consumers.^{1/}

3.19 However, if farm prices tend to be depressed, particularly at harvest time, an effective price support would help reduce price risks faced by farmers and encourage investment in improved technology. Major factors causing depressed harvest prices would be large foodgrain imports and subsidized foodgrain distribution. In a situation of a depressed harvest price, price support through government acquisition of foodgrain should be made effective to complement technology policies.

3.20 In the case of wide and systematic seasonal price variation, price stabilization would be helpful. Expectation of a stable price level can help farmers in production planning while consumers (including small farmers who are net buyers of foodgrains) could gain from a dampening of price peaks. Achievement of the price stabilization objectives through price support and open market sales to curtail seasonal price swings would require sales at flexible quantities and prices designed to influence market prices in desired directions.

^{1/} Mellor, J.W., *Food Price Policy and Income Distribution in Low Income Countries*. Economic Development and Cultural Change, 27(1), 1978.

3.21 The success of a technology-based foodgrain production strategy critically depends upon adequate and timely supplies of farm inputs, relevant technical advice, and suitable marketing, processing and storage facilities. Moreover, the benefits from price support depend on the ease with which farmers can obtain additional inputs in response to the price incentive. Clearly, adequate and timely supply of inputs is a requisite for deriving benefits from price incentives. To a considerable degree, the weakness in support services reflect simply the excessive reliance on the bureaucracy and the failure to utilize private sector initiatives. The government should move toward much greater reliance on the private sector to relieve such bottlenecks.^{1/}

3.22 With the rapid increase in population, the man/land ratio has increased dramatically in Bangladesh. As land becomes more and more scarce, increased food production to keep pace with growing food requirement can be achieved only through increases in the intensity of cultivation and in productivity per unit of land.

3.23 Among the basic determinants of agricultural productivity, irrigation is crucial. Expansion of irrigation is a precondition for increased crop production. Three factors may be cited as the rationale for this argument. First, irrigation can effectively ease the land constraint by increasing cropping intensity. Second, irrigation, complemented with fertilizer and modern high yielding seed varieties, can significantly raise yields of foodgrains in comparison to rainfed agriculture. Third, supplemental irrigation can take much of the risk out of the two predominantly rainfed rice seasons, Aus and Aman, thereby enhancing the adoption of high yielding varieties in these seasons.

3.24 Bangladesh is blessed with an abundance of water resources. A large volume of surface inflow of water through the major rivers, and the high level of rainfall during the monsoon season bring about a significant water availability. A World Bank study reports that the country has one of the largest and richest aquifers in the world, and only about one fourth of the potential is being tapped ^{2/}. Thus, groundwater development and lift irrigation offer a largely under-exploited resource an opportunity. Moreover, there are still some expansion opportunities for irrigation through surface water sources.

^{1/} World Bank, **Bangladesh: Food Policy Issues**. Report No.2761-BD, 1979.

^{2/} World Bank, **Economic Aspects and Policy Issues in Groundwater Development**. Staff Working Paper No.496. Washington, D.C., 1981

3.25 An irrigation-induced technological change (IITC) in foodgrain production, complemented by a price support and stabilization policy, is recommended as the foodgrain production strategy for Bangladesh. The main thrust will be on rice production, but wheat will play an important role- both domestically produced wheat and imported wheat.

IV. IMPACT ANALYSIS

A. Production and Price

4.1 The effects of an IITC in foodgrain production are measured using a mathematical model that considers the semi-subsistence nature of production (for methodology, please see Annex 2A). FY 87 is used as the base year; hence price and income are at constant FY 87 market prices. Current yield growth rates of rice and wheat are used for the projected foodgrain production. The impact of the IITC on foodgrain production and prices is estimated for the next three Five-Year Plan periods, through FY 2005, based on two scenarios:

- (i) an "optimistic" scenario, using the implementation schedule for irrigation provided in the MPO report*;
- (ii) a "realistic" scenario, assuming slower growth rates in irrigated area**.

4.2 The effects on production and price of foodgrains are summarized in Table 3. It may be mentioned here that the projected foodgrain production would be supported by effective demand, hence production equals consumption. The estimated foodgrain quantities and prices represent market-clearing quantities and prices, resulting from the interactions between supply and demand. Thus, the projected levels of production will be self-sustained, without requiring government interventions such as price support or input subsidy. However, when a gap between production and requirement exists, and if the gap is closed by foodgrain imports, then a price-targeted procurement policy should be followed to offset the adverse effects of imports on domestic production.

* "Optimistic" - because foodgrain production growth was only 1.9% during FY82 to FY88. With the MPO projected level of irrigation, the production growth rate would be 4.1%, between FY87 and FY95, which has not been achieved during the past.

** Growth rate of production between FY87 and FY95 would be 2.7%, which is considered achievable, in the "realistic" scenario. This scenario is based on the MPO irrigation schedule, but moved forward one five-year plan period. MPO data are used because their irrigated area figures are technically derived and include several physical and social factors, and the use of different models.

Table 3. Effects of the Irrigation-Induced Technological Change on Foodgrain Production and Price.

	FY 1987 (Base)	FY 1995	FY 2000	FY 2005
<u>"Optimistic" irrigation development scenario:</u>				
Irrigated area (million ha)	2.2	4.2	5.0	5.4
Foodgrain production (million tons)	16.5	22.8	26.6	28.9
Foodgrain price (Taka/Kg, at FY 87 prices) <u>a/</u>	11.09	9.26	10.12	11.95
<u>"Realistic" irrigation development scenario b/</u>				
Irrigated area (million ha)	2.2	3.3	4.2	5.0
Foodgrain production (million tons)	16.5	20.4	24.3	27.8
Foodgrain price Tk/Kg	11.09	11.07	11.60	11.71

a/ Foodgrain price represents the weighted average retail price of rice and wheat.

b/ In FY 2000 and FY 2005 under the "realistic" scenario, higher levels of production would be achieved from the same levels of irrigated area in FY 1995 and FY 2000, respectively, under the optimistic scenario, because the shifts in effective demand would be larger primarily due to higher levels of population.

4.3 The projections of foodgrain production resulting from the above two scenarios are compared with the "past trend" production growth scenario (i.e., if the IITC is not implemented), and are presented in Table 4. Figure 2 illustrates the gaps between foodgrain requirements and availability based on the "past trend" and "realistic" scenarios, and also incorporates the estimates of foodgrain potentials from three scenarios discussed in the preceding section.

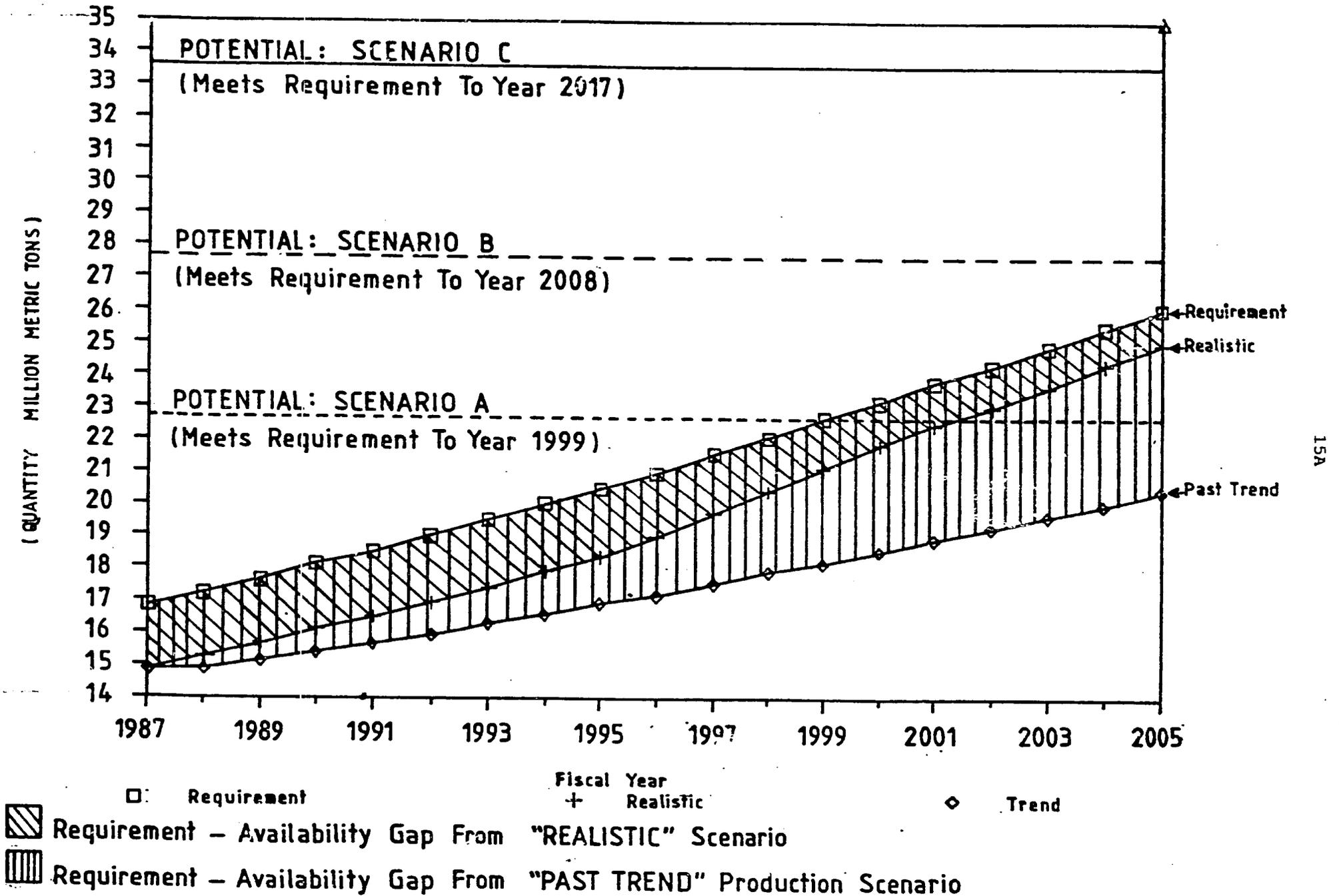
Table 4. Projections of Foodgrain Production Under Alternative Scenarios (in million metric tons)

	FY 1995	FY 2000	FY 2005
Requirement <u>a/</u>	20.5	23.2	26.1
<u>"Past trend" production growth scenario:</u>			
Production	18.8	20.6	22.7
Availability <u>b/</u>	16.9	18.5	20.4
Shortfall	3.6	4.7	5.7
<u>"Optimistic" irrigation development scenario:</u>			
Production	22.8	26.6	28.9
Availability	20.5	23.9	26.0
Shortfall	0.0	-0.7	0.1
<u>"Realistic" irrigation development scenario:</u>			
Production	20.4	24.3	27.8
Availability	18.4	21.9	25.0
Shortfall	2.1	1.3	1.1

a/ Foodgrain requirement is estimated on the basis of 15.5 ounces per capita per day actual availability for consumption in FY87, as reported in a recent World Bank report, **Bangladesh: Adjustment in the Eighties and Short-Term Prospects**.

b/ Domestic production minus 10% for seed, feed and waste.

Figure 2. FOODGRAIN PRODUCTION GAP



4.4 The effects of IITC on employment, income and its distribution, poverty and nutrition are measured for the end of the Fourth Five Year Plan (i.e. FY 95), based on the "realistic" irrigation development scenario, are shown below.

B. Employment

4.5 Increased cropping intensity and agricultural productivity through irrigation and biochemical technology will directly create employment for a large segment of the rural population, and the landless labor class will have the major share of the incremental employment. Moreover, secondary employment opportunities generated by activities such as grain processing, marketing of inputs and produce, transportation and services resulting from increased food production would be substantial.

4.6 According to a World Bank report, the growth of the labor force in Bangladesh over the next two decades will depend primarily on the size and age structure of the population and on labor force participation rates. Due to rapid past population increases, Bangladesh's population is very young and additions to the labor force will therefore be very large well into the next century, even if population control measures are successful. As certain indicators suggests, future female participation rates in the labor force can be expected to increase. However, the share of rural labor force in the total labor force is expected to decline. Labor force projections are presented in Table 5.

Table 5. Labor Force Projections (Millions)

	1985	1990	1995	2000	2005
Population <u>a/</u>	99.19	112.74	127.92	144.73	162.66
Total Labor Force <u>b/</u>	27.77	31.99	37.20	43.37	50.91
Male	26.19	29.90	34.15	38.80	44.04
Female	1.58	2.09	3.04	4.57	6.87
Rural labor force <u>c/</u>	24.66	27.83	31.77	34.61	38.18
Male	21.31	23.21	25.51	26.27	27.07
Female	3.35	4.62	6.26	8.34	11.11
Total Labor Force/ Population (%)	28.0	28.4	29.1	30.0	31.3
Rural Labor Force as % of Total	88.8	87.0	85.4	79.8	75.0

a/ Population projection figures obtained from the Office of Population & Health, USAID/Dhaka, are based on the assumption of "slow increase in CPR".

b/ Total labor force projections are based on the Master Plan Organization (MPO) estimates, adjusted for the USAID population projection figures.

c/ Rural labor force projections are based on World Bank estimates, adjusted for total labor force projections as estimated above.

4.7 From an IFDC study, labor coefficients for foodgrains can be estimated 1/. Based on these labor coefficients, it is possible to estimate rough orders of magnitude of labor absorption corresponding to the actual cropping patterns for FY87, and to those expected for FY95. If 3.3 million hectares of land are brought under irrigation in FY95, with area under jute and minor crops remaining at the FY87 level, labor required in crop production will be 231 million workdays more than FY87. Secondary employment effects, however, are not included in this estimate. During the same time the rural labor force will have increased by nearly 1.5 billion workdays.

4.8 After crop production, post harvest activities are the biggest source of rural employment. Crop processing provides a valuable source of employment and income for the landless and marginal farmers' families; it is also one of the major opportunities for productive employment open to rural women. It is estimated that labor requirements in rice processing are at least 25% of those in rice production.2/ Thus, in FY 95, the volume of additional employment generated in processing rice would be 58 million workdays. In total, increased foodgrain production would absorb about 20% of the increase in rural labor force during the period FY87-FY95. Additional employment would be created in marketing and distribution of both inputs and production.

4.9 Expansion of the area under irrigation and HYVs involves a switch of activity into relatively slack periods. The projected expansion of irrigation and the resultant change in cropping pattern cannot be expected to remove entirely the seasonality of the demand for crop labor. It will, nevertheless, help reduce under-employment during some parts of the year.

4.10 The above estimate indicates that opportunities for expansion of employment in the crop sector is limited in the face of the high rate of growth of the labor force. The solution to the unemployment - and underemployment problem will therefore have to be sought in non-agricultural activities in both rural and urban areas.

C. Income

4.11 The results of the analysis indicate that, due to IITC in foodgrain production, per capita real income will increase by 12%, from Taka 5,012 in FY87 to Taka 5,613 in FY95.

1/ Sidhu, S.S. et. al. Agricultural Production, Fertilizer Use and Equity Considerations: Results and Analysis of Farm Survey Data 1980-82, IFDC, Alabama, 1984.

2/ Greeley, M., Rural Technology, Rural Institutions and Rural Poorest: The Case of Rice Processing in Bangladesh. IARI, New Delhi, 1981.

4.12 The total benefits of the IITC are worth about 12 billion taka over the period FY87 to FY95. Of this amount, 81% goes to consumers as an increase in consumers' surplus, and 19% goes to producers as an increase in producers' cash income (i.e., producers' surplus). Producers' cash income increases by 2.3 billion taka. This increase in income would be above the FY87 level. A recent World Bank report concludes that the current incentives to producers are reasonably attractive 1/. Therefore, this additional income would further improve the incentive regime.

D. Poverty and Nutrition

4.13 Since the income elasticity of demand for foodgrains is relatively high among low income people, any improvement in the income of the poor is expected to create a substantial increase in foodgrain consumption. Moreover, the income elasticities of demand for some other high-value food items are even higher. Thus, an increase in income of the poor would significantly improve the poverty situation through an improvement in their nutritional status.

4.14 Using the estimated Engel's elasticity for calories, the effects of an IITC on poverty and nutrition are calculated, assuming the pattern of income distribution remains the same in FY95 as it was in FY86 (for methodology, please see Annex 2B). The results suggest that, the proportion of the rural and urban population below the poverty line would decline from 52% and 67%, respectively, in FY86 to 37% in rural areas and 34% in urban areas in FY95. On the average, the level of calorie intake by the rural and urban poor would increase by 16% and 14%, respectively, from the FY86 levels.

1/ The World Bank, **Selected Issues in Agricultural Development**. March, 1989.

Projection for the CDSS Period

4.15 Table 6 presents an indicative scenario of how Bangladesh's foodgrain situation and public food grain operations might evolve over the FY91-FY95 CDSS period. The estimates indicate that even if the projected foodgrain production can be achieved through the IITC, Bangladesh will still need to import about 2.0 to 2.1 million tons of foodgrains annually to meet the 15.5 ounce per capita per day average foodgrain consumption requirement. It may be mentioned here that an average quantity of 15.5 ounce per capita per day was available in the base year FY87, as reported in a recent World Bank report.^{1/} Some vagaries around these trends are to be expected, of course, given the variability of weather and other uncertainties. The above estimates are based upon the premise that weather condition during the projection period will not be worse than average. Achievement of the projected foodgrain production from the IITC will critically depend on an effective price support and foodgrain import management program. Since imports are expected to depress farm prices of foodgrains, a price-targeted domestic foodgrain procurement policy should be made effective in order to offset the adverse effect of imports on domestic production. The required domestic foodgrain procurement quantities are estimated assuming 50% of the imports are to be distributed through PFDS monetized channels, and using the price elasticities of foodgrain demand and supply.

4.16 The BDG has a consumption target of 16 ounces of foodgrain per capita per day. Table 6 also presents the required procurement quantities if additional imports of foodgrains are required to meet the gradual increase in the level of requirement from 15.6 ounces in FY91 to 16 ounces in FY95.

^{1/} World Bank, Bangladesh: Adjustment in the Eighties and Short-Term Prospects. Report No. 7105-BD, Washington, D.C., 1988.

Table 6. Foodgrain Projections for the CDSS Period Based on the "Realistic" Irrigation Development Scenario

	1987 (Base)	1991	1992	1993	1994	1995
Irrigated Area (MHa)	2.2	2.7	2.8	3.0	3.1	3.3
Foodgrain Production (MT)	16.50	18.36	18.86	19.37	19.90	20.44
Foodgrain Price (Tk/Kg)	11.09	11.08	11.08	11.07	11.07	11.07
Net Production (MT) <u>a/</u>	14.85	16.52	16.97	17.93	17.91	18.40
Requirement (MT) <u>b/</u>	16.79	18.51	19.01	19.52	20.02	20.52
Shortfall/Imports (MT)	1.94	1.99	2.04	2.09	2.11	2.12
Required Domestic Procurement (000MT) (actual)	260	662	680	694	703	708
<u>Target requirement of 16 ounces/capita/day:</u>						
Requirement (MT) <u>c/</u>	16.79	18.63	19.25	19.89	20.53	21.18
Shortfall/Imports(MT)		2.11	2.29	2.46	2.63	2.79
Required Domestic Procurement (000 MT)	260	702	761	820	875	928

a/ Domestic production minus 10% for seed, feed and waste.

b/ Foodgrain requirement is estimated on the basis of 15.5 ounces per capita per actual availability.

c/ BDG has an average foodgrain consumption target of 16 ounces per capita per day. The requirement is increased gradually (i.e. 15.6 oz/capita/day in FY 91 to 16.0 oz/capita/day in FY95) and the required foodgrain procurement figures are estimated.

IRRIGATION INVESTMENT PLAN

4.17 The irrigation investment program by five-year plan periods is adapted from the MPO report, and after adjusting for the "realistic" irrigation development scenario, is summarized in table 7. The total investment for irrigation (at 1987 prices) during the plan period FY1991 - FY2005 is about 115 billion taka or U.S. \$ 3.8 billion.

Table 7, INVESTMENT SCHEDULE FOR IRRIGATION - PUBLIC AND PRIVATE SECTOR /a
(Million Taka, FY87 Prices) /b

I T E M S	Fourth FYP		Fifth FYP		Sixth FYP		Total Investment		
	Public	Private	Public	Private	Public	Private	Public	Private	Total

Replace Pre-1985 Equipment & Facilities									
LLP	580	1737	580	1737	580	1737	1739	5210	9266
STM	-	4477	-	4477	-	4477	-	13432	17910
DTW	2149	936	2149	936	2149	936	6446	2808	12338
Sub-Total	2728	7150	2728	7150	2728	7150	8185	21450	39514

New-Investment 1985-2005 Including Replacement									

Surfacewater:									
LLP	244	733	102	307	160	479	506	1518	2025
Groundwater:									
STM	-	8034	-	9933	-	14266	-	32233	32233
DTW	8840	3787	10360	4439	9932	4256	29132	12404	41616
Sub-Total	9085	12555	10462	14679	10091	19001	29638	46236	75874
TOTAL INVESTMENT	11813	19705	13191	21829	12820	26151	37824	67686	115388
(Million US \$)	386	643	431	713	419	854	1235	2210	3767

/a The investment schedule is adjusted according to the "realistic" irrigation development scenario.

/b The base is changed from 1983 to 1987 using the national income deflator.

Source: "National Water Plan", Master Plan Organization, Ministry of Irrigation, Water Development and Flood Control, 1986.

CRITICAL ASSUMPTIONS

- Irrigation will expand as expected under the "Realistic" scenario.
- Price support and procurement policies will be as required to maintain adequate incentives.
- Research and Technology Transfer will continue on past trends.
- Support services and input supplies will be adequate to support production.
- Infrastructure development will permit timely supply of inputs and will facilitate marketing of products.
- The Higher Education system will provide the human resources required to sustain agricultural production.

PARADIGM INDICATORS - "Realistic" Scenario

Area under irrigation

1991	2.7 Mil. Ha.
1993	3.0 " "
1995	3.3 " "

Production of foodgrains

1991	18.4 Mil.MT.
1993	19.4 " "
1995	20.4 " "

Imports of foograins

1991	2.0 Mil.MT.
1993	2.1 " "
1995	2.1 " "

Per Capita GNP

1987	Tk. 5012
1995	Tk. 5613

Percent below Poverty Line

1987	
Rural	52%
Urban	67%
1995	
Rural	37%
Urban	34%

V. CURRENT EFFORTS AT CLOSING THE GAP

A. Government of Bangladesh

5.1 The Bangladesh Governments's Third Five Year Plan-1985-90(TFYP) has as its goals

- Self-sufficiency in food cereals by 1990
- Expansion of employment opportunities (mainly through increasing irrigation acreage)
- Land and resource conservation
- Stabilization of agricultural output
- Broadening the genetic base of HYVs

5.2 The government fell well-short of meeting its TFYP goals. Foodgrain production did not keep up with population growth during the Plan period and, in fact, the percentage increase was negative in 1987/88. The increase in irrigated acreage did not meet expectations due mainly to government policy just prior to and during the Plan period. After freeing up the installation of STWs by the private sector during the FY79/80 period, the government adopted a policy of restricting this development. The installation of STWs dropped from an annual growth rate of 9.5% to almost zero in FY 83/84. The restrictive policy was lifted in 1986/87 and the number of STWs began to increase again. However, a great deal of production potential was lost due to the government's policy.

5.3 During the period FY82 to FY84, the public investment program in agriculture and water resources fell about 14% in real terms. By FY89, it had fallen to 69% of the 1982 level. About 10% of this drop was due to the elimination of the subsidy on fertilizer, but much was caused by a sharp drop in public investment in groundwater irrigation. There was an increase in investment in flood control, drainage and other irrigation, but these are normally high cost and low pay-off projects.

5.4 The broadening of the genetic base of HYVs did not occur, or was not transferred to farmers, especially for oilseeds, pulses and potatoes, all of which showed declines in production during the 1980s. The crop yields obtained by the better farmers were one and a half times greater than the national average, indicating that technology transfer was not reaching a majority of the farmers.

5.5 The Fourth Five Year Plan-1990-95 (FFYP) is in preparation but indications are that the program will be an extension of the TFYP. The Secretary of Agriculture recently stated that the government will be stressing

- Increasing the area under irrigation, especially in the non-flooded zones.
- Promoting the use of power tillers and working to reduce their cost.
- Increasing research on micro-nutrient requirement of crops.
- Increasing the supplies of improved seed.
- Utilizing private sector initiatives in fertilizer and seed distribution and in credit.

B. USAID

Development Assistance

5.6 The current CDSS strategy focuses on improved food security through increased production, more appropriate pricing, and more equitable distribution. Within the production area, increased yields and cropping intensity, greater crop diversification, more efficient distribution of fertilizer, and a functional, sustainable research system are the goals. Other areas include appropriate pricing, elimination of subsidies except for the needy, foodgrain price stability, and improved distribution of food to the very needy.

5.7 Some of the objectives of the CDSS have been met, others were not. Some of the reasons for not reaching objectives are tied to governmental policies which restricted the expansion of irrigation.

5.8 The fertilizer distribution and improvement project demonstrated the positive benefits to be gained through privatization. The privatization of retail distribution of fertilizer is virtually completed and wholesale distribution is increasingly being handled by the private sector.

5.9 The National Agricultural Research System (NARS) has not been able to deliver the technology required for diversification into crops other than rice and wheat. Even with rice, the concentration on HYV Boro rice has impeded research on other rice crops. The main rice crop, Aman, has not shown any significant increase in production in the past 10 years. USAID has assisted agricultural research for a number of years which has contributed substantially to improvements in HYVs, especially in Boro rice and wheat. However, USAID has recognized that the research system is not performing at an efficient level and that the system as a whole needs to be strengthened. Consequently, it is providing assistance to the Bangladesh Agricultural Research Council (BARC) which was established to rationalize the NARS. This phase of USAID assistance has only recently begun and will require several years to show results. The ASA team is recommending that the current effort be broadened to bring more research to the farm level and to strengthen BARC's administrative capability and that of the research institutes.

5.10 Efforts by USAID to expand rural employment have met with limited success in terms of numbers of people employed. However, one of the programs involves rural women and the project is providing insights into ways that such programs can have a greater impact in the future. Programs to increase employment in urban areas have shown modest results but much of this is due to the newness of the programs and the need to develop the institutional capacity to implement them. (See Annex-5 Agribusiness Analysis).

5.11 Credit programs involving rural finance can be considered a partial success although the poor performance of the banking system has negated most of the gains. USAID is working with the World Bank on a program to revitalize the banking system, both urban and rural.

5.12 Other USAID programs include rural electrification, and rural and feeder road maintenance. A rural roads sector analysis team will provide insights into USAID's future assistance to this sector.

5.13 USAID's program in higher education is presently limited to providing assistance to the Institute for Post Graduate Studies in Agriculture (IPSA) in cooperation with the Japanese International Cooperation Agency. Assistance to the Bangladesh Agricultural University (BAU) is being considered and a team is preparing the design for a project that would begin in the upcoming CDSS period. More will be said about this later.

5.14 Current funding for USAID Development Assistance activities is about \$20 million per year.

PL480 Programs

5.15 USAID has provided food commodities on concessional terms since the early 1970s. Title I programs, which were phased out by 1980, provided \$520 million. Title II, which provides grants of food for humanitarian purposes, has amounted to \$385 million since 1977. These foods are used mainly for Food for Work projects. (Current Title II funding is about \$15 million per year). Title III, which was initiated in 1978, has provided approximately \$707 million during the 11 years it has been in operation. Food and commodities under Title III are sold by the government and, if the funds are used in development projects, these funds can offset the amount owed by the government. Of the \$265 million used for development between 1981 and 1988, over half went for Low Lift Pumps(LLPs) and tubewells. Almost 40% of the funds programmed for FY89 and FY90 will go for flood control, drainage and irrigation, and about 15% for research and extension. It is difficult to evaluate the impact of the Title III projects since most have been in cooperation with other donors who generally are the primary implementers. Programming during the upcoming CDSS period is likely to be more focused than in the past.(Current funding of Title III is approximately \$60 million per year).

C. Other Donors

5.16 Total donor project aid commitments for FY 89 were \$1.1 billion. Another \$800 million was committed for non-project aid (commodities \$500 million; food \$300 million). A UNDP report on donor aid estimated that agriculture, forestry and fisheries accounted for 19% of donor project aid in 1987. Project aid in land and water was 11%.

5.17 There has been an increasing backlog of donor project aid commitments. A World Bank study shows that project aid in the pipeline increased from \$2.0 billion in FY81 to \$4.7 billion in FY89. Ways to streamline project approval and improve project implementation is high on the agenda of both the government and donors.

VI. CONSTRAINTS TO AGRICULTURAL PRODUCTION AND OPPORTUNITIES TO ALLEVIATE THESE CONSTRAINTS

6.1 Before going into the constraints to agricultural production, we should look at the overriding constraint that affects the entire economy. It is more a statement than a constraint, but its impact affects everything we discuss in this report. This is the increasing population and the lack of gainful employment in rural and urban areas. The effect is that a constantly increasing percentage of the population may not have enough income with which to pay for food. Without an effective demand for its products, the agriculture sector cannot grow. And even if the food gap is closed, unless there is an equitable distribution of benefits among the entire population, poverty will persist.

6.2 In this portion of the paper, we will deal only with ways to overcome those major constraints which are preventing the achievement of maximum food production. These constraints are related to land, water and the ceilings imposed by existing technology and the diffusion of this technology. They encompass four main areas: expansion of irrigated area and improving water management technology, improvement in research technology and technology transfer, improvement in infrastructures, and assisting the higher education system in improving the human resources required to sustain agriculture over the long term. Two complementary constraints and means of overcoming them are discussed because they, along with irrigation, are part the trio of inputs required for maximum crop production. These are seed and fertilizer.

6.3 The annexes to this report provide a wide array of constraints not discussed in the main report. While not as crucial as those listed above, overcoming them will enable the agriculture sector to more fully reach its productive potential, help generate additional employment and improve rural incomes. USAID should consider providing assistance to some of the suggested interventions through its TRP II project and other funding sources, and to encourage and support other donor programs designed to overcome these constraints.

VII. PRIORITY AREAS FOR USAID ASSISTANCE

Priority 1: Increasing the Utilization of Water Resource Potentials

7.1 As discussed in Section III, the key to increased agricultural production in Bangladesh lies in expanding the area under irrigation. Unless the irrigated area is expanded rapidly, the gap between food requirements and food production will widen dramatically. Without adequate irrigation, inputs such as HYV seed and fertilizer will not be utilized to their full potential. At the present time, less than 30% of the potential irrigable area is under irrigation. And much of this irrigated area is under-utilized, representing a large loss of potential production. The lack of an efficient and widespread service network for maintenance and repair of irrigation equipment is partly responsible for this low efficiency rate. The lack of knowledge on irrigating crops other than rice has impeded the crop diversification program.

7.2 There are strong economic incentives for farmers to expand minor irrigation. A World Bank report cites four studies which show that adding irrigation raised production of foodgrains almost 3 mt./ha. and raised incomes an average of about Tk 12,900/ha.^{1/} With an average command area for STWs of 4.5 has., and an average capital cost of Tk 6,000 per hectare, a farmer or farmers would need Tk 27,000 to install a STW. However, the expected income from the command area, if it were fully utilized, would rise to Tk 58,000. It is likely that farmers will not hesitate to install irrigation provided they can raise the initial capital and/or obtain credit. Consequently, an important aspect of any expansion of the area irrigated is likely to be the availability of credit for purchasing and installing irrigation equipment and for the inputs required for production. The formal banking system is generally able to assist traders and medium and large farmers by providing credit for LLPs and STWs. Small farmers generally are unable to get credit from the formal banking system, depending primarily on non-institutional credit- relatives, money lenders, landlords, traders, etc. The interest rates charged by money lenders, landlords and traders are often three or four times that charged by banks. Some NGOs have developed credit programs whereby groups of small farmers have been able to acquire irrigation facilities.

7.3 The MPO estimates the total cost of replacing and installing STWs over the 20 year period at US\$2.0 billion, all of which will come from the private sector. (This US\$2 billion does not include investments in flood control and irrigation). The cost for LLPs will be approximately US\$ 380 million, of which about US\$ 290 million will come from the private sector.

^{1/} World Bank. Selected Issues in Agricultural Development, April 1989

7.4 The installation of DTWs is normally beyond the means of even the largest farmers and the government has been installing them on a subsidized basis (70% subsidy). The MPO calls for the replacement and installation of DTWs over a 20 year period at a cost of approximately \$2.0 billion, of which about \$600 million will come from the private sector. A World Bank report suggests that the government should encourage the private sector to enter into the procurement, sales and installation of DTWs. The reasoning is that the private sector will find ways to reduce the cost of such wells. The unanswered question is: where will the approximately US\$ 4.4 billion for installing LLPs, STWs and DTWs come from and will the government continue to subsidize the installation of DTWs and some LLPs?

7.5 The low utilization of command areas is an important problem in that it reduces the potential production to be gained from irrigation. Some have estimated utilization as low as 50% of the potential command areas. There are a variety of reasons for low irrigation efficiency, including command areas smaller than potential, low discharge of pumps, inadequate water distribution systems, and a wide range of physical and social factors that affect utilization. Some of these problems can be overcome through an effective extension service whose personnel have been trained in water management techniques, and through proper organization and management.(MPO, Vol.1).

Opportunities for Expanding Irrigation

7.6 Funds must be directed to the irrigation sector to enable farmers to install and operate irrigation equipment. The expansion of irrigation in the early 80s was fueled by a World Bank Agriculture Credit project which provided funds to the Bangladesh Bank for on-lending to three nationalized commercial banks and the BKB. Private traders were able to obtain credit from these banks for importation of diesel engines which were sold to farmers. It is likely that the dealers sold many of these engines on credit.

7.7 Although some feel that private sector credit is not a problem, it is more likely that considerable amounts of credit will have to come from the banking system, especially after the early stages of growth. Given the degree of uncertainty and the importance of the question, it would be well to conduct a survey to determine the likelihood that the private sector will be able to support with its own funds the expansion in irrigation that will be required to increase production.

7.8 In the past, the World Bank and ADB have been the largest suppliers of credit to the BDG for developing irrigated areas. These banks are likely to continue to be the major sources of funds for accelerating irrigation. Funds will be channeled through the formal banking system and through support of BADC. The latter will continue to be the principal means of expanding DTWs until government policy permits the private sector to enter into the sale and distribution of DTWs.

7.9 Small farmers have difficulty obtaining funds to buy irrigation equipment and therefore must depend upon others for their water supplies. There is a role for donors and the government in supporting realistic programs for providing funds to small farmers to obtain irrigation equipment. Several mechanisms have been developed for doing this.

USAID's Role in the Irrigation Sector

7.10 USAID has a role to play in the irrigation sector, especially in providing assistance in water management techniques. USAID has had a long history of involvement in Asia and S.E.Asia in water management. This should be a major focus of USAID's participation in the drive to increase and improve the operation of small scale irrigation in Bangladesh. Assistance in improving water management techniques would include research conducted at Farming Systems Research sites and training of extension irrigation specialists.

7.11 USAID can assist the private sector develop a service capability for maintaining and repairing irrigation equipment to ensure that the system operates at optimum capacity. Equipment breakdown during the crucial growing season can be disastrous unless service and spare parts are available. This is a serious problem and will become even more so as the number of pumps in operation increases. By working through existing training institutes and NGOs, USAID can provide technical assistance in developing private sector service centers throughout irrigated areas. Credit to establish these centers will be required, especially for equipment and spare parts inventories. The widespread distribution of such service capabilities will contribute to a higher water use efficiency and will contribute to the goal of increased production.

Estimated costs

Improved water management techniques over a 5 year period (research, demonstrations, training) LC \$10 mil.; FX \$5 mil.	\$15 mil.
Assistance in establishing service facilities, credit and training for the private sector over a 5 year period LC \$5 mil.; FX \$10 mil.	\$15 mil.
Loans to assist small farmers in minor irrigation projects over a five year period, all LC	\$25 mil.

Assumptions

- Credit and/or private funds will be available for expansion of minor irrigation.
- The government will remove all restrictions on private importation and installation of LLPs, STWs and DTWs.
- The government will complete the privatization of DTWs and turn over their maintenance and repair to the private sector.

Program Indicators

- There will be a measurable increase in water use intensity and improvement in efficiency.
- Adequate service facilities will be established in all major irrigation areas by 1995.
- Up to \$5 million annually of donor funds will be available for small farmer irrigation projects.
- Expansion of irrigation will be at a rate to increase the irrigated area from 2.2 mil. hectares in 1987 to 3.3 mil. hectares by 1995.

Priority No.2: Expand Research Technology and Accelerate Technology Transfer

7.12 In the optimal projection shown in Section III, if farmers use all the available irrigable land and maintain current yield trends. Bangladesh can achieve foodgrain self-sufficiency until the year 2008. What happens after that if the maximum yield levels are not raised? In the case of HYV Boro rice, the better farmers have already obtained yield levels equal to those of the research stations (Table 8). The same is true for HYV T.Aman rice. It is vital that research technology raise the existing limits so that Bangladesh can extend the production limits imposed by current technology. A strong research program can be expected to increase production by 1 to 2% a year. If this can be achieved in Bangladesh, the gap between food requirement and production can be reduced much quicker.

Table 8 . Estimation of Yield Gap for Selected Crops Between National Average Yields and Yields Obtained by Research Stations and Better Farmers Using HYVs and Recommended Cropping Practices_ MT/Ha. a/

Crop	Research level	Yields		yield gap A - B
		by better farmer <u>a/</u> A	Nat. avg. 1983-86 <u>b/</u> B	
Rice-Boro (HYV)	6.5	6.5	2.7	3.8
Rice-Aus(local)	2.0	1.6	0.8	0.8
Rice-Aus(HYV)	4.5	3.6	1.9	1.7
Rice-T Aman(HYV)	5.0	5.0	2.0	3.0
Rice-B Aman(local)	2.5	2.0	1.0	1.0
Wheat(HYV)	5.5	5.0	2.2	2.8
Jute	3.0	2.4	1.5	0.9
Rabi maize	8.0	6.4	0.8	5.6
Pulses	2.5	1.6	0.7	0.9
White Potato <u>c/</u>	35.0	28.0	10.4	17.6
Mustard	2.5	2.0	0.7	1.3
Sesame	1.5	1.2	0.6	0.6

a/ Estimates by BARI and BIRRI

b/ Statistical Yearbook of Bangladesh, 1987

c/ Yield as fresh weight

7.13 The wide differences between the yields obtained by the better farmers and the national average is an indication that technology is not being transferred to a large majority of the farmers. There are other factors, such as access to inputs, variability of soils, different climatic conditions, access to water, etc., that account for some of these differences. But, differences of 50% or more in yields of the better farmers indicates that they are obtaining technological information and, by inference, many farmers are not. This observation is supported by field observations of the ineffectiveness of the extension service in reaching a majority of the farmers. Increasing average yields offers a large potential for closing the gap between production and food requirements. Extending existing technology to more farmers is the most effective way to accomplish this.

Opportunities to Improve Research Technology and Technology Transfer

7.14 The Bangladesh Agricultural Research Council (BARC) has developed a Strategic Plan for rationalizing the National Agricultural Research System. This Plan, if fully implemented, provides a blueprint for the NARS to adapt to changing conditions in the agriculture sector and will assist farmers in increasing production and incomes. The Plan holds the hope that current technological limits can be raised, enabling Bangladesh to meet its food requirements well beyond current limitations and to sustain production until the population growth stabilizes. However, basic to any rationalization of the NARS is the need to improve the overall management capability of BARC and all units in the system. This will be a major task that must be accomplished if BARC is to be effective and the system improved.

7.15 Among the major needs of the NARS is greater intensification of research in the different agro-ecological zones. This is best done through the Farming Systems Research (FSR) program which has been designed to overcome the problems of transferring research results to farmers. This system, which includes On-Farm Research (OFR), brings the researcher, extension worker, and the farmer together and accelerates the flow of information to the farming area. Because research is conducted on farms, the rate of adoption is greatly increased in the areas surrounding the OFR sites.

7.16 Existing FSR facilities need to be brought up to adequate standards and the system expanded to include all agroecological zones. This is a natural extension of USAID's assistance to BARC and should be undertaken as soon as the Strategic Plan is approved and BARC given authority to rationalize the NARS.

Estimated cost

Improvement in existing FSR sites and expansion to all ecological zones

FX \$9 mil. LC \$36 mil. Total \$45 mil.

Assumptions

- BARC's Strategic Plan will be approved.
- Financial and government support will be available for BARC to fully carry out its Plan.
- The administrative capabilities of BARC and the research institutes will be strengthened to permit full rationalization of the NARS

Program Indicators

- Yield levels of rice and wheat will be raised above existing limits and more HYVs will be developed for crops other than rice and wheat.
- A substantially increased number of farmers will be involved in on-farm-research through expansion and intensification of the FSR system.
- A coordinated, smoothly functioning NARS will be in place by 1995

Priority No.3: Improvement and Expansion of Infrastructure, Including Flood Control and Drainage Systems in Moderately Flooded Areas

7.17 There are some who would place improved infrastructure as Priority No.1. Certainly, adequate infrastructures - roads, bridges, transport, service facilities, electricity, etc.- must be in place if farmers are to produce at optimal levels. Unless they have an adequate infrastructure, farmers are not likely to install irrigation equipment. The inability to obtain inputs such as seed, fertilizer, fuel oil for pumps, spare parts, etc., or to have to pay very high prices for them because of poor infrastructure, reduces farmers' incentives to intensify production. Farmers in areas with inadequate infrastructure are usually poorer than those who live in areas with more developed infrastructures.

7.18 Infrastructure also reinforces the effectiveness of the process of technology diffusion. Studies have shown that where infrastructure was developed, the area irrigated was 105% higher than areas with undeveloped infrastructures; the adoption of HYVs was 71% higher and fertilizer use was 92% greater.

7.19 Large areas of Bangladesh are subject to annual flooding and in many areas drainage is a problem, frequently delaying or preventing the planting of crops. A more extensive problem is caused by roads and drains that are poorly designed and constructed which exacerbate the problem of flood control and drainage.

Opportunities for Alleviating Constraints in Infrastructure

7.20 PL480 Title II and Title III and other donor funds should continue to be used for developing the infrastructure, especially for roads and bridges in those areas where infrastructures are inadequate. As part of the infrastructure development, rural civil works should be upgraded so that moderately flooded lands are drained quicker enabling farmers to expand the area cultivated, adopt HYV and increase use of other inputs. The Rural and Feeder Roads Sector Analysis team will recommend specific ways this part of the rural infrastructure can be improved.

Estimated Cost

It is estimated that \$15 million will be available annually in non-monitized food under Title II for infrastructure works, or \$75 million over a 5 year period. It is estimated that one-fourth of Title III funds will be available for infrastructure, or approximately \$15 million annually for a total of \$75 million over a five year period. All of this will be in LC.

Assumptions

- PL480 and other donor funds will be available to improve infrastructure.
- Road and bridge construction and maintenance will be upgraded.
- The quality of rural civil works will be improved in flood control and drainage projects enabling farmers to better utilize lands in moderately flooded areas.

Program Indicator

-A substantial increase in number of farmers having access to serviceable rural roads by 1995 and an increase in installation of small scale irrigation in these areas.

Priority No.4: Intensifying Human Resource Development-Higher Education

7.21 The future success of programs in research technology and the transfer of this technology to farmers will depend upon the availability of well-trained personnel. The primary source of this expertise will be the institutions of higher learning in Bangladesh, mainly those institutions devoted to agriculture. However, these have not been providing the type and quality of graduates required to enable the agriculture sector to attain the level of development required to meet food and development needs. This will become crucial as the population expands and the present scientists and other trained personnel retire.

7.22 There has been only a limited expansion in the institutions of higher agricultural education in Bangladesh since 1971. At present the agricultural education system consists of the Bangladesh Agricultural University (BAU), three agricultural colleges located in Dhaka, Dinajpur and Pathuakali, and a recently established Institute of Post Graduate Studies in Agriculture (IPSA). Higher education in several fields of agriculture-related disciplines such as economics, soil sciences, chemistry and entomology are also provided by other major universities in the country.

7.23 The primary institution for graduate and post-graduate studies in agriculture since 1961 has been BAU. The agriculture colleges and IPSA are under the academic control of BAU. Evaluations of BAU's academic programs indicate an unsatisfactory performance. The programs are too theoretical with too little concern being given to the practical problems of agriculture, and students and faculty are involved in very little field work. BAU's curriculum has not been significantly revised in the past fifteen years and the University has been able to produce only a limited number of PhDs in the past 20 years.

Opportunities for Improving the Quality of Higher Education in Agriculture

7.24 An Oregon State University design team, supported by USAID, is addressing the problems outlined above. The ASA team feels the improvement in the quality of graduates is essential to Bangladesh meeting its food production goals and supports the effort to improve the performance of the Higher Education system. This will require administrative and other changes which will enable the Higher Education system to produce the quality and quantity of graduates required by the agriculture and agribusiness sectors.

7.25 If the project in Higher Education is started within the next two years, better trained graduates from the system will not come on stream until about 1995 and the full effect will not be felt for 10 to 15 years. It is necessary to begin now to prepare qualified graduates to take over as existing scientists, extension workers, administrators, and agribusiness persons retire. Consequently, improvements in the quality of graduates turned out by the Higher Education system and the type of training they receive have become critical to the long run sustainability of the agriculture sector.

Estimated cost

The estimated cost of the proposed project to assist the Higher Education system is \$16.5 million in FX and \$6.5 million in LC.

Assumptions

- Administrative changes in the Higher Education system can be effectively instituted and maintained.
- An attitude of excellence can be developed within the University system.

Program Indicator

- USAID's intervention in Higher Education during the 1990-95 CDSS period will be mainly the institutional strengthening of the administration and improving the teaching staff and outreach program. Tangible results, in terms of quality of graduates and focused training, will not begin until after 1995. By the year 2000, it is expected that graduates from the system will begin filling senior positions in research institutions and other governmental institutions. Also, the demand from agribusiness and agroindustries will absorb on increasing number of these graduates.

Priority No.5: Development of a Private Seed Industry to Supply HYV and Improved Seeds

7.26 The three principal contributors to increasing food crop production are HYV seed, fertilizer and irrigation. The three inputs cannot be separated without loss of production. In cereals, improved seed can contribute 30 to 50% of the gain in yield when all three inputs are utilized. The optimum goal, to ensure maximum genetic response, would be to provide enough certified seed to plant 20% of the area each year with improved seed. This means that new improved varieties would be cycled into the production system every 5 years. Bangladesh is falling far short of this goal except for wheat. Of the total requirement of 70,000 mt. of HYV rice seed, the BADC supplies only a little more than 3000 mt., or less than 5%, 1/. BADC supplies 18% of the HYV wheat seed requirement, but practically none of the pulse seed needed. BADC provided about 15% of the requirement for vegetable seed, most of which was imported.

7.27 A loss of genetic potential may occur when improved seed are not introduced into the cropping system. The low rate of new improved seed being used for rice could be one reason average farm yields are well below potentials. A vigorous private sector seed industry would assure that farmers have an adequate supply of seed when and where they are needed. Also, freeing up the importation would enable farmers to experiment with seed that have proven to be successful in other countries. Private seed companies would complement field research trials carried out by the NARS. The competition could be healthy for the research system. In the U.S., private seed companies are doing a large share of seed research.

Ways to Increase Supplies of HYV and Improved Seed Varieties

7.28 The importation, production and distribution of seed should be opened to the private sector for seed that are now the monopoly of BADC. Most of the donor assistance for seed to date has been aimed at improving BADC's seed operation or in providing donated seed. Attention should be given to seeking ways the private sector can fully participate in supplying seed to farmers. This is likely to involve a complete study of the seed industry and developing a mechanism for privatization. The BDG will have to be convinced that privatization of the seed industry is in the best interest of the agriculture sector. BADC is likely to resist such a study and other donor assistance might be required to help persuade the government to give its blessing to such a study.

7.29 The U.S. has a predominate capability in seed production and could supply the expertise to undertake the study. The U.S. seed industry has developed a partnership relationship with universities, not-for-profit foundation seed companies, farmer seed contractors, and government agencies which set standards and regulate the industry. Such a relationship, if it could be developed in Bangladesh, would be highly beneficial to the agriculture sector.

Estimated cost

A feasibility study of all aspects of seed importation, production and distribution, including estimates of the cost of privatization, would be approximately:

FX \$300,000 LC \$100,000 Total \$400,000

Assumptions

- The government system of seed importation, production and distribution will be phased out and the private sector will take over these functions.

Program Indicators

- Between 1990 and 1995, the seed industry will be privatized and one or more multi-national seed firms will begin operating in Bangladesh. Improved seed utilization, especially for rice, will increase from the current 5% of total seed requirements to 10% by 1995 and to 20% by 2000. The latter is the recommended rate, representing a renewal of genetic stock every 5 years.

Priority No.6: Improving the Fertilizer Production and Distribution System

7.30 The increasing use of irrigation, fertilizers and HYVs has been the principal contributor to raising crop yields. To be effective, the correct fertilizers must be readily accessible at the time required for growing the crop. The old marketing system established under the BADC has proven inefficient and costly. The new marketing system, whereby the private sector is participating in the wholesale and retail distribution of fertilizers, is proving a much more efficient mechanism for getting fertilizer to farmers. Fertilizer is being distributed to more distribution points and at a lower distribution cost. During the transition of fertilizer distribution from the public to the private sector, subsidies on fertilizers were greatly reduced. In spite of higher prices, fertilizer use has increased.

7.31 Only two major fertilizers are produced in Bangladesh-- urea(5 plants), and one plant producing triple super phosphate(TSP). The TSP plant produces only about 25% of the phosphatic fertilizers required and at a high cost. The rest is imported. The imported TSP is preferred by farmers because of its handling characteristics. The advantages of privatizing the importation, production and distribution of TSP appear to be large. Infanger and Gertsch list a number of benefits, including new blended fertilizers that meet farmers' needs and lower costs of imported fertilizers because of more efficient purchasing by the private sector 1/.

7.32 In 1985/86, the actual use of fertilizers was only 29% of the recommended agronomic levels. This represents a large loss in potential production. A privatized fertilizer industry is expected to improve this situation substantially.

Ways to Improve Production and Distribution of Fertilizers

7.33 The gains that have resulted from privatizing the wholesale and retail distribution of fertilizers should be consolidated. Pressure to reduce BADC's role in the wholesale distribution of fertilizers should continue until BADC is no longer a major factor. Efforts should be made to privatize the importation of fertilizers, adding another competitive element into the fertilizer system. As Infanger and Gertsch pointed out, the private sector's ability to respond quickly to world supply and price situations will result in lower cost of imports.

7.34 A logical step is the privatization of the TSP plant and its conversion into a formulating/blending plant capable of providing the various blends required by different crops. Such blends are not now available and results in lower crop production and/or higher production costs than can be obtained from properly formulated fertilizers.

1/ Infanger, C.L. and M.E.Gertsch. An Analysis of the Feasibility and Consequence of Private Sector Fertilizer Imports into Bangladesh. Prep. for USAID/D. Dec. 1988.

7.35 The USAID's experience in the privatization of retail and wholesale distribution of fertilizers should be utilized in persuading the BDG to undertake further privatization of the industry. Other donors have cited the benefits and would likely participate in efforts to carry through a privatization program. The USAID-sponsored International Fertilizer Development Corporation (IFDC) has had a number of years' experience in working with the fertilizer industry in Bangladesh. It has a predominate capability in assessing fertilizer formulation and blending plants and would be in a unique position to assist in the conversion of the TSP plant. It could also provide counsel on the means to transfer fertilizer facilities to the private sector.

Estimated cost

The cost, including conversion of the TSP plant to formulating/blending, research and demonstration of new formulations over a 10 year period, with most of the costs coming in the first five years:

FX \$15 mil. LC \$25 mil. Total \$40 mil.

Assumptions

- The fertilizer distribution system will be completely privatized.
- The government will take the necessary steps to privatize fertilizer importation and production.
- Donor assistance will be provided to assist the above processes.

Program Indicators

- The wholesale distribution of fertilizer will be fully privatized between 1990 and 1995.
- The conversion of the TSP plant to a private sector formulating/mixing plant will begin by 1992 and be completed by 1995.

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ANNEX 1

The Bangladesh Economy:

An Overview

AN OVERVIEW OF THE BANGLADESH ECONOMY 1/

In the early 1980s, an international recession and a stagnation of external aid receipts seriously eroded Bangladesh's economic situation. The GDP real growth rate fell from 6.8% in FY 81 to 0.8% in FY 82. The BDG started a major stabilization program and over the next three years Bangladesh's economy grew at a rate of between 4.1% and 4.7%. There was some improvement in the poverty situation and in needed policy reforms. Public expenditures were cut back sharply, credit growth was restricted from the mid-eighties to improve credit discipline, and imports were constrained. The rapid growth of non-traditional exports, mainly garments and shrimp, and an increase in worker remittances from abroad, helped reduce the external deficit.

Significant efforts were made to increase private involvement in economic activity. The National Industrial Act of 1982 resulted in a substantial denationalization of public enterprises, with over 650 public enterprises being transferred to the private sector. The public share of fixed industrial assets fell from 85% in FY 81 to 40% in FY 86. Export incentives were strengthened, subsidies were reduced, and market-oriented pricing for agricultural inputs initiated. A substantial devaluation of the effective exchange rate in the second half of the eighties provided a boost to exports. However, the rate of growth in agriculture and industry stagnated. Agriculture's GDP rate of growth fell from 4.0% in FY 86 to 0.1% in FY 87 and an estimated -0.2% in FY 88. Manufacturing GDP growth rate which rose from 1.8% in FY 86 to 6.4% in FY 87, fell to an estimated 3.6% in FY 88. There are several factors that account for this decline in agriculture during the latter part of the eighties, including the devastating effect of two major floods.

1/ This section is based primarily on two World Bank reports: **Bangladesh: Adjustments in the Eighties and Short-term Prospects**, March 10, 1988 and **Bangladesh: Recent Economic Developments and Short-term Prospects**. Feb. 3, 1989. Draft.

The general macroeconomic situation for FY 86/87 can be seen in the data presented below.

Per capita income	US\$160
GDP at market prices	US\$17.60 billion
Gross domestic invest.	2.19
Gross national	1.22
Export of goods, fob	1.07
Raw jute	US\$104 mil.
Jute goods	301
Tea	30
Leather	135
Fish & shrimp	136
Garments	299
Other	69
	<u>US\$1074</u>

Sector	Value added Bil\$US	Labor force Million	Val.add./worker US\$
Agriculture	8.3	16.9	495
Industry	2.4	3.1	764
Service	<u>6.9</u>	<u>8.6</u>	<u>803</u>
	17.6	28.5	617

<u>Balance of payments:</u>	<u>FY86/87</u>
Export of goods	US\$1.07 Billion
Import of goods	<u>2.62</u>
Trade gap	US\$-1.55
Public debt at end of 1986	US\$ 7.3 billion
Debt service ration	19.1%

The domestic inflation rate during the period FY1981-87 can be seen below.

Year	%
1981	12.5
1982	16.3
1983	9.9
1984	9.7
1985	11.0
1986	10.0
1987	10.4

The floods of 1987 and 1988 reversed the improvements that were underway in the economy during the mid-eighties. The flood of 1987, which covered 35% of the land, caused substantial crop losses and a reduction in seasonal employment in rural areas. The flood of 1988 was much more serious, inundating 84% of the country, causing loss of lives and badly damaging property and infrastructure. A localized cyclone in late 1988 caused further damage. Total crop losses in 1988 were estimated at 2.2 million mt of foodgrains, more than the loss due to the 1987 flood. Flood damage to physical and economic infrastructure was much greater in 1988 than in 1987. Flood control structures, minor irrigation equipment, national roads and highways, local roads (an estimated 10,000kms), railways, bridges (several hundred), schools, health centers, and housing units (2.9 mil.) were damaged. Many fish ponds, fish hatcheries, livestock and poultry were badly affected. Industrial units, both large and small, were affected. The cost of rehabilitation and reconstruction was estimated to be over US\$ one billion, not including housing (much of which was of low quality). The 1987 flood caused an estimated US\$ 285 million in damage. Consequently, the total damage of the two floods and cyclone approached US\$ 1.5 billion. This was a severe blow to a poor country and although donors contributed considerable amounts toward recovery, the loss in wages, lost markets and time to repair the damages, set back the economy severely.

The economic outlook in FY 89 is clouded by the effect of the recent floods. The loss of income caused by these disasters will reduce demand for some time and have a negative effect on real farm prices. The damage to industries and the loss of productivity will hamper growth, especially in jute and garment industries. Imports of foodgrains, edible oils and construction materials will add to the government's import bill. The recent floods caused the government to shift to a cautious policy on the amount of foodgrains required for food security causing a debate between the government and the donors of foodgrains as to the levels actually needed. The government's ability to increase expenditures for the agriculture sector will be limited until short term needs are taken care of. This has implications for the donor community which is pressing for a step up in the implementation of projects that are well behind schedule. This is discussed more fully in Section V.

ANNEX 2

Methodology for Economic Analysis

Prepared by

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May 1989

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Annex 2A

Mathematical Model of IITC

**EFFECTS OF IRRIGATION-INDUCED TECHNOLOGICAL CHANGE IN
FOODGRAIN PRODUCTION IN BANGLADESH
Akhter U. Ahmed**

Foodgrain production in Bangladesh is semi-subsistence in nature. A major portion of the crop output is consumed by farm households and a minor portion is sold in the market. The impact of an Irrigation-Induced Technological Change (IITC) on production as well as on distribution of benefits can be measured employing the model developed by Hayami and Herdt (1977). The Hayami-Herdt (HH) model is briefly presented here (for details, see Hayami and Herdt, 1977).^{1/}

The Model

In Figure 1, the vertical line DhH represents the foodgrain demand curve of producers for home consumption. DhH is drawn as insensitive to prices assuming that farm households consume a given quantity of their produce irrespective of prices and sell the rest in the market. The market demand for foodgrain is represented by DmD, and the horizontal distance between DmD and DhH measures the quantity purchased by nonfarm households. The total demand curve is represented by DhDmD.

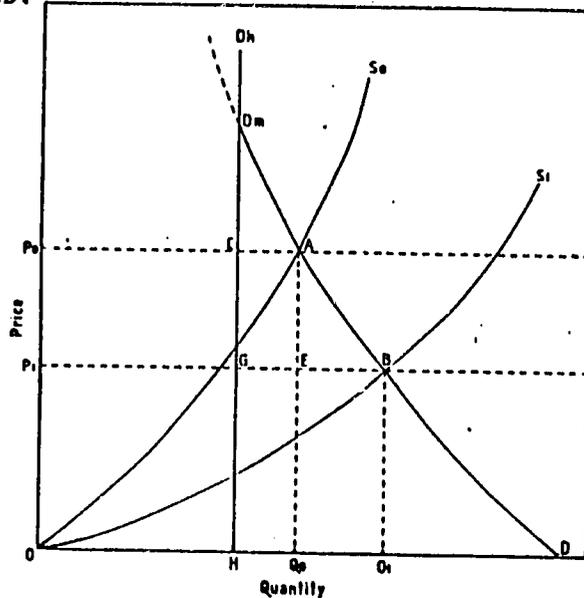


Figure 1. The impact of IITC in a semisubsistence crop.

^{1/} Hayami, Y. and R.W. Herdt, Market Price Effects of Technological change on Income Distribution in Semisubsistence Agriculture. Amer. J. Agr. Econ., 59.

The supply curve before and after an IITC are OS_0 and OS_1 . The quantity consumed by nonfarm consumers increases from HQ_0 to HQ_1 at the reduced price, OP_0 to OP_1 . Consumers' surplus increases by area $ACGB$. Producers' cash revenue changes from area $ACHQ_0$ to area $BGHQ_1$ with producers' home consumption remaining unchanged at OH . The cost of production changes from AOQ_0 to BOQ_1 .

Assuming that the real income value of home consumption of foodgrain by producers is represented by the quantity consumed, income changes to producers are reflected in changes in their cash income. Whether producers' cash income (=revenue-cost) is increased by IITC depends on the demand and supply functions.

In order to quantify the impact of IITC, a formal mathematical treatment of the above relationship is provided. Assume a constant elasticity demand function for the relevant range of the total demand schedule $D_h D_m D$:

$$q = ap^{-\epsilon} \quad (1)$$

where p and q respectively represent price and quantity demanded of foodgrains; a includes demand shifters; and ϵ is the price elasticity of demand.

Assume a constant elasticity supply function:

$$q = bp^{\beta} \quad (2)$$

where p and q are the price and the quantity supplied; b includes supply shifters except IITC and β is the elasticity of supply. Let us assume that IITC leads to a $k\%$ shift in supply, so that the new supply function (OS_1) can be expressed as

$$q = b(1+k)p^{\beta} \quad (3)$$

Let the equilibrium price and quantity before the IITC be denoted as p_0 ($=OP_0$) and q_0 ($=OQ_0$), and those after the IITC, p_1 ($=OP_1$) and q_1 ($=OQ_1$). Employing equations (1), (2) and (3) and using a Taylor's expansion, we can approximate p_1 and q_1 as

$$p_1 \cong p_0 \left(1 - \frac{k}{\beta + \epsilon}\right) \quad (4)$$

and

$$q_1 \cong q_0 \left(1 + \frac{\epsilon k}{\beta + \epsilon}\right), \quad (5)$$

provided that k is a relatively small percentage change.

Change in consumers' surplus can be expressed as

$$\begin{aligned}
 & \text{Area ACGB} = \text{area APOPlB} - \text{area CPOPlG} \\
 & = \int_{P_1}^{P_0} a p^{-\epsilon} dp - q_0 (1-r) (P_0 - P_1) \\
 & \cong P_0 q_0 (kr/\beta + \epsilon) \quad (6)
 \end{aligned}$$

where r is the ratio of marketable surplus, i.e. HQ_0/OQ_0 .

Change in producers' cash revenue is given by

$$\begin{aligned}
 & \text{Area BEQOQl} - \text{area ACGE} \\
 & = P_1 (q_1 - q_0) - q_0 r (P_0 - P_1) \\
 & \cong P_0 q_0 k \frac{(\epsilon - r)}{\beta + \epsilon} \quad (7)
 \end{aligned}$$

Cost of production will change by

$$\begin{aligned}
 & \text{Area BOQl} - \text{area AOQO} \\
 & = [P_1 q_1 - \int_0^{P_1} (1+k) b p^\beta dp] - [P_0 q_0 \int_0^{P_0} b p^\beta dp] \\
 & \cong P_0 q_0 k [\beta (\epsilon - 1) / (1 + \beta) (\beta + \epsilon)] \quad (8)
 \end{aligned}$$

Therefore, with IITC, the cash income of the producers will change by

$$\text{Change in cash revenue} - \text{change in cost} \quad (9)$$

Modification of the Model

The model presented above is static. It does not incorporate the impact of population growth and change in income resulting from an IITC over a certain time period. For example, if an IITC takes place in five years, then population will increase, and it is likely that an increase in production resulting from an IITC would increase employment and income substantially. The population growth and increased income will shift the demand schedule. The rightward shift in the total demand schedule from $D_h D_m D$ to $D_h^* D_m^* D^*$ is shown in Figure 2. Corresponding to this shift, the market equilibrium after an IITC will be established at B^* instead of B .

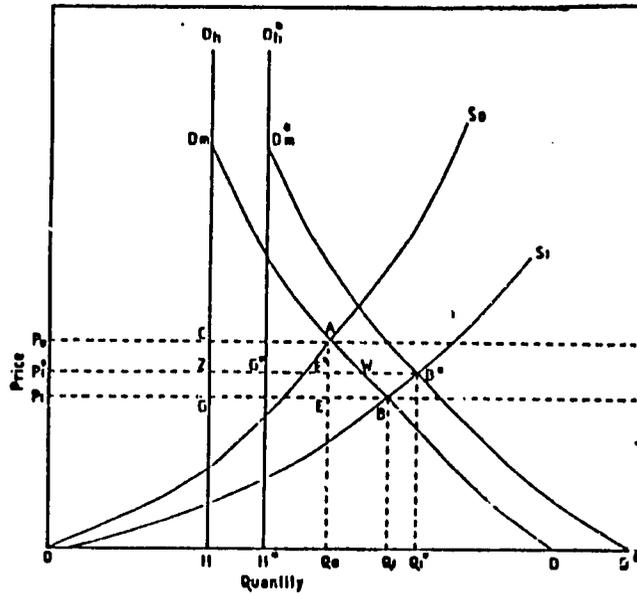


Figure 2. The impact of an IITC with the shift in demand over time.

The consumers' surplus of nonfarm consumers is represented by area $B^*D_m^*G^*$. Since $D_h^*D_m^*D^*$ is parallel with D_hD_mD , area $B^*D_m^*G^*$ is equal to area $W^*D_m^*Z$. Thus, the increase in consumers' surplus due to the IITC with demand shift is larger than the increase in consumers surplus without the demand shift.

The rate of increase in demand for foodgrain can be expressed as a linear function of the rate of growth of population and the rate of growth of per capita real income. Let m represent the percentage shift in the total demand function:

$$m = P_0 + \eta_y (\gamma_0) \quad (10)$$

where P_0 = rate of growth of population

η_y = income elasticity of demand for foodgrains

γ_0 = rate of increase in per capita real income.

The total demand schedule ($D_h^*D_m^*D^*$) can be approximated by

$$q = a(1 + m) p^{-\epsilon} \quad (11)$$

The equilibrium price and quantity after the IITC and the shift in demand can be obtained by solving the simultaneous system consisted of equation (3) and (11) as follows:

$$p_1^* \approx p_0 \left(1 - \frac{k}{\beta + \epsilon} + \frac{m}{\beta + \epsilon} \right) \quad (12)$$

and

$$q_1^* \approx q_0 \left(1 + \frac{\epsilon k}{\beta + \epsilon} + \frac{\beta m}{\beta + \epsilon} \right) \quad (13)$$

Correspondingly, the changes in consumers' surplus, producers' cash revenue, and production cost due to the IITC are recalculated for the shift in demand as

Change in consumers' surplus

$$\begin{aligned} &= \text{area } W D m Z - \text{area } A D m C \\ &\approx p_0 q_0 \left(\frac{k r}{\beta + \epsilon} \right) - \left(\frac{m r}{\beta + \epsilon} \right) \end{aligned} \quad (14)$$

Change in producers' cash revenue

$$\begin{aligned} &= \text{area } B^* G^* H^* Q_1^* - \text{area } A C H Q_0 \\ &\approx p_0 q_0 \left[\frac{k(\epsilon - r)}{\beta + \epsilon} - \frac{m(\epsilon - r) - m(k - m)}{\beta + \epsilon} \right] \end{aligned} \quad (15)$$

and

Change in production cost

$$\begin{aligned} &= \text{area } B^* O Q_1^* - \text{area } A O Q_0 \\ &\approx p_0 q_0 \left[\frac{k \beta (\epsilon - 1)}{(1 + \beta)(\beta + \epsilon)} + \frac{\beta m}{\beta + \epsilon} \right] \end{aligned} \quad (16)$$

The second terms of each expression represents the additional effect from the shift in the demand schedule due to the increases in population and per capita real income.

Distribution Among Consumers

As presented in equation (5), IITC in production of the semi-subsistence crop represents a gain in the economic welfare of nonfarm consumers. In Bangladesh, the nonfarm consumers include the urban population and the rural landless class. Moreover, the economic welfare will also improve for the small farmers who are net buyers of foodgrains.

If the IITC in production results in a lowered price of foodgrains, then its impact on the welfare and income of urban households depends on the importance of foodgrains in their expenditure pattern.

Suppose that total income (y) is spent on foodgrains (f) and other commodities (x) as

$$y = P_f q_f + P_x q_x \quad (17)$$

where P_f , P_x , q_f , and q_x represent, respectively, the prices and the quantities of foodgrains and other commodities. Then the percentage change in real income due to a decline in the price of foodgrain can be approximated by

$$\frac{\Delta y}{y} = e \frac{\Delta P_f}{P_f} \quad (18)$$

where $e = P_f q_f / y$ is the ratio of expenditure on foodgrain to total per capita income.

According to equation (12), the percentage change in foodgrain price due to a shifts in supply and demand functions by $k\%$ and $m\%$, respectively, is $(\frac{k-m}{\beta+\epsilon})$. Therefore, the percentage increase in real income is approximated by

$$\frac{\Delta y}{y} \cong e \left(\frac{k-m}{\beta+\epsilon} \right) \quad (19)$$

As e is inversely related to per capita income, a price decline of foodgrain due to IITC has the effect of reducing the income gaps among urban consumers.

Parameters

The model is applied to data on foodgrain (rice + wheat) economy of Bangladesh to illustrate the potential impact of IITC on national level foodgrain production, foodgrain prices, and income of consumers and producers. FY1987 is used as the base year for price, quantity, and per capita income.

Estimates of the price elasticity of demand for foodgrain for Bangladesh vary widely among different studies. Estimates by Alamgir and Berlage (1973) range from -0.172 to -0.177. Ahmed (1979) estimates a value of -0.19 for price elasticity of demand. Mahmud (1979) provides an estimate of -0.4, while estimates of Pitt (1983) range from -0.26 to -0.57. In this analysis a value of 0.3 is used for ϵ .

The price elasticity of foodgrain supply was estimated by Scandizzo and Bruce (1980) for Bangladesh range from 0.13 to 0.23 in the short-run and 0.19 to 1.28 in the long run. Based on a study by Cummings (1974), Ahmed (1978) estimates price elasticity of supply to be 0.18. A value of 0.2 is used for β in this study.

The estimate of shift in the foodgrain supply function due to IITC is based on the information provided in the National Water Plan, Master Plan Organization (MPO), 1986. The value of k represents the percentage shift in supply.

Estimates of the marketable surplus of foodgrains are available in the Socio-economic Indicators of Bangladesh, Bangladesh Bureau of Statistics, 1986. Based on this study, the value of r is determined as the marketable surplus ratio.

In order to evaluate the effect of shift in demand, the value of m is required. The elasticity of GNP with respect to foodgrain production is estimated to be 1.32. This result includes the multiplier effect of foodgrain production on GNP growth. Using the rate of increase in foodgrain production, the estimated population growth, and the income elasticity of demand for foodgrains, a value for m is derived.

Figure 3 FOODGRAIN PRODUCTION GAP
(Million metric tons)

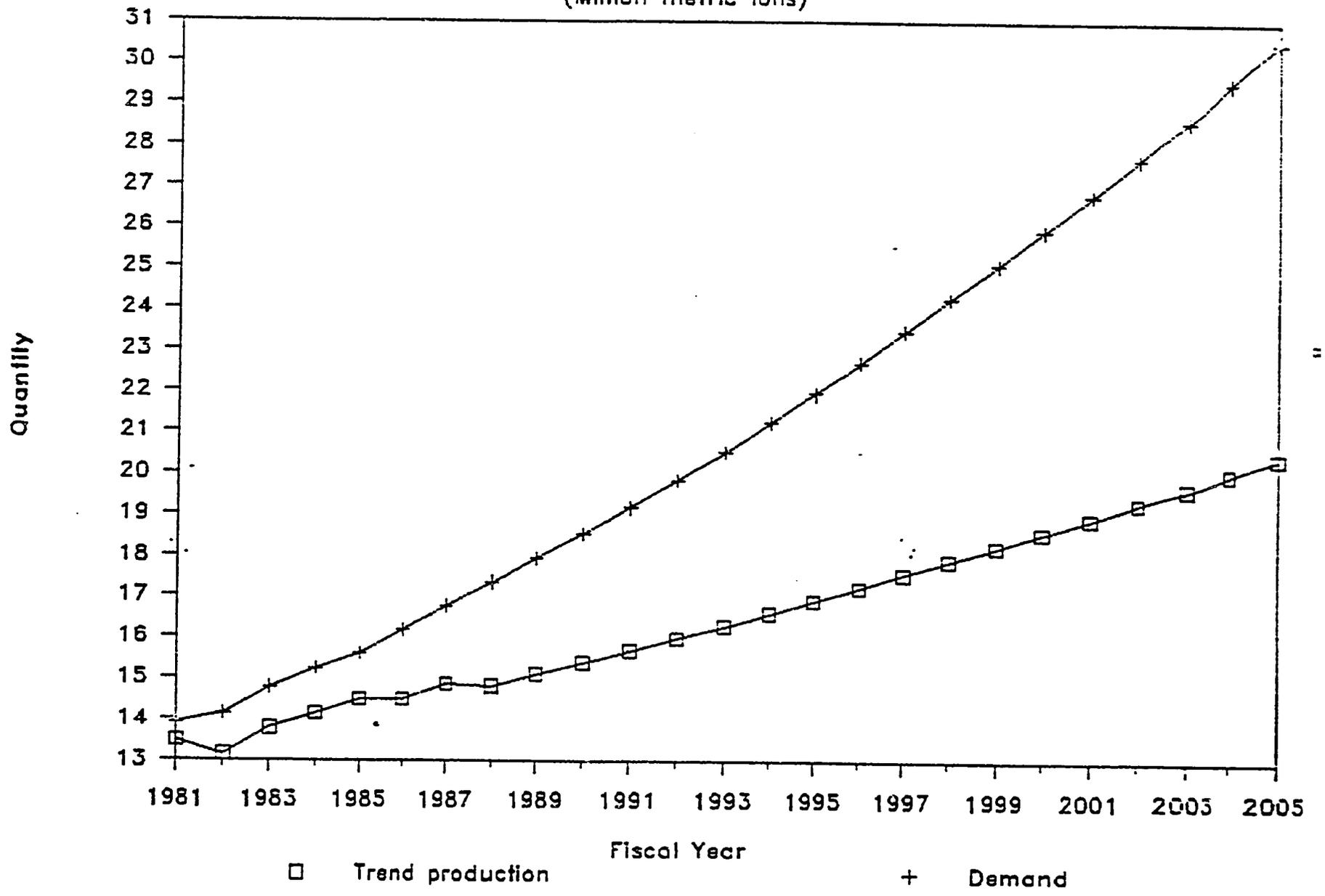
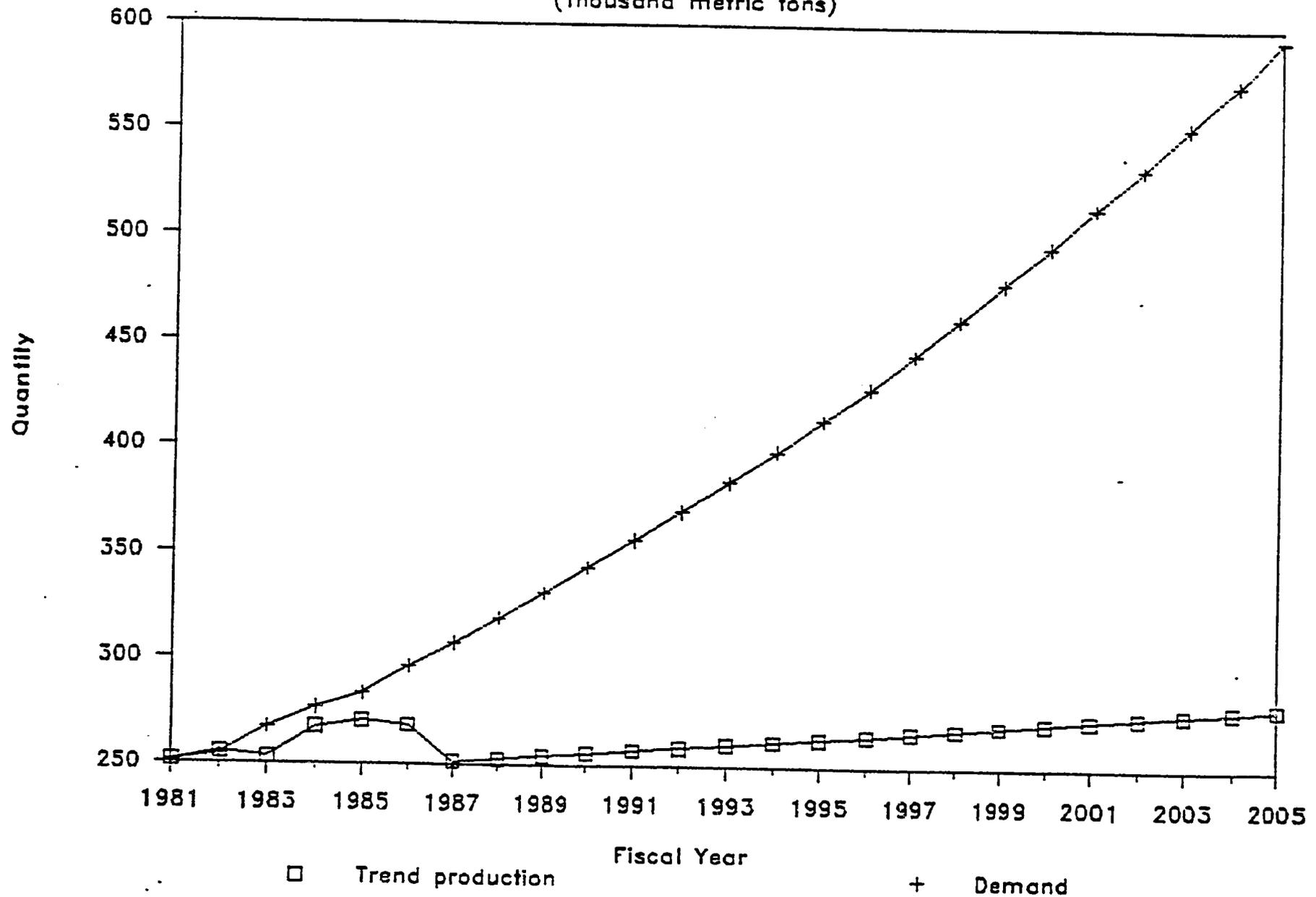


Figure 4 OILSEEDS PRODUCTION GAP
(Thousand metric tons)



13-

Figure 5 PULSES PRODUCTION GAP

(Thousand metric tons)

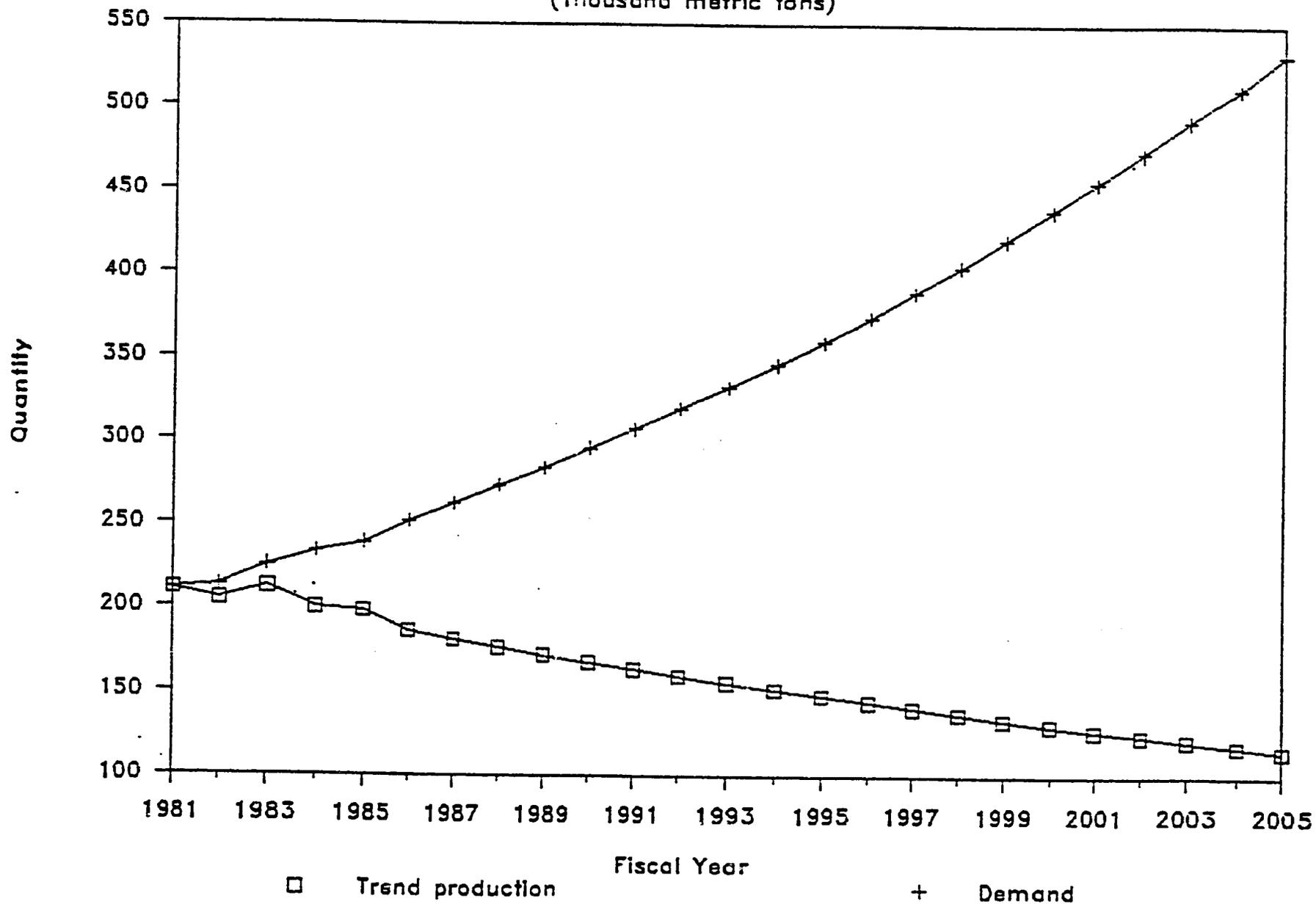
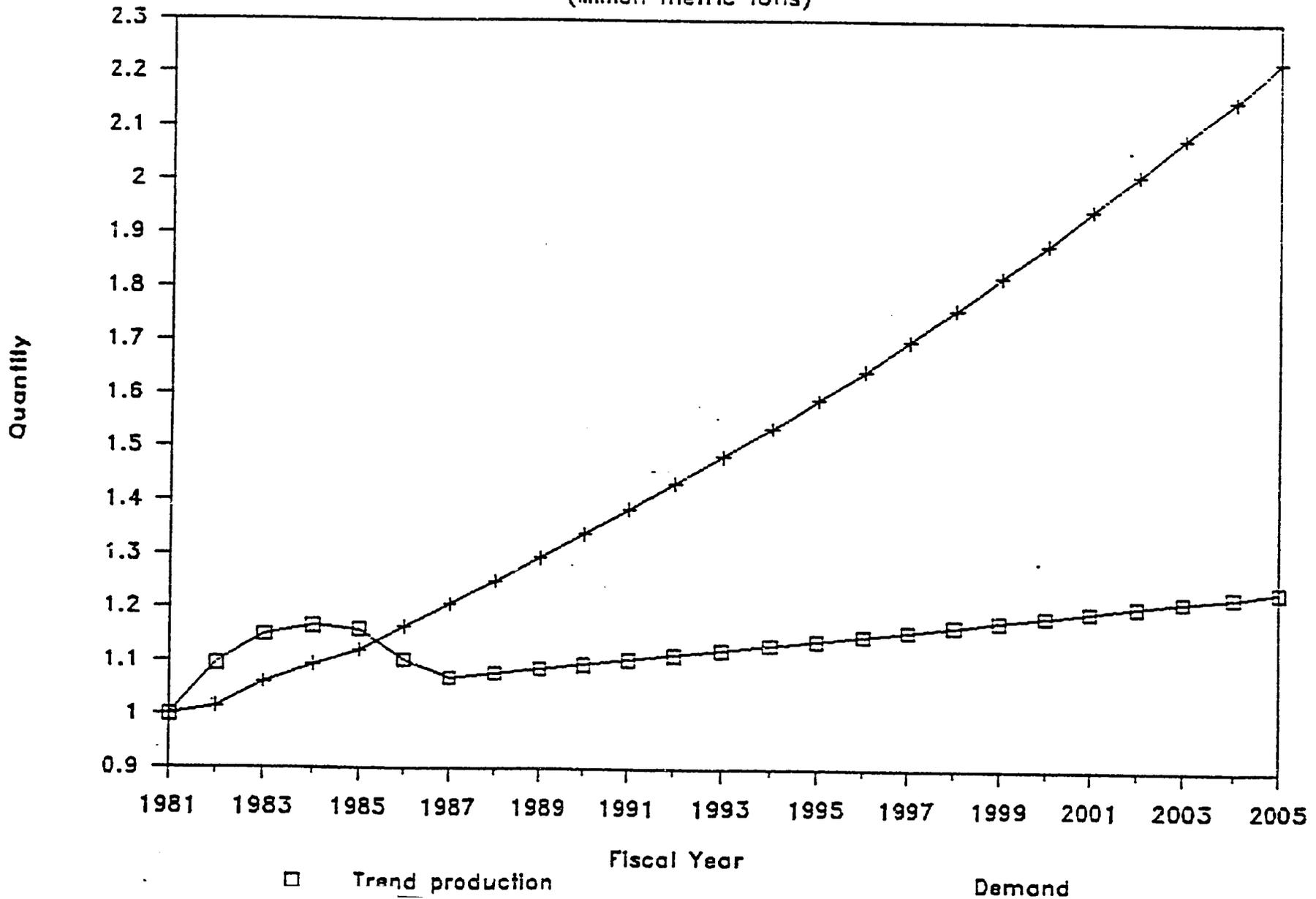


Figure 6 POTATOES PRODUCTION GAP
(Million metric tons)



Annex 2B

Poverty Analysis

MEASUREMENT OF FOOD POVERTY: A METHODOLOGY APPLIED TO BANGLADESH

Akhter U. Ahmed

Introduction

The majority of the people in Bangladesh are among the poorest in the world. Poverty alleviation is one of the principal objectives of development planning, and to attain this objective it is necessary to measure the incidence of poverty in the country. In this context, first we need to identify the poor using an appropriate poverty line. There are basically two approaches to derive a poverty line: the absolute norm, which considers the poverty line to represent a certain minimum living standard, and the relative norm according to which certain percentage of the population at the lower end of income distribution would be termed as poor. Such an approach, however, makes poverty elimination impossible, because there is always a bottom percent of population in the income distribution. Nevertheless, with a Rawlsian criterion of justice, one is concerned with improving the welfare levels of the worst-off group, therefore, it could still be reasonable for the policy-makers to be continually concerned with the lowest percentage of the population (Anand, 1983).

For an outrageously poor country like Bangladesh, an absolute measure is more pertinent to evaluate the success of a policy of poverty alleviation. Once the absolute poverty line is derived, it is then useful to determine the severity of poverty. At this stage of measurement, the inequality of distribution of resources among the poor needs to be examined, which is relevant to the notion of relative poverty.

In the poverty literature several approaches have been utilized to derive a poverty line based on absolute measure. Jackson (1972) defines poverty as the failure to meet minimum needs, thereby impairing the ability of the individual to function adequately in society. To overcome this situation, it is not only necessary to maintain health but also certain minimum social needs should be satisfied. However, the most essential need is of course food, and in a situation of extreme poverty, the absolute poverty standard may be determined on the basis of a purely biological minimum by calculating the cost of the minimum acceptable nutrients available from food.

There has been an increased concern on poverty in Bangladesh which has led to several studies on the measurement of poverty level (Alamgir, 1974; Mujahid, 1977; Muqtada and Alam, 1983; Ahmad and Hossain, 1985; B.B.S., 1986; Islam and Khan, 1986; World Bank 1987; Rahman, Mahmud and Haque, 1988; Rahman and Haque, 1988). Most of these studies have used the nutritional norm and defined the

poverty line in terms of minimum calorie requirements. However, the major problems that afflict these studies have been in determining the minimum food consumption basket that represent the food habit of the poor, and the use of certain value judgement becomes unavoidable. The problems have been further complicated by the choice of appropriate price index for the poor to deflate their current food expenditure. Due to these (and some other) problems, there has been a wide variation in the results of poverty measurements that makes it difficult to utilize appropriate poverty measures for policy purposes. Moreover, in order to measure poverty, most of the studies used the head-count ratio that identifies the proportion of the population below a given poverty threshold. It is a simple method and its implications are straightforward. However, head-count ratio merely determines the size of the poor population, and it is incapable of measuring neither the shortfall in income of the poorest of the poor from the threshold of poverty, nor the inequality in the distribution of income among the poor. This measure remains completely insensitive as the poor gets poorer.

A few studies incorporated the famous Sen index which is an axiomatically derived, Gini coefficient based measure of poverty (e.g, B.B.S., 1986; Islam and Khan, 1986). Sen index of poverty is sensitive to the gaps in the income of the poor, and gives more weight per unit to lower incomes. Sen's measure is obviously more informative than a head-count of the poor. However, this measure does not satisfy the desirable property of additive decomposability. Moreover, since Sen's measure uses the Gini coefficient, it suffers from a fundamental limitation: if the Lorenz curves for the two distributions intersect, it is no more possible to make any judgement from the corresponding Gini coefficients about the relative welfare implications of the two distributions.

The present study provides food poverty measures for Bangladesh using a new methodology formulated by Foster, Greer and Thorbecke (FGT) in 1984. (Foster, Greer and Thorbecke, 1984; Greer and Thorbecke, 1986). This methodology satisfies the desirable fundamental theoretic properties and has the advantage of being additively decomposable. The measure can be adjusted to take into account the differences in tastes and preferences, and prices between and within groups. Moreover, in contrast with the more general concept of poverty, the estimation of food poverty provides a measures of the success of national food policies.

Methodology

The concept and the methodology of the approach used to measure food poverty is summarized in this section from FGT, 1984, and Greer and Thorbecke, 1986. Food poverty is defined as "a condition of lacking the resources necessary to acquire a nutritionally adequate diet". Individuals who have the ability to meet their minimum food consumption requirements would not be considered poor even if they do not do so.

The food poverty line is set on the basis of recommended daily allowances (RDA) of nutrient. The calorie RDA is used for this purpose. Calorie is one of the property of food along with protein, vitamins, taste, texture and color. However, nutritionists have recognized that when commonly consumed cereal-based diets meet energy needs, they meet protein needs as well (Latham, 1987). Many vitamin and mineral deficiencies would be eliminated if sufficient calories were consumed (Greer and Thorbecke, 1986). The food poverty line denoted by Z , allows identifying the poor. G measures the food expenditure shortfall for the k^{th} individual. Let X_k represent food expenditure, then $G_k = Z - X_k$.

The FGT poverty measure provides a method to calculate the intensity of deprivation suffered by the poor. Sen (1976, 1978) has formulated two axioms which a poverty measure should satisfy:

Monotonicity Axiom: Given other things equal, a reduction in the income of any poor individual must increase the poverty measure.

Transfer Axiom: Given other things equal, a pure transfer of income from a poor individual to any other individual who is richer must increase the poverty measure.

The head-count ratio does not satisfy these axioms, since it does not show greater poverty as the poor get poorer.

The monotonicity axiom assures that the poverty measure is responsive to severity of poverty of each individual. The transfer axiom captures the concept of relative poverty which requires that a poverty measure be most sensitive to the welfare of the poorest of the poor. To satisfy the transfer axiom, it is necessary to weigh the shortfalls so that the deprivations of the poorest are counted more heavily than those of the less poor.

In the FGT method, the shortfalls themselves are used as weights. In the general case, if there are q households below the poverty line (Z) in a population of n , with income in ascending order, then the FGT poverty measures is

$$P = \frac{1}{n} \sum_{k=1}^q (G_k/Z)^\alpha \quad (1)$$

A larger value of α gives greater emphasis to the poorest poor. P satisfies the monotonicity and the transfer axioms. Moreover, P is additively decomposable with population share weights according to the formula

$$P = \sum_{r=1}^m (n_r/n) P_r \quad (2)$$

where n is the population and P_r is the severity of poverty in subgroup r , $r = 1, \dots, m$. P_r is measured by

$$P_r = \left(\frac{1}{n_r z^\alpha} \right) \sum_{k=1}^q G_k^\alpha \quad (3)$$

Equation (3) is the measure of P given in equation (1) applied to the income distribution of subgroup r . As claimed by FGT, P is the only measure which satisfies the monotonicity and transfer axioms and is decomposable. The decomposability property makes it possible to determine the percentage contribution of the subgroup to total poverty. If the poor in that subgroup are made non-poor then poverty would decrease precisely by this percentage. Without decomposability it is only possible to compare poverty measures to demonstrate which subgroup is more seriously poor.

Measurement of Food Poverty for Bangladesh

The methodology to measure food poverty has been applied to Bangladesh. The data on which the measures of poverty in this analysis are based is provided by the FY82 and FY86 Household Expenditure Surveys (HES). The measurement involves two steps. First, the cost-of-calorie functions are estimated for rural and urban areas for FY82 and FY86. The poverty line Z is estimated from the cost-of-calorie function. Next, the corresponding poverty measure is estimated.

Setting the Food Poverty Line: The welfare level of a household depends both on the total income of the household and on its size. Household income needs to be adjusted to take account of variations in household size. The HES provides data by monthly household income groups as well as monthly per capita income groups. Since the poverty among individuals is of ultimate interest, the classification of per capita household income is used in the analysis, based on aggregated grouped data for FY82 and FY86.

The advantage of the cost-of-calorie function procedure for determining the poverty lines is that it calculates the actual cost of acquiring the minimum calorie requirement to a consumer (a group of consumers in this case). The minimum calorie requirements are determined by taking into account both age and sex distributions in urban and rural areas in Bangladesh, provided by the FY86 HES. Adjusting for the age and sex compositions, the weighted average per capita daily minimum calorie requirement is estimated at 2,021 kcal (61,472 kcal per capita per month) for rural areas and 2,075 kcal (63,115 kcal per capita per month) for urban areas. Although rural and urban sex-ratios are quite similar, urban population reportedly had a less proportion of children than rural areas. This results in a slightly higher estimation of minimum calorie RDA for the urban population. It is assumed that the poor in urban areas (e.g., rickshaw drivers) work as hard, hence require as much calories as the poor in rural areas (e.g., landless agricultural laborers).

The estimation of calorie-cost-function requires information on calorie consumption and food expenditure. Data on per capita average quantity of the various food items consumed by members in each income group is available from the HES. The quantities of actually consumed food items are converted to per capita monthly calorie intake levels, C , using calorie conversion tables. The average per capita monthly food expenditure, denoted by X is computed for each income group. The information on food expenditure and calorie consumption are then used to estimate the cost of acquiring a given number of calories from the cost-of-calories function, using the Ordinary Least Squares (OLS) method.

Since the estimation involves grouped data and the number of observations is not the same in every group, the regression disturbance term ϵ would be heteroskedastic, implying that the OLS parameter estimators using group means would not be efficient, although would be unbiased and consistent. To overcome this problem, a weighted regression technique designed for heteroskedastic regression is used to estimate the equation using

the number of observations in each group as weights. In semi-log form, the function is

$$\ln X = a + b C \quad (4)$$

The poverty line Z is the estimated cost of acquiring the calorie RDA, R . From above equation,

$$Z = e^{(\hat{a} + R\hat{b})} \quad (5)$$

where \hat{a} and \hat{b} , are the coefficient estimates of a and b , respectively, from equation (4). Besides the semi-log form, linear, polynomial, Cobb-Douglas, and translog functional forms have been used to estimate the function, but the semi-log form is selected for its properties and good fit. This functional form allows to estimate the corresponding elasticity of calorie consumption with respect to food expenditure for each group, and it is theoretically consistent because the elasticity is positive and decreases at higher expenditure levels.

Povety Measures: The poverty measure P uses G_k/Z , the relative monetary shortfall as the indicator of the relative degree of poverty. However, two individuals having different food preferences and facing different relative prices in different regions may display the same monetary shortfall, but this does not necessarily imply the same caloric shortfall. Biological deprivation depends on which foods are dropped from the poverty line consumption pattern. These will differ between regions in accordance with regional income elasticities (Creer and Thorbecke, 1986).

Hence, the monetary shortfalls are converted into the corresponding implicit calorie deficit, to measure the biological deprivation more accurately.

The implicit calorie shortfall D_k as a proportion of the minimum calorie requirement, R is calculated from $D_k/R = \epsilon_k^a (G_k^a/Z^a)$ (6)

where ϵ_k^a is the elasticity of calorie demand faced by individuals in k income group in area a , $a = 1, \dots, m$, G_k^a is the monetary food gap of income group k in area a and Z^a is the food poverty line in area a .

Using the implicit calorie shortfalls as weights, the poverty measure is given by the sum of the food consumption gaps squared according to the formula:

$$P' = \left(\frac{1}{N}\right) \sum_{a=1}^m \sum_{k=1}^{q^a} (\epsilon_k^a G_k^a / Z^a)^2 \cdot n^a \quad (7)$$

where

$$g_k^a = z^a - x_k^a \quad \text{if } x_k^a < z^a, \quad 0 \quad \text{if } x_k^a > z^a,$$

(x_k^a = average per capita food expenditure of k income group),

q^a = the number of per capita income groups below the poverty line,

n_k^a = population size in k income group, and

N = total population in Bangladesh.

P' is the poverty measure used in this analysis with a value of $\alpha = 2$, which satisfies Sen's (1976) Monotonicity and Transfer Axioms and also a weak form of Kakwani's (1980) Transfer Sensitivity Axiom (the "strong form" requires $\alpha > 2$). The value of $\alpha = 2$ has been preferred in past empirical applications; see for example, Foster et al. (1984), Greer & Thorbecke (1986), Ravallion (1988a), Ravallion & Chao (1988b). The poverty measure P has the added advantage of additive decomposability with population share weights as in equation (3). Moreover, it captures the differences in food preferences and relative prices in rural and urban areas, as well as among different income groups.

Results and Discussion

This section presents a discussion of the results of poverty estimates. Two levels of decomposition of poverty measures will be provided: total Bangladesh population decomposed into rural and urban areas, and decomposition of rural and urban population by income groups. We shall compare the results between fiscal year 1981-82 (FY82) and fiscal year 1985-86 (FY86).

The poverty lines are determined based on the estimated calorie-cost function $\ln X = a + bc$, as mentioned earlier. The regression estimates of the calorie-cost functions, estimated poverty lines, and the calorie demand elasticities at the poverty lines are presented in Table 1. The coefficients of b are statistically highly significant at the 0.01 level of significance. The higher calorie requirements as well as the relatively higher food prices are reflected in the higher values of poverty lines for urban areas in FY82 and FY86, compared to poverty lines for rural areas. The demand elasticity for calories at the poverty line are estimated as \hat{b}/R where \hat{b} is the estimate of b in $C = a' + b'x$, the Engle's curve for calories. R represents the minimum calorie requirement. It is interesting to note that the elasticity is substantially higher in rural areas than urban areas, indicating differences in food preferences and/or relative prices between the two areas. However, the absolute values of demand elasticities for calories do not show any remarkable change over time.

Table 2 presents a profile of poverty in Bangladesh. Rather surprisingly, the poverty measures show that a considerable poverty alleviation has taken place in Bangladesh. The severity of rural poverty declines sharply by 51 percent from FY82 to FY86. Similarly, the head-count index indicates a remarkable decrease in the percentage of poor population in rural areas. Even the absolute size of poor population in rural areas reduces by 15 percent, from about 53 million people in FY82 to 45 million people in FY86. However, both the severity of poverty as well as the percentage of poor population in urban areas register slight increases. The absolute number of those consuming less than recommended minimum calories in urban areas rises from 7.7 million people in FY82 to 8.4 million people in FY86.

The decomposability of poverty measure makes it possible to attribute a given amount of poverty to rural and urban areas. In FY 82, rural areas contributed to 94% of total poverty in Bangladesh, although 86% of total Bangladesh population lived in rural areas. In FY86, rural areas accounted for 87% of total population, and 90% of total poverty. However, rural poverty was 29% more severe than urban poverty in FY86, in spite of significant reductions in both severity of poverty and in percentage of rural people below the poverty line, from FY82 to FY86.

The large reduction in rural poverty in the four-year period may be questionable, despite the fact that there has been improvements in some of the poverty indicators. A change in the methodology in collection of the HES data from FY84 could have contributed to show a delusive picture of the actual situation. These issues have been discussed in detail elsewhere (please see Rahman and Haque, 1988; World Bank, 1987 and 1988). We shall examine the factors that might have contributed to the reduction in rural poverty.

There has been a significant (35%) increase in real wage in agriculture, which constitutes a major portion of income of the rural poor. Moreover, real wage in the small scale rural industry increases by 43% over the period FY82 to FY86. A World Bank study (1987) reports an upward trend in rural employment situation - a 23% increase in employed rural labor force from FY81 to FY84. It is likely that the improvements in rural real wages and employment situations have had a significant positive impact on income of the rural poor. Since the income elasticity of demand for food is relatively high among the low income people, it is expected that income gains to the poor would create a substantial increase in effective demand for food, and thereby increased calorie intake. The World Bank (1987) study also reports an increase in food availability to the rural poor through substantial progress in the Food-for-Work and the Vulnerable Group Feeding Programs.

There was also a considerable increase in rural credit (such as the program initiated by the Grameen Bank) and inflow of other resources (e.g. an increased allocation for rural infrastructure development) during 1982-86 period (World Bank, 1987). A more recent World Bank report compares the results from the surveys conducted by the Institute of Nutrition and Food Science (INFS), and the nutritional status assessment module of the Household Expenditure Survey (HES). The results suggest that the proportion of children in rural areas suffering acute malnutrition had declined from about 20% in FY76, to about 8% in FY86 (World Bank, 1988).

The above evidences support our results that at least some improvement in rural poverty situation has taken place.

As mentioned earlier, our results show a slight increase in the incidence and severity of urban poverty over the period FY82 - FY86. Indications of this increase is however, less apparent. Trends in daily real wages in the urban industrial and construction sectors show modest increases in a few industries while decline in others. The World Bank Study (1987) reports a 5% decline in the absolute number of employed urban civilian labor force from FY81 to FY84, despite an increase in urban population. The HES reports a 3.2% reduction in per capita average quantity of foodgrain consumption (foodgrains accounted for 83% of total calorie intake) in urban areas from FY82 to FY86.

Table 3 presents a comparison of our results with a recent, and perhaps, the most widely discussed study on poverty in Bangladesh by Rahman and Haque (1988), commissioned by the World Bank. Two interesting observations can be drawn from Table 3:

- i) In terms of head-count measure of rural poverty our results conform with that obtained by Rahman and Haque although the later shows a higher magnitude in rural poverty reduction;
- ii) In the case of urban poverty our results contradict the one claimed by Rahman and Haque.

Although both studies have used the HES data for poverty measurement, the difference in the results are due to the difference in the methodology. The Rahman and Haque study has adopted the method of valuing the minimum consumption bundle to arrive at the poverty line. We have already discussed the problems of using this method, which ignores the difference in tastes and preferences of individuals between different income groups, region, and over time. Rahman and Haque recognize that the direct method of measuring poverty on the basis of actual consumption of calories is more reliable. But they justify the adoption of income method because it satisfies the poverty of ability of an individual to acquire minimum consumption items. As mentioned earlier our methodology preserves this important property of ability to consume, while provides an accurate measure of poverty by consumption, and thereby, captures the difference in taste and preferences, and relative prices.

In their study, Rahman and Haque also presents the Sen indices of poverty (which measures the severity of poverty), however, their Gini Coefficient based intertemporal Sen indices cannot be meaningfully compared, because we have found that the corresponding Lorenz curves for the two time periods intersect, for both rural and urban areas.

The comparative results of our second level of decomposition of absolute poverty measures are presented in Table 4. Due to different sizes of income groups within as well as between time periods, and the differences in the value of nominal income brackets, the groups are not directly comparable. In order to facilitate comparisons, therefore, we have plotted the cumulative distribution of population ranked from poor to rich according to increasing implicit calorie consumption, and fitted curves. For example, the poorer individuals labeled "percentile 5", have an average level of per capita food expenditure less than 95 percent of population in the respective rural or urban areas. Similarly, the high income individuals, labeled "percentile 90" have per capita average food expenditure greater than 90% of the population. The results indicate that, despite striking improvements in calorie intake in rural areas considerable differences between rural and urban areas remain in FY86 for the bottom two percentile groups.

Table 5 and 6 present the measures of the severity of poverty, i.e. the measure of inequality of distribution of individuals in terms of calorie consumption among the poor -- the concept of relative poverty. The measures suggest that, if the bottom 10 percent of the poor were made non-poor in rural and urban areas then poverty would have decreased by 42% and 33% respectively in rural and urban areas in FY82. The contributions of the poorest 10 percent to poverty have increased to 57% and 43% in FY86 in rural and urban areas, respectively.

Therefore, poverty has become relatively more severe for the poorest of the poor over time in both urban and rural areas, although absolute poverty situation has improved in rural areas. This notion of relative poverty has important policy implications. For instance, elimination of poverty of the bottom 30% of the poor in FY86 would lower rural poverty by 86%, while poverty would decline by only a meager 1% if top 30% of the poor are made non-poor. In terms of head-count index, however, poverty elimination from 30% of the poor in FY86 would reduce the percentage of poor population in rural areas from 51.6% to 36.1% regardless of what segment of the poor population are brought above the poverty line. The measurement of the severity of poverty (i.e. the concept of relative poverty) is crucial as long as any portion of the population exists below the poverty line.

Table 1. Estimated Food Poverty Lines

Area	Calorie cost function $\ln X = a + bC$	R^2	Minimum calorie requirements (R) (Per capita Per month)	Food poverty line (Taka per month per capita) (Z^a)	Elasticity of calorie demand with respect to food expenditure at the poverty line (ϵ^a)
1981/82					
Rural	$\ln X = 3.10 + 0.267 \times 10^{-4} C$ (38.5)	0.99	61,472	113.98	0.61
Urban	$\ln X = 2.70 + 0.364 \times 10^{-4} C$ (54.8)	0.99	63,115	147.88	0.43
1985/86					
Rural	$\ln X = 3.72 + 0.248 \times 10^{-4} C$ (23.4)	0.99	61,472	190.01	0.64
Urban	$\ln X = 3.10 + 0.592 \times 10^{-4} C$ (33.5)	0.99	63,115	264.07	0.40

Figures in parentheses represent t - ratios.

/a The demand elasticity for calories at the poverty line, ϵ^a , are estimated as $\frac{\hat{b}'}{R}$ where \hat{b}' is the estimate of b' in $C = a' + b' \ln X$, the Engel's curve for calories.

Table 2: A Profile of Poverty in Bangladesh

Area	Poverty Line (Taka)	Poverty Servity ($\alpha=2$)	% contribution to total Poverty /a	Poor Population	
				% of Area	% of Total
FY 82					
Rural	113.98	0.0401	94.3	71.8	61.8
Urban	147.88	0.0150	5.7	65.3	9.1
Bangladesh	-	0.0366	100.0	-	70.9
FY 86					
Rural	190.01	0.0197	89.9	51.6	45.1
Urban	264.07	0.0153	10.1	66.8	8.4
Bangladesh	-	0.0191	100.0	-	53.5

/a Calculated as: $100 \times (\text{area population}/\text{total population}) \times (\text{area P})/\text{total P}$.

table 3: Comparative trends in Poverty

Year	Rahman & Haque Study /a		Present Study /b	
	Rural	Urban	Rural	Urban
(Percentage of Population Below Poverty Line)				
Indirect Measure /c				
FY82	79.1	50.7	71.8	65.3
FY86	47.1	29.1	51.6	66.8
Direct Measure /d				
FY82	74	67		
FY84	77	68		

/a Results from Rahman and Haque (1988) study correspond to a poverty line calorie requirement of 2200 calories per person per day. Poverty line in our study are based on calorie requirement of 2021 and 2075 calories per person per day, for rural and urban areas, respectively.

/b Our estimates is based on implicit calorie consumption method, which utilizes both consumption expenditure as well as actual consumption of calories, thereby satisfies the property of economic ability to consume.

/c Based on consumption expenditure.

/d Based on consumption of calories.

Table 4: A Comparison of Calorie Intake

Percentile of Population (Ranked from Poor to Rich)	Estimated Calorie Consumption as Percent of Minimum requirement /a			
	FY82		FY86	
	Rural	Urban	Rural	Urban
5	48	71	60	70
10	58	76	69	75
20	69	81	82	81
30	76	86	89	86
40	82	89	94	90
50	88	93	99	94
60	95	97	104	98
70	99	102	110	101
80	104	107	119	107
90	114	114	124	111
95	121	117	132	113

/a Estimated implicit calorie consumption based on the concept of ability to consume.

Table 5: A Comparison of Contribution to Poverty

Cumulative Percentage of Poor Population (according to increasing income)	% Contribution to Poverty /a			
	FY82		FY86	
	Rural	Urban	Rural	Urban
5	29	20	36	27
10	42	33	57	43
20	66	57	78	63
30	79	72	86	76
40	89	84	93	87
50	94	91	96	93
60	98	95	97	97
70	99	98	99	99
80	99.5	99	99.5	99.6
90	99.8	99.8	99.7	99.8

/a Estimated using $\alpha=2$.

Table 6: Decomposition of Poverty by Income Groups

Monthly Income Groups (Taka/capita)	% Contribution to Poverty /a		% of Rural Population	% of Urban Population
	Rural	Urban		
FY82				
< 50	5.1	-	0.5	--
50- 74	24.0	3.9	3.2	0.4
75- 99	33.9	12.0	9.1	1.9
100-124	23.7	20.0	13.5	4.8
125-149	11.5	25.5	16.3	7.3
150-174	1.6	18.4	13.7	8.5
175-199	0.1	10.4	11.5	8.1
200-249	0.0	8.5	4.0	15.5
250-299	-	1.2	-	11.8
300-349	-	0.2	-	7.0
	100.0	100.1	71.8	65.3
FY86				
< 150	32.3	7.2	2.1	0.5
150-174	22.7	4.2	2.8	0.5
175-199	20.2	9.7	3.8	1.4
200-249	18.9	25.4	12.8	5.4
250-299	4.9	22.8	16.4	8.1
300-349	1.0	16.1	13.7	10.1
350-399	-	8.7	-	8.5
400-449	-	3.9	-	8.1
450-499	-	1.8	-	6.5
500-599	-	0.2	-	13.1
600-699	-	0.0	-	4.6
	100.0	100.0	51.6	66.8

/a Calculated as:

$100 \times (\text{income group population}/\text{area population}) \times (\text{income group P})/\text{area P}$.
Estimated using $\alpha=2$.

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ANNEX 3

AGRICULTURAL SECTOR ANALYSIS

Food Production

Prepared by

William H. Judy

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Food Production

EXECUTIVE SUMMARY:

THE SITUATION:

Bangladesh is a riverine environment. Eighty percent of the country is delta which floods annually. The floods are a mixed blessing. As the uncontrolled inundation imperils people, infrastructure, crops and livestock, the floods deposit silt and recharge the water table. Rivers are the principal means of transport and communication. The tropical monsoon climate, along with the uplands, favors production of almost any variety of crop and tree. The people work hard and are very resourceful. They have learned to live with floods and typhoons, while producing rice and other crops for domestic consumption. The delta, which comprises 80% of the land area, consists of deep moderately fertile alluvial and terrace soils. The balance of the land is hilly, rising to as much as 1,000 meters, where agricultural potential is limited by fertility and erosion. The supply infrastructure is less well developed than the rice marketing system which moves this basic food staple efficiently.

Population is currently growing at the rate of 2.5 percent per year. Production of food grains and vegetable oils lags behind national demand. Productivity, whether measured as food produced per hectare or per person, appears to have reached a plateau after dramatically increasing for several years.

THE POTENTIAL:

If current research yields represent crop productivity potentials, national average yields have reached only about one-fourth of the potential, except for Boro and T. Aman rice. The better farmers, using HYVs and recommended inputs, have attained yields of twice the national average. If technology were fully utilized with the current cropped and irrigated area, the country could meet food grain requirements to the year 2000. Irrigated area could be increased about 3.6 times from the current 1.92m hectares. If the irrigated area were increased and current technology were applied to Boro and T. Aman rice, the country could meet food grain requirements to the year 2007.

Diversification into high-yielding food crops, such as maize and white potatoes, and improved oilseeds, offers even greater potential. Planting HYV boro rice and wheat could supply food requirements to year 2005. Using Boro rice and maize, food requirements could be met to year 2017.

So Bangladesh has the potential for meeting food grain requirements with current technology into the early 21st century. Additional production to meet food needs beyond 2020 can be achieved through agricultural research, which could obtain gains of around 1-2% per year from most crops. Thus, assuming that the population growth rate continues to decline at the current rate, Bangladesh should be able to meet food requirements well beyond 2020.

THE OPPORTUNITIES:

Food production could be increased significantly by three approaches.

Increase irrigation: An additional 4.98m hectares of irrigable land could be brought into production using available water resources.

Diversify crop production: Diversification into high-yielding food crops such as white potatoes and maize and/or improved oilseeds offers even greater yield potential.

Intensify production: Resource investment, i.e. inputs and husbandry techniques, could be intensified to increase production per acre. Current crop production technology could be utilized on all existing irrigated and rainfed areas.

THE CONSTRAINTS AND PROBLEMS:

Technical problems: Some HYV and husbandry recommendations do not fit the cropping system or take into account the productivity potential. Farm draft power is not sufficient to expand acreage nor do cattle have sufficient capacity to prepare existing land rapidly and effectively as cropping intensity increases. Fertilizers are not formulated to include micro-nutrients.

Sustainability: Virtually all plant residues are used for fuelwood and livestock feed which reduces soil organic matter and thus productivity. Unless micro-nutrients are included in fertilizers, soil fertility will decrease as cropping is intensified.

Systems problems: Farmers frequently are not aware of research technology. If aware, they may not have the means or facilities to utilize this technology in their environment. Inputs such as irrigation water and HYV seed may not be available. Efficient use of irrigation water is reduced by the system of distribution and irrigation techniques.

Socio-economic problems: Fragmentation of land and inequitable lease arrangements cause reduced investments of production resources to reduce risk. People are unaccustomed to production and consumption of crops other than rice and oilseeds and markets have not been developed.

Policy: The fixation on "Rice and Water" by policy makers and planners prevents consideration of other viable options for crops and cropping systems.

POSSIBLE APPROACHES TO ALLEVIATE CONSTRAINTS:

Increase the Adoption of Technology: Increase the rate of technology transfer to farmers by intensifying on-farm research in more agro-ecological zones; by involving more of the existing research officers in on-farm research; and by intensifying the technical training of extension personnel. Concentrate on crop diversification, irrigation techniques, fodder for draft animals, poultry, and fisheries. Improve coordination and cooperation among institutions to enhance technology transfer, on-farm research, result demonstrations, and the supply of inputs.

Improve the Utilization of Irrigation Water: Improve distribution systems to deliver more water. Teach improved irrigation techniques. Diversify crop production using low water requirement crops.

Increase the Availability of Improved Seed and Fertilizer: Provide fertilizer blended to meet crop and soil requirements including micronutrients. Establish a national seed production and distribution company to provide high quality, genetically pure seeds for field crops and vegetables at more sales outlets. Provide enough HYV or "improved" varieties of crop and vegetable seed every year to plant 20% of the production area.

Increase Farm Power for Cultivation: Grow additional green fodder as field crops and forage-producing trees to improve the work capacity of draft animals. Switch from a span of two oxen to a single animal. Encourage use of power tillers which can be used for multiple tasks such as cultivation, water pumping, operating mills, and for local transport.

Increase Diversification of Crop and Livestock Enterprises: Increase use of agro-forestry to supply fuelwood, livestock fodder, and fruit. Establish commercial and village poultry flocks for meat and eggs. Improve village fisheries. Provide research technology for alternative crops and cropping systems, with emphasis on low water requirement crops.

Improve Drainage and Flood Protection: Reduce risk and increase intensive investment of resources on areas of low level flooding by building low embankments. Revamp roads and drains so that moderately and deeply flooded lands will drain more quickly and completely.

Reduce Fragmentation of Land Parcels and Improve Equity of Leases:

Determine cause and possible approaches which can be used in educational programs to reduce further fragmentation of land parcels and to encourage equitable leases.

Improve the Health of the Farming Population Through Better Nutrition: Crops such as wheat, white potatoes, most vegetables, maize, and oilseeds produce higher yields with less irrigation water than rice. Vegetables would also improve nutrition.

PRESENT AND ADJUSTED USAID PROGRAM

Since 1977, USAID activities have been devoted to rural electrification, higher education, agricultural research and fertilizer marketing.

The agricultural research activities have developed a national capacity for food research and on-farm research. It is recommended now that USAID refocus efforts toward developing an accelerated technology transfer capacity from the research institute to the farmer. The program would concentrate in the areas of on-farm research and training for extension workers in the areas of crop diversification, irrigation systems and techniques, draft cattle nutrition and fisheries.

The fertilizer program has privatized the marketing structure for imported and domestic manufactured fertilizer. It is recommended that this program now address privatization of TSP manufacturing and, in the future, nitrogen manufacturing plants and blending plants.

A complementary program is recommended for involvement of a private seed company in the privatization of the seed import and marketing sector.

It is recommended that USAID work with knowledgeable institutions and other donors to determine ways that land fragmentation can be slowed down and that improvement can be made in the equity of land leases so that farmers are more willing to invest in intensive production.

It is recommended that USAID give attention again to national efforts to improve the quality of human resources for the total agricultural industry.

PROGRAMS RECOMMENDED FOR USAID INTERVENTIONS:

The following programs are recommended for consideration by USAID. They are ranked by priority.

- Fertilizer Formulation, Marketing, and Distribution - US\$25m
- Research Technology Transfer - US\$40m
- Expansion of Irrigated Land and Improved Water Use Efficiency - US\$15m
- Reduce land Fragmentation and Improve Equity of Leases - No cost estimate made
- Seed Import, Production, and Distribution - US\$20m
- Shrimp and Prawn Production - No cost estimate made
- Farm Power for Cultivation of Food Crops - US\$10m

CONCLUSION:

Assuming current decline in population growth rate, the Bangladesh agricultural system can meet national food requirements, provide more employment in the agricultural production and support sectors, and even generate modest amounts of food for export well into the 21st century. However, some important adjustments will need to be made in both production and support components of the system. Production will need to be diversified from major emphasis on rice to alternative higher yielding lower water requirement food crops. Investment in production must become more intensive than extensive as land and water resources are stretched to the limit. More efficient use of irrigation water must occur. Research will need to concentrate on increasing the yield ceiling of food crops and sustaining productivity of the soil. The rate of transfer of technology will need to be accelerated. Government investment will need to shift from involvement in production to regulation of the privatized supply sector and to monitoring of the production system to remove disincentives.

Agriculture Sector Analysis

Food Production

I. Introduction

A. Population Growth vs Potential Food Supply

The population of Bangladesh is currently growing at the rate of 2.5 percent per year. Food production, in terms of food grains and vegetable oils, lags behind national demand (Fig. 1). Productivity, whether measured as food produced per hectare or per person, appears to have reached a plateau after dramatically increasing for several years. The deficits between national production and food requirements have been made up by imports of food grains and vegetable oils.

Shortfalls in national foodgrain production during the 1983-1988 period ranged from 299,000 mt in 1983/84 to 1,019,000 mt in 1987/88 (Table 1). During recent years, the better farmers using HYVs and recommended inputs attained yields which were twice the national average (Table 5). If we consider current research yields to represent crop productivity potentials in Bangladesh, then average farmer yields have reached only about one-fourth of the potential, except for Boro and T. Aman rice.

Put another way, if existing crop technology were applied, production could be substantially increased. For example, if technology were fully utilized with the current cropped and irrigated area, the country could meet food grain requirements to the year 2000 (Table 8).

Another unexploited potential is expansion of the irrigated area. The MPO 1986 National Water Plan (16) gives net cultivatable area (NCA) as 9.03m hectares (not including 0.42m hectares of active floodplain). Of the total NCA, 7.56m hectares is suitable for irrigation, but water resources are available for only 6.90m hectares. The MPO Report estimated that 1.92m hectares was under irrigation, so irrigated area could be increased about 3.6 times to fully utilize the available water. If the irrigated area were increased to the limit of available water and current technology were applied to Boro and T. Aman rice, the country could meet food grain requirements to the year 2007.

Diversification into high-yielding food crops, such as maize and white potatoes, and improved oilseed crops, such as mustard, offers even greater production potential. Using current technology, if all irrigable land were brought into production and 50% of the total irrigated NCA were planted in irrigated HYV Boro rice and the balance of suitable land into HYV wheat, then food requirements could be met to year 2005 (Table 11). Using the mix of Boro rice and maize, food requirements could be met to year 2017 (Table 12). In comparison, with the current mix of food grains, food requirements could be met only to year 2000.

So, with current technology, Bangladesh has the potential for meeting food grain requirements into the early 21st century. But what then?

Agricultural research can coax gains of around 1-2% per year from most crops. Most of this gain could be translated through technology transfer into additional foodgrain production. Thus, assuming that the population growth rate continues to decline at the current rate, Bangladesh should be able to meet food requirements well beyond 2020.

B. Bangladesh Agriculture in the 21st Century: Some Scenarios

Assuming current decline in population growth rate, the Bangladesh agricultural system can meet national food requirements, provide more employment in the agricultural production and support sectors, and even generate modest amounts of food for export earnings well into the 21st century, if some important adjustments are made in both production and support components of the system. Production will need to be diversified from major emphasis on rice to alternative higher yielding lower water requirement food crops. Investment in production must become more intensive than extensive as land and water resources are stretched to the limit. More efficient use of irrigation water must occur. Research will need to concentrate on increasing the yield ceiling of food crops and sustaining productivity of the soil. The rate of transfer of technology will need to be accelerated. Government investment will need to shift to regulation of the privatized supply sector and monitoring of the production system to remove disincentives.

If the strategy is to concentrate agricultural production on rice and water rather than diversification and water use efficiency, then the industrial sector will need to develop more rapidly to create employment and export earnings.

Great care must be taken to avoid those changes in flood management, ground and surface water reservoirs, and soil conditions which could reduce soil productivity and availability of irrigation water during the the non-flood season.

In short, the human and natural resource productive potential is there and it can be realized with those adjustments and investments which will allow and encourage expression of that potential.

II. Domestic Food Production:

Food production could be increased significantly by three approaches. Suitable land not now under irrigation could be expanded to the limit of available water resources. Resource investment, i.e. inputs and husbandry techniques, could be intensified to increase production per acre. The mix of food grains, pulses, and oilseeds could be expanded by adding different high-yielding low water requirement crops such as maize, wheat, and white potatoes.

Increase irrigated area: An additional 4.98m hectares of irrigable land could be brought into production using available water resources. If current yield levels (with 1.9% annual increase) were obtained on all available irrigated land, then food grain production would be sufficient to meet national requirements only to year 1992. This would require irrigable land to be brought under irrigation at the rate of 25.7% per year.

Intensify production per hectare: Current crop production technology could be utilized on all existing irrigated and rainfed areas. To meet national food requirements at the year 1995 would require a growth rate of 5.0% per year in yield per acre obtained from adoption of technology. The current growth rate trend is 1.9%.

Diversify the mix of cereal grains: Crop diversification into high-yielding food crops such as white potatoes and maize and/or improved oilseeds offers even greater yield potential. If part of the potential irrigable land were planted to maize, the national food grain requirement at year 1995 could be met by increasing maize area from 810 hectares to 706,000 hectares (assuming continuation of present growth rate for other cereals). This would require allocation of 14.2% of the potential irrigable land to maize.

III. Constraints to Increased Production

The lag and stagnation in growth of national food production can be attributed to several problems. These include technical, systems, human, and policy dimensions.

Technical problems: The research recommendations may not fit the cropping system or take into account the productivity potential. The command area of many deep tube wells (DTW), shallow tube wells (STW), and low lift pumps (LLP) may not be effectively irrigated (16). Draft power may not be available; draft cattle may not have sufficient capacity to prepare existing land rapidly or to cultivate additional area (26). Use of all plant residues for fuelwood and livestock feed reduces soil organic matter and thus productivity. Livestock and poultry are not managed in such a way that they contribute the maximum to human nutrition.

Systems problems: Farmers may not be aware of research technology. If aware, they may not have the means or facilities to utilize this technology in their environment. Inputs such as irrigation water and HYV seed may not be available. Efficient use of irrigation water may be reduced by the system of distribution. Lack of coordination and cooperation among various agricultural institutions may delay or dilute the full benefits of information and services. Markets may not be able to absorb overflow production. Markets have not been developed for new crops.

Human problems: Land may be so fragmented as to cause reduced management efficiency and intensity of production. There is a strong tendency toward risk avoidance among lease-holders and those who cannot control irrigation and flood water; production factors are under-utilized and poorly mobilized with the result that household efforts and resources are not invested intensively toward increasing output per acre (14). Individuals with means tend to accumulate additional land (extensive investment) rather than make intensive investment in production. There may be socio-cultural inhibitions to newer crops. Poor human nutrition may reduce efficient and effective output.

Policy problems: The fixation on "Rice and Water" by policy makers and planners may prevent consideration of other viable options for crops and cropping systems (1).

IV. Opportunities and Methods to Alleviate Constraints

In section III above, major constraints have been identified which prevent closing the gap between national food requirements and food production. These problems are examined in more detail below, along with some opportunities and methods to alleviate the constraints.

A. Expand area under irrigation: The key to increased agricultural production lies in the expansion of the area under irrigation. Without adequate water, other inputs such as fertilizer and HYV seed will not be utilized to their full potential. Bangladesh has demonstrated that it has the capacity to expand the area under irrigation in a very short time. From 1976/77 to 1986/87, the area irrigated increased from 1.2 million hectares to 2.2 million hectares, an increase of 83%. The initial thrust should be in the development of groundwater sources through shallow tube wells (STWs) and deep tube wells (DTWs). These are less expensive and less complex to operate and maintain than surface water development. The World Bank has estimated that it is entirely feasible for Bangladesh to install some 24,000 DTWs and 412,000 STWs between now and the year 2000 in order to reach self-sufficiency in foodgrain production. This rate of increase is actually below the levels already achieved in peak years.

The assumptions are made that:

--The government will remove all restrictions on private importation and installation of STWs and DTWs.

--The government will complete the privatization of DTWs and turn over their maintenance and repair to the private sector.

--Land under irrigation will expand to the limit of irrigable land available water..

B. Increase access to research technology: Intensive agriculture involves highly technical and very complex subject matter which, in turn, requires a research staff which understand the technology, as well as effective dissemination methods. The tropical and sub-tropical climate in Bangladesh favors a wide variety of crops, plus livestock, fisheries, and agro-forestry enterprises (10). The large number of farmers further exacerbates the situation. But technology is available now which could increase productivity (see Table 4). If that technology were applied, production could be increased immediately and sustained at a higher level. For most crops, there is a high potential for success in transferring technology (Table 13). The opportunity now exists to exploit transfer of technology. Research technology can be transferred by intensifying on-farm research in more agro-ecological zones; by involving more of the existing research officers in on-farm research; and by intensifying the technical training of extension personnel (see, for example, FSR reports (23), (24), and (25)). While expansion of the irrigated area would increase production extensively, only accelerated technology transfer can intensify and diversify production and bring about significant sustained growth in production and income. Impact could be expected in the short term.

The assumptions are made that;

--Productivity of delta and terrace soils can be sustained

--Intensive agricultural technology can be transferred to farmers and they will utilize technology to intensify production

--Adequate inputs will be made available

--Surplus production and imports of foods will be managed in such a way that farm-gate prices and production per acre will not be depressed

C. Provide Human Resources Trained to Support the Changing Demands of Agriculture

See Annex 4-Institutional Analysis

D. Maintain Economic Production Units of Land and Improve Equity of Land Leases: While land fragmentation may spread risk because of different physiographic location of parcels, the usual result is loss of efficiency. Eventually the land parcel becomes so small that the farmer cannot earn income sufficient to support the household. Inequitable lease-holds significantly reduce the willingness of the tenant to invest fully in those inputs required for intensive production (14). Because leases are short-term, tenants are unwilling to invest in measures that will sustain agricultural production. This is a serious problem which has accelerated in the last five years. The causes are complex and deep-rooted. The solution will likely involve socio-cultural and legal considerations, as well as economic issues, as some groups gain and others lose in the rural community. This is a high priority problem. Resolution and impact on production are medium to long term.

The assumptions are made that:

- Farming will continue as a labor intensive enterprise with increasing rural employment
- Farmers will intensify investment per acre and increase production
- Research can continue to develop technology for increased sustained crop yields

E. Improve Distribution Systems for Irrigation Water and Teach Farmers Irrigation Techniques for Low Water Requirement (LWR) Crops: While lack of pumping capacity may affect irrigation efficiency in some areas, the opportunities for increasing production lie in improving distribution systems to deliver more water and in increasing the area of LWR crops (10). If farmers are taught how to irrigate LWR crops, production can be diversified and yields will increase. Efficiency of delivery systems and equity of water distribution can be improved by training of informal irrigator groups. If this constraint is alleviated, increase in production can be expected in the short term.

The assumptions are made that:

- Ground and surface water resources for irrigation will continue to be available at the current level
- Land under irrigation will expand to the limit of irrigable land and available water
- Intensive irrigation technology can be transferred to farmers

F. Increase the Availability of HYV Seed Which Fits the Cropping System: In some cropping systems, the HYV available does not fit the conditions of the cropping system. One example is the HYV developed for T. Aman rice which, if planted late, suffers a drastic reduction in yield. One avenue for alleviating this constraint is the On-Farm Research program which has responsibility for identifying and solving such problems. There are not adequate seed stocks of HYV or "improved" varieties available to provide replacement every 4-5 years, and, for many crops, seed is not available at all (Table 14). The opportunity exists for a national seed production and distribution company to provide high quality genetically pure seeds for field crops and vegetables at more sales outlets (Table 15). Time to alleviate this constraint would be medium term, but the impact could be realized in the short term.

The assumptions are made that:

- Adequate inputs will be made available for an intensified and diversified agriculture

- Research can continue to raise the yield ceiling

- Ground and surface water resources for irrigation will continue to be available at the current level

- The BDG make consistent and orderly progress toward privatization of the input supply side of agriculture

G. Improve Coordination and Cooperation Among Agricultural Institutions so That the Farmer is Served Effectively and Efficiently: If coordination and cooperation were improved among institutions such as BADC, BARI, DAE, BAU, and BWDB, then inputs and information could be delivered to the farmer more quickly and efficiently. A coordinated approach would focus organizational energies on technology transfer, on-farm research, result demonstrations, and the supply of inputs. Resolution of these problems could be realized in the medium term but the impact could be occur in the short term. (See also Annex 4-Institutional Analysis).

H. Increase Farm Power for Cultivation: Adequate numbers of draft animals may be unavailable due to flood-related deaths. Oxen lack sufficient strength to effect rapid turn-around between crops and during the dry (rabi) season (26). The opportunities lie in two directions: one is to improve the capacity of draft animals and the other is to accelerate introduction of power tillers.

Improving the capacity of draft animals can be accomplished by growing additional green fodder as field crops and forage-producing trees (8). As animal nutrition improves, draft capacity increases. Cattle grow larger which permits the switch from a span of two oxen to a single animal.

Introduction of power tillers offers both advantages and disadvantages. The advantages are that power tillers can be used for multiple tasks such as cultivation, water pumping, operating mills, and for local transport. Tillers require no herding nor diversion of land for fodder and grazing. The disadvantages are that they require different maintenance skills, special tools, and cash for engine fuel. Power tillers may create additional problems of equity.

Alleviation of this constraint by improving draft power or mechanical tillers would have impact in the short term. Improving draft power would require medium term effort. Providing mechanical tillers could be accomplished in short term.

The assumptions are made that:

--Technology for improved nutrition and management of draft cattle can be transferred to farmers

--Adequate farm power for cultivation and irrigation will be made available

--Land under irrigation will expand to the limit of irrigable land and available water

I. Drain Moderately Flooded Lands More Quickly and Protect Fields from Flash Floods: Two methods would provide alleviation in the short term. One method is to install low embankments and polders to restrict damage from flash flooding and low level flooding. This measure is within the means of groups of farmers. A more extensive large scale problem is revamping roads and drains so that moderately and deeply flooded lands will drain more quickly and completely (16). Better engineering and culverts would provide better drainage in the near term.

The assumptions are made that:

- Land under irrigation will expand to the limit of irrigable land and available available water.
- Farmers will intensify investment in production.
- Farming will continue to be a labor intensive enterprise.

J. Improve the Health of the Farming Population Through Better Nutrition: The problem is that many people in rural areas do not receive adequate calories and vitamins (19). This situation is exacerbated by growing landlessness and unemployment during part or all of the year. Improvement in nutritional status can be partially alleviated through diversification of field crops and by household vegetable production. If the irrigated area can be expanded and production diversified, some additional rural employment should be generated which would provide more income for purchasing food. If technology and inputs such as seed of improved varieties were made available, then increased vegetable production and diversification in field crops could be expected (2). Impact could be expected in the short term.

The assumption is made that:

- Diversification of the cropping pattern will increase rural incomes and nutrition as well as increased work output of male and female farmers

K. Increase Access to Affordable Credit for Food Crop Production:

See Annex 4-Institutional Analysis

V. Food Production Programs

In the table that follows, a series of programs are described to alleviate constraints to food production. The programs include a statement of objective and methodology. Estimates of the time required to implement the program, the expected time to pay-off, and predicted impact on agricultural production and rural income are included.

The following criteria were used to allocate priority among the programs:

- High priority - Critical constraint to increased production and rural income. Alleviation would have significant impact on production and income.

- Medium priority - Significant constraint to increased production and rural income. Alleviation would have moderate impact on production and income.

- Low priority - Important constraint to increased production and rural income. Alleviation would have moderate impact on production and income.

The length of time in the categories of "Time to Pay-off" are:

Short: 2-5 years

Medium: 5-10 years

Long: 10+ years

Program and Priority	Time to Implement	Time to Pay-off	Predicted Impact
<u>High Priority</u>			
A. Expand irrigated area and improve irrigation techniques to diversify crops and increase production of winter season crops.	Short-medium	Short	High
B. Expand transfer of research technology to increase national food production, yield per acre, and net farm income through: --crop diversification --irrigation techniques --fisheries --fodder for draft cattle	Short-medium	Short	High
C. Privatize the fertilizer marketing, distribution, and manufacturing industry to improve distribution of appropriate fertilizers and to reduce government costs.	Medium-long	Medium	High
D. Privatize the seed system to increase quality and quantity of seeds to increase yields and diversify crop production.	Medium	Medium	High
E. Reduce land fragmentation and improve lease equity to increase intensity of investment in production and to promote greater equity of farm income.	Medium-long	Medium	High
F. Expand shrimp production, to earn more foreign exchange and increase income.	Short	Short	High
G. Expand farm power capacity so that more land can be cultivated, production investment is intensified, and crop production increases.	Medium	Medium	High

Program and Priority	Time to Implement	Time to Pay-off	Predicted Impact
<u>Medium Priority</u>			
A. Develop technically qualified personnel oriented toward improving the efficiency and effectiveness of technology transfer and input supply.	Medium-long	Medium-	Medium
B. Improve drainage and protection for moderately flooded lands to reduce risk to investment and increase crop production.	Medium-long	Short-medium	Medium
C. Improve coordination and cooperation among agricultural institutions to increase flow of information and availability of inputs and services to farmers.	Medium-long	Medium	Medium
D. Expand commercial and farm poultry flocks for meat and eggs to increase income and to improve health through better nutrition.	Medium-long	Medium	High

Program and Priority	Time to Implement	Time to Pay-off	Predicted Impact
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<u>Low Priority</u>			
A. Improve the supply of affordable credit to increase intensity of investment in agricultural production and net farm incomes.	Short	Medium	Medium
B. Expand agro-forestry to provide fuel wood, livestock fodder and fruit to conserve the soil resource base, to increase draft power for production, and to improve health through better nutrition.	Medium-long	Medium	Medium

VI. Food Production Programs: Objectives and Approaches

This section expands on the programs listed above. The objective is restated along with suggested approaches and the rationale supporting the program.

A. Expand Irrigated Area and Improve Irrigation Techniques to Diversify Crops and Increase Production of Winter Crops.

The objective is to expand the area of irrigable land using available water resources to increase national production of foodgrains and to diversify and intensify crop production.

The approach is to make tubewells readily available; transfer technology for diversified and intensified crop production in the rabi season.

The rationale is that technology is now available for increase in irrigated crops and there is a ready market for additional rice and wheat. Technology is available to teach improved irrigation skills.

B. Expand Transfer of Research Technology

The objective is to increase the adoption of technology leading directly to increased production per acre and increased net income.

The approach is to expand on farm research (OFA) sites to verify station research and train extension agents in result demonstrations. Emphasis will be on crop diversification, irrigation techniques, fisheries, and draft cattle fodder.

The rationale is that research findings now exist which could double or triple yields. If research findings are verified in on-farm trials, extension agents will become informed and farmers can evaluate the recommendations. If farmers can evaluate recommendations, they will adopt them and thereby increase production and net income.

C. Privatize the Fertilizer Marketing, Distribution, and Manufacturing Industry

The objectives are to improve distribution of appropriate fertilizers and to reduce government costs.

The approach is to privatize import and distribution of fertilizer. The second phase will be to privatize formulation and blending of complete fertilizers with nutrients. The third stage will be to privatize nitrogen manufacturing plants.

The rationale is that privatized systems are more efficient, thus reducing costs to government, and they are more responsive to the farmer's needs. If farmers can obtain conveniently the proper fertilizer at the proper time, then usage and crop production will increase.

D. Privatize the Seed System

The objective is to increase availability of HYV crop and vegetable seeds, which would lead to increased diversification, yields, and net income.

The approach is to privatize the supply and distribution of imported and locally produced adapted high quality seed in order to provide 20% replacement seed and to increase crop diversification.

The rationale is that private company would fully exploit the market to maximize return on investment by providing more seed of more varieties at more outlets. If reliable high yielding seed were available, farmers could increase production of traditional crops and diversify into new crops.

E. Reduce Land Fragmentation and Improve Lease Equity

The objective is to maintain land parcels large enough and leases equitable enough to support a household and justify intensive investment so as to increase yields per acre.

The approach is to be determined.

The rationale is that, if land parcels are large enough to sustain the household and leases more equitable, farmers will be willing to invest more intensively thus leading to higher yields per acre. In addition they will be more willing to make capital improvements on the land to sustain productivity.

F. Expand Shrimp Production

The objective is to increase the acreage being farmed for shrimp and to intensify production leading to greater yields per acre.

The approach is to provide technical assistance to private farmers to improve their knowledge of shrimp farming methods.

The rationale is that there is a huge potential for increased shrimp production for both export and domestic markets in Bangladesh. Better shrimp farming will mean higher incomes for the farmer and more hard currency for Bangladesh to use in further developing the economy.

G. Expand Farm Power Capacity

The objective is to increase farm power capacity so that more land can be cultivated with quicker turn around between crops, thus permitting expansion of irrigable land diversification and more intensive cultivation.

The approach is two fold: One is to produce adequate fodder for oxen so that they maintain adequate capacity year round. The other approach is to increase availability of power tillers and maintenance facilities.

The rationale is that irrigated acreage and crop intensification cannot be increased significantly without additional capacity to cultivate, especially in the dry season. If adequate farm power is provided, national production and year-round offtake from each hectare will increase due to more land under cultivation and more crops per year. If livestock fodder is grown for draft cattle, more plant residues will be available to improve soil fertility which will help sustain long term productivity.

H. Develop Technically Qualified Personnel for Technology Transfer and Input Supply

See Annex 4-Institutional Analysis

I. Improve Drainage and Protection for Moderately Flooded Lands

The objective is to reduce risk and increase intensive investment of resources on periodically inundated land in order to increase national and per unit crop production.

The approach is to improve the rural civil works so that moderately flooded land will drain expeditiously. The second approach is to install embankments around cultivated fields to protect against flash flooding.

The rationale is that if flooded land is drained more quickly and if fields are protected from intermittent flooding, then farmers will expand acreage and increase input use on these lands as the risk of loss is reduced. Thus production and net income will increase.

J. Improve Coordination and Cooperation Among Agricultural Institutions

See Annex 4-Institutional Analysis

K. Expand Commercial and Farm Poultry Flocks

The objective is to establish commercial and village flocks to provide increased meat and eggs for increased income and better nutrition.

The approach is to simultaneously introduce production of feed grains and improved flock management systems. A concurrent step would be improved genetic stock to improve feed conversion and layer potential.

The rationale is that poultry meat is a preferred food and eggs are highly nutritious and readily vendable. If concentrated feeds are provided concurrently with flock management techniques and improved breed stock, then the industry will be established on a profitable and sustainable basis. If meat and eggs are more available in the villages, women will benefit from income and the families will benefit from a healthier diet.

L. Expand Agro-Forestry for Fuelwood, Fodder and Fruit Production

The objective is to increase the supply of fuelwood, fodder and fruit using available waste and common lands so as to increase crop production.

The approach is to provide assistance in seedlings and information so that improved trees and shrubs will be integrated into the existing farmstead.

The rationale is that, as trees provide fuelwood and livestock fodder, more plant residues will be available for soil incorporation which would increase fertility, soil productivity and sustainability. If more fodder were available, draft cattle could cultivate more land more quickly, increasing national and per unit production. If tree fruit were available, the nutrition and thus health of the family would be improved.

VI. Rural Income Generation: Objectives and Approaches

Increased rural income could be generated from higher value crops, poultry enterprises, fisheries, improvement in the efficiency and effective use of crop inputs, and through agro-industries.

A. Higher Value Crops

Higher value crops include vegetables, fruits, herbs and spices. Some field crops, such as maize consumed as green cobs, can be grown for specialty markets. A more difficult adaption involves growing crops in the off season, e.g., vegetables in the kharif monsoon season. Winged beans and most root crops grow very well under high rainfall and high humidity with a minimum of disease problems. Introduction and expansion of higher value crops should be included in the diversification component of the research technology transfer program (see section VI.B. above). For example, watermelons have been very successfully introduced into the Comilla area. High income vegetable, fruit, and spice crops were introduced under improved irrigation in the Tangail area development project (10). This program should be considered as high priority, because the potential for impact in terms of employment and income generation is high and can be realized in the short term. Improved nutrition and increased equity for women and the landless are associated benefits.

B. Livestock and Poultry

In the livestock industries, production of poultry meat and eggs offers the greatest potential for exploitation. It is unlikely that household or national income will be significantly affected by increased meat and milk production by cattle or goats (26). Expansion in poultry production will require a major improvement in flock management and the development of a source of feed concentrate. Poultry production should be included in the diversification component of research technology transfer program (see section VI.A. above). Expanded poultry production should be medium priority. The impact could be medium to high and pay-off could be expected in the medium to long term. Associated benefits of village flocks include greater equity for women and landless and improved nutrition.

C. Fisheries

Improvement in fresh water fisheries would generate additional off-take but would not significantly increase rural income. If more fish were available over more months of the year, nutrition would be improved. Improvement in fisheries is a medium priority and would result in medium impact. People are accustomed to fish culture so technology could be introduced within a short period of time.

On the other hand, shrimp and prawns are significant generators of income. Most entrepreneurs are large scale operators in coastal areas. Expansion of shrimp and prawns is a high priority which would result in high impact in a short time (see section VI.F above).

D. Agro-Industries

See Annex 3-Agroindustry Analysis

E. Improved efficiency of input use

Investment in inputs such as HYVs, fertilizer, and irrigation provide benefits in terms of higher yields and increased net income per acre. However, there are additional gains in net income which can be realized by more efficient use of inputs without sacrificing yield. Some examples of improved efficiency include: plowing fewer times, determining threshold damage before applying pesticides, increasing seed germination rate which reduces seed requirement, applying the most optimum fertilizer mix near the plant roots (rather than broadcasting), and controlling the amount of water applied to crops, especially to crops other than rice (10). The gain in production may be small, but the gain in net income per acre can be significant. An effective technology transfer program can bring about improved efficiency in input use (see section IV.A.1. above). The time required to implement is short to medium term. The level of impact is medium but the benefits accrue directly to the farmer in terms of increased income. Longer term benefits include yield sustainability and decrease in national investments in manufactured and imported inputs.

VII. Priority Areas for USAID Assistance:

Programs to increase food production and rural income generation have been outlined under sections V and VI above. Priorities among these activities for the USAID Food and Agriculture program are recommended below.

<u>USAID PROGRAM AND PRIORITY</u>	<u>TYPE OF PROGRAM</u>
<u>HIGH PRIORITY</u>	
1. Expansion of Irrigated Crop Land and Improved Water Use Efficiency <u>a/</u>	Intervention
2. Research Technology Transfer <u>a/</u>	Intervention
3 Fertilizer fomulation, Marketing and Distribution	Intervention
4. Reduce Land Fragmentation and Improve Equity of Tenancy	???

<u>MEDIUM PRIORITY</u>	
5. Seed Import, Production, and Distribution	Intervention
6. Human Resource Development	Intervention
7. Shrimp and Prawn Production	Intervention

<u>LOW PRIORITY</u>	
8. Fam Power for Cultivation of Food Crops <u>a/</u>	Intervention

a/ These programs could be considered as a cluster because the predominate emphasis in all three is in technology transfer

1 Fertilizer Formulation, Marketing, and Distribution

Expanded use of fertilizer, irrigation, and HYVs have been the principal contributors to raising crop yields beyond the subsistence level to the level where national production nearly supplies national requirements. To be used effectively, the correct fertilizer must be made readily accessible to the farmer at the time it is required for growing the crop. In Bangladesh, the old marketing system (OMS) for fertilizer, as operated by BADC, was inefficient in marketing and distribution. Subsidies to the system used a disproportionate share of the national agricultural budget. The new marketing system (NMS) for fertilizer has proven effective in distributing more fertilizer to more buying points at a lower cost than the OMS. During the time that the transition took place in the marketing system, national subsidies were greatly reduced. In spite of higher prices, fertilizer consumption has increased. Thus, the fertilizer program has proved an effective method for USAID to engage in policy dialogue with the BDG, resulting in privatization of the fertilizer marketing system and reduction of an input subsidy (13).

However, nitrogen fertilizer manufacturing plants are still owned by the BDG, the price of phosphate fertilizer TSP is disproportionately high (2), and research has demonstrated the need for micronutrients (sulfur, zinc, magnesium, etc) which are essential for sustaining and increasing productivity. Pressure has developed from several sources (see UNDP Agriculture Sector Review (5)) to reinstitute the subsidy on fertilizer.

Thus, now is a very critical period to consolidate gains and complete rationalization of the fertilizer industry by eliminating the TSP manufacturing plant, privatizing the nitrogen manufacturing plants, and establishing a formulating/blending plant for N-P-K and P-K fertilizers which would include micronutrients to match soil and crop needs. Investments would be made to reduce over capitalization of existing plants by writing down debt, introduction and test production of formulations and blends, and demonstrating and marketing new formulations and blends.

The program could be expected to continue to show results over the next 10 years and beyond. The performance indicators would include:

- Continued increase in fertilizer demand with associated increase in production per acre and national production
- A continuing reduction in BDG national agricultural budget expended to subsidize the fertilizer industry

The program is expected to cost US\$40m over 10 years
FX - \$15m; Local - \$25m

The U.S. has an advantage in this type of assistance because of predominate capability in fertilizer manufacturing, marketing, and training. The very success of this program now gives the U.S. an additional advantage to press for additional activities to rationalize the entire industry.

2. Research Technology Transfer

Research technology has been developed which can significantly raise production and net income of major food crops. But national production and per acre yields suggest that farmers are not fully utilizing the available technology. Technology is not being rapidly and effectively transferred from the research station to the farm. Intensification of technology transfer requires more on-farm trial sites, greater involvement of station researchers, and more effective demonstrations by technically skilled extension staff of both private and public sector institutions. This will require an effective national agricultural education system that provides basic and in-service training in communication and systems management. Such a program could be expected to more accurately identify significant problems limiting production; provide earlier verification of on-station research under farm conditions; and bring about more rapid adoption of improved varieties and husbandry. Results could be measured by increased yield per acre and national production as farmers benefit from greater net income.

Results could be expected within three years. The magnitude of results would depend on the number of researchers and disciplines involved and the geographic distribution of on-farm research and demonstration sites. The program is a logical next step in USAID assistance for agricultural technology development.

Investments would be made in technical assistance; long and short term training, development of mini-research areas and on-farm research sites in all agro-ecological zones, training for extension staff, and assistance to extension for result demonstrations.

The program is expected to cost US\$25m over 7 years
FX - \$15m; Local - \$10

The U.S. has a comparative advantage in agricultural research and technology transfer which involves university researchers of all disciplines working with a network of extension staff and private firms possessing both technical and communication skills. In Bangladesh, the U.S. has an advantage because of demonstrated skills in developing on-station and on-farm food crop research.

3. Expansion of Irrigated Crop Land and Improved Water Use Efficiency

Additional increments of production at present yield levels can be expected from utilization of current technology and expansion of land under irrigation. Further gains can be achieved through greater water use efficiency (WUE) obtained by improving water systems (10) and irrigator skills and from crops which utilize less water than rice. Expansion of irrigated area is dependent on easy availability of pumps and unrestricted installation of well-heads which are national policy issues 1/. Increased WUE is an educational or technology transfer issue. USAID can influence the ready availability of STW, DTW, and LLPs at lowest real cost. USAID can support technology transfer and organization of water user groups.

The program can be expected to show results within two years.

Indicators of success would be improved water management new area irrigated and higher production on irrigated land.

Investments would be made in training programs for extension workers and farmers in areas such as improved water systems, diversification into low water requirement crops, land levelling, and flood and furrow irrigation techniques. Other investments would be made in test sites, long and short term training, and in technical assistance. Local organizations such as NGOs and BARD and private sector input supply companies could be effectively utilized in the program activities.

The program would cost US\$15m over 6 years
FX - \$5m; Local - \$10m

The U.S. has a comparative advantage in water user associations and improving water use efficiency because of its long involvement in programs in South Asia which emphasize farmer involvement. Extensive resource and training materials now exist which emphasize low cost local improvements in systems. The U.S. has gained access to policy dialogue with the BDG through successful programs and high investment in the fertilizer sector.

1/ It is assumed that other donors will provide the assistance needed to expand the irrigated area.

4. Reduce Land Fragmentation and Improve Equity of Tenancy

Land parcels have become fragmented to the point that it causes reduced efficiency of management and discourages intensive investment of resources to increase yield. Eventually, the land parcel becomes so small that the household cannot grow enough food for its own needs which leads to sale or leasing out of land. The net result is decreased production, creation of additional landless rural population, and rural food poverty. In the case of land leases, the proportion of investment by the renter has escalated due to increased use of purchased inputs (irrigation water, seed, fertilizer, and pesticides); in addition, leases are short term, usually for that crop and, at most, for the year. These two factors cause the renter to reduce risk through minimal input use and to avoid any investment in long-term land improvements.

The methodology to accomplish this objective is not defined. USAID should initiate studies and discussions with institutions knowledgeable in this area as well as with appropriate donors.

The activity, when defined, should bring about more intensified investment in field crop production and diversification into other new crop enterprises with resultant increase in yield per acre. One result should be increased net income for the landless and near-landless.

The program should be able to show results within 5 to 10 years.

Performance indicators might be per acre yield increases beyond the current growth rate and increased net income for the landless and near-landless.

No estimate of cost has been made.

The U.S. does not necessarily have a comparative advantage but then neither does any other donor.

5. Seed Import, Production, and Distribution

The three principal contributors to increasing food crop production to meet national food requirements are HYV seed, fertilizer, and irrigation water. In cereals, improved seed can contribute 30-50% of the gain in yield when all three inputs are utilized. The optimum goal would be to provide enough certified HYV seed to plant 20% of the acreage each year (see projected seed requirements (30)). An independent national seed company could be expected to provide higher quality seed for more different crops and increase farmers' access to this seed at more distribution points.

USAID involvement could be expected to reduce or eliminate subsidy on seeds and to put yet another agricultural input industry onto a business-like footing while providing a reliable high quality product.

Initial results could be expected within two years and significant impact within five years.

Performance would be measured by volume of improved seed sold and provision of seed for a range of major grain, oilseed, and vegetable crops.

Secondary impact would be additional income for contract growers and increased production attributable to use of improved seed. Policy impact would be reduction or elimination of a subsidy which now limits BDG funds for agricultural development activities.

Investments would be made to bring in a private U.S. seed company to import a wide variety of crop seeds and test the market potential for quality seed. Assistance would be provided for the company to set up in business in Bangladesh to evaluate new introduced varieties, increase and package seed, and establish a seed marketing system through private outlets all over the country.

The program is expected to cost US\$20m over 6 years
FX - \$10m; Local - \$10m

Involvement of other donors (ADB and IBRD) would reduce overall program cost to USAID and help bring about the policy changes which would permit development of this type of crop seed program.

The U.S. has comparative advantage because the U.S. seed industry has developed as a partnership among universities, not-for-profit foundation seed companies, farmer seed contractors, private processing and distribution companies, and government agencies which set standards and regulate the industry. The U.S. industry has avoided restrictions such as seed patents and unresponsive seed release boards which, in most other countries, have severely limited rapid introduction and proliferation of varieties.

6. Farm Power for Cultivation of Food Crops

Almost all land is cultivated by draft oxen. Mechanical tillers cultivate only a minor area so far. The relative rate and effectiveness of oxen cultivation during the kharif season is reduced by small oxen which have limited power. During the dry season, oxen may be fed half or even less of an adequate ration required for their body weight (see IBRD Subsector Review (26)). Much of that fodder comes from grazing which takes up potential work time.

Reduced strength and work rate prevents rapid turn-around between crops with the result that farmers are able to raise only two rather than three crops. Thus, additional irrigable land cannot be cultivated in the dry season even if water were made available because the draft oxen are undernourished and scavenging for grass. Therefore, if production is to be increased by intensifying resource investment, crop diversification, and bringing additional land under irrigation, the capacity of draft oxen must be increased or power tillers made available.

The expected results would be intensification of resource investment in food crop production leading to increased yield per acre. A companion effect would be expansion of irrigated land which would increase national production of food crops. As mechanical tillers are introduced, mechanical repair industries would develop which would also improve maintenance of irrigation engines and pumps. In coordination with other donors, USAID could encourage liberalization of imports and distribution of power tillers.

The program could be expected to show results in 4-5 years. The impact on production would be medium to high.

Performance indicators would be increase in irrigated area and intensification of resources invested leading to higher cropping intensity, increased crop diversification, and increased yield per acre.

Investments would be made in technology transfer for fodder production, crop diversification, and livestock management for improved nutrition and health. Other investments would be made to develop repair shops and train mechanics to maintain power tillers.

The program is expected to cost US\$10m over 6 years
FX - \$7m; Local - \$3m

The U.S. has a comparative advantage in informal education and technology transfer techniques required to change farmers attitudes about growing fodder and feeding it to draft cattle. USAID is already involved in a technology development and on-farm research project which provides crop production technology and facilitates access for research officers, to farmers and to extension workers.

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Table 1: Food grain consumption requirements and imports in Bangladesh during the years 1981/82 through 1987/88 a/

YEAR	Food grains (MT x 1,000)			
	National requirements <u>b/</u>	National production	Shortfall	Imports
1982/83	15,258	14,598	660	1,256
1982/83	15,633	15,311	322	1,798
1983/84	16,018	15,719	299	2,089
1984/85	16,412	16,087	325	2,631
1985/86	16,818	16,079	739	1,222
1986/87	17,209	16,497	712	1,797
1987/88	17,611	16,592	1,019	n.a.

a/ The Agricultural Sector in Bangladesh - A Database. USAID. 1988.

b/ Calculated by BDG food requirement target for foodgrains of 16oz/person/day

Table 2: Production of selected food and oil crops in Bangladesh for the years 1981/82, 1984/85, and 1987/88 a/

CROP	1981/82		1984/85		1987/88	
	Area Hectares (000)	Prod MT (000)	Area Hectares (000)	Prod MT (000)	Area Hectares (000)	Prod MT (000)
Boro HYV Rice	898	2,515	1,230	3,348	1,619	4,273
Aus Local	2,626	2,247	2,472	8,213	2,291	7,798
Aus HYV	472	1,075	466	862	498	891
T.Aman HYV	955	1,546	1,080	2,040	1,197	2,450
B.Aman Local	5,055	5,140	4,630	5,315	4,394	5,240
Wheat	534	1,092	676	1 464	597	1,048
Jute	571	842	676	928	512	853
Rabi Maize	2	1	1	1	2	1
Pulses	303	255	273	204	250	184
White Potato	106	1,016	111	1,075	106	1,069
Mustard	193	128	198	132	176	119
Sesame	42	21	55	15	32	19

a/ Statistical Yearbook of Bangladesh. 1987 and 1988

Table 3: Production of livestock and poultry during 1977 and 1984 in Bangladesh a/

ANIMAL	Number of Head x 1,000		Annual Growth
			Rate
	Year 1977	Year 1984	(%)
Cattle	20,509	21,495	0.6
Buffalo	469	567	2.7
Sheep	508	667	2.7
Goats	8,436	13,558	7.0
Total livestock	29,922	36,287	2.8
Fowl	41,465	61,093	5.7
Ducks	12,125	12,620	0.6
Total poultry	53,590	73,713	4.7

a/ The Agricultural Sector in Bangladesh - A Database. USAID. 1988

Table 4: Yields of selected crops that researchers and better farmers have obtained in Bangladesh using the current best HYV and recommended husbandry practices a/

CROP	Yields in MT/Ha		
	Research Level	Better Farmer Level	Farmer 50% Input Level
Rice-Boro(HYV)	6.5	6.5	4.3
Rice-Aus(Local)	2.0	1.6	1.0
Rice-Aus(HYV)	4.5	3.6	2.3
Rice-T. Aman(Local)	3.5	3.5	2.3
Rice-T. Aman(HYV)	5.0	5.0	3.3
Rice-B. Aman(Local)	2.5	2.0	1.3
Wheat	5.5	5.0	3.0
Jute	3.0	2.4	1.2
Rabi maize	8.0	6.4	2.6
Kharif maize	4.5	3.6	1.5
Soybeans	2.5	2.0	0.8
Lentil	2.5	2.0	1.0
Mungbean, black gram, cowpea	2.0	1.6	0.7
White potato <u>b/</u>	35.0	28.0	15.0
Groundnut	3.0	2.4	1.5
Maize fodder (DM)	3.4	2.2	1.1
Legume fodder (DM)	2.0	1.3	0.7
Mustard	2.5	2.0	1.0
Sesame	1.5	1.2	0.6

a/ Estimates by BARI and BRRI

b/ Yield as fresh weight

Table 5: Estimation of yield gap for selected crops between national average yields and yields obtained by better farmers using HYVs and recommended husbandry.

CROP	Yields in MT/Ha x 1,000		
	Better Farmer Level <u>a/</u>	National Average 1983-1986 <u>b/</u>	Yield Gap
Rice-Boro(HYV)	6.5	2.7	3.8
Rice-Aus(Local)	1.6	0.8	0.8
Rice-Aus(HYV)	3.6	1.9	1.7
Rice-T. Aman(HYV)	5.0	2.0	3.0
Rice-B. Aman(Local)	2.0	1.0	1.0
Wheat(HYV)	5.0	2.2	2.8
Jute	2.4	1.5	0.9
Rabi maize	6.4	0.8	5.6
Pulses	1.6	0.7	0.9
White Potato <u>c/</u>	28.0	10.4	17.6
Mustard	2.0	0.7	1.3
Sesame	1.2	0.6	0.6

a/ Estimates by BARI and BRRI

b/ Statistical Yearbook of Bangladesh. 1987

c/ Yield as fresh weight

Table 6: Current land resources available for crop production in Bangladesh rated by degree of suitability for growing major field and vegetable crops under irrigated conditions. (From FAO/UNDP BGD/81/035 Technical Report 6: Land Suitability Assessment 1988).

CROP	WITH IRRIGATION /a (area in hectares x 1,000)				
	Very Suitable	Suitable	Moderate Suitable	Marginal Suitable	Not Suitable
HYV T. Aman	0	1422	905	2759	3950
Local T. Aman	0	1936	2353	1259	3489
B. Aman	0	1178	2136	3022	2700
Local T. Aman after Aus	0	2006	2294	1261	3475
HYV T. Aman after Aus	0	1456	894	2773	3933
HYV T. Aus	0	507	1169	3176	4184
Local T. Aus	0	507	1634	3081	3814
B. Aus	0	1385	1614	2714	3323
HYV Boro (Quick Mature)	0	594	3359	3231	1852
HYV Boro (Late Mature)	0	107	1253	4240	3436
Local Boro	675	3080	2332	1789	1161
Wheat	415	507	1189	3291	3634
Jute (Capsularis)	788	1522	1786	2439	2501
Jute (Olitorius)	638	1162	1735	2346	3156
Sugar Cane	0	63	140	1322	7511
Lentil	682	1889	2193	2354	1918
Mungbean, Bl.gram, Cowpea	0	50	380	1222	7384
Mustard	693	2068	2186	1822	2266
Rabi Soybeans	0	5	286	1065	7681
Rabi Groundnut	90	2063	2349	1919	2615
Kharif Groundnut	0	49	301	1144	7541
Potatoes	551	1457	1583	2894	2551
Cabbage, Cauliflower	490	1582	1506	2768	2691
Tomatoes	0	914	1791	3315	3016
Kharif Binjal	0	50	380	1222	7384
Rabi Maize	428	1266	1292	3243	2808
Kharif Maize	0	21	297	1049	7669
Onion, Garlic	0	1648	2204	3035	2149
Rabi Chillies	972	1963	2162	1755	2183
Kharif Chillies	0	50	377	1221	7388

/a The total area of 11,561,957 ha in the Technical Report has been reduced to 9,037,232 ha to conform with available arable area as reported in the "1987 Statistical Yearbook of Bangladesh", Bangladesh Bureau of Statistics.

Table 7: Current land resources available for crop production in Bangladesh rated by degree of suitability for growing major field and vegetable crops under rainfed conditions. Rainfed area is not additive to irrigation area in Table 6. (From FAO/UNDP BGD/81/035 Technical Report 6: Land Suitability Assessment 1988.

CROP	RAINFED /a (area in hectares x 1,000)				
	Very Suitable	Suitable	Moderate Suitable	Marginal Suitable	Not Suitable
HYV T. Aman	0	512	1413	3024	4086
Local T. Aman	0	539	2133	2794	3569
B. Aman	0	965	1465	3447	3160
Local T. Aman after Aus	0	36	524	3767	4709
HYV T. Aman after Aus	0	0	187	750	8099
HYV T. Aus	0	297	1274	3069	4396
Local T. Aus	0	423	1784	3145	3683
B. Aus	0	875	1472	2837	3852
HYV Boro (Quick Mature)	0	0	0	0	9036
HYV Boro (Late Mature)	0	0	0	0	9036
Local Boro	0	0	0	0	9036
Wheat	0	878	1418	3175	3565
Jute (Capsularis)	0	800	1298	3267	3671
Jute (Olitorius)	0	512	1167	3069	4287
Sugar Cane	0	0	59	1353	7624
Lentil	0	1479	1476	3582	2499
Mungbean, Bl.gram, Cowpea	0	0	20	939	8078
Mustard	503	1662	1907	2297	2667
Rabi Soybeans	0	221	1057	3436	4322
Rabi Groundnut	0	918	1781	3266	3071
Kharif Groundnut	0	15	302	1056	7663
Potatoes	0	0	14	2014	7008
Cabbage, Cauliflower	147	535	470	2252	5631
Tomatoes	0	211	1067	3723	4035
Kharif Binjal	0	0	0	936	8100
Rabi Maize	149	655	1098	3300	3834
Kharif Maize	0	0	0	668	8368
Onion, Garlic	0	0	0	0	9036
Rabi Chillies	0	279	1100	3959	3698
Kharif Chillies	0	0	20	796	8221

/a The total area of 11,561,957 ha in the Technical Report has been reduced to 9,037,232 ha to conform with available arable area as reported in the "1987 Statistical Yearbook of Bangladesh", Bangladesh Bureau of Statistics.

Table 8: Scenario A: Use existing technology (HYVs and recommended husbandry practices) on the current acreage of rice and wheat.

Production level <u>a/</u>	Estimated national foodgrain production	Available for consumption <u>b/</u> (MT x 1,000)	Meets food grain requirements to year <u>c/</u>
Research Level	26,646	23,982	1999/2000
Better Farmer Level	25,246	22,721	1997/98
Better Farmer 50% Level 1983/84		17,795	16,015

a/ Source for three levels of production: BARI and BRRI

b/ Deduction of 10% made for seed, feed, and wastage

c/ Requirements based on BDG food requirement target for foodgrains of 16 oz/person/day at the level of 16oz/person/day

Table 9: Scenario B: Use available water water to bring all irrigable land into production during the dry season.

Plant all irrigable land into HYV Boro rice using all existing technology (recommended husbandry practices)

Production level <u>a/</u>	Estimated national foodgrain production	Available for consumption <u>b/</u> (MT x 1,000)	Meets food grain requirements to year <u>c/</u>
Research Level	27,466	24,720	2000/01
Better Farmer Level	27,466	24,720	2000/01
Better Farmer 50% Level	20,886	18,797	1989/90

a/ Source for three levels of production: BARI and BIRRI

b/ Deduction of 10% made for seed, feed, and wastage

c/ Requirements based on BDG food requirement target for foodgrains of 16 oz/person/day.at the level of 16oz/person/day

Table 10: Scenario C: Use available water to bring all irrigable land into production during the dry season.

Plant all irrigable land into HYV Boro rice and HYV T. Aman rice using all existing technology (recommended husbandry practices)

Production level <u>a/</u>	Estimated national foodgrain production	Available for consumption <u>b/</u> (MT x 1,000)	Meets food grain requirements to year <u>c/</u>
Research Level	30,779	27,701	2006/07
Better Farmer Level	30,779	27,701	2006/07
Better Farmer 50% Level	21,544	19,390	1990/91

a/ Source for three levels of production: BARI and BIRRI

b/ Deduction of 10% made for seed, feed, and wastage

c/ Requirements based on BDG food requirement target for foodgrains of 16 oz/person/day at the level of 16oz/person/day

Table 11: Scenario D: Use available water to bring all irrigable land into production during the dry season.

Plant 50% of all irrigable land into HYV Boro rice and balance of suitable land into HYV wheat using all existing technology (recommended husbandry practices) on rice and wheat

Production level <u>a/</u>	Estimated national foodgrain production	Available for consumption <u>b/</u> (MT x 1,000)	Meets food grain requirements to year <u>c/</u>
Research Level	29,709	26,739	2004/05
Better Farmer Level	28,730	25,857	2002/03
Better Farmer 50% Level	21,523	19,370	1990/91

a/ Source for three levels of production: BARI and BIRRI

b/ Deduction of 10% made for seed, feed, and wastage

c/ Requirements based on BDG food requirement target for foodgrains of 16 oz/person/day at the level of 16oz/person/day

Table 12: Scenario E: Use available water to bring all irrigable land into production during the dry season.

Plant 50% of all irrigable land into HYV Boro rice and balance of suitable land into HYV maize using all existing technology (recommended husbandry practices) on rice and maize

Production level <u>a/</u>	Estimated national foodgrain production	Available for consumption <u>b/</u> (MT x 1,000)	Meets food grain requirements to year <u>c/</u>
Research Level	37,262	33,536	2016/17
Better Farmer Level	33,597	30,237	2016/17
Better Farmer 50% Level	21,602	19,442	1991/92

a/ Source for three levels of production: BARI and BRRI

b/ Deduction of 10% made for seed, feed, and wastage

c/ Requirements based on BDG food requirement target for foodgrains of 16 oz/person/day at the level of 16oz/person/day

Table 13: Assessment of current state of technology in Bangladesh and relative difficulty in introducing and transferring new technology to farmers

KIND of CROP or LIVESTOCK	Present state of technology in Bangladesh	Potential that new technology can be introduced/ developed		Difficulty in trans- ferring technology	Would develop- ment promote equity for		Other benefits
		Short term	Long term		Women	Land- less	
Rice (B.Aman)	Low	Low	Low	Easy	Yes	Yes	
Rice (T.Aman)	Med	Med	High	Easy	Yes	Yes	
Rice (Aus)	High	High	High	Easy	Yes	Yes	
Rice (Boro)	High	High	High	Easy	Yes	Yes	
Wheat.	High	Med	Med	Easy	No	Yes	
Maize	Med	High	High	Mod diff	No	Yes	
<u>CEREALS</u>	High-Med	High	High	Easy	Yes	Yes	
Jute	Med	Med	Med	Easy	Yes	Yes	
Soybeans	Med	High	High	Mod diff	No	Yes	Nutrition
Sunflower	Med	Med	High	Mod diff	Yes	Yes	
Brassicac	Med	High	Med	Easy	Yes	Yes	
Sesame	Med	High	Med	Easy	Yes	Yes	
<u>OILSEEDS</u>	Med	High	Hi-Med	Mod diff			
Pulses	Med	High	High	Easy	Yes	Yes	Nutrition
White potato	Med	High	High	Easy	Yes	Yes	Nutrition
Sweet potato	Med	High	High	Easy	Yes	Yes	Nutrition
<u>VEGETABLES</u>	Med	High	High	Easy			Nutrition
Fruit trees	Med	High	High	Mod diff	Yes	No	Nutrition
Freshwater fish	Med	High	High	Mod diff	No	Yes	Nutrition
Shrimp	Med	High	High	Mod diff	Yes	Yes	
Cotton	Low	Med	Med	Mod diff	No	Yes	
Sugar cane	Med	Med	Med	Mod diff	No	Yes	
Forage crop	Low	High	High	Mod diff	Yes	Yes	More draft
Forage trees	Med	High	High	Mod diff	Yes	No	More draft/fuel
Draft Cattle	Low	High	High	Mod diff	No	No	Incr cultiv
Milk Cattle	Low	High	High	Diff	Yes	No	Nutrition
Sheep/Goats	Low	Med	Med	Mod diff	Yes	Yes	Nutrition
Poultry	Low	High	High	Mod diff	Yes	No	Nutrition
<u>Livestock</u>	Low	High	Hi-Med	Mod diff	Yes	No	Draft/Fuel/Nutr
Seed pro- duction	Low	High	High	Diff	No	Yes	Cash & Incr production

Table 14: Quantity of Certified Seeds Supplied by BADC Compared with Total Current Requirements for Improved Varieties a/

CROP	Area (000 Ha)	Estd. Seed Requirement (MT)	BADC Production (MT)	Percent of National Requirement %
Rice				
HYV	2,825	70,625	3,373	4.8
Local	500	15,000	180	1.2
Wheat	600	90,000	16,500	18.0
Maize	20	500	20	4.0
Potato	110	165,000	6,165	3.7
Jute	2,435	11,480	1,148	10.0
Pulses	100	2,500	6	0.2
Rape & Mustard	100	1,200	32	2.7
Groundnut	10	1,000	2	0.2
Vegetables	140	67	10	15.0

a/ From draft BARC paper titled "Towards Self Sufficiency in Seed: The Vital Input for Crop Production"

Table 15: Projected Requirements of Certified Seeds for Selected Crops
Based on Existing and Projected Areas Using Improved Varieties a/

CROP	Area (000 Ha)	Total Annual Seed Requirement (MT)	Present BADC Supply (MT)	Replacement Seed At 25% level <u>b/</u> (MT)	Replacement Seed At 20% level <u>c/</u> (MT)
Rice					
HYV	4,225	105,625	3,373	26,406	21,125
Local	500	15,000	180	3,750	3,000
Wheat	600	90,000	16,500	22,500	18,000
Maize	20	500	20	125	100
Potato	110	165,000	6,165	41,250	33,000
Pulses	100	2,500	6	625	500
Mustard	100	1,200	32	300	240
Groundnut	10	1,000	2	250	200
Vegetables	140	67	10	17	13
Jute	1,435	11,480	1,148	2,870	2,296
Totals	7,240	392,372	27,436	98,093	78,474

a/ From draft BARC paper titled "Towards Self Sufficiency in Seed: The Vital Input for Crop Production"

b/ Assuming enough new seed to plant 25% of acreage each year

c/ Assuming enough new seed to plant 20% of acreage each year

Figure 1: Foodgrain requirement based on estimated population growth rate to the year 2020 in Bangladesh and the production trend for foodgrains.

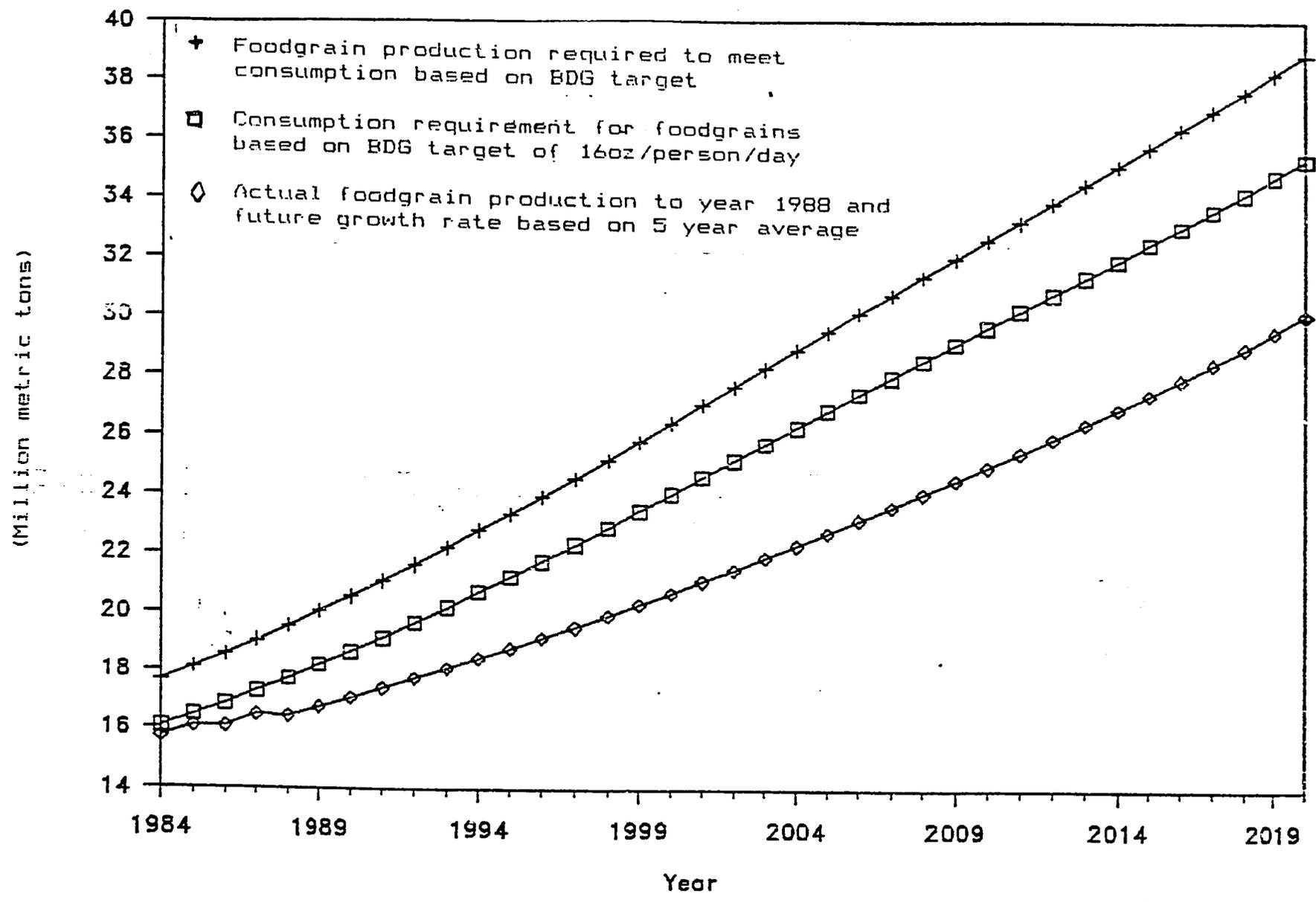


Figure 1: Foodgrain requirement based on estimated population growth rate to the year 2020 in Bangladesh and the production trend for foodgrains

Foodgrain production required to meet
consumption based on BDG target

Consumption requirement for foodgrains
based on BDG target of 16oz/person/day

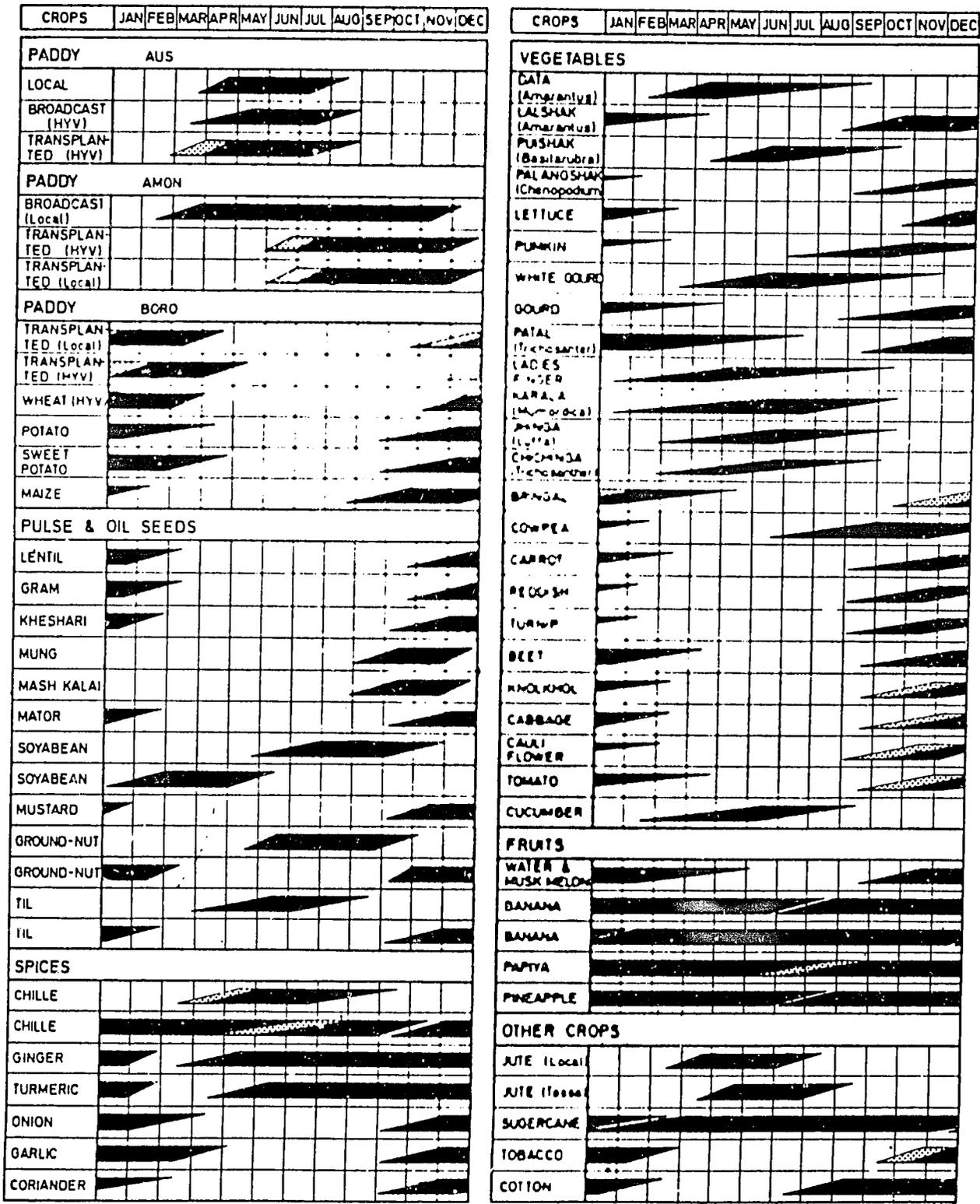
Actual foodgrain production to year 1988 and
future growth rate based on 5 year average

(Million metric tons)

Footnotes for figure 1 for population and food grain
requirements to the year 2020

- a/ Years 1983/84 through 1987/88 from The Agricultural Sector in Bangladesh - A Database. USAID. 1988. Other years are estimates/projections.
- b/ Population projections are based on USAID/Bangladesh Population Office assuming modern fertility decline where average exponential growth rates are project at 1981-86 - 2.60%; 1987-91 - 2.31%; 1992-96 - 2.32%; 1997-2000 - 2.20%.
- c/ Calculated by BDG food requirement target for foodgrains of 16 oz./per person/day.
- d/ Addition of 10% for losses due to seed, feed, and wasteage.

Figure 2: Crop Calendar showing existing cropping patterns in Bangladesh (Source: The Agricultural Sector in Bangladesh - A Database, USAID, 1988)



▨ = Seed bed
 (HYV) = high yield variety

EXISTING CROPPING PATTERNS:

- | | | |
|--------------------------------------|---|---|
| 1 AUS / JUTE + 1 AMON | 5 AUS + MUSTARD / PULSES / RABBI VEGETABLES / TOBACCO / COTTON / POTATO | 8 AUS AND B. AMON MIXED |
| 2 AUS + 1 AMON + KHESHARI (LATHYRUS) | 6 AUS AND ARHAR (CAJANUS) / TIL (Sesamum) MIXED | 9 BORO |
| 3 JUTE + KALAI (PULSE) | 7 B AMON | 10 SUGARCANE |
| 4 AUS AND 1 AMON MIXED | | 11 SUMMER VEGETABLES + MUSTARD / PULSES |

Figure 3: The 30 agro-ecological regions derived from physiography, soils, inundation, rainfall, Temperature and length of growing season (Source: Land Resources Appraisal: Report 2: Agro-ecological Region of Bangladesh., FAO/UNDP, Rome. 1988)

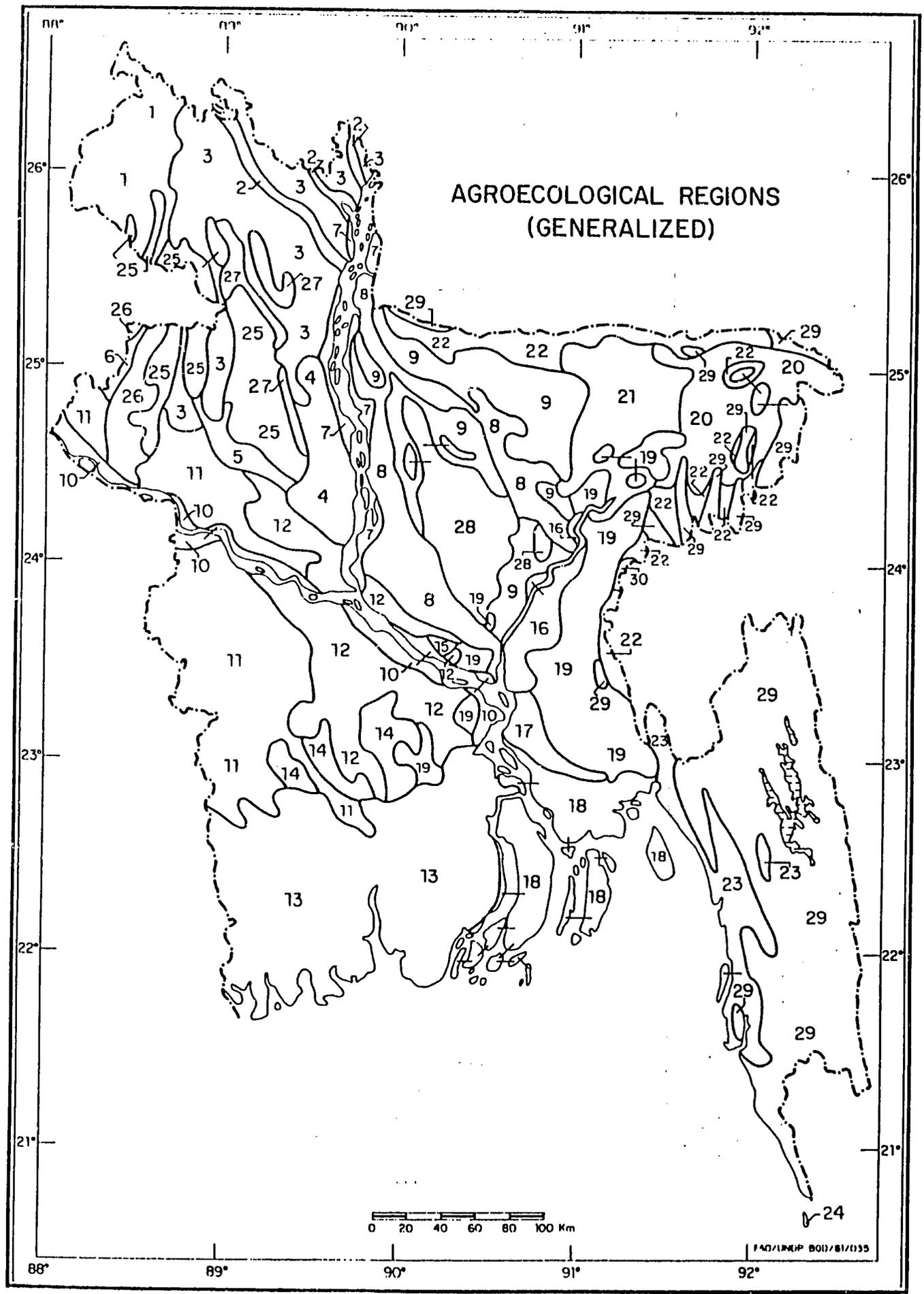


Figure 3a: Legend for the 30 agro-ecological regions shown in Figure 3

AGROECOLOGICAL REGIONS

- 1 Old Himalayan Piedmont Plain
- 2 Active Tista Floodplain
- 3 Tista Meander Floodplain
- 4 Karatoya-Bangali Floodplain
- 5 Lower Atrai Basin
- 6 Lower Purnabhaba Floodplain
- 7 Active Brahmaputra-Jamuna Floodplain
- 8 Young Brahmaputra and Jamuna Floodplains
- 9 Old Brahmaputra Floodplain
- 10 Active Ganges Floodplain
- 11 High Ganges River Floodplain
- 12 Low Ganges River Floodplain
- 13 Ganges Tidal Floodplain
- 14 Gopalganj-Khulna Bils
- 15 Arial Bil
- 16 Middle Meghna River Floodplain
- 17 Lower Meghna River Floodplain
- 18 Young Meghna Estuarine Floodplain
- 19 Old Meghna Estuarine Floodplain
- 20 Eastern Surma-Kusiyara Floodplain
- 21 Sylhet Basin
- 22 Northern and Eastern Piedmont Plains
- 23 Chittagong Coastal Plain
- 24 St Martin's Coral Island
- 25 Level Barind Tract
- 26 High Barind Tract
- 27 North-eastern Barind Tract
- 28 Madhupur Tract
- 29 Northern and Eastern Hills
- 30 Akhaura Terrace

Figure 4: The 20 physiographic units derived from landforms and soil parent material. Physiography is one of seven factors contributing to the definition of Agroecological Regions. (Source: Land Resources Appraisal Report 2: Agro-ecological Regions of Bangladesh. FAO/UBDP, Rome, 1988)

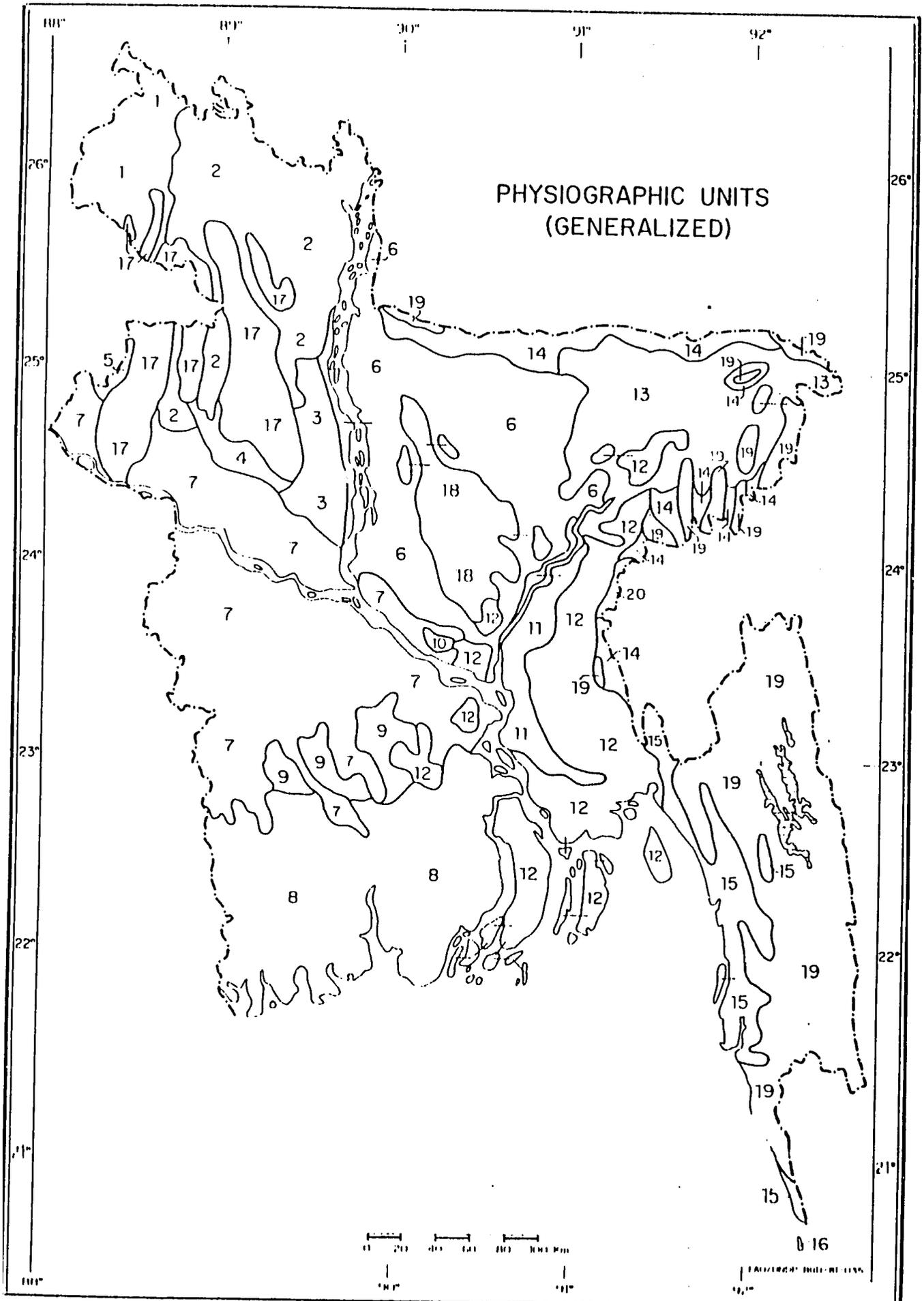


Figure 4a: Legend for the 20 physiographic units shown in Figure 4

PHYSIOGRAPHIC UNITS

- 1 Old Himalayan Piedmont Plain (Ph) 1/
- 2 Tista Floodplain (Ta, Tm)
- 3 Karatoya-Bangali Floodplain (Kb)
- 4 Lower Atrai Basin (Al)
- 5 Lower Purnabhaba Floodplain (Pl)
- 6 Brahmaputra Floodplain
 - 6a Active Floodplain (Ba)
 - 6b Young Brahmaputra and Jamuna Floodplains (By)
 - 6c Old Brahmaputra Floodplain (Bo)
- 7 Ganges River Floodplain
 - 7a Active Floodplain (Ga)
 - 7b High Ganges River Floodplain (Gh)
 - 7c Low Ganges River Floodplain (Gl)
- 8 Ganges Tidal Floodplain (Gn, Gs, Gm)
- 9 Gopalganj-Khulna Bils (Gb)
- 10 Arial Bil (Ab)
- 11 Meghna River Floodplain (Mm, Ml)
- 12 Meghna Estuarine Floodplain
 - 12a+ Young Meghna Estuarine Floodplain (saline & non-saline)
 - b (Mn, Ms)
 - 12c Old Meghna Estuarine Floodplain (Mo)
- 13 Surma-Kusiyara Floodplain
 - 13a Eastern Surma-Kusiyara Floodplain (Se)
 - 13b Sylhet Basin (Sb)
- 14 Northern and Eastern Piedmont Plains (Pn)
- 15 Chittagong Coastal Plain (Cc)
- 16 St Martin's Coral Island (Ci)
- 17 Barind Tract (Bl, Bn, Bd)
- 18 Madhupur Tract (Mt)
- 19 Northern and Eastern Hills (Hh, Hl)
- 20 Akhaura Terrace (Ha)

1/ Prefix symbol for Physiographic Unit/Subunit used on Land Resources Inventory Map sheets and in map Legend

Figure 5: The 15 general soil types derived from physical and chemical characteristics. Soil type is one of seven factors contributing to the definition of Agroecological Regions. (Source: Land Resources Appraisal: Report 2: Agro-ecological Regions of Bangladesh. FAO/UNDP, Rome. 1988)

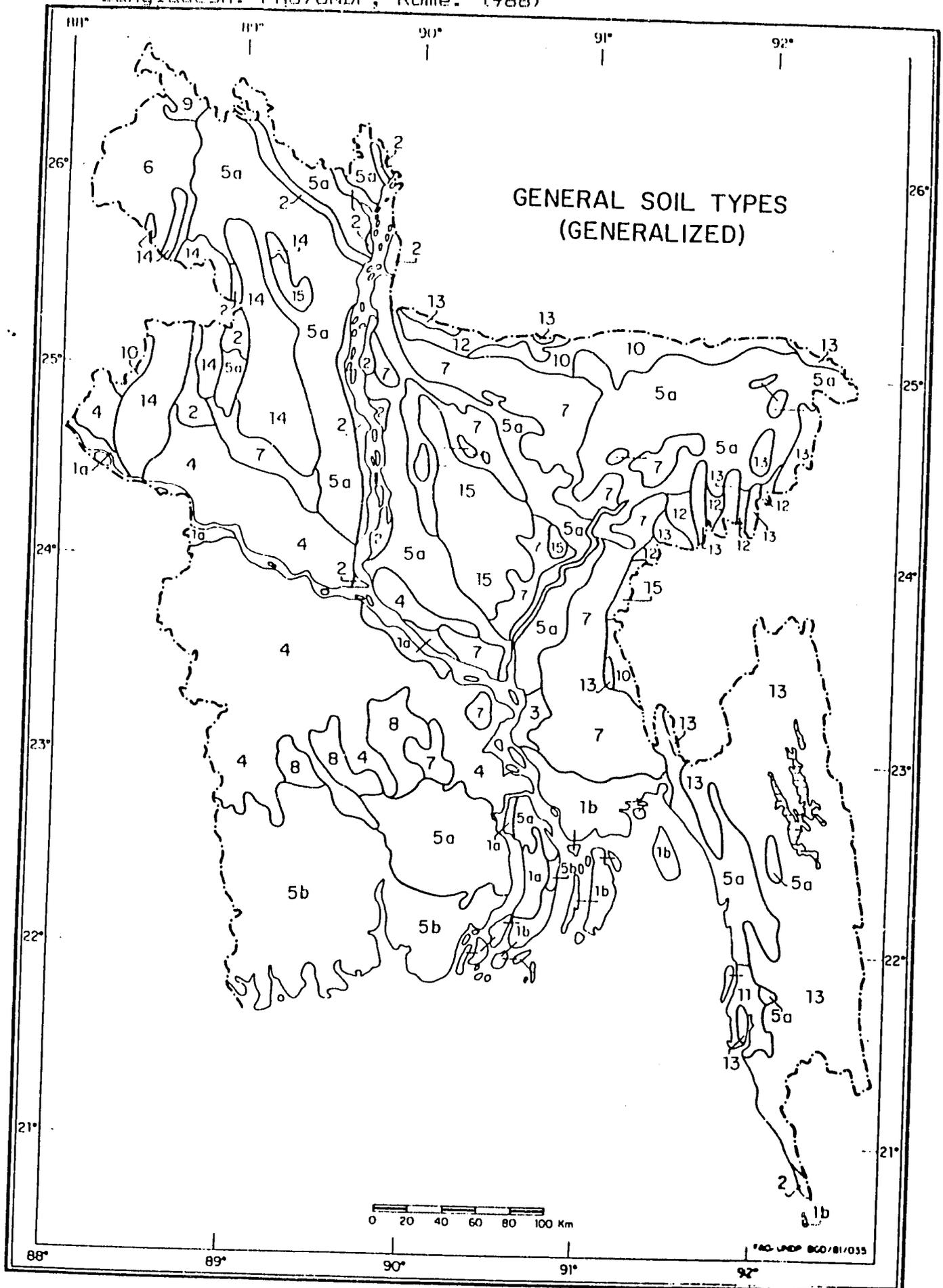


Figure 5a: Legend for the 15 general soil types shown in Figure

GENERAL SOIL TYPES

- 1a Calcareous Alluvium (non-saline)
- 1b Calcareous Alluvium (seasonally saline)
- 2 Noncalcareous Alluvium
- 3 Calcareous Grey Floodplain Soils
- 4 Calcareous Dark Grey Floodplain Soils
- 5a Noncalcareous Grey Floodplain Soils (non-saline)
- 5b Noncalcareous Grey Floodplain Soils (seasonally saline)
- 6 Noncalcareous Brown Floodplain Soils
- 7 Noncalcareous Dark Grey Floodplain Soils
- 8 Noncalcareous Dark Grey Floodplain Soils and Peat
- 9 Black Terai Soils
- 10 Acid Basin Clays
- 11 Acid Sulphate Soils
- 12 Grey Piedmont Soils
- 13 Brown Hill Soils
- 14 Shallow and Deep Grey Terrace Soils
- 15 Deep Red-Brown Terrace Soils

Note: Only the principal General Soil Type of the unit is indicated. A more detailed soils legend is given on the Agroecological Regions and Subregions Map in Report 2.

Figure 6: The 8 inundation land types derived from degree and depth of seasonal flooding. Inundation is one of seven factors contributing to the definition of Agroecological Regions. (Source: Land Resources Appraisal: Report 2: Agro-ecological Regions of Bangladesh FAO/UNDP, Rome. 1988)

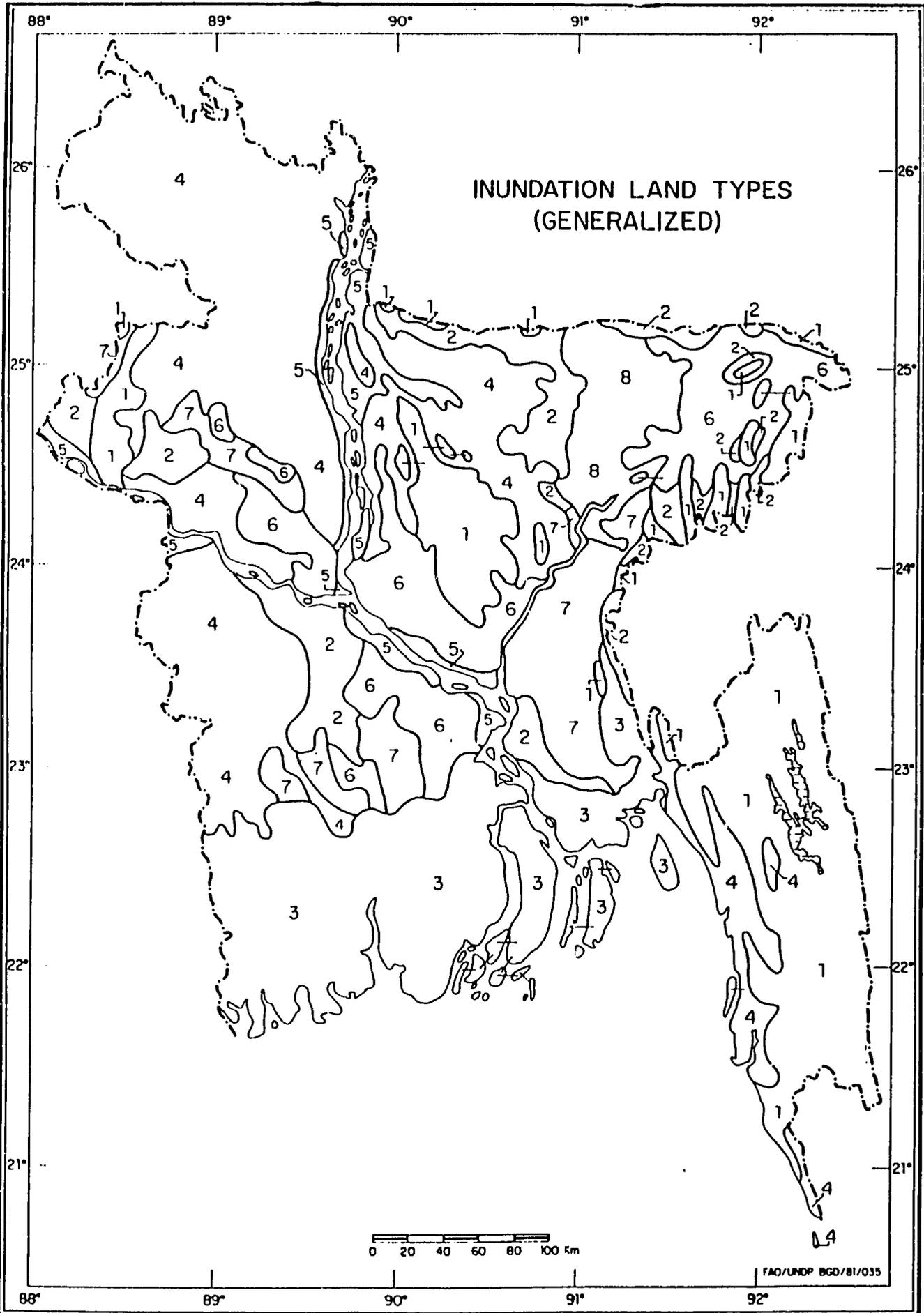


Figure 6a: Legend for the 8 inundation land types shown in Figure 6

INUNDATION LAND TYPES

1. Mainly Highland
2. Highland to Medium Lowland
3. Mainly Medium Highland
4. Medium Highland and Highland
5. Medium Highland and Medium Lowland
6. Medium Highland to Lowland
7. Medium Lowland and Lowland
8. Lowland and Very Lowland

CONVERSION TABLE

1 Metric ton	= 0.98420653 Long ton
	= 2204.6 Ibs
	= 26.7928 Maunds
	= 1000 Kg.
1 Long ton	= 1.0160469 Metric ton
	= 2240 Ibs
	= 27.2208 Maunds
	= 1016.0469 Kg.
1 Acre	= 0.40467806 Hectare
	= 4840 Sq.yards
	= 3.025 Bighas.
1 Hectare	= 2.471 Acres
	= 1000 Sq.metres.
1 Maund	= 0.73169 Hundred Weight
	= 37.32416 Kg
	= 0.03573 Long ton
	= 0.03732 Metric ton
	= 40 Seers
	= 82.2857 Pounds.
1 Pound	= 453.59237 Grams
	= 0.4359 Kg
	= 0.486086 Seer .
1 Seer	= 0.93315 Kg
	= 2.05725 Pounds.

APPENDIX I: AGRICULTURAL PRODUCTION

INTRODUCTION:

Bangladesh is a riverine environment. One person characterized it as an "amphibious society." Eighty percent of the country is delta which floods annually. The floods are a mixed blessing. As the uncontrolled inundation imperils people, infrastructure, crops and livestock, the floods deposit silt and recharge the water table. For much of the year, rivers are the principal means of transport and communication. The tropical monsoon climate, along with the uplands, favors production of almost any possible crop and tree. The people work hard and are very resourceful. They have learned to live with floods and typhoons, while producing rice and other crops for domestic consumption.

The population of Bangladesh is currently growing at the rate of 2.5 percent per year. Food production, in terms of food grains and vegetable oils, lags behind national demand (Fig. 1). Productivity, whether measured as food produced per hectare or per person, appears to have reached a plateau after dramatically increasing for several years. Shortfalls in national foodgrain production during the 1983-1988 period ranged from 299,000 tonnes in 1983/84 to 1,019,000 tonnes in 1987/88 (Table 1). The deficits between national production and food requirements have been made up by imports of food grains and vegetable oils.

Forty percent of the delta area floods annually from both the rain swollen slow moving rivers and from tide surges during the typhoon season. Exceptionally deep and widespread flooding as in 1988 can occur when rain-swollen rivers combine with the tide surge which inhibits the normal slow discharge of shallow silted-up rivers. There is no bedrock except as deep bedrock in the hill areas. People rely on the flood waters to replenish the water table and to add some fertility in areas of silt deposits. The rivers provide a means of transport and communication as well as fish.

People utilize the replenished soil moisture in several ways. Crops are planted behind receding waters to mature in residual moisture and high water table. Deepwater rice is broadcast before the deep floods arrive. Lakes, ponds and old river courses are replenished and serve as reservoirs for use throughout the dry season. Underground water reserves are utilized by shallow and deep wells. Low lift pumps raise much irrigation water from natural reservoirs.

SITUATION:

Land and Water Resources:

Bangladesh has a total area of 14.448m hectares of which 8.766m hectares is cropped. An additional 0.403m hectares lies fallow and 2.119m hectares is in forestland. The country lies between 20° and 36° north latitudes with temperature ranges from 7°C to 31°C in the winter and higher ranges in the humid summer when the temperature rises to 37°C. Rainfall during the monsoon season of July - September ranges from 1194mm in the western and northern areas to 1454mm around Chittagong and Sylhet. As a result of this generally sub-tropical climate, no less than 24 crops and groups of related crops are grown in sufficient quantity to be mentioned in the annual Statistical Yearbook ***. Of these, 17 were evaluated for land and climatic suitability in the FAO/UNDP agro-ecological zone resources appraisal.

Bangladesh is the largest delta in the world. A country the size of the U.S. state of Wisconsin is situated at the confluence of three large and some 30 additional principal rivers. Of these, 32 originate outside of Bangladesh, including the Padma (Ganges) and Jamuna (Brahmaputra) which arise in the Himalayas. The Meghna comes through the Sylhet basin within Bangladesh. During the flood season which occurs between May and September, two thirds of the 9.03m hectares of cultivated area is vulnerable to flooding. An additional 1.214m hectares are subject to saline water from the Bay of Bengal, especially during the typhoon season.

There are two small geologically uplifted areas, one to the north and west of Dhaka and one in the northwest province which has an oblong shape running generally north and south. The uplifted areas are old weathered alluvial deposits and rise no more than 15 meters above sea level. Low hills rise on the east and northwest sides. The Chittagong hills in the southeast range up to 60 meters elevation. The hill soils are easily weathered and eroded soft material covered by rain forests. The northeast Sylhet areas rise up to 1000 meters and are covered by rain forest; the tea growing areas are located in that region.

Of the 9.03m hectares of non-cultivated area, 7.56m hectares or 84% is suitable for irrigation 16/. Water is available to irrigate 6.90m hectares or 91% of the irrigable land. Only 1.92m hectares or 25% of the irrigable land is currently being irrigated.

Soils are broadly differentiated into three broad groups - floodplain soils, terrace soils, and hill soils 11/. The floodplain and terrace soils comprise 80% and 8% respectively, of the country's land area. The hill lands make up the balance of 12%.

The floodplain soils receive silt annually which adds some fertility and are only mildly acidic or calcareous, but they are low in organic matter, frequently form plowpans, and often have low permeability 11/. Crop productivity is determined mainly by permeability, water holding capacity, and availability of irrigation, as well as, depth and duration of flooding. The terrace soils are developed from clay lying on geologically uplifted blocks. They are usually well drained, strongly acidic, and low in organic matter and fertility. Crop productivity is determined mainly by fertility. The hill soils are formed from soft rock, well drained, strongly acidic, and contain moderate organic matter and fertility. Their agricultural potential is limited by steep slopes and rapidly depleted fertility.

The summation of the soil, water, and climatic resources of Bangladesh is that virtually any crop plant can be grown with a medium to high yield during one and sometimes two seasons somewhere in Bangladesh but not all crops can be grown at all locations in every season. However, diversification is not widespread because people have come to rely on a one-crop economy - rice in the delta and tea in the highlands. Fish has provided the 80% of the animal protein. Cattle, sheep and goats harvest the lush growth during the rainy season and consume crop residues in the winter. But population pressure has caused an intensification and extension of the rice season and reduced the forage available for livestock.

Farm Characteristics:

Of the 13.8 million households enumerated in the 1983/84 Agricultural Census, 3.8 million (27.5%) owned no land or cultivated less than 0.04 acres. Of the 10.0 million households with farm holdings, 24.0% had less than one-half an acre, 16.4% had between 0.5 and 0.9 acres, 13.3% had between 1.0 and 1.49 acres, and 16.6% had between 1.5 and 2.49 acres. Medium-size farmers, those having between 2.5 and 7.49 acres, accounted for 24.7% of the holdings. Large farmers, those having more than 7.49 acres, accounted for about 5% of all farm holdings

Crop production:

Trends in acreage and production of major crops are shown in Table 2. Rice has increased steadily with the major increase coming with the Boro type. Wheat and white potato production increased significantly in the earlier part of the decade, but growth has slowed in the last six years. While there has been a 1.9% annual growth in foodgrain production, population has increased at 2.5% per year (Figure 1). If the growth rates of both foodgrains and population continue at the projected rate, there will be a deficit of some eight million tons in year 2020.

Livestock Resources:

Cattle provide draft power as well as some meat and milk. Goats and sheep provide some meat. However, essentially, the cattle provide farm draft power. There has been very little increase in cattle numbers over the last seven years (Table 3). Poultry and ducks provide eggs and meat which is the most expensive animal protein. Most of the animal protein comes from the 794,000 MT of fish harvested from rivers and ponds 19/. Shrimp and prawn production is increasing in importance and production has doubled from 1182 MT to 3822 MT between 1982 and 1986.

Agricultural Research:

Agricultural institutions to develop technology have become well established in Bangladesh. USAID has been instrumental in developing food crop research through BARI and the rice institute BRRI. In conjunction with two IARCs (International Agricultural Research Centers) - CIMMYT for wheat and IRRI for rice - high yielding varieties (HYV) and improved technology have been developed and adopted by many farmers. In a corollary effort, an on-farm research unit has been established in BARI to identify farmers problems through village surveys by researchers and to coordinate the efforts of scientists from many disciplines in solving those problems. The consistent rise in use of HYVs and fertilizer demonstrate the adoption of improved rice and wheat technology. One example of the success of the BARI on-farm research program was given by the Ishurdi group working with 40 farmers at Kalikapur. After observing the benefits of vegetables and fruit trees which were introduced by the OFR team, 43% of the farmers extended their homestead gardens after the first year. Another benefit was that the landless and marginal farmers earned twice the income of larger farmers. The potential gain from existing technology is demonstrated using land suitability estimates from the AEZ program of BARC and yields obtained by better farmers who have used that technology.

Agricultural extension:

Agricultural extension is established throughout the country. Extension has taken a "prescriptive" approach to working with farmers. Upazilla and Zilla headquarters staff have participated in selecting the critical constraints which are included in the OFR program of BARI. Extension is also actively involved in crop estimating. In the places that we visited, extension had field demonstrations of improved varieties and husbandry.

Input organizations

Inefficiencies in the agricultural supply organizations have reduced the incentive to farmers to produce. For example, BADC supplied from 0.2% to 18% of the national requirement for HYV and improved seeds (Table 14). However for HYV rice, the amount supplied was 4.8% and 3.7% for white potato. Very little amounts of crop and vegetable seed have been made available except in special integrated area development projects.

But the situation has improved with regard to fertilizer with the USAID-sponsored fertilizer marketing program. The supply of tubewells has been opened to private suppliers with significant rise in number of installations.

It is difficult to say that seed is overpriced. The price for varietal (composite) seed should be about three times grain price and the price for hybrid seed about ten times grain price. In one example of a contract seed grower for wheat, BADC paid the contract grower grain price for the seed and took only 10% of the crop (personal communication). The seed was then sold at grain price. Therein lies the problem. There is no incentive for the contract grower to give the special care and inputs required for a seed crop. No sound business can operate on this kind of margin. And the BADC price policy prevents the contract grower from selling his remaining 90% of the seed crop at a premium to fellow villagers.

Inefficiencies in making credit available under policies and at interest rates that the farmer can afford have forced the farmer to turn to village moneylenders at 200% or higher interest rates. The result has been reduced net income at best and at worst the loss of total income and land.

While transport is not a problem in the grain market, it is a serious constraint in the perishable vegetable and fruit market. A small surplus can disproportionately depress prices and lack of cold stores and suitable transport can cause a tenfold difference in the price at Dhaka compared to the village market.

POTENTIAL PRODUCTIVITY:

Potential impact of current technology on agricultural production:

The purpose of this agricultural sector analysis is to determine the potential impact of current Bangladesh agricultural technology on the production of major crops.

Potential impact was estimated by multiplying the best research yields with the total suitable land for that crop.

Potential impact was also estimated using farmers, yields at two levels. One estimate was the production that better farmers have obtained with research technology in on-farm trials. Another production estimate was made using better farms yields when HYV seed and a 50 percent level of recommend crop husbandry.

Several conclusions can be reached. By comparing research yields with average national yields (Table 4), the yield gap due to lack of technology adoption can be estimated. From Table 5, it appears that the farmers have achieved about one-fourth of the yield in potential, except in Boro and T. Aman rice. On the other hand better farmers have approached research yields in rice and wheat (Table 4).

Another unexploited potential is expansion of the irrigated area. The MPO 1986 National Water Plan 16/ gives net cultivatable area (NCA) as 9.03m hectares (not including 0.42m hectares of active floodplain). Of the total NCA, 7.56m hectares is suitable for irrigation, but water resources are available for only 6.90m hectares. The MPO Report estimated that 1.92m hectares was under irrigation, so irrigated area could be increased about 3.6 times to fully utilize the available water. If the irrigated area were increased to the limit of available water and current technology were applied to Boro and T. Aman rice, the country could meet food grain requirements to the year 2007.

Diversification into high-yielding food crops, such as maize and white potatoes, and improved oilseed crops, such as mustard, offers even greater production potential. Using current technology, if all irrigable land were brought into production and 50% of the total irrigated NCA were planted in irrigated HYV Boro rice and the balance of suitable land into HYV wheat, then food requirements could be met to year 2005 (Table 11). Using the mix of Boro rice and maize, food requirements could be met to year 2017 (Table 12). In comparison, with the current mix of food grains, food requirements could be met only to year 2000.

ANNEX 4

AGRICULTURAL SECTOR INSTITUTIONAL ANALYSIS

Prepared by

Rashid S. Ahmad

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EXECUTIVE SUMMARY

I. Introduction

Agricultural development is the linchpin of economic and industrial development in Bangladesh. It currently provides 45 percent of the nation's GDP and 40 percent of the foreign exchange. The role of agriculture in creating employment and alleviating poverty will continue to be important. Agricultural activities are the most important source of employment. It is estimated that there is 30-40 percent under-employment and unemployment in rural Bangladesh. Growth in agriculture will be essential to partly absorb the increasing numbers of unemployed in the coming years. An increase in food production to alleviate the problems of poverty and malnutrition further underscores the importance of agriculture.

The importance of the agriculture sector in Bangladesh is reflected in the number and size of governmental and semi-governmental institutions. Responsibility for agricultural programs is dispersed over more than ten ministries which have direct or indirect authority of control and supervision of thirty-five different departments, corporations, research and educational institutes and specialized banks. Some of the agricultural institutions like BADC, BRDB, BWDB, and DAE are among the largest employers in the public sector. The agricultural research and educational institutions have also grown considerably over the years. Additionally, there is an increasing number of banks and credit institutions directly involved in providing services in the agriculture sector. The sheer size of institutions coupled with fragmented structures and overlapping jurisdiction present serious problems to an efficient management of the sector.

In terms of public investment in agriculture, total expenditure on agricultural services and water resource development has been rapidly declining since the beginning of the Second Five Year Plan in 1980-85. Agriculture's total share in the Annual Development Program allocations has declined from 33% in FY-81 to 17% in FY-88. The reduction in fertilizer subsidy accounts for less than 10 percent of the reduction in agricultural budget. In addition to the reduced investments, public expenditure in the agriculture sector has not yielded the expected economic returns largely due to the institutional problems in implementing and maintaining the projects.

The current structure and performance of the major agricultural institutions, both at centralized and decentralized levels, is characterized by considerable fragmentation, imbalance in resource allocation, limited fiscal and managerial accountability, and limited mobilization of existing institutional and human resources. While the technological and financial resources for growth in agriculture are being procured from abroad, the acceleration in growth will partly depend upon the government's ability to make necessary institutional adjustments in order to efficiently utilize these resources. Whether the required institutional changes will take place implies a number of critical assumptions as identified below:

- The overall capacity of the institutions at the ministerial level to plan and coordinate their functions in the agriculture sector will improve.
- The functions of the supply and management of agricultural inputs will be efficiently carried out by the public agencies and some of the appropriate functions will be transferred to the private sector.
- Public expenditure in agricultural research, extension, and education will increase.
- The government will support and collaborate with NGOs in delivery of services to rural populations.
- The Upazila administrative system will plan and implement development programs in accordance with local needs and conditions.

At the Macro-level, the responsibility for agriculture sector planning and management is dispersed over several ministries. There is no one specific ministry which is fully responsible for the sector's planning. The MOA has a partial portfolio in agriculture and a limited capacity to engage in sector-wide planning. The planning is based on a fragmented understanding of the overall sector and lacks a strategic perspective. It is essentially undertaken within a process of political bargaining among competing ministries

The Government's inter-sectoral planning mechanisms and procedures should be strengthened. The Planning Commission should perform the functions of macro-level planning rather than project-level planning. With regards to the Ministry of Agriculture, the Policy Planning Cell of the Ministry should be strengthened and staffed with adequate qualified personnel.

Efficiency in supply and management of agricultural inputs is adversely affected by the overgrown structures and conflicting jurisdictions and functions of the major parastatals.

Bangladesh Agricultural Development Corporation (BADC) is involved, directly and indirectly, in the supply and management of all major agricultural inputs (fertilizer, seeds, water, credit). Its functional overlap with other agencies is enormous and creates problems in a well coordinated supply and management of inputs. BADC continues to engage in functions which can be more efficiently carried by the private sector and other public agencies.

BADC should gradually change its role to the management rather than the supply of agricultural inputs. Its supply side activities in irrigation equipment, seeds, and agricultural credit should be transferred to other appropriate private and public sector organizations.

Bangladesh Water Development Board (BWDB) is primarily responsible for designing and implementing large-scale projects in flood control and irrigation. It is also partly responsible for minor irrigation. BWDB's coordination with other agencies in the water sector is very weak. It undertakes projects without appropriate planning and environmental considerations. The maintenance of the completed projects is inadequate.

BWDB should concentrate only on major irrigation projects and their maintenance. It should closely coordinate its planning with other organizations and involve the local governmental bodies in the planning process.

Bangladesh Rural Development Board (BRDB) is responsible for a wide variety of activities in rural and agricultural development. Its primary functions are to form cooperatives and provide them with credit for economically productive activities. BRDB cooperative system does not adequately cover the rural poor and landless. The formation of cooperatives is generally involuntarily imposed from the above, and dominated by rural elites. The rate of credit recovery is low.

BRDB should change the by-laws governing the cooperatives to allow for open membership for smaller farmers and provide credit and intensive assistance to cooperatives for economically viable projects.

In the area of technology development and diffusion, the organizational and functional linkages among research, education, and extension are not well-established

The agricultural research institutions and their activities are not sufficiently coordinated and directed toward the development of applicable technologies. BARC has limited authority and management capacity to direct the research system.

The physical infrastructure in research is extensive and has high overhead and operating costs. In spite of the government's increased allocations to research, there are limited finances to support the operational costs.

The agricultural education system has been severely neglected over the years. The quality of teaching in the Bangladesh Agricultural University (BAU) has deteriorated and the University is not sufficiently geared to meet the manpower needs in agriculture.

The agricultural extension system does not function efficiently. It provides inadequate coverage to the farmers and services are mainly concentrated in crop-production. The needs of the vast majority of small farmers and women are not met by the extension service. The provision of agricultural extension services is constrained by lack of operational expenditure.

The local government bodies and the NGOs provide the potential interlinkages to the governmental agencies and parastatals in the implementation of agricultural programs. Without the development of local rural institutions and mobilization of human resources, both in governmental and non-governmental spheres, the overall performance of agricultural institutions will continue to be inadequate.

The capacities of the Upazila administration in planning and implementing agricultural and rural development projects needs to be improved. The resource allocations at the local level have to be monitored by the central ministries to ensure that the resources are directed to rural development and service sectors rather than to physical infrastructure development only. The Non Governmental Organizations (NGOs) and their activities and resources, should be appropriately integrated with the government's programs.

AGRICULTURE SECTOR INSTITUTIONAL ANALYSIS

I. INTRODUCTION

The agriculture sector in Bangladesh plays a critical role in the nation's economy. It provides about 45 percent of the nation's GDP, 40 percent of the foreign exchange and about 80 percent of the direct and indirect employment. Agricultural development is considered as the linchpin of economic and industrial development in the nation. The Bangladesh Government (BDG), in its Third Five Year Plan (TFYP) emphasized agricultural development as a primary means for achieving food self-sufficiency, alleviating poverty, and increasing employment in the rural areas.

The importance of the agriculture sector in Bangladesh is reflected in the number and size of governmental and semi-governmental institutions. Responsibility for agricultural programs is dispersed over more than ten ministries which have direct or indirect authority of control and supervision of thirty-five different departments corporations, research and educational institutes and specialized banks (Table 1). Some of the agricultural institutions like BADC, BRDB, BWDB, and DAE are among the largest employers in the public sector. The agricultural research and educational institutions have also grown considerably over the years. Additionally, there is an increasing number of banks and credit institutions directly involved in providing services in the agriculture sector. The sheer size of institutions coupled with fragmented structures and overlapping jurisdiction present serious problems to an efficient management of the sector.

The various agricultural institutions in Bangladesh can be classified into four subsystems in order to examine their functional constraints and discontinuities and their effect on agriculture sector management. At the macro-level, the structure and functions of the important ministries and the problems in sectoral planning are examined. A second institutional subsystem is examined which comprises of the major corporations and parastatals that are responsible for the supply and management of agricultural inputs, i.e., fertilizer, water, seeds, credit and support services. The primary actors in this subsystem include BADC, BWDB, and BRDB. Another crucial subsystem is related to the production and diffusion of technology and the development of necessary manpower. This subsystem includes institutions of research, education and extension. Lastly, an important subsystem which is responsible for implementing the agricultural programs and for the delivery of support services of the the local administrative bodies includes the Upazila administration.

All of the above four institutional subsystems are interdependent. The effectiveness of one is as important as the effectiveness of the others. A strategy of overall institutional development in the agricultural sector, therefore, must take into account these subsystems in a totality.

The overall purpose of the study is to undertake a broad assessment of the major public sector institutions in terms of their structure, functions and current performance, and to identify feasible methods for improving their effectiveness. The fundamental objective is to recommend options and priorities to the USAID for its future programs in institutional and manpower development of the agriculture sector in Bangladesh.

II. INSTITUTIONAL STRUCTURE IN AGRICULTURE SECTOR

A. Ministries and Their Functions -- Macro-Level Planning and Management

1. Ministry of Agriculture (MOA)

The Ministry of Agriculture is one of the several ministries responsible for agricultural development. The central focus of the MOA is food crop production and forestry. In the past, the Ministry was also responsible for several other subsectors in agriculture such as fisheries and livestock, jute, water and irrigation which are now reorganized under separate ministries.

The MOA is organized into two divisions - the agricultural division and the forest division. The division of agriculture is the larger division and is charged with the overall responsibility of policy-planning, research, input distribution and extension in the agriculture sector (see Appendix for the MOA organizational chart). The division is administered by a Secretary, an additional Secretary, and three Joint Secretaries. The Secretary is responsible for the overall administration of the Ministry and its divisions, including the decentralized agencies of the Ministry which include: Bangladesh Agriculture Research Council (BARC), Bangladesh Agriculture Development Corporation (BADC), Department of Agricultural Extension (DAE), and the Cotton Development Board (CBD). The decentralized agencies are considered as semi-autonomous bodies and have their own independent budget which allows them operational flexibility.

The MOA has division, district, and upazila level offices to support agricultural development at the regional and local level. The Upazila level is an important link of the Ministry in providing extension, irrigation, and other inputs in conjunction with the services in education, family planning and health that are provided by other technical departments of different ministries. The coordination of the services of the department of other ministries at the Upazila level is crucial for an effective implementation of agricultural development projects.

The existing structure of the MOA and its restricted functional authority in the agriculture sector has several negative effects on the overall planning of the sector. The MOA does not have full authority and functional jurisdiction over some important agricultural subsectors such as fisheries, livestock, and water resources. Therefore, it does not have a direct say in the planning and resource allocation within these subsectors. For instance, irrigation is only partially under the jurisdiction of the MOA. Similarly, research in fisheries and livestock does not fall directly under the domain of the MOA. The division of authority without well-defined coordinating mechanisms tends to minimize the role of the MOA in the agriculture sector planning.

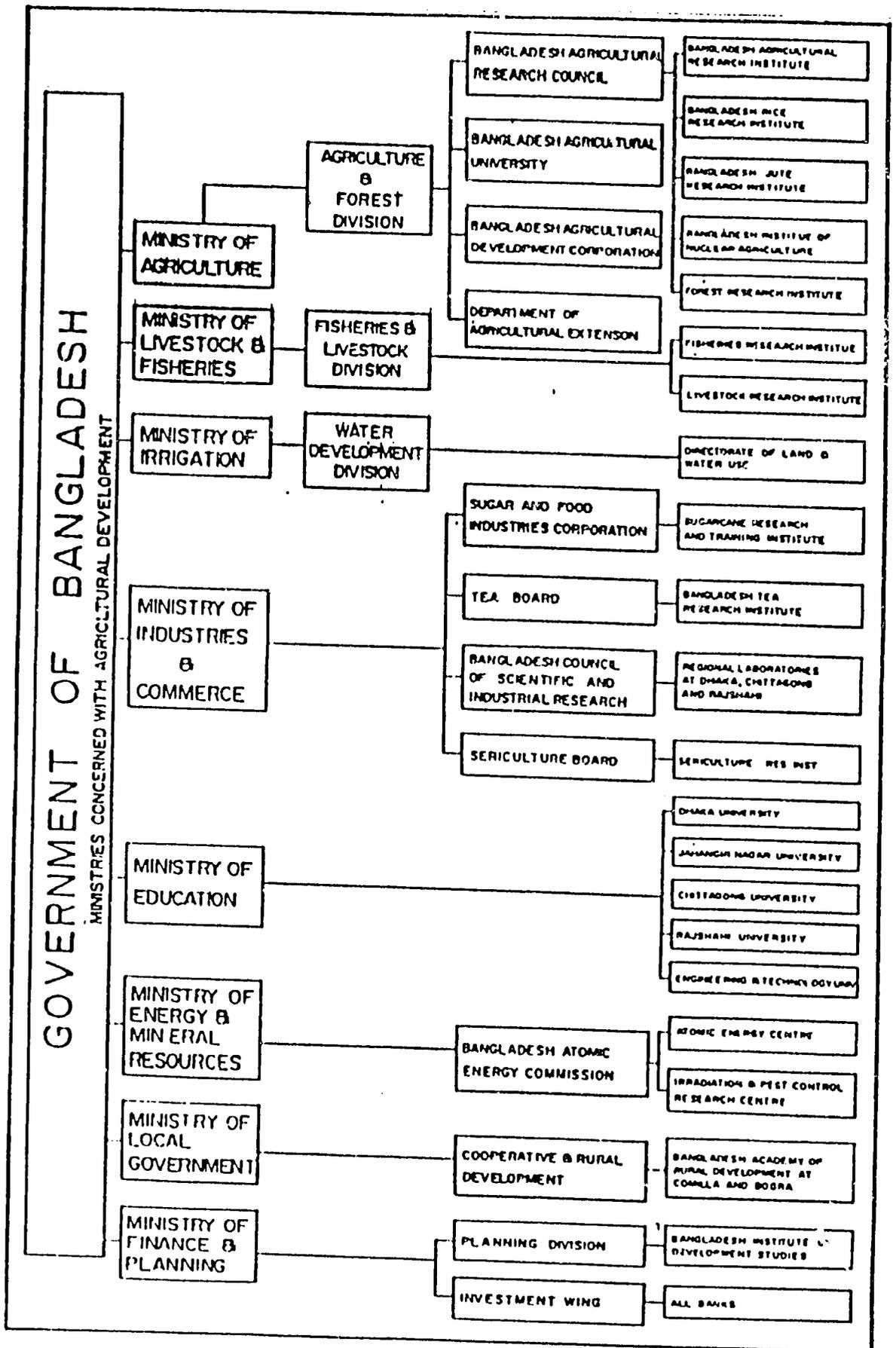


Chart 1. Ministries Concerned with Agricultural Development

The MOA should be the lead Ministry in the planning and management of the agriculture sector. However, the partial portfolio of the Ministry and especially the lack of its jurisdiction over non-crop subsectors, fisheries, and water resources diminishes the role and functions of the MOA in agriculture sector decision-making.

2. Ministry of Food

The Ministry of Food (MOF) is one of the most important ministries in the agriculture sector. It is responsible for the procurement, movement, storage, distribution, and rationing of food grains. The MOF operates a price guarantee program for the farmers by purchasing food grains at preannounced prices. It is also in charge of importing food grains. Locally purchased as well as imported food grains are utilized for food security stock building and for the rationing system. Moreover, the MOF imports other food items, including sugar, edible oil, salt etcetera.

The MOF is organized along four of its essential functions: procurement, storage, rationing, supply and distribution. The Directorate of Food of the MOF performs the function of monitoring the food supply and demand conditions in the nation.

The authority and functions of the MOF give the ministry a strategic position in the agriculture sector and the overall national policy-making. Thus, the MOF is in the position of influencing the functions of MOA and other related ministries in the agriculture sector. The effects of MOF policies on food grain imports are critical in the formation of domestic prices which have broader impacts on the agriculture sector.

3. Ministry of Irrigation, Water Development, and Flood Control

The Ministry of Irrigation, Water Development and Flood Control (MIWDFC) is in charge of water resource development, flood control, and major and minor irrigation. The Ministry was first created in 1981 by splitting from the Ministry of Energy and Mineral Resources and was merged with the MOA. In 1984, the MIWDFC was separated again as an independent ministry.

The MIWDFC is basically responsible for supervising the Bangladesh Water Development Board (BWDB) and the Joint Rivers Commission (JRS). The main activities of the Ministry are those relating the BWDB. The Ministry is also responsible for coordinating its activities in water resource development with the MOA, the Ministry of Finance, and the Planning Commission, and other water sector agencies.

4. Planning Commission

The Planning Commission is primarily responsible for providing the inputs for the general direction of the Five Year Plan. It issues guidelines and outlines the broad sectoral targets two years in advance which are transmitted to the individual ministries as a basis for their respective sectoral planning. The Ministries, including the MOA generally submit a list of projects in their sector without undertaking any independent sectoral planning. The compiled list of projects from the Ministries is reviewed by the Sectoral Panels in the Planning Commission as well as representatives from line ministries and agencies, ERD, Ministry of Finance, Implementation, Monitoring, and Evaluation Division (IMED), and private and public sector organizations. The review of the sectoral plans by the Planning Commission has been described as an exercise in political bargaining over rearranging priorities and resource allocation.

The MOA provides a limited input to the Planning Commission in the analysis of the agriculture sector and in establishing targets and the methods to accomplish them. The TFYP does not specifically address the structure of agriculture sub-sectors and the various constraints as policies, pricing, tariff controls, and the availability of inputs in achieving the targets. In preparation for the TYFP, it was found that the MOA undertook some analysis of the projects but submitted these materials to the Planning Commission too late to be included into the sectoral draft analysis (1).

A lack of sufficient macro-level planning capacity in the MOA and other ministries gives the Planning Commission increased authority in establishing sectoral targets and allocating resources.

5. Other Ministries

Because of the dominance of agriculture in the economy, there are a number of other Ministries which directly or indirectly influence the decision-making process in the agriculture sector. The Ministry of Local Government and Rural Development and Cooperative (MLGRDC) occupies an important role in agricultural and rural development. The MLGRDC is responsible for the formation of rural cooperatives and providing credit through the Bangladesh Rural Development Board (BRDB). The Ministry of Industries and Commerce is responsible for the regulation in tea, textile, jute industries and has a direct impact on the agriculture sector. The Ministry of Communication monitors the operations of six decentralized public corporations that are responsible for land and water transport, and communication.

In addition to the above ministries, there are approximately 40 different ministries, agencies, corporations, and research and educational institutes involved in the agriculture.

B. Major Parastatals and Their Performance -- Supply and Management of Inputs

1. Bangladesh Agricultural Development Corporation (BADC)

BADC was created in 1961 with a very broad mandate to provide modern agriculture technologies to farmers. Since then it has been responsible for procuring and distributing seeds, fertilizer and agricultural machinery. It has also been involved in the supply, operations, and maintenance of irrigation equipment, in the formation of cooperatives, and in the provision of extension services. The broad mandate with which BADC has been operating for the past twenty-seven years has burdened the corporation with gross inefficiencies and mismanagement.

The overlap of functions between BADC and other public sector agencies is enormous. BADC's present operations require it to interact with more than twenty agencies. These have been grouped into five major categories by a UNDP study in 1988 (2).

(i) Agencies involved in the development of agriculture technology, such as BARC, BRRI, BARI, BINA, BAI.

(ii) Agencies involved in the diffusion of agriculture technology such as DAE, BWDB, BRDB.

(iii) Agencies involved in manufacturing of agriculture inputs such as BCIC, BDP, BMTF.

(iv) Agencies providing support services like credit, direct inputs, electricity, etc., such as Banks, REB, BIWTC, BRTC, and BRI.

(v) Regulatory agencies like NSB, SCA.

A number of assessments of BADC have been conducted in recent years with many common conclusions about the required changes in BADC's organization and operations (3). It is generally concluded that many of BADC's functions can be effectively performed by the private sector and that its overall role and functions, for instance in irrigation, cooperatives, and extension, should be aligned with other organizations engaged in similar activities to minimize the overlap and conflict of operations between BADC and other agencies. Major recommendations from these assessments are synthesized below.

(a) Fertilizer

BADC's functions in fertilizer marketing should be regulatory and supplementary to the activities of the private sector. The USAID's privatization program in fertilizer distribution and marketing has been successful and the private sector now is capable of managing the entire system from factories to the farmers. Hence, the BADC should now be involved in only monitoring the distribution system and regulating it to keep it competitive. BADC should also engage in market research for estimating future demand and promote new technologies.

There is a general agreement on this recommendation among the government and the donor community. However, it should be pointed out that BADC's capacity to perform these new functions is limited by the lack of trained manpower and management capacity in its Fertilizer Division.

(b) Minor Irrigation

BADC's functions in the sale and rental of STWs, DTWs, LLPs have been gradually shifted to the private sector. BADC is responsible for planning and implementation of minor irrigation schemes. BADC's responsibilities in these areas overlap with the responsibilities of other agencies like BKB, BWDB, and BRDB. The planning and operation and maintenance is not systematically undertaken. There are no guidelines for private buyers on the installation of pumps. BADC's equipment maintenance services are deficient which include poor training of pump drivers, insufficient supply of spare parts, and undue delays in providing service.

BADC's planning responsibilities in minor irrigation should be improved and coordinated with those of the other agencies. The Organization should serve as a regulatory agency responsible for providing guidelines on siting of all types of equipment. Its essential functions should be to assist cooperatives and user groups in site selection and layout of distribution systems.

The equipment maintenance services of BADC should be gradually transferred to the private sector. The BADC field workshops could be either leased out to private groups or BADC maintenance staff could be provided incentives to buy out the workshops. BADC could assist in the training of the mechanics in the manufacturing of local pumps, and in the maintenance and delivery of spare parts. The organization should also encourage small farmers and landless groups in buying and maintaining pumps for the purposes of selling water commercially.

(c) Seeds

BADC is responsible for seed farming and seed multiplication. It works with BARI, BIRRI, NSB, SCA, and other agencies for the production and certification of high quality breeder seeds.

BADC's seed program needs a marketing system that works with the private sector. It should provide supervising roles in the production, certification, and storage of seeds rather than being directly involved in these functions. It should involve more farmers and contract growers in the production of seeds. Changing the functions of BADC in seed production will facilitate the development of private seed companies.

BADC is also involved in agro-services involving the production of vegetables and poultry at BADC agricultural estates and marketing of these products for domestic consumption and export. Seeds are marketed through the agro-service centers. Dairy cattle, fish and poultry, which now occupy a very small portion of the Agro-Service Centers, should be more integrated into the activities of the Centers.

2. Bangladesh Water Development Board (BWDB)

BWDB has the primary responsibility for macro-planning in the water sector. The responsibility is shared with at least thirty-five different ministries and agencies involved in water planning.

BWDB is in charge of performing the following projects:

- Dams, barrages, reservoirs, and other original works, as well as irrigation, embankment, and drainage structures and facilities for bulk water supplies;
- Flood control, including watershed management;
- Prevention of salinity and water congestion, and reclamation of land;
- Maintenance, improvement and extension of channels, including dredging of channels; and
- Regulation of channels for more efficient movement of water, silt, and sand.

A number of assessments of BWDB's organizational structure and performance have been undertaken in recent years. The assessments generally indicate a dismal performance of the organization (4). BWDB has undertaken large-scales projects in flood control and irrigation without appropriate planning and environmental considerations. The projects have been poorly designed and maintained. Coordination with other major agencies has been lacking. There is very little input from the local level in planning the projects. Beneficiaries of the BWDB projects are not involved in their preparation and implementation.

The division of responsibilities for major and minor irrigation between BWDB, BADC and other agencies is a major issue. A number of alternatives have been advanced in existing studies. For example, the creation of a separate irrigation organization by combining the land use and water directorate of BWDB and the minor irrigation departments of BADC into a new organizational entity which will be exclusively responsible for minor irrigation. An alternative recommendation is to transfer BADC's functions in minor irrigation to BWDB so that the entire water resource planning and development could be better coordinated.

The option to create a new organization responsible for minor irrigation does not appear feasible. There are already too many organizations in the water sector. To transfer the BADC's existing functions in minor irrigation to BWDB would simply add to overbureaucratization and mismanagement. **Instead, a feasible alternative may be to relocate the current Master Plan Organization (MPO) under the Ministry of Planning with functional responsibilities to coordinate the development and utilization of national water resources through the cooperation of all agencies.**

MPO

The MPO has developed a comprehensive National Water Plan according to the needs of all water use-subsectors. The MPO was established in 1986 within the Ministry of Irrigation with funding from the UNDP. It does not have any formal authority in relation to the Ministry, BWDB or other agencies. The organization currently operates as an analytical body composed of the Harza Consortium, local consultants, and personnel drawn from BWDB on a seconded basis. Without further financial support to continue its activities and a clear mandate, MPO's efforts may be wasted.

The MPO has the technical resources to perform a planning and regulatory role under the overall control of the Ministry of Planning. It can be located as a division within the Planning Commission with jurisdiction and resources for water sector planning and could provide an effective base for coordinating the diverse activities of all agencies within the framework of the National Plan.

3. Bangladesh Rural Development Board (BRDB)

BRDB is responsible for the implementation of a variety of agricultural and rural development programs. Its prime functions are to organize the rural poor into cooperatives and provide credit, agricultural inputs, irrigation equipment, training and other support services for employment, income generation, and capital formation. BRDB's current activities also include area development projects and special programs like the South-West Rural Development Program. Additionally, BRDB is engaged in a number of program-oriented activities such as the Tangail Agricultural Development Project and DTW project.

The primary vehicle for implementing BRDB activities is the development of a two-tier cooperative system. At the village level, primary agricultural cooperatives KSS and MSS (Women Cooperative Society) are formed by the BRDB which are federated at the Upazila level as Upazila Central Cooperative Associations (UCCA). BRDB extends credit and other services to these cooperatives for rural and agricultural development activities.

The stated objective in development of the cooperative system, based on the Comilla model, was to facilitate the process of rural institutional development, increase income and employment, and alleviate poverty. The cooperative system and the BRDB's activities have been analyzed in a number of studies which indicate that the cooperative system in Bangladesh has not succeeded in achieving the stated objectives. In fact, the BRDB cooperative system and credit activities have benefited the large farmers more than the rural poor.

A survey conducted in 1987 to study the impact on BRDB credit on income generation indicates that the rate of return on investment is very low, ranging from 8.3% to 12.1%. The national coverage of the BRDB activities is limited to 12% to 15% of rural population. The average credit recovery rates are about 60% and only 40% of cooperative members engage in economically productive activities. These problems, in addition to other management deficiencies in the organization, raises serious concerns about the viability of the cooperative system.

The evaluations of the performance of the BRDB indicate that its administrative structure and procedures constrain the development of self-sustaining, income-generating projects. In the case of the BRDB cooperatives, the rural affluent employ improper means to form cooperatives and obtain credit for their individual self interests. A great percentage of the BRDB credit remains unrecoverable. BRDB credit activities do not adequately cover small farmers and especially women (5).

C. Research, Education, and Extension -- Technology Development and Diffusion

1. Agricultural Research

The present National Agricultural Research System (NARS) is composed of a total of 10 semi-autonomous institutions which conduct research under the administrative responsibility of several different ministries. The primary institutions under the NARS include:

- Bangladesh Agricultural Research Council (BARC)
- Bangladesh Rice Research Institute (BRRI)
- Bangladesh Agricultural Research Institute (BARI)
- Bangladesh Fisheries Research Institute (BFRI)
- Bangladesh Institute of Nuclear Agriculture (BINA)
- Bangladesh Livestock Research Institute (BLRI)
- Bangladesh Jute Research Institute (BJRI)
- Bangladesh Tea Research Institute (BTRI)
- Bangladesh Cotton Research Institute (BCRI)
- Bangladesh Forest Research Institute (BFRI)

Several other research and educational institutions are also involved in agricultural research.

The research system has grown considerably over the years with the assistance of USAID and other international donors. BARC, under the Government's 1988 ordinance, has been assigned responsibility to coordinate, monitor, and redirect the system toward a sustained development and diffusion of applicable technologies.

The main responsibility of BARC is to strengthen and coordinate agricultural research at the national level. According to the current mandate of BARC, it serves as the coordinating body for research on crops, soils, water, crop protection, forestry, livestock, fisheries, economics, and social sciences.

All of the research institutes fall under the coordinating umbrella of BARC. However, BARI, BRRI, BJRI, and BINA which are directly under to MOA, are the constituent units of BARC.

BARC has prepared a Strategic Plan to coordinate and redirect the national research towards a sustained development and diffusion of modern crop and management technologies for increasing farm productivity under all agro-economic and ecological conditions at the farm level. The overall plan will be implemented by improving planning, management and accounting, evaluation and monitoring, information management, and training systems of BARC and its client institutes. The targetted objectives of the plan are to rationalize the allocation of research among crop and non-crop subsectors, to minimize redundancy and overlapping jurisdictions in research, and to redirect research toward a farming systems approach.

BARC has already initiated the implementation of its strategic plan. Coordination is being partly achieved through the contract research mechanism by which BARC directly funds projects and monitors the quality of their progress and evaluates the research findings. BARC has also been given review powers of all new research activities, irrespective of the source of funding.

The overall coordination of the research and its decentralization and redirection toward a farming systems approach can be hampered by the lack of BARC's internal management capacity and the existing autonomous structure of the individual research institutes. Organizational and institutional constraints in the implementation of BARC's plan are addressed in Section III.

2. Education and Human Resource Development in Agriculture

Growth in agriculture in Bangladesh is as much dependent upon investment in human capital as it is upon investments in technology and infrastructure development. Education and training provide the primary means for the development of human resources. Increased agricultural productivity requires availability of scientific manpower to develop and transfer agriculture technologies as well as increased know-how on the part of the users of the technology, the farmers.

2.1 Higher Agricultural Education

There has been a limited expansion in the institutions of higher agricultural education in Bangladesh since 1971. At present, the higher agricultural education system consists of the Bangladesh Agricultural University (BAU), three agriculture colleges, located in Dhaka, Dinajpur, and Palhuakali, and a recently established Institute of Post Graduate Studies in Agriculture (IPSA). Higher education in several fields of agriculture-related disciplines, such as economics, soil sciences, chemistry, and entomology, is also provided by other major universities in the nation.

BAU has been the primary institution for graduate and post-graduate studies in agriculture since 1961. All other colleges and IPSA are under the academic control of BAU. Evaluations of BAU's academic programs indicate an unsatisfactory performance of the University (6). The programs are too theoretical with little concern for the practical problems in agriculture. Students and the faculty engage in very little field work. BAU curriculum has not been significantly revised in the past fifteen years. There is limited representation of the students and teaching faculty in the administration and management of the University. The University has been able to produce a limited number of PhDs in the last twenty years and is only weakly linked with other related institutions.

The problems in agricultural education are further exacerbated by low attendance, low retention rates, campus violence, and other disruptive factors prevalent in the entire educational system of the country.

An increase in the quantity and quality of agricultural graduates, may be needed to meet the manpower requirements in the agriculture sector. BAU is considered as the primary institution for meeting these requirements. Given the deterioration in the quality of education at BAU, it is not clear if BAU without fundamental changes in its administration and educational philosophy, can produce quality graduates in the near future. It may take seven to ten years of technical assistance and financial support, plus an administrative will, before BAU is able to meet the near and medium term manpower requirements in the agriculture sector. Therefore, an investment in BAU should be viewed in the context of other viable options to support higher agricultural education programs through alternative means.

2.2 Farmers' Education

Literacy rates in Bangladesh have been almost stagnant over the last twenty years. About 40% of the primary age population never attends school and the drop-out rate is approaching about 70% (7). Adult illiteracy is equally widespread. Approximately 70% of the adult population in 1981 never attended school and another 17% had only a primary education.

Education may not have direct relevance for farmers working in a system of agricultural production that relies upon traditional technology and cultural practices. However, education plays an important function in productivity once modern technologies are available. In a modernizing environment, farmers need the information about the sources of new inputs, their optimal use, and the economic benefits from the application of modern technologies (8).

Farmers tend to benefit from farm-specific education. A certain level of basic literacy in reading and writing is required for farmers to seek and make a better use of the information on technology adoption and farm management, e.g., fertilizer use, pest control, efficient use of water, etc.

2.3 Education and Training for Employment Creation

The ability of the rural poor to take initiatives and to create and sustain non-farm productive activities is severely constrained by illiteracy, lack of skills and access to resources. While an accelerated rate of crop-production will create increased employment and may absorb, at best, one-third of the rural labor force, direct investments in education and training to create employment is required. The educational strategies should focus on organizing the poor and landless and providing them access to basic literacy and skills training for employment and self-employment. **Labor intensive sectors such as livestock, agro-processing and support service sectors such as equipment maintenance and operations, and accounting and management provide potential arenas for educational investments.**

3. Agriculture Extension

The extension system in Bangladesh is primarily based on the Training and Visit System. There are more than twenty different institutions that are mandated to provide extension services to farmers. The Directorate of Agriculture Extension (DAE) is the major extension organization. The DAE jurisdiction covers more than 80% of the cropped area of Bangladesh. Its present organizational pattern follows the decentralized administrative pattern of the Government. DAE has six levels of management: National level, Regional level, Zila level, Upazila level and Union Council level. The extension block supervisors, operate at the Union Council level.

The DAE employs about 12,000 Male Block Supervisors (MBS) and about 400 Female Block Supervisors (FBS). In theory, each MBS is assigned to cover 1,000 farm families. The Food and Agriculture Organization (FAO), in an evaluation of the effectiveness of the extension system, shows that there is a bias in favor of large and educated farmers with 6 or more hectares of land (9). Similarly, the UNDP/ASR Census showed that about 92% of households involved in crop and non-crop cultivation had never been visited by a Block Supervisor. Further, the ASR pointed out that female-headed households are even less visited (7.5%) than male headed households (10.4%). It has also been indicated that the extension activities are more focused on production of food grains and less focused on production of vegetables, fodder, and livestock development. The extension bias toward food grain production especially affects the homestead production potential.

There are several other institutions which provide extension services in selected areas. The major research institutes including BARI and BRRI provide extension through their outreach programs and farm trial divisions. The BRDB, BADC, and BWDB also engage in extension activities directed at the cooperatives. In the case of BAU, extension activities are used to enhance the training of the university students.

D. Upazila Administration

The Government reorganized local administration in 1983 under the Upazila System. Administratively, the Government abolished the previous subdivisions and amalgamated them into Districts, thus increasing their number by more than twofold. The Thana, the immediate subordinate level to the district in the old system, was reclassified as Upazila. The reorganization produced 64 districts and 495 Upazilas. Each Upazila is comprised of about 8-10 Unions.

Decentralization of administration was undertaken by replacing the Circle Officer of Thana with the Upazila Nirbahi Officer (UNO), a career civil servant of the level of an Assistant Commissioner. The UNO is given direct supervisory authority over all the technical departments and its personnel at the Upazila level. The direct authority of the Central Department under the previous system has been dissolved by this means. Furthermore, political accountability is assigned to the Upazila Council and its chairman. The Upazila chairman is made responsible for coordinating all the development activities, initiating development plans and policies, and identifying projects according to local needs. The UNO and technical officers were to be under the supervision of Upazila chairman.

The Upazila Administration provides potentially a crucial link in the planning and implementation of agricultural development projects. At this level, major agriculture institutions (BADC, BRDD, BWDB, DAE) and the line ministries are represented through their technical departments and personnel. The government provides funds, under ADP allocations and direct block grants, for the specific development purposes. The local administration is technically accountable to the Upazila Parishad which is the final approving authority for all projects. Each Upazila has a project identification and selection committee consisting of both official and representative members. In sum, all the ingredients for local-level planning for the participation of the beneficiaries, maintenance and operations of infrastructure, and local revenue collection exist at the Upazila level.

E. Other Important Institutions

1. Non-Governmental Organizations (NGOs)

The NGOs in Bangladesh play an important role in the implementation of development assistance programs in the agricultural sector as well as in other sectors. The NGOs have been implementing programs with demonstrated success in poverty alleviation, population and health, education, income-generation, and agricultural development. All major donors have come to recognize the institutional efficiency of the NGOs.

The USAID Mission is presently programming about one-third of its annual development assistance through NGOs. The Food-for-Work Program is managed and monitored through CARE, an international NGO. Similarly, the Private Rural Initiatives, the Family Planning and Health Services, the Enterprise Development Project are all implemented by NGOs. The Mission funds the NGOs directly in some cases, as in the Private Rural Initiatives Project and in other cases funds them indirectly through bilateral project agreements with BDG for channeling a portion of project funds through the NGOs.

The NGO coverage of the total target population is very small. It is estimated that about 10% of the targetted population is reached by the activities of the NGOs. A significant increase in NGO activities that could be supported by donors will be difficult without enhancing the technical and managerial capacity of the major national NGOs. The higher unit cost of NGOs in the delivery of services, because of their required intensive inputs and supervision, may also be a limiting factor in their rapid expansion. However, the cost in delivery of NGOs' services, and especially in the delivery of credit, because of high recovery rates, is probably much lower if compared to costs of the government's credit mechanisms which have high rates of defaults (11).

The BDG's stated policy toward NGOs has not been fully supportive. The government has promoted collaboration with NGOs in certain specific sectors such as health and family planning, education, and forestry. The policy and the mechanisms for government-NGO partnership needs to be explicitly articulated. The BDG has recently been delaying the process of approval of projects and funds to be implemented by NGOs. The government requires prior approval for all foreign-funded NGOs and scrutinizes NGOs' activities to ensure that the funds are being used within the framework of the government's programs. The BDG's strict clearance procedures with respect to NGO-funded activities present a problem for the donors in the future utilization of the NGO mechanism.

The Upazila system has introduced major changes in the allocation of resources and its budgetary control at the local level. The BDG block grants for local development amounted to TK 4 billion in 1985-85. In addition to these grants, the combined FFW Programs disburse some 350,00 metric tons of wheat a year to the Upazilas, which in monetary terms would amount to about TK 2 billion. There are additional bilateral programs such as USAID Bridges and Culverts Projects, which allocate funds directly to the Upazilas. **The net result of these direct resource allocations is that the Upazila administration has significant discretion in spending resources on development projects. While the BDG has issued guidelines on spending the allocations to priority sectors, the Upazila administration does not follow these guidelines and allocates resources according to its own interests (10).**

The effectiveness of the Upazila system is constrained by a number of factors. Generally speaking, the system continues to maintain the status-quo in the rural power structure and is not properly organized or supported by the central institutions. The BDG guidelines for allocating resources to agriculture and rural development are not being followed at the Upazila level.

F. Assumptions About Institutional Changes

The current structure and performance of the major agricultural institutions, both at centralized and decentralized levels, is characterized by considerable fragmentation, imbalance in resource allocation, limited fiscal and managerial accountability, and limited mobilization of existing institutional and human resources. While the technological and financial resources for growth in agriculture are being procured from abroad, the acceleration in growth will partly depend upon the government's ability to make necessary institutional adjustments in order to efficiently utilize these resources. Whether the required institutional changes will take place implies a number of critical assumptions as identified below:

- The overall capacity of the institutions at the ministerial level to plan and coordinate their functions in the agriculture sector will improve.
- The functions of the supply and management of agricultural inputs will be efficiently carried out by the public agencies and some of the appropriate functions will be transferred to the private sector.
- Public expenditure in agricultural research, extension, and education will increase.
- The government will support and collaborate with NGOs in delivery of services to rural populations.
- The Upazila administrative system will plan and implement develop programs in accordance with local needs and conditions.

2. Women

Womens' role in agriculture, particularly in food production is much more significant than is indicated by the National Agriculture and Livestock Census data. According to the ASR, about 42 percent of women have agriculture as their primary occupation and another 12 percent as their secondary occupation (12). Womens' work in agriculture includes field agriculture, homestead production, livestock and poultry, rice husking and processing, and agriculture wage labor. The highest involvement of women in agriculture is found in very small households followed by women in landless, and small and medium size farm households. Approximately 15 percent of all rural households are headed by women. In female headed households, women make the important decisions in cultivating the land, hiring labor, selling the produce and controlling income from sales. Moreover, the rate of savings has been found to be higher among women as reported in the national census data.

Womens' extensive involvement in agriculture indicates a potential arena for institutional and human resource development. The institutional mechanisms to support womens' agricultural productivity are limited and ineffective. At present, the BRDB Womens' Cooperative (MSS) and Cooperatives for assetless women (MBSS), represent the largest institutional efforts. The objective of these programs is to set-up cooperatives which would provide credit, training, and technical assistance to members for employment and income-generation. The other major institutional mechanism for supporting women is provided by NGOs. Major NGOs, like BRAC, Proshika, RDRS, and Grameen Bank have been active in organizing women and providing credit, training and other services. Both BRDB and NGO mechanisms continue to place more emphasis on male members than on female members and encounter problems in reaching women. Womens' access to credit, training, extension, and other necessary inputs are more limited than mens' access to these inputs. Targetted programs and fundings to increase womens' access to essential inputs, especially credit and skills training, should be expanded.

The recognition that women, as a sizeable labor force, will be involved in future growth in agriculture, has a number of implications for agricultural research, extension, and education. In the area of research, development of appropriate technologies of production, livestock, fisheries, and forestry would be needed. The extension services specifically geared to womens' activities have to be increased. The education and training of women in order to enable them to create and sustain employment and income-generating activities, both in on-farm and off-farm sectors, must be expanded. The involvement of women in designing and implementing research, and educational programs, which is limited at present, is necessary in order to increase the effectiveness of the existing institutions.

III. ANALYSIS OF INSTITUTIONAL GAPS AND CONSTRAINTS

1. Public Sector Efficiency

1.1 The role of the public sector in the management of the national economy has substantially increased since Independence in 1971. Soon after Independence, the government nationalized the major industries and financial institutions and assumed the responsibility for all public enterprises. Successive governments since then have embarked upon massive development plans often without the financial and institutional resources to support them. The breakdown of the administrative system in 1971 created major gaps in institutional capacities and trained manpower to sustain the developmental efforts. These gaps continue to exist and affect overall administrative efficiency. In addition, the vast amount of development assistance by multiple donors with varying conditionalities has placed a serious stress the administrative capabilities of the government.

1.2 There are too many organizations, especially in the agriculture sector, with overlapping authorities and functions. The mandates of these organizations have neither been clearly defined nor updated to be responsive to their management functions.

1.3 The coordination mechanisms, both at the central and local levels, are weak resulting in inconsistent policies and procedures.

1.4 The training and educational institutions are not adequate for supplying a critical mass of well-qualified management personnel. There is a critical shortage of personnel in the ministries and related agencies to plan and monitor large numbers of sectoral programs.

1.5 The salary structures in the public service do not provide sufficient incentives to the government personnel to be efficient and productive.

2. Public Sector Investment in Agriculture

Actual development expenditure in agriculture has been rapidly declining since the beginning of Second Five-Year Plan in 1980-85. The expenditure for agriculture includes sub-categories of expenditures on crop-agriculture, forestry, livestock, rural development and flood control and irrigation. Agriculture's total share in the Annual Development Program (ADP) allocations has declined from 33% in FY-81 to 17% in FY-88 (Table 1). The ADP allocations to agriculture in FY-88 approximated TK 110 billion. However, the actual expenditure on agriculture during the same period amounted to only TK 75 billion.

Table 1. Public Investment Program--Agriculture and Water Resources
(Tk Cr: based on ADP Budget Allocations)

	FY81	FY82	FY83	FY84	FY85	FY86	FY87	FY88	FY89	Percentage Distribution		Annual Percentage Change
										FY81	FY89	FY81-89
<u>CROP AGRICULTURE</u>	<u>286.5</u>	<u>307.8</u>	<u>300.4</u>	<u>337.0</u>	<u>244.6</u>	<u>166.1</u>	<u>160.0</u>	<u>201.0</u>	<u>216.3</u>	<u>33%</u>	<u>17%</u>	<u>-3%</u>
Extension	24.8	31.6	11.3	13.0	11.5	12.6	14.1	24.9	27.2	3	2	1%
Research /a	11.7	19.0	31.0	26.9	42.9	42.8	64.0	72.0	83.7	1	7	28%
Input Supply	154.7	171.5	167.5	232.7	151.4	90.7	53.1	30.1	39.7	18	3	-16%
Fertilizer (supply)	(111.8)	(114.8)	(120.0)	(100.0)	(88.0)	(46.3)	(-)	(-)	(-)	(13)	(-)	(-)
Fertilizer (facilities)	(13.3)	(26.0)	(24.3)	(102.3)	(33.2)	(12.4)	(17.2)	(1.6)	(-)	(2)	(-)	(-)
Seeds	(29.6)	(30.7)	(23.2)	(30.4)	(30.2)	(32.0)	(35.9)	(37.5)	(39.7)	(3)	(3)	(4%)
Food Storage	80.7	69.7	68.1	38.8	24.6	11.1	16.3	31.1	26.9	9	2	-13%
Other	14.6	16.0	22.5	25.6	14.2	8.9	12.5	33.9	28.8	2	3	13%
<u>WATER RESOURCES</u>	<u>406.8</u>	<u>450.8</u>	<u>352.3</u>	<u>473.2</u>	<u>624.0</u>	<u>415.7</u>	<u>527.2</u>	<u>572.5</u>	<u>703.8</u>	<u>48%</u>	<u>55%</u>	<u>7%</u>
Surface Water (FCG & FCDI)	171.1	229.8	166.6	240.0	382.6	274.2	366.9	419.0	530.5	20	41	15%
Ground Water (pumped irrig)/b	235.7	221.0	185.7	233.2	242.3	141.5	160.3	153.5	173.3	28	14	-4%
<u>FORESTRY</u>	<u>23.8</u>	<u>40.0</u>	<u>36.6</u>	<u>41.3</u>	<u>35.4</u>	<u>24.7</u>	<u>47.3</u>	<u>43.0</u>	<u>56.1</u>	<u>3%</u>	<u>4%</u>	<u>11%</u>
<u>FISHERIES</u>	<u>32.9</u>	<u>37.4</u>	<u>31.8</u>	<u>55.9</u>	<u>47.1</u>	<u>23.0</u>	<u>32.7</u>	<u>56.9</u>	<u>64.3</u>	<u>4%</u>	<u>5%</u>	<u>9%</u>
<u>LIVESTOCK</u>	<u>14.8</u>	<u>32.9</u>	<u>24.0</u>	<u>34.0</u>	<u>33.5</u>	<u>16.2</u>	<u>30.4</u>	<u>70.3</u>	<u>47.4</u>	<u>2%</u>	<u>4%</u>	<u>16%</u>
<u>RURAL DEVELOPMENT AND INSTIT.</u>	<u>90.7</u>	<u>95.0</u>	<u>100.9</u>	<u>76.0</u>	<u>104.0</u>	<u>101.7</u>	<u>143.0</u>	<u>182.3</u>	<u>196.5</u>	<u>10%</u>	<u>15%</u>	<u>10%</u>
Cooperatives	39.0	44.6	45.9	45.2	55.8	63.9	97.8	99.0	75.5	4	6	9%
Rural Infrastructure	51.7	50.4	55.0	30.8	48.2	37.8	45.2	83.3	121.0	6	9	11%
<u>Total</u>	<u>855.5</u>	<u>953.9</u>	<u>846.0</u>	<u>1017.4</u>	<u>1089.5</u>	<u>747.4</u>	<u>940.6</u>	<u>1126.0</u>	<u>1284.4</u>	<u>100%</u>	<u>100%</u>	<u>5%</u>
Real Expenditure Index /c	100	100	84	86	81	52	58	65	69 /e			
Real Expenditure Index (not including fertilizer supply) /c	100	101	83	90	85	56	67	75	79 /e			

/a BARI, BRRI, BARC, BINA, SRDI, BJRI
/b Includes Tubewell Project in North Bangladesh under BWDB
/c Based on GDP price deflator (FY81=100)
/e estimate

Source: World Bank, April 1989

Within the actual ADP expenditure of TK 75 billion in FY-88, about 55% was spent on flood control, drainage, and irrigation (FCDI), 15% on rural development, 3% on extension, 7% on research, 4% on forestry, 5% on fisheries, and the rest on input supply and food storage.

2.1 Investments in agricultural research, education, and extension are in decline. In the allocation of resources to research, currently 7% of the agriculture ADP budget, there is a need to increase the expenditures for the management, monitoring and evaluation of research. The investment in research as a percentage of the agriculture GDP in Bangladesh is only 0.22% which is significantly lower than what is spent on agriculture research in similar developing countries.

The current FDG expenditure on research is barely enough to meet personnel salaries and overhead costs of the research system. Limited funds are available for research activities or for training research scientists and support personnel. The operations and maintenance of facilities at the substation level is especially affected by inadequate funds.

2.3 The total allocations to extension from the ADP and revenue budget to cover the operating costs of 403 Upazila field offices in 1988 amounted to TK 85 million, which is extremely inadequate for providing services to 8-10 Councils in each Upazila. There is no allocation of funds for important activities such as field days and demonstration projects.

2.4 The BDG allocations to the Upazila administration through the block grants have been significantly increased but are not directed toward the development of agricultural and service sectors. There is an increasing tendency among the Upazila administrations to utilize development funds for infrastructure projects.

3. Constraints in Research

BARC's Strategic Plan and its implementation, which has already begun, holds great promise for coordinating and improving the management of resources in research. However, a number of constraints in the effective implementation of the proposed plan should be anticipated. Major constraints include:

3.1 BARC does not have the authority over the allocation of research funds other than funds earmarked for Farming Systems Research (FSR). Funding for agricultural research is provided by eight different ministries. BARC's capacity to coordinate research is undermined by the funding practices of the ministries.

3.2 BARC's own capacity to perform a comprehensive set of functions in review, coordination, monitoring, and resource allocation has to be significantly improved. Building this capacity within BARC will take a minimum of five years. Continuity in donor support and BARC's leadership will be essential to accomplish this purpose. The capacity-building process currently underway in BARC is heavily dependent upon technical assistance by USAID, and other donors. Institutional sustainability of BARC after the foreign technical assistance personnel are withdrawn is a critical issue.

3.3 The implementation of BARC's plan depends partly upon the cooperation of the regional institutes and research stations. The cooperation can be mandated only to a certain extent, for example, by making the separate mandate of BARC and the mandates of the institutes consistent with each other. BARC can also exert its authority in review and funding of research proposals to induce cooperation. The research institutes, however, in practice operate as autonomous bodies with their own research agenda. The methods to develop voluntary cooperation, therefore, should be emphasized.

3.4 The Farming Systems Research (FSR) approach involves collaboration across disciplinary and institutional lines. The success of the FSR approach requires reorienting research from individual scientist/crop-oriented research practices to multi-disciplinary team research which is different from current institutional practices. Long-term commitment of qualified personnel at on-farm research sites is essential for a sustained development of the FSR. The rural living conditions are not very attractive for the scientists to reside and work at on-farm sites on a continuous basis.

3.5 The existing organizational patterns of the institutes are not consistent with organizational requirements of FSR approach. The practical application of FSR involves decentralization of research to the farm level. The FSR approach offers a potential to decentralize the research activities away from the regional and local stations to the substations specifically for the purpose of FSR expansion. The approach provides the opportunity to move research and scientists closer to the farmers.

3.6 The allocation of resources is highly skewed in favor of rice research which raises problems for technology development for other crops and non-crops. The concentration of scientific manpower is disproportionately high in crop research as compared to non-crops' research as indicated by the manpower pattern in the institutes (13).

3.7 The allocations to research, for instance in the economics of fisheries, livestock and forestry have been lagging. The institutes of fisheries, livestock and forestry, are small with fewer personnel specializing in agricultural economics. The capacity to undertake resource economic analysis in non-commodity areas and water and irrigation is negligible. The development of an resource economic analysis capacity in NARS is crucial.

3.8 There are few female scientists in NARS. Training and recruitment of female scientists, and their involvement in FSR and homestead agricultural production technologies should be addressed as a major priority.

4. Constraints in Higher Agricultural Education

Higher agricultural education in Bangladesh has been severely neglected over the years. Development of the educational system has not kept pace with the demand in technology development and transfer.

The improvement of higher agricultural education faces a number of constraints as discussed below:

4.1 A complete study of agricultural manpower needs in Bangladesh that provides a projected demand and supply of trained manpower has not been undertaken. Such a study is needed to analyze the present and future demand and supply of all categories of agricultural manpower, farm labor included. The available assessments of agricultural manpower (Eisgruber, 1987, Thomas, 1987) are valuable but focus exclusively on educational and research categories of manpower needs and rely on aggregate data (14).

4.2 The demand in the private sector for agricultural graduates appears to be low. Out of the total 6,945 graduates employed in 1986-1987, only about 100 were employed in the private sector (15). A large number of M.Sc. and PhD degree holders are concentrated in research and educational institutions, while the majority of B.Sc. degree holders are employed by the government and parastatals.

4.3 According to the Mission's Project Identification Document on BAU Higher Agricultural Education Project (1988), "there is a strong evidence that the supply of presently available BS graduates from BAU, Bangladesh Agricultural Institute (BAI) and Patuakali Krishi College (PKC) is greater than the demand. As a result, there is growing pressure for admission to MS programs, but the graduates at that level also face strict demand limits. Public sector demand has levelled off and the private sector demand is uncertain. However, it is hypothesized that demand for BS graduates in agriculture with more relevant and sharper honed skills will be strong, especially in the private sector."

4.4 The existing institutions produce an average of 500 B.Sc. and about 100 M.Sc.s annually. More than half of the B.Sc. graduates seek admission to post-graduate studies and almost two-thirds leave their post-graduate studies to join government jobs as they become available. The supply-demand estimates indicate an oversupply of B.Sc. graduates, and an undersupply of M.Sc.s and PhD graduates (16). The public sector's demand for agriculture graduates has levelled off. Investment in higher agricultural education is needed to increase the number of M.Sc. and PhD graduates to meet the demands of agricultural research and other fields such as marketing, operations research, and business management that are increasingly in demand in the private sector. The government's restricted policies with respect to budget, sanctioned posts, seniority, and recruitment tends to curb the demand. Additional B.Sc. graduates, if available, will not likely be absorbed in the public sector.

5. Constraints in Extension

The effectiveness of DAE in providing extension services to a large number of small farmers is constrained by several major factors as discussed below:

5.1 Extension and research linkages at the field level are weak. Linkages between extension and research are established by the Subject Matter Specialist (SMS) and the Subject Matter Officer (SMO) at the Zila and Upazila levels, respectively. Research messages are passed from SMS to SMO and then to the village extension worker. Thus, the technical messages from the research community pass through several intermediate points before reaching the farmer. The whole process of communication potentially affects the utility of the message to the farmers. BARI's and BRRI's extension activities by the Research Institutes, where their regional stations act as a focal point of contact between research and extension through the coordination of a network of adaptive research trial sites and farmers' days at the field stations, provide better alternatives to DAE's T & V approach.

5.2 There is a duplication of activities between the DAE and other extension organizations leading to an inefficient use of personnel. The incentives and the training of the personnel are not adequate. Travel facilities and allowances, which are essential, for effective extension, have been curtailed over the years. Supervision, administrative coordination, and accountability of personnel is deficient in the entire system.

5.3 The overall reorganization and expansion of the extension system does not appear feasible. It will involve significant financial resources to increase the number of personnel, provide better salary and incentives, and improve the overall management and supervision. It is more feasible to improve the quality of the extension service, without increasing the coverage, by deploying more extension personnel in on-farm trials, and by expanding extension through organized groups rather than through individual contact farmers. And there is a need to focus more on small farmers. Extension personnel should increasingly work with farmers' groups organized by NGOs. Extension services to the big farmers can be taken care of by private dealers of fertilizer and irrigation equipment and other inputs suppliers.

5.4 The problem of reaching women farmers by the DAE deserves special consideration. Some of the major problems include:

- Only 7.5 percent of female-headed households engaged in homestead and small farm agricultural production are visited by the extension agents.

- There are only 404 Female Block Supervisors (FBS) who are posted at the District level and these do not have any means of transport to travel to villages. The FBS are unable to reach women farmers except in villages close to the District Headquarters. There is an equal lack of female supervisors.

- The Extension Service assumes that the women's role in agriculture is only marginal. The services provided are more focused on health and sanitation, rather than on homestead production, livestock and poultry. The FBOs have little training in horticulture, livestock, fuelwood, and plant production, the main areas of concentration of women's agricultural labour.

- The Farming Systems Research teams do not sufficiently take into account the division of male and female labor in agriculture, and the different female labor requirements in crops and livestock production. There are limited links between Subject Matter Specialists (SMS) and women farmers.

6. Constraints in Irrigation Planning and Management

The potential expansion of irrigation is constrained by a number of management and institutional deficiencies as discussed below:

6.1 Irrigation Policy and Planning

The BDG has undertaken various steps for water development and irrigation. There are a number of independent agencies, under the Ministries of Agriculture, Irrigation, and Local Government and Rural Development, that are responsible for irrigation. A well-defined policy for water resource development and irrigation is, however, lacking. There is no distinct institutional focus within the Government to coordinate the diverse activities and requirements in the sector.

The Bangladesh Water Development Board (BWDB) under the Ministry of Irrigation is responsible for flood control, drainage, and irrigation (FCDI). The BADC under the Ministry of Agriculture is in charge of the sale of minor irrigation equipment and its maintenance and repairs. The organization and registration of cooperatives (KSS) that qualify to get the credit for the purchase of equipment is handled by BRDB. The extension services are provided by DAE.

The need for coordinated planning in all aspects of water resource utilization has been partly addressed through the National Water Plan prepared by the Master Plan Organization. The MPO has prepared a comprehensive plan and investment strategies for flood control and drainage as well as minor irrigation. The MPO's work provides a useful basis of information for planning in the Water Sector but needs to be incorporated within the functions of an appropriate organization.

6.2 Allocation of Resources

The Government's allocation of financial resources, under the ADP, shows that a higher percentage of resources are allocated to FCD than to minor irrigation. Of 1987/88, ADP allocations to water resources, approximately sixty percent was spent on FCD.

6.3 Subsidies in Irrigation

BADC sells irrigation equipment at subsidized prices. STW's are sold without subsidy at the cost price directly to individuals and cooperatives. DIW's are sold at approximately seventy percent subsidy and LLP's at about thirty percent subsidy. For large-scale irrigation project undertaken by the BWDB, capital as well as recurrent costs are entirely borne by the government with little recovery of capital costs.

6.4 Underutilization

The command area of irrigation pumps, due to fragmented nature of land holdings, belongs to several farmers. In cases where the ownership of the irrigation equipment is not commensurate with the ownership in command area, the underutilization of irrigation equipment is quite common. The location of irrigation equipment plays an important part in its efficient utilization. In 1987-1988, more than 230,00 irrigation pumps were owned mostly by individuals and cooperatives. Efficient utilization of these pumps has been constrained by the discrepancies in the ownership of pumps and the organization of land. The underutilization in a command area is mainly due to the difficulty in organizing a sufficient number of small farmers within an appropriate distance from the irrigation equipment

Low utilization has also been attributed to a lack of effective extension service and inefficient methods of distribution.

6.5 Water Charges

There are no effective mechanisms to collect water charges for financing the recurrent costs of irrigation. The government has a water rate policy based on land classification. The collection of water charges, in practice, has been unsatisfactory. There are no viable Water User Associations (WUAs) to perform as collection agencies. Owners of STWs and DTWs charge the farmers for water on the basis of a percentage of the crop which accrues as a private profit which is generally not invested back in the agricultural production activities.

6.6 Lack of Credit for the Purchase of Irrigation Equipment

Institutional credit for the purchase of STWs and DTWs is made available to cooperatives formed under the BRDB. The BRDB-KSS cooperatives are generally dominated by large farmers and other resourceful individuals who are able to purchase irrigation pumps with credit from the BKB on very liberal terms. BKB offers five year loans for the purchase of STWs and DTWs at 14.5 percent interest. Independent assessments of these cooperatives indicate a poor performance. The repayment performance of the cooperatives' is very low while the costs of their operations are high.

Small farmers and the landless poor do not have access to credit from BKB. The lack of access to credit to purchase irrigation pumps puts the farmers under the monopoly of the irrigation equipment owners.

6.7 Adverse Distributional Effects

Different modes of irrigation have different effects on the income and employment of small farmers and farm labor. An efficient utilization of irrigation under a command area tends to increase crop production as well as labor requirements and therefore carries a potential of increasing income and employment (17). The economic benefits of irrigation are mostly reaped by the private owners of irrigation equipment who are large and medium land owners. The small farmers buy water from the owners of the pumps at the market clearing rates. The BADC sale system has introduced certain degrees of competition in prices of water which are reported to have declined from 1/3 of crop share to 1/5 of crop share. However, studies also indicate that small farmers and tenants, unless they have co-ownership of equipment, pay higher costs of irrigation per hectare as compared to others (18). The inequality of conditions in obtaining credit and other inputs of provide higher benefits of irrigation to large and medium farmers.

6.8 Lack of Trained Manpower

A planned expansion of irrigation will be difficult to undertake without a well trained manpower to execute the irrigation projects at all levels. At present, an optimum utilization of irrigation equipment is affected by the lack of extension personnel to advise the farmers on the efficient use of water as well as the lack of personnel in BADC needed for the maintenance and repair of irrigation equipment. The organizational viability of WUAs is constrained by the lack of education and skills of the small farmers. An assessment of manpower and training needs of different water agencies is necessary to develop and implement a well-coordinated national water plan.

An understanding of the dynamics of irrigation and agricultural production and its input on rural economy is limited by the lack of multi-disciplinary research. Irrigation-specific research is inadequately emphasized in the agricultural research programs.

6.9 Lack of Infrastructure Development

The availability and expansion of irrigation in Bangladesh has been constrained by the level of the underdevelopment of infrastructure (19). The infrastructure also affects agricultural production through its impact on adoption of other modern inputs. The present twenty percent irrigated land is mainly concentrated in areas with relatively developed infrastructure.

7. Constraints in Employment Creation

The ability of the rural poor to take initiatives in creating and sustaining non-farm productive activities is severely constrained by their illiteracy, lack of skills and access to resources. While an accelerated rate of crop production will create increased employment and could absorb, at best, one-third, of the labor force in the rural sector, most of the employment creation will necessarily concentrate on self-employment in various agricultural and non-agricultural enterprises. Direct investment strategies to create employment is required. The strategies should focus on organizing the poor and the landless and providing access to resources and skills' training in labor-intensive sectors.

7.1 A major issue concerns the institutional mechanisms and their effectiveness in employment generation. BRDB's two-tier cooperative system to reach the poor in agricultural and rural development activities has not served as an effective model. The formation of cooperatives is generally involuntary, imposed from the above, and dominated by the rural elite to gain access to credit and other inputs. The existing system of cooperatives is an extension of BRDB's bureaucracy and is not suited to reaching and organizing the poor. The rigid bureaucratic procedures in the formation and operation of the cooperatives, as followed by BRDB, do not allow for the flexibility to promote employment generation schemes.

7.2 The Non-Governmental Organizations (NGOs), such as the Grameen Bank, BRAC, Proshika, and RDRS, have demonstrated success in reaching and organizing the poor. However, the financial and management capacity of the NGOs needs to be improved in order to develop sustainable employment programs. The NGO programs have been operating, in most cases, in isolation from BRDBs and other government programs in rural development. The NGOs and the government's institutional strategies need to be coordinated without compromising the autonomy of the NGOs. The lines of responsibilities and roles among the NGOs and between the Government and NGOs should be demarcated so that NGOs can serve as implementing agents for government programs in specific areas such as group organizing, skills' training, and linkage development with the government's service delivery institutions.

7.3 The potential collaborative mechanisms between the NGOs and the Government do not exist and need to be explored. This would involve the definition of roles and responsibilities of agencies like BRDB vis-a-vis the NGOs as well as the contractual mechanism to engage the NGOs in the Government-financed programs.

It is uncertain whether the Government is willing to undertake necessary changes in policy and procedures toward NGOs in order to facilitate Government-NGO linkages.

7.4 The NGOs' capacity to manage and monitor employment programs is limited by their lack of functional expertise. The NGOs are successful in organizing but need to build a capacity to implement programs that could be sustained by the groups themselves within a reasonable time period. The NGOs have a tendency to do all things at all time which dilutes the potential impact of their activities. They need to determine the areas of their comparative strengths, develop these strengths, and concentrate on providing in-depth assistance to the beneficiaries of their programs.

8. Constraints In Upazila Administration

The Upazila System has, in theory, a significant role to play in agricultural and rural development programs. The necessary technical departments and personnel have been organized at the Upazila level. The total number of sanctioned technical personnel has more than doubled but the positions actually filled are below the sanctioned levels. The Upazila councils have been given the responsibility of initiating development projects. However, the system is essentially under the dominance of rural elites, as it was under the previous systems, and is motivated by political imperatives rather than development. The resources are generally diverted to politically visible projects in infrastructure development.

Major constraints in the Upazila Administration and their effects upon agricultural and rural development include:

8.1 The technical capability of the Upazila administration to undertake agricultural development projects is limited. The technical personnel are not sufficient in number and do not have the rank or the expertise to plan and implement projects.

8.2 There is no well established planning process at the Upazila level, although the task of local planning is most appropriate at this level. Upazila Parishads has been assigned the final authority in approving projects but partly because of their lack of planning capacity, this authority is not properly utilized.

8.3 The agricultural and rural development programs at the Upazila level have been severely affected by reduced ADP allocations. Real expenditure on agriculture and rural development is estimated at 9% for 1987. A large portion of this expenditure goes to pay the salaries of the increased personnel and operational expenses and to physical facilities development. The Government's prescribed guidelines to allocate block grant funds to different developmental sectors is not followed at the Upazila level.

8.4 The direct authority of agricultural extension and other agencies has been decentralized so that extension agents are placed under the supervision of UNO and the Upazila chairman. Moreover, about 50% of the Extension Staff is concentrated at the Upazila level while the needs for extension are greater below the Upazila level.

8.5 The coordination among different technical departments at the Upazila level is weak. The Upazila administration is technically under the authority of the Ministry of Local Government while the technical departments are affiliated with different ministries. Programs requiring close coordination between departments are not governed by common guidelines from different agencies. In addition, the technical personnel often have to respond to varying priorities of the UNO and the Upazila chairman.

8.6 The resource allocations to agricultural and other projects at the Upazila level are influenced by political considerations of the chairman. The authority of the chairman varies according to his competence and social position. Since the majority of members of the Upazila Council are non-elected, there is limited representation of broader interest in the Upazila decision-making.

9. Important Institutions

The importance of institutions depends upon their current and anticipated functions in the agricultural growth and development. As the analysis in the previous section indicates, the gaps and constraints in certain institutions are more pronounced than in others. For instance, education and extension institutions, critical for agricultural development, are weak relative to research institutions. The progress in development and transfer of technology, however, relies on an integrated institutional development of research-education-extension. The institutions responsible for the management of supply of agricultural inputs are important and therefore their effectiveness, which is constrained by a number of factors, needs to be improved. At the macro-level, the capacity of the Ministry of Agriculture to play a lead role in the sector is crucial. In addition, the decentralized apparatus of the government and a broader mobilization of non-governmental and rural development institutions is necessary to implement programs and meet the needs of the rural population.

The various institutions in terms of their importance in providing the necessary functional inputs into the process of agricultural growth are ranked as follows:

1. Ministry of Agriculture
2. Research-Education-Extension Institutions
3. BADC, BWDB
4. Upazila Administrative Bodies
5. BRDB
6. NGOs
7. BARD

IV. POSSIBLE METHODS TO ALLEVIATE INSTITUTIONAL CONSTRAINTS

1. Methods for NARS' Development

To strengthen the organization and management in research, a three-pronged strategy is needed. First, BARC's internal capacity to coordinate and regulate the research programs of the different institutes has to be developed. Second, research and its organization have to be decentralized to the farm level. Third, operational linkages among the researchers, extension agents, farmers, and local organizations have to be established.

The following methods will help to implement the strategy.

1.1 Support BARC's Functions in Planning, Coordination, Monitoring and Evaluation of Agricultural Research

The support is aimed at four primary functions: financial planning and management, manpower development, monitoring and evaluation, and support services.

Planning and financial, budgetary, and accounting procedures to allocate funds to the programs should be strengthened. A consistent set of procedures should be institutionalized at BARC and the research institutes.

BARC's capacity in manpower development planning needs to be strengthened. The training department at BARC should be staffed with qualified personnel. The department should conduct an assessment of manpower needs and design and implement appropriate training plans. The training plans should take into account the needs in all categories of professional personnel including administrative and support personnel, and the methods to improve their management efficiency.

There is no lack of local expertise and personnel among various research institutes, especially in BIRRI and BARI. It may be quite feasible for BARC to draw upon the personnel from other institutes, on a short-term contract basis, to be placed in appropriate positions in BARC. USAID may consider supporting a program of internal transfer of personnel within the NARS on a rotational basis with incentives in the form of salary supplements, housing and transport allowances.

A standardized system of monitoring and evaluation of research needs to be implemented. Each institute will have to develop an information system, according to a common format, that is able to document its research projects. The evaluation of research projects is to be determined on the basis of the rates of diffusion of technologies rather than on the basis of their production only.

Support services for the administration, operations and maintenance of the regional and substations should be provided. The services will include maintenance of facilities, training of administrative and operational personnel, and maintenance and repair of equipment.

1.2 Decentralize Research to the Farm-Level

To apply and expand the FSR approach, the organization of research needs to be decentralized to substation level. The decentralization implies the establishment of vertical linkages among the central, regional, and substations. The personnel on all levels should work as a team and participate in all phases of planning and implementation of FSR. Accommodation facilities, transport, and travelling allowances will be required for a continuous interaction of personnel at all levels.

1.3 Develop Linkages Among Research, Extension, Local Bodies

Linkages among research/extension personnel and personnel of local bodies and NGOs need to be developed to facilitate the transfer of existing technologies and to determine the needs for the development of additional appropriate technologies. Linkages with the Upazila administration will be especially important to mobilize necessary local resources towards increasing on-farm research sites.

2. Methods to Develop Higher Agricultural Education

A strategy for the development of higher agricultural education should simultaneously focus on the introduction of basic structural changes in the higher agricultural institutions as well on the support of alternative programs for manpower development in the existing educational and research institutions. Without certain structural changes, the investment in one single institution and program is not likely to produce the desired benefits.

The methods to support structural changes and to diversify investments in higher agricultural education are briefly discussed below.

2.1 Structural Changes in BAU and its Affiliated System

A number of important organizational and policy changes in the BAU system are required in order to create a conducive academic environment. Changes have to be made in the current BAU Ordinance which governs the policies and procedures regarding admissions, curriculum, academic standards, and personnel. A broader representation of BAU departments and affiliated institutions in decision-making should be the objective of these changes. Delegation of authority to BAU faculties and affiliated colleges in the development of curriculum and academic standards will have a positive impact on agricultural education.

2.2 Development of Selected BAU Departments

A number of BAU departments, selected on the basis of manpower needs in public and private sector, and the quality and performance of the departments, should be supported through technical assistance.

2.3 Pre-Service and In-Service Training at BAU

The Graduate Training Institute (GTI) at BAU conducts pre and in-service training for agricultural personnel. The expansion of GTI programs can be supported to meet the need for well-trained agricultural personnel in the public and private sectors. The GTI's training resources and personnel can be strengthened through collaboration with other universities and research institutions.

2.4 Academic and Research Scholarships

A scholarship program for the B.Sc. and M.Sc. graduates can be established under BARC. The purpose of this program will be to award scholarships for degree programs, on a competitive basis, in different universities and institutions such as BAU, IPSA, and Dhaka University. This program should be a part of BARC's overall manpower development activities. The recurrent unit costs per student year at the University level is estimated at TK 22,752. To increase the number of well-trained agricultural graduates at the M.S level, for instance by 20 per year, will cost approximately TK 405,000.

2.5 Textbooks and Audio-Visual Material Development

A program for the development of basic textbooks and appropriate audio-visual materials in agricultural education and training can be implemented. Such a program provides an excellent mechanism to develop indigenous curriculum materials with a broad involvement of experts in education and research. Technical assistance will be needed to design and implement this program.

3. Methods for Farmers' Education

There are many opportunities to educate farmers in order to increase their access and adoption of agricultural technologies.

3.1 Integrated Programs in Basic Literacy and Farm Management

Literacy programs can be designed and adapted which impart basic literacy and farming techniques in an integrated manner. The programs should be undertaken on a pilot basis using audio-visual technologies. The programs can be jointly implemented by the extension and other departments of the Upazila with the assistance of the NGOs. A small number of farmers should be selected to formally participate in these programs for a six-month duration. Once a small number of farmers have developed a basic know-how in modern farming techniques, they can be expected to induce other farmers in adopting this know-how more effectively than can be achieved through extension or mass literacy programs.

3.2 Special Programs

Special education and training programs can be implemented for women only in homestead production.

3.3 NOGs

Educational and training programs can be implemented on nation-wide basis through the NOGs.

Production of videos on different aspects of agricultural production (homestead, fertilizer use, pest control, poultry etc.) should be undertaken for the purpose of implementing the above programs.

4. Methods for Increasing Effectiveness of Extension

4.1 Focus

The focus should be on providing extension services to organized groups of small farmers rather than large individual farmers. This can be achieved by cooperation between the extension services and the NGOs in targeting the existing farmers' groups.

4.2 Linkages

Improve research-extension linkages at all levels and specifically at Upazila and Union levels so that the technical information flow from research to extension to farmers becomes more accurate and technically viable at the farm level. Farming Systems Research and on-site trials provide a good vehicle for this purpose.

4.3 Scope

The extension activities are limited to cash crops, food crops, and horticulture and should be more responsive to the on-farm and off-farm employment potential in livestock, forestry, fisheries, and animal feed.

4.4 Training

Training of the existing cadre of FBOs in homestead production, poultry and livestock and female-specific agricultural activities should be undertaken. Teams of existing FBOs can be formed and located in a few villages on a pilot basis.

4.5 Women

Some of the socio-cultural constraints in reaching women farmers can be overcome by MBS and FBS working together as a team. Recruitment of a husband-wife Block Supervisors should be considered. A couple providing extension services may create special advantages both in reaching female and jointly headed households and in providing extra incentives to the employees. As a couple, Block Supervisors may overcome some of the socio-cultural constraints of restricted female mobility and social taboos.

4.6 Coordination

The overall training of the extension personnel at all levels needs to be well coordinated. The methods and training curriculum need to be revised. More frequent refresher courses should be provided. In this area, an integrated program with the collaboration of research institutes and BAU could be designed to upgrade the curriculum and to train trainers at AETIs. The NGOs could be utilized for the purposes of on-the-job training of extension workers at the Union level.

5. Methods in Employment Creation

There are substantial opportunities for developing skills training programs in agriculture and non-agriculture areas. Skills training in various aspects of agricultural production, for example, in horticulture, livestock development, and maintenance and repair of irrigation equipment, can create increased employment in the rural areas. Training for the members of the organized groups in management and accounting would help the groups to sustain the income generation projects. Training for women on how they can increase their participation in the rural markets, both in production and distribution of goods, is likely to have a positive impact on rural employment.

Some NGOs have been successfully organizing groups and providing skills and human development training. For example, Proshika has been conducting training for its organized groups in livestock management as well as in accounting and management. RDRS is quite successful in working with both men and women groups and providing training in homestead agricultural production.

5.1 Groups of small farmers and landless men and women are being organized by the NGOs. These groups could be provided credit without collateral for the purchase of irrigation equipment. The NGOs can form these groups as WUAs and provide training in management, accounting, and operations and maintenance.

5.2 Employment in rural cottage industries, trade, transport, construction, and maintenance of rural infrastructure could be created through a systematic process in which NGOs' programs are linked with the BRDBs and Upazila's rural development programs at the Union and Upazila level. The current activities in developing NGO and Upazila cooperation under the USAID's Private Rural Initiative Project (PRIP) provides a viable mechanism for rural employment creation.

5.3 The BRDB's rural poor programs in organizing and assisting the landless through formation of cooperatives could be strengthened through a joint BRDB-NGO mechanism. Credit without collateral is necessary to assist the rural poor in generating self-employment in livestock and poultry, and in petty trades.

6. Methods for Irrigation Management and Development

Irrigation could play a critical role in achieving the potential of agricultural growth in Bangladesh. Irrigation, complemented with other inputs, has increased the food grain yield per unit of land. In cases where small farmers or the landless are able to have direct control over the irrigation, there is evidence of increased income and employment (19). Irrigation, therefore, should be viewed as a vehicle for increasing food production as well as for increasing income of the rural poor.

A number of institutional and management constraints to irrigation development were discussed in section III. Alternative feasible methods to alleviate these constraints include:

6.1 Improve the Planning and Management Capacity at the National Level

A national level body to plan and manage water resources should be organized at the inter-ministerial level. The body could serve as a national policy making and regulatory agency in the water sector preferably located in the Planning Commission. The functions and authority of MPO could be revised for this purpose and the MPO could be attached to the proposed entity.

6.2 Coordination

The responsibilities and function of different water agencies should be demarcated as well as better coordinated. Responsibilities for flood control, drainage, and irrigation are concentrated in BWDB. Flood control and drainage as an element of major irrigation should be demarcated from minor irrigation. BADC should be restricted to regulation of the sale of irrigation equipment

6.3 Irrigation Manpower Development and Training

An assessment of manpower development needs in irrigation sector is required for developing training requirements for different categories of irrigation personnel. For this purpose, creation of an independent irrigation training institute is a plausible option. In the short-term, overseas and in-country training for irrigation personnel can be designed and implemented.

Agricultural research institutions in the country should be encouraged to focus on irrigation-related research in water resource economics, and in socio-political institutional constraints to the expansion of irrigation.

6.4 Support the Development of Water Users Associations (WUAs)

The development of WUAs is much needed to optimize the utilization of irrigation pumps. The formal BRDB-KSS are not viable entities to manage and utilize the irrigation equipment. It is more feasible to support the NGO-organized groups because of their open membership and their demonstrated experience to optimize utilization. The NGO groups of small farmers and landless men and women, provided with credit and training, have greater potential of acting as effective WUAs.

6.5 Withdraw Subsidies on Pumps

DTWs are currently subsidized at about seventy percent of the cost price. Since the cost of recovery of DTW's and other large projects is extremely difficult, and the net profits to the beneficiaries are high, subsidies on DTWs should be reduced or withdrawn. The sale of STWs at the cost price to BRDB-KSS cooperatives has a hidden subsidy since more than fifty percent of the BKB loans are unrecoverable. Credit should be extended, through NGOs to the small farmers and the landless without collateral. The NGOs, like the Grameen Bank, Proshika, and BRAC, have successfully demonstrated that informally organized groups are quite accountable in making repayments and in making better use of equipment.

6.6 Support NGOs to Develop Farm-Level Management Capabilities in Irrigation Projects

Selected NGOs, with demonstrated experience in organizing small farmers and landless for irrigation projects, could be directly supported through credit facilities, technical assistance and training. Technical assistance and training can be provided by local institutions such as BARD in Comilla and Bogra, and by educational and research institutions. A more effective method would be to support ADAB to coordinate NGO activities and provide technical assistance and training to NGOs in a variety of agricultural and rural development activities, including irrigation.

7. Methods to Improve Upazila Administration

7.1 ADP allocation to agricultural development should be increased from the current 9% to about 20%. The Upazila Councils should be required to set aside the allocated block grants for rural agricultural development only. Specific guidelines should be provided and monitored at the Upazila level to allocate a balanced share of resources to employment and income generating projects.

7.2 A planning process can be instituted at the Upazila level which requires the Council to plan integrated projects under specific criteria. Assistance in the institutionalizing of this process can be provided through the Academies of Rural Development, at Comilla and Bogra, and other institutions.

7.3 Informally organized groups of NGOs can be federated at the Upazila level along the same lines as KSS cooperatives, to channel the demand for services in extension and credit.

7.4 Technical and managerial training for categories of personnel with interdependent functions can improve both competence and coordination among personnel of different departments.

V. Recommended Programs for the USAID Mission

1. Develop and Strengthen Policy-Planning Capacity of the Ministry of Agriculture

Objective: To strengthen the MOA's agricultural sector planning capacity to analyze, design, and review projects through organizational and personnel development of the Policy-Planning Cell (PPC) of the Ministry.

Approach: Increase the number of technically qualified personnel in PPC, provide the personnel with on-going training in project preparation and appraisal, improve the functional coordination of PPC with other MOA departments, and develop linkages between PPC and research institutes, especially BARC and BIDS.

Rationale: If there are enough qualified people in PPC who can utilize and organize the available information from outside sources, to identify projects and prepare policy briefs, the MOA's planning capacity will make incremental improvements.

The USAID has a comparative advantage in supporting programs in policy and planning capacity building in agricultural sector. Since 1970, USAID has funded 129 agricultural policy and planning projects in developing countries through professional development of key individuals, organizational development of planning units, linkage development between research and decision-making bodies and the like. The lessons learned from these experiences provide valuable resources for the USAID.

Impact: There will be an increased number of technically qualified people in the PPC, increased demand of information by the decision-makers, better flow of information and communication between researchers and policy-makers, and improvements in project planning procedures.

Performance Targets: Number of trained personnel in PPC; improved project planning.

2. Support BARC in Developing its Capacity in Coordination, Monitoring, and Evaluation of Agricultural Research

Objective: To enhance BARC's internal capacity in financial management and accounting, manpower development, and monitoring and evaluation of research.

Approach: Provide BARC with financial assistance, in order to facilitate an effective implementation of BARC's Strategic Plan. Financial assistance to BARC should be provided on a flexible basis but accompanied by specific guidelines for disbursement of funds to priority areas.

Rationale: BARC's existing capacity to coordinate and manage the agricultural research system is limited and its Strategic Plan has yet to be approved. The number of well-qualified personnel in BARC to manage the entire research system is inadequate. There is also a lack of financial resources to support the research infrastructure and personnel at the substations which is necessary for the sustained development of on-farm research.

The USAID has a comparative advantage in this area on the basis of its past and present support to agricultural research in Bangladesh and its current intensive relationship with BARC. The utilization of Title III funds to support an expanded program gives USAID extra leverage to further redirect research system towards the diffusion of applicable technologies and increasing food production.

Impact: The program will improve management capacity in BARC and facilitate decentralization of research to the farm-level, better coordination among institutes, and monitoring and evaluation of research.

Performance Indicators: Increased management capacity in BARC; financial and accounting systems development; increase in on-farm research; rates of technology diffusion and increases in production of crops, livestock and fisheries.

3. Support Higher Agricultural Education and Manpower Development

A) Support Higher Agricultural Education Project Currently Under Design by Oregon State University (OSU) Team

Objective: According to the BAJ PID Document, the objective of the project is to "make the BAJ a more developmentally relevant institution and strengthen its capabilities to produce, on sustained basis, high quality appropriately trained graduates who will effectively serve in public and private entities supporting the rural sector."

The rationale, impact, performance indicators are being developed by the OSU team.

B) Develop and Support a Program in Academic Scholarship and Textbook and Curriculum Materials Development

Objective: To produce well-trained M.Sc. level graduates in agricultural sciences and related disciplines and agricultural curriculum resources and materials.

Approach: A program graduate scholarship and curriculum development should be created under the administration of BARC. BARC will determine the priority areas for manpower and curriculum resource development through the establishment of a Task Force comprising of BARC, BARI, BIRRI, BAU, IPSA, and representative from the private sector. Based on the assessment of the Task Force, a program in graduate fellowship will be administered, on a competitive basis, to support M.Sc. degree level education in agricultural sciences and related disciplines in different universities and institutes in the country such as Dhaka University, BAU, and IPSA. Similarly, for the curriculum resource development component of the program, the Task Force will mobilize appropriate in-country institutions and their personnel on a contract basis to develop textbooks and training materials in agricultural education and arrange for the publication and dissemination of these materials.

Rationale: A sizeable number, from 20-30, individuals can be trained at the MS level at various national universities and institutes in the near-term. The curriculum materials and textbooks, can be developed in Bangla as well as English that are adaptive of the local problems and conditions.

The USAID has a comparative advantage in the area of indigeneous curriculum development on the basis of similar programs it has supported in Mexico, Honduras, and other developing countries.

Impact: The program will produce 20-30 quality graduates at the MS level thus increasing the number available manpower at low cost. Textbooks and curriculum and training materials will be developed through the network and involvement of the research and academic community.

Performance Indicators: Number of MS graduates produced every two-years; increased collaboration among academic and research institutions and the private sector; increased number of textbooks and training materials in agricultural education and greater acceptance of graduates by both the public and private sectors

4. Support Extension Training in Non-Crop Areas

Objective: To retrain about 10 percent of the extension block supervisors in providing services to small farmers in homestead production, forestry, livestock rearing, and other non-crop agriculture.

Approach: Develop appropriate curriculum and training methods to retrain male and female block supervisors in providing extension services in non-crop agriculture to the small farmers. Candidates should be selected from each Upazila and trained by the Graduate Training Institute at BAU for a short duration followed by on-the-job training at the Upazila level by NGOs. Additional incentives in the form of salary supplements, transport, and housing allowances should be provided to this special cadre of extension agents.

Rationale: The coverage of small farmer and especially women engaged in homestead production is very limited. Extension services are largely focused on crop-production.

The USAID does not have a special comparative advantage in this area but could jointly support the effort with other donors.

Impact: The program will increase the coverage of small farmers and help to provide extension services in homestead production, forestry, and livestock rearing.

Performance Indicators: Number of block supervisors trained; training curriculum and methods; increased coverage of small farmers; increased extension services in non-crop production; increased income of beneficiaries.

5. Farmers Education Program

Objective: To design and implement non-formal integrated programs in basic literacy in farm management in order to increase the farmers' know-how and abilities to choose and adapt technologies.

Approach: Literacy programs should be designed which are able to impart basic literacy and farm-management techniques in the use of fertilizer and irrigation, pest control and produce marketing, preferably using audio-visual media. The programs should be implemented on a pilot basis among the NGO-organized groups of farmers at Upazila and Union levels. NGOs can be contracted to produce the appropriate audio-visual materials and to implement the programs with the assistance of DAE.

Rationale: The farmers' limited know-how about the application of modern technologies is an impediment to increased adoption of technologies. A small number of farmers induced to practice modern farm-management methods could serve as informal extension agents for a broader number of farmers.

Impact: The program will have positive effects on the basic literacy and farm-management know-how of the target groups and increase their productivity.

Performance Indicators: Number of farmers educated; increase in rate of adoption of modern technologies; curriculum and audio-visual materials developed, and increased production.

6. Development of Upazila Planning Capacity

Objective: To provide assistance to the Upazila Councils in developing capacity in local level planning.

Approach: To select a small number of Upazilas and provide technical assistance and training, to the members of the Upazila Council as well as to the functional personnel, in planning and budgeting of integrated development projects. The assistance can be provided by the BARD at Comilla and Bogra.

Rationale: There are no systematic planning procedures at the Upazila level. The planning is generally undertaken by the "old plan" book approach which was designed by the Government in the 1960's. Preparation of annual budgets, collection of revenues, and maintenance of infrastructures are not adequately undertaken.

The USAID has a comparative advantage in providing this form of assistance to the local bodies.

Impact: The program will have a positive impact on increased capacity of the Upazila Administrations to efficiently utilize the financial and technical resources at their disposal. It will also facilitate the development of a participatory process at the local level.

Performance Targets: Number of Upazilas adopting planning and budgetary systems; increased number of trained staff; better resource allocation patterns; beneficiary participation.

7. Employment Creation for Rural Poor

Objective: To create on-farm and off-farm employment including self-employment opportunities for targeted groups of rural poor by integrating credit programs with programs in skills training.

Approach: First, an appropriate institutional mechanism for employment generation needs to be established. The USAID supported PRIP/PACT to develop the NGO "new vision initiative" seems to offer a feasible mechanism. Funds can be directly provided to NGOs or to local bodies who can subcontract NGOs for designing and implementing programs. Second, targetted groups of rural poor can be organized and provided credit and other required assistance and training in income and employment generating projects in rural cottage industries, vegetables and livestock production, and maintenance of rural infrastructure and other support services. And third, given the potential of income and employment in STW operations, a number of groups can be provided in-kind credit to purchase STWs. These groups can be trained by the NGOs to operate and manage the operations. Some NGOs are already engaged in similar programs.

Rationale: The cooperative system does not work as an effective mechanism for employment creation. The NGOs provide an alternative but their activities need to be consolidated and their management capabilities improved. The rural poor do not have sufficient access to formal bank credit.

The USAID has a comparative advantage in this area. Its current support to strengthen NGOs through PRIP/PACT activities offers further comparative advantages.

Performance Targets: Number of jobs; income-level; self-sustainability of projects; NGO development; NGO-Upazila collaboration

8. Irrigation Manpower Development

Objective: To assess the manpower needs in the irrigation sector agencies and to design and implement overseas and in-country training programs.

Approach: An assessment of manpower needs in minor irrigation should be conducted by a team of foreign or local consultants. Such an assessment could also be undertaken by the MPO with USAID funding. Based on the needs assessments, training plans could be designed and implemented with the assistance of USAID and other donors. Services of the International Center for Irrigation Management in Colombo could be enlisted for this purpose.

Rationale: There is a lack of well-trained irrigation personnel, especially in the non-engineering fields such as economics, rural sociology, irrigation management, and maintenance and operations.

The USAID has a comparative advantage in irrigation manpower development.

Impact: The program will improve the capacity of the water sector agencies in the management of the expansion in irrigation. It will meet the needs for qualified personnel in maintenance and operation and optimize water use efficiency.

Performance Targets: Number of trained personnel; improved water use; better utilization of irrigation equipment; increase in agricultural production.

VI. RECOMMENDED PROGRAMS AND PRIORITIES

<u>Programs</u>	<u>Priority</u>	<u>Objective</u>	<u>Performance Targets</u>
1) Develop and strengthen Policy-Planning capacity of PPC in MOA. (MOA/PPC)	(H)	Organizational development of PPC; recruitment and training of personnel.	Number of well-trained personnel; Improved procedures in Project Planning and Monitoring; Improved flow of communication between research organizations and MOA
2) Support BARC in developing its capacity in coordination, monitoring, and evaluation of Agricultural Research. (BARC)	(H)	Enhance BARC's capacity in financial management and accounting; manpower planning and development; and monitoring and evaluation	Financial and accounting systems and procedures; managerial efficiency; increased on-farm research, rates of technology diffusion
3) Support higher Agricultural Education and Manpower Development.			
A) Higher Agricultural Education Project.	To be determined on the basis of OSU design		
B) Develop and implement a program in Academic Scholarships and curriculum materials development. (BARC, BAU IPSA, Dhaka University, and other academic and research institutions.	(H)	Produce well-trained graduates in country in short period; Develop indigeneous curriculum materials and textbooks.	20-30 graduates every 2 years; Curriculum; Textbooks.

<u>Program</u>	<u>Priority</u>	<u>Objectives</u>	<u>Performance Targets</u>
4. Support extension training in non-crop areas. (BAU/GTI; NGOs, Upazilas)	(M)	Retrain DAE Extension personnel in homestead agriculture forestry, and livestock.	10 percent of male and female block supervisors retrained; Curriculum development; Increased coverage of small farmers; Increased income of beneficiaries
5. Develop and implement farmers' education program. (NGOs, Upazila)	(M)	Increased farmers' know-how and ability to choose and adopt technologies	Basic literacy; no. of farmers educated; audio-visual materials; increased rates of technology adoption.
6. Development of Upazila planning capacity. (Selected Upazilas; NGOs, BARDS)	(M)	Provide technical assistance and training to Upazila personnel.	Number of Upazilas adopting planning and budgetary systems; improved revenue collection; better maintenance of infrastructure; beneficiary participation.
7. Employment creation for rural poor. (NGOs; Upazilas; rural poor)	(H)	Create employment and self-employment opportunities for targetted groups of rural poor; integrate credit programs with programs in skill training.	Number of jobs; increase in beneficiaries income; NGO development; NGO-Upazila cooperation
8. Irrigation Manpower Development. (MFO, BWDB, BADC, others)	(M)	Manpower needs assessment in irrigation sector; training of irrigation personnel.	Number of trained personnel; utilization of irrigation equipment; water-use efficiency; agricultural production.

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The marginal return from an acre of irrigated land is about TK 5,712. Thus, irrigation associated increased use of HYV's and fertilizer increases agricultural income at the margin by 76 percent over that of non-irrigated land, see Mahbub Hossain, Nature and Impact of Green Revolution in Bangladesh, IFPRI/BIDS Report 67, ch.9, 1988.

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10. For the most part, the Upazila Parishads spend the allocated resources on physical infrastructure projects such as roads, bridges, school building. There seems to be a distinct tendency to maximize spending on infrastructure and minimize spending on services. A good example is agricultural development where according to BDG guidelines, Upazilas must allocate 15-20 percent of funds to agriculture, irrigation, and industry. The actual expenditure on agricultural development at the Upazila level is estimated to be less than 5 percent.

See, Harry Blair, (1987) Decentralization and Possibilities for USAID Assistance in Bangladesh, Final Draft, PP 1-3.

11. UNDP-AST, op. cit.

12. Op. cit.

13. The concentration of scientific manpower in crop research centers as is indicated by the following table:

<u>COMMODITY</u>	<u>Ph.D</u>	<u>M.Sc.</u>	<u>B.Sc.</u>	<u>TOTAL</u>
Crops	73	42	2	117
Livestock	15	13	1	29
Fisheries	8	2	-	10
Forestry	7	8	-	15
Non-commodity	46	53	16	115

Source: O.P. Gautam, The Role of Agricultural Universities/Faculties of Agriculture in NARS, FAO Report, 1986.

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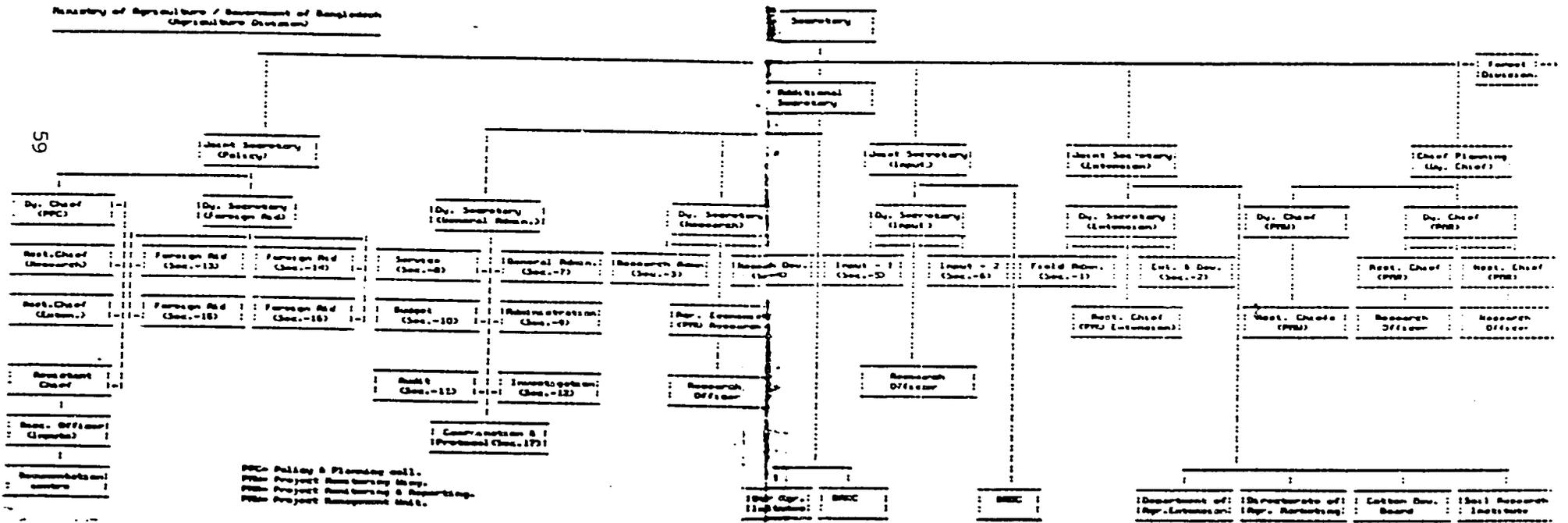
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Appendix

1. Organization Chart of the Ministry of Agriculture
2. List of Institutions in Agriculture Sector
3. Agriculture Research Funding and Personnel
4. Number of Agricultural Graduates Employed by Employer Category

Best Available Document

Figure 1



MOA / Govt. of Bangladesh
(Forest Division)

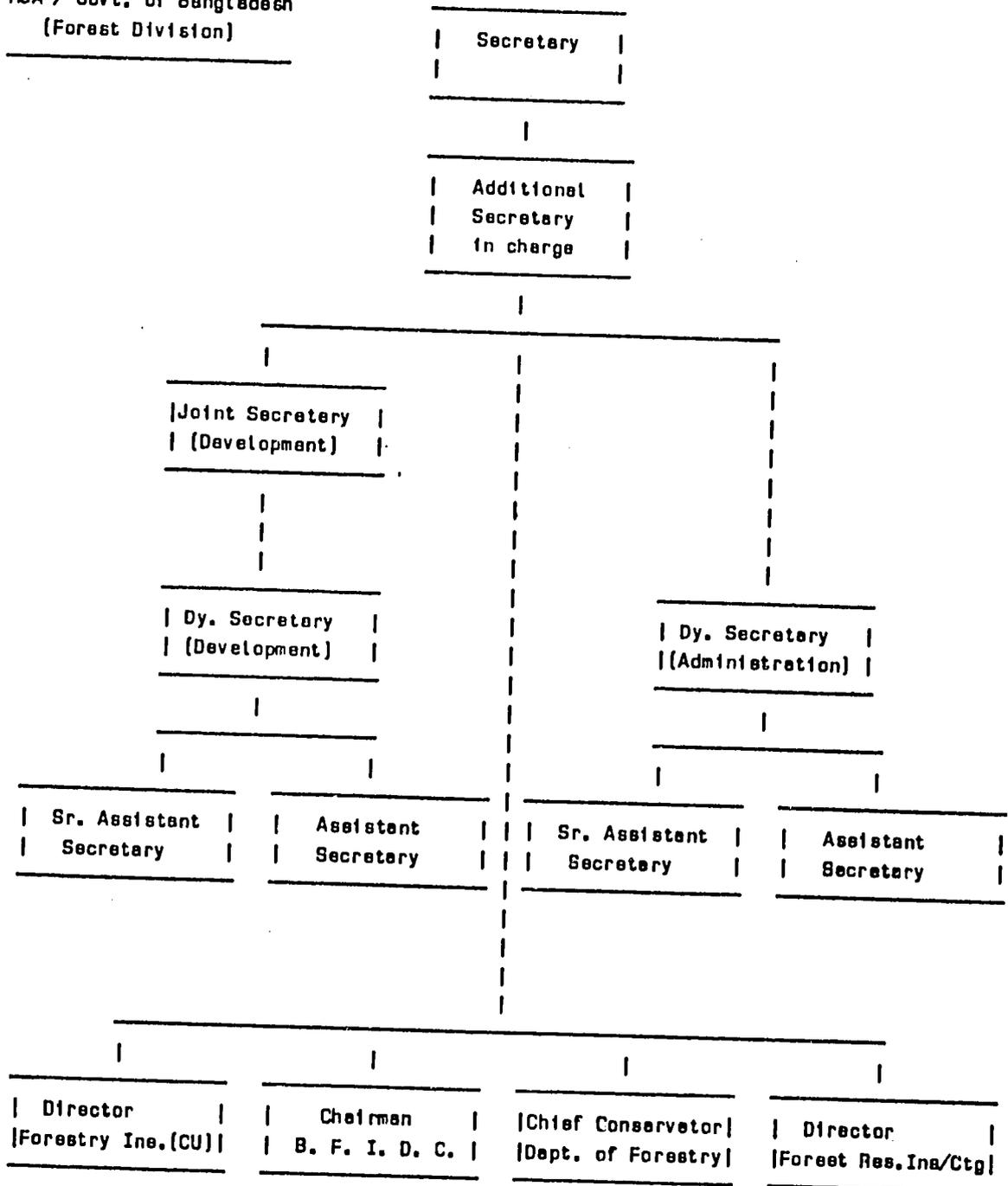


Table 1 Public Agencies in the Agriculture Sector

Ministries

1. Ministry of Agriculture and Forest
2. Ministry of Fisheries and Livestock
3. Ministry of Irrigation, Water Development and Flood Control
4. Ministry of Local Government, Rural Development and Cooperatives
5. Ministry of Food
6. Ministry of Jute
7. Ministry of Industries
8. Ministry of Commerce
9. Ministry of Education
10. Ministry of Land

Departments/Agencies/Institutes

Ministry of Agriculture and Forest

1. Department of Agriculture Extension (DAE)
2. Agriculture Information Service (AIS)
3. Department of Agricultural Marketing (AMD)
4. Soil Resource Development Institute (SRDI)
5. Cotton Development Board (CDB)
6. Seed Certification Agency (SCA)
7. Agro-Economic Research Unit (AER)
8. Bangladesh Agriculture Research Council (BARC)
9. Bangladesh Agriculture Research Institute (BARI)
10. Bangladesh Rice Research Institute (BRRI)
11. Bangladesh Jute Research Institute (BJRI)
12. Bangladesh Institute of Nuclear Agriculture (BINA)
13. Institute of Agricultural Technology (IAT)
14. Department of Forest (DF)
15. Bangladesh Forest Research Institute (BFRI)

Ministry of Fisheries and Livestock

16. Department of Fisheries (DOF)
17. Fisheries Research Institute
18. Department of Livestock Services (DLS)
19. Bangladesh Livestock Research Institute (BLRI)

Ministry of Local Govt., Rural Development and Co-operatives

20. Bangladesh Rural Development Board (BRDB)
21. Department of Co-operatives (DOC)
22. Bangladesh Academy for Rural Development (BARAD)
23. Bangladesh Co-operative College
24. Rural Development Academy, Bogra
25. Rural Development Training Institute, Sylhet
26. Milk Vite--Milk Producers Co-operative Union
27. Engineering Bureau, Local Government Division

Ministry of Irrigation, Water Development and Flood Control

28. Bangladesh Water Development Board (BWDB)

Ministry of Food

29. Department of Food

Ministry of Jute

30. Directorate of Jute

Ministry of Industries

31. Sugarcane Research Institute under BSFIC

Ministry of Commerce

32. Bangladesh Tea Board
33. Tea Research Institute

Ministry of Education

34. Graduate Training Institute under the Bangladesh Agriculture University
35. Institute of Forestry under the Chittagong University

Autonomous Corporations

1. Bangladesh Agricultural Development Corporation (BADC) under MOA
2. Bangladesh Forest Industries Development Corporation (BFIDC) under MOA
3. Bangladesh Fisheries Development Corporation (BFDC) under MFL
4. Bangladesh Jute Corporation (BJC) under the Ministry of Jute
5. Bangladesh Jute Mills Corporation (BJMC) under the Ministry of Jute
6. Bangladesh Sugar and Food Industries Corporation (BSFIC) under the Ministry of Industries

Special Banks

1. Bangladesh Kriahi Bank (BKB)
2. Grameen Bank (GB)

AGRICULTURAL RESEARCH FUNDING AND PERSONNEL, BANGLADESH, FY76-FY85/a
[millions of taka]

Item\FY	1976	1977	1978	1979	1980	1982	1983	1984	1985
Total Agr.Resch (current price):	103.5	99.8	164.5	192.8	379.9	297.7	351.3	422.1	481.7
Domestic sources	63.9	78.7	97.7	125.4	233.5				
Foreign Assistance	38.8	21.1	66.8	67.2	146.4				
Capital	83.1	73.3	131.0	148.5	296.9	178.0	201.1	251.3	284.8
Recurring	20.4	26.5	33.5	48.1	83.0	119.7	150.2	170.9	197.1
Total Agr.Resch (const.price):/b	103.5	89.7	131.7	135.0	242.0				
Domestic sources	63.9	73.7	78.2	87.9	148.7				
Foreign Assistance	39.8	19.0	53.5	47.1	93.3				
Capital	83.1	85.9	104.9	102.8	189.1				
Recurring	20.4	23.8	28.8	32.3	52.9				
Total Agr.Resch(current price)/c									
As % of GDP	0.10	0.09	0.13	0.14	0.24	0.11	0.12	0.12	0.14
As % of Agr. GDP	0.18	0.18	0.23	0.25	0.40	0.24	0.28	0.25	0.22
As % of Agr. Budget /d	3.35	3.07	4.54	3.98	5.58	8.58	7.70	8.02	11.63
Scientists Engaged in Agr. Resch:									
National	943	984	1,234	1,281	1,302				1,373
Expatriate	22	32	44	51	48				73
Budget/National Scientist [000Tk]	112	105	198	157	302				355

/a Except FY81 for non-availability of data.

/b At 1975-78 constant prices.

/c GDP figures taken from table 1.1 .

/d ADP and Current budget.

/e Calculated by least squares method.

Notes: Compare this budget table with actual expenditures reported in Table 7.11.

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USAID/Dhaka.

NUMBER OF AGRICULTURAL GRADUATES EMPLOYED BY EMPLOYER CATEGORY

Employer	Educational Level		
	Ph. D	M. Sc.	B. Sc.
BARC	18	28	3
BARD	1	9	0
BARI	35	281	148
BINA	7	32	9
Jute Research Institute	10	77	24
BRRI	23	118	51
Fisheries Research Institute	4	23	13
Forestry Research Institute	7	52	13
Livestock Research Institute	8	2	0
SRTI	8	25	18
BAI	3	48	8
BAU	112	124	8
IPSA	12	12	2
PKC	1	24	0
Agricultural Public Admin.	1	22	273
Agricultural Extension	4	118	1,472
Fisheries Department	2	60	738
Forestry Department	1	5	24
Livestock & V.S.D.	4	90	1,100
Water Development Board	1	15	184
Cotton Development Board	0	3	37
Others/*	0	8	82
TOTAL	258	1,178	4,213

/* Includes banks, private sector, and international agencies.
 Source: Eisgruber, L., "Bangladesh Agricultural Manpower
 Needs Assessment," May 1988, IPSA/USAID, pp. 38-46.

ANNEX 5

AGRI-BUSINESS IN BANGLADESH

Prepared by

Dickinson J. Miller

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EXECUTIVE SUMMARY

I. Introduction

Agri-business in Bangladesh includes enterprise in agricultural production, agricultural processing (or agro-industry), agricultural marketing (including domestic and international agricultural trade in commodities, fertilizer, equipment, seeds, processed food) and agricultural services (including financial services such as crop loans, crop insurance, etc. and maintenance/repair). They are micro, small, medium and large scale in size. In some cases the public sector is the dominant player. In some cases the private sector is preeminent.

The relationships between the different types of agri-business at different organizational levels are complex.

From 1981-1986 there has been strong growth in employment levels in some agro-industrial sub-sectors. Wood and bamboo products were the lead sub-sectors, followed by pan (betel) and cigarettes. Grocery stores, grocery and other food items, confectionery shops, and fruit and vegetable retail stores also saw increased rates of employment. All of these sub-sectors averaged above 10% annual rates of employment growth during this period.

In terms of investment, on the basis of the secondary literature reviewed, there has been an overstatement of actual growth in two critical subsectors. In one study investments (\$US .501-1.0 million) in fruit and vegetable processing were said "to have soared to the ranks of the top 5 ranking industrial sub-sectors for 7 times in 10 years". Actually, this growth occurred only 3 times in 2 years, once at the large-scale level and twice at the medium-scale level and was among those industries with a "high percentage of foreign component of investment".

Nevertheless, during the 1980-85 planning period provisional targets of investment were exceeded by actual sanctioned investment in large/medium scale investments in food and allied industries and tanning, leather and rubber. Small and cottage industry-scale investment in food and allied industries was well below the target.

During this same period gross value added in agro-industrial sectors fell from 29% to 27% of total gross value added across all industrial sectors, and, despite a 27% increase in the number of registered, reporting factories in the food and allied products businesses, there was only a 6% increase in the average daily employment with over a 100% increase in industrial production costs in food manufacturing between 1978 and 1983. The trend was neither towards increasing labor intensity nor productivity.

In select years the paper industry (1976-77), the tanning industry (1976-77), the seafood industry (1980-81), the agricultural machinery industry (1981-82), the leather products

industry (1982-83), the hydrogenated vegetable oils industry (1983-84) and the leather finishing industry (1986-88) registered comparatively high levels of investment in large-scale enterprise.

In summary, while one can see an overall employment trend in certain agri-businesses, one cannot see an overall investment trend; that is, there has been an increase in employment in some agribusiness subsectors averaging above 10% per annum between 1981 and 1986, but the actual investment in similar subsectors, according to the data used, has been spotty.

In current development planning, food processing is being placed in a hallowed position. This is no more clearly stated than in the recent UNDP Draft Agricultural Sector Review (ASR), where it is suggested that " Bangladesh could develop agro-processing of fruits, vegetables, mushrooms and spices for export. Such processing and, even more, field production of these goods are highly labor intensive activities. Increasing labor costs in SE and East Asian countries which now dominate regional markets for such products suggest that Bangladesh might try to capture part of these markets."

While Bangladesh currently exports fruits and vegetables valued during the 1987-88 fiscal year at Tk. 60 crore, it faces many obstacles to achieving this goal, not the least of which is a tremendous need for building a nutritional base at home. In fact, the BDG's Investment Centre has found mushroom production infeasible and Bangladesh is currently a heavy importer of spices.

It is much more likely that the export of raw shrimp and raw and processed jute will continue to lead export earnings in the agricultural sector. The small amount of raw fruits and vegetables exported will probably not grow as domestic markets are opened up. The expansion of shrimp and fish culture in Bangladesh could have a significant impact on domestic food availability in the coming decades.

In short, expansion of the domestic food market in the long term is possible without expansion of export markets and, provided alternative sources of hard currency can be found, may be desirable from the point of view of the nutritional needs of a growing population.

Very few of the major donors have directly tackled the issues involved in developing either a domestic or an export-oriented food-processing industry. If diversification in the agricultural base is pursued by the country as a national economic goal, major donors will have to develop strategies to assist this process of change. Some of the NGOs have approached this development problem with innovative solutions to a resource scarce environment.

II. Priorities in Agri-business Development in Bangladesh

USAID priorities in agri-business can be identified at the program, policy and firm levels. The following is a prioritization schedule describing goals, measures and recommended funding levels.

1. Program level: Integrated Product Development (IPD)

The goal of this initiative in the next ten years is USAID acceptance of the concept of the notion of Integrated Product Development (IPD) as a thematic principle of project development in Bangladesh agri-business. Integrated Product Development links production, food technology and market development into a conceptual delivery package for agri-business development through crop diversification and intensification, food product development and market development.

The measure of success will be the number of projects into which the theme of IPD has been incorporated.

Although this is considered the first priority, the funding allocation is 0 since this is an issue of internal USAID policy.

2. Policy level: Privatization

The goal of this initiative is full privatization of agro-industries in Bangladesh by the year 2000.

Measures of success will include: (1) number of agro-industries privatized, (2) amount of reductions in government allocations to parastatals.

The recommended cost allocation is 40% of total budgetary levels across programs in the agricultural sector.

3. Firm level: Job Creation

The goal of this initiative is the creation of more commercially viable agri-businesses and jobs.

Measures of success will include: (1) Number of businesses/jobs created, (2) Number of on-the-job training programs developed, (3) Number of trained graduates at work in private agri-business.

The recommended cost allocation is 60% of total budgetary levels across programs in the agricultural sector.

III. Constraints to the Growth of Agri-Business in Bangladesh

There are a number of constraints to growth in agri-business in Bangladesh. On the policy level these constraints revolve around the role of government in agro-processing. On the firm level these constraints revolve around barriers to technology and market access.

Some of the specific constraints identified by the Agricultural Assessment team are described below.

A. Policy

1. Government is in and continues to get into agro-processing: jute, sugar, pineapple concentrate, tomato paste, paper. This discourages the private sector and burdens government with unnecessary costs. The Bangladesh Chemical Industries Corporation (BCIC) owns five paper mills and the rate of export of newsprint produced at these mills has been increasing in recent years. This, combined with the brisk business being done at roadside saw mills around the country, does not augur well for the future of the nation's forests.

2. The Trading Corporation of Bangladesh enjoys a monopoly on counter trade. This discourages the development of private trading companies which, ironically, the BDG is officially encouraging.

3. The domestic cost of sugar is a major cost constraint to expanded exports of jams and jellies (84). As processing grows this cost component must be reduced to compete internationally.

4. The current food processing industry needs clearer focus in credit institutions. One processor tried to obtain credit from major industrial banks, but was told that his industry does not have a legitimate "cell" in the banking system. This is a problem of lending by prescription. According to this same source, the absence of a cell for the food industry in the Export Promotion Bureau, as well as at the Board of Revenue, means no XPL or XPB can be assigned to local processors, if they could export.

5. Import duties on packaging material discourage agro-processing. The UNDP report states that customs duties on packaging materials are prohibitively high, ranging between 67% and 145%.

B. Technology

1. Constraints on the production side restrict growth in food processing. Vegetable and fruit diversification and intensification is necessary to increase the availability of local raw material produce for processing.

2. The ability to identify commercially viable food processing investment opportunities is hampered by a lack of knowledge on how to introduce new foods into the market. The relationship between the food research community and food product development needs to be strengthened.

3. In the existing food-processing industry adulteration is a major problem and needs to be addressed if Bangladesh wants to get into export markets.

4. Another constraint to export of currently processed foods in Bangladesh is the quality of glass. According to the industry, the alkaline content in glass jars made available to the processing industry is high due to the sodium content of the manufacturing process. This allows for product life of one year only.

IV. Specific Recommendations for USAID Assistance to Agri-business in Bangladesh

USAID/Dhaka is appropriately involved in promoting agri-business in several of its projects on both the policy and firm level. Some of this involvement is explicit. Some of it is implicit.

On the input side USAID/Dhaka supports agribusiness through technical assistance and credit to the Bangladesh Agricultural Development Corporation (BADC) for the privatization of the fertilizer marketing system in its Fertilizer Distribution II Project.

On the output side USAID/Dhaka has supported the development of rural micro-enterprise through the Womens' Entrepreneurship Development Project (WEDP) implemented by the Bangladesh Small and Cottage Industry Corporation (BSCIC). In its Enterprise Development Project (EDP), at the Micro Enterprise Development Assistance Society (MIDAS), it has supported small-scale enterprise in treadle pump manufacture, shrimp farming, commercial seed production, leather hand glove and fast food restaurants.

Through Title II and Title III local currency funds, USAID/Dhaka has contributed to the expansion of infrastructure in the electrification and transportation sectors. This basic infrastructure is necessary for the development of more efficient distribution systems.

Through the utilization of existing project resources and by programming PL480 funds to enhance current and planned projects, USAID could further develop the agribusiness portion of its investment portfolio on both the policy and firm levels in the following manner.

A. Program

1. USAID should explicitly promote an INTEGRATED PRODUCT APPROACH in project design and between projects. For example, MIDAS could be linked to Fertilizer II and the ARP II in an effort to develop a delivery mechanism that packages technical assistance with policy dialogue (privatization) and training (Example: seed farm at MIDAS, seed privatization at BADC and research and training at BARC).

B. Policy Reform

1. USAID should develop a long-term strategy to work with larger business groups to achieve full privatization in the following industries: jute, sugar, paper, fertilizer, agricultural

chemicals and agricultural credit. The Center for Privatization is a logical choice for assistance in this area.

2. USAID should work with the government to define more closely the relationship between trade policy, agricultural production and private versus public sector investment priorities. Example: The country is exporting pineapple concentrate, but has no local juice industry. If Pepsi and Miranda can get into rural areas so can a local tetra pak beverage product. Fruit juice distribution can have a high impact on nutrition. Example: The Trading Corporation of Bangladesh should relinquish its monopoly on countertrade.

3. USAID should explore the possibility of working with the Bangladesh Standards and Testing Institute to develop a better grading and labelling system (low, high grade) to help consumers differentiate between products.

C. Technology Access

1. MIDAS should be strengthened in three areas: (1) financial management, (2) entrepreneur identification and (3) agri-business project identification. Currently MIDAS has a stated 85% loan recovery rate. In Bangladesh this is a very high recovery rate, but it needs to be improved to make MIDAS sustainable. Resources need to be expended in the area of entrepreneur identification. A recent GTZ project has developed a model of screening and training which should be supported by USAID and institutionalized within MIDAS. One of the foci of future IESC assistance should be on agri-business.

2. USAID should request the Employment and Enterprise Policy Analysis Project or the Enterprise Policy Reform project to undertake a survey of the food-processing industry, including traditional cottage-industry and more newly mechanized processes of food transformation. The purpose of this survey would be to establish a benchmark for growth.

3. USAID should bring out Project Sustain on a Reconnaissance visit (no cost to Mission) to look at the private food industry by targeting several food industry groups (jams, jellies). No major donors are working in this area of processed foods. The US has a comparative advantage in this field.

4. USAID should encourage the organization of a seminar or a series of seminars on food processing investment opportunities through MIDAS using FRIP resources with coverage in the ADAB Newsletter. Demonstrations of different kinds of food popular in the Bengali household could be prepared. First, an inventory of basic ingredients, primary processed ingredients and then more complex pre-processed ingredients. This could be followed by a series of home economic workshops in secondary towns organized by

womens' cooperatives. The knowledge of womens' role in food processing gathered through the WEDP project is relevant here. Themes such as pride in Bengali culinary tradition could be linked to developments of new processing industries.

5. USAID should explore ways of working with the Packaging Association to tackle adulteration problems. MIDAS' work in the area of packaging technology might be relevant. An IESC volunteer might look at the capping industry to devise ways to assure quality control through improved capping procedures.

D. Training

1. USAID should commission a study on agricultural product dealer training as currently practiced in Bangladesh. The purpose of this study would be to develop an understanding of opportunities for transferring new techniques through private markets. Targets include USAID's own fertilizer dealer training, the pesticide industry, the irrigation industry, the seed industry and agricultural machinery manufacturing industries.

2. USAID should explore ways to assist the Institute of Business Administration in developing a course on agri-business. Currently, case studies on agribusiness subjects are used to help students develop better business analysis skills.

3. USAID should explore ways it can promote the acquisition of skills in agricultural credit analysis at the local level. Rapid Rural Appraisal techniques need to be added to the skills portfolio of extension agents and lending agencies in Bangladesh. Credit itself is not a barrier to growth. The ADB has had a loan on its books targeted at agro-industry for a number of years, but has not been able to lend the funds.

I. Introduction

Bangladesh is undergoing a "liberalization" of its economic policies. In the New Industrial Policies of 1982 and 1986 it took steps to privatize nationalized industry, to simplify investment procedure, and to free up hard currency availability for investment through the Wage Earner's Scheme (WES). Export bonus systems have been put in place to provide incentives for export-oriented industry. On paper the government looks much more private sector oriented than it has at any time since the Liberation of 1971 (1).

Bangladesh has done a great deal in terms of building the necessary institutional support for private business. Industrial estates, an Export Promotion Bureau, and a Commercial Court system have been established. A Federation of Chambers of Commerce and Industry in addition to local Chambers are active in promoting commercial interests (2). A set of trade associations lobby on behalf of their membership for better government policy (3).

While these institutions function with greater or lesser success, at first glance their sum total is impressive. It will take time for these structures to become fully operational. No more institutions need to be built. They need to be made more efficient and active.

In the field of agri-business the general move towards liberalization of economic policy has had a noticeable impact on the development of agricultural processing, agricultural marketing, agricultural engineering and agricultural services, especially credit. The most visible result of these policies has been in the partial divestiture of jute mills, tanneries, tea estates and textile mills (4). The privatization of the marketing system of the public sector fertilizer industry as well as the opening of private markets for irrigation equipment and seeds are further testimony to a more pragmatic government approach in using competitive free market trading for the purposes of accelerating growth in the agricultural sector.

Liberalization has also been felt in the rapid expansion of targeted credit for agricultural production and rural industry (5). Bank advances to agriculture as a percentage of agricultural GDP, were 11.3 percent in FY86, up from 2 percent in FY78. Unfortunately, this expansion occurred without adequate financial safeguards and led to near insolvency of major Development Finance Institutions. (DFIs) The President's personal program in FY87 of interest forgiveness on the repayment of crop loans succeeded in increasing recoveries among the poorer segments of the population, but his program did not even attempt to address the problem of large loans that are overdue in the agricultural sector..." (6).

II. Agri-business in Bangladesh

There is an enormous number of agri-businesses in Bangladesh. The economy of the country is primarily agrarian, although changing, and the sheer variety of enterprise is staggering. In addition, according to official statistical criteria and donor project files there are micro, small, medium and large scale agricultural enterprises, although these distinctions are not always so clear. Sometimes they refer to farm size, sometimes to investment size, sometimes to organizational form.

The relationships between the different types of agri-business at different organizational levels are complex. Agricultural production, agricultural processing (or agro-industry, including agro-chemical), agricultural marketing (including domestic and international agricultural trade in commodities, fertilizer, equipment, seeds, processed food), agricultural engineering and agricultural services (including, financial services such as crop loans, crop insurance, etc. and maintenance/repair) are activities which occur in micro, small, medium and large scale enterprise. In some cases the public sector is the dominant player. In some cases the private sector is preeminent.

It is with these concerns in mind that the following pages seek a basic understanding of the nature of the agri-business system in Bangladesh. In many instances one part of the agri-business system cannot do without the other so disaggregating their function in the abstract may not be practical in the real world.

A. Structural Determinants

There are four main sources of secondary information on agri-business in Bangladesh: labor force statistics, firm level descriptions in project files, market data and investment figures. Within the limitations of data validity these sources provide a rough picture of the structure of agribusiness in Bangladesh today.

1. Employment

According to official statistics, 16,704,000 persons (16,468,000 men and 236,000 women) were employed in agricultural, forestry, livestock and fisheries production in 1984-1985. 16,169,000 (15,938,000 men and 231,000 women) or 96.8 % were directly employed in agriculture, livestock and hunting. Fishing employed 508,000 (all men) or 3%. Forestry and logging employed 27,000 (22,000 men and 5,000 women).

In the manufacturing sector, the manufacture of food, beverage and tobacco employed 580,000 persons (403,000 men and 177,000 women) or 22% of the manufacturing labor force of 2,669,000; manufacture of wood and wood products employed 118,000 (87,000 men and 31,000 women) or 4% of the manufacturing labor force; manufacture of paper and paper products employed 56,000 (all male) or 2% of the manufacturing labor force. The exact number of leather workers is not known because they are aggregated with either shoemakers or textile workers in the data base (7).

Some finer occupational distinctions can be made in these broad industrial categories. Groceries and other food items are disaggregated in other presentations at 1,976,000 and fishing pegged at 454,000. Food processing, preserving and packaging is split out at a total of 328,000, restaurants and cafes at 251,000, tobacco at 232,000, livestock and poultry rearing is combined for a total of 147,000 and wood and cork products (except furniture) at 79,000. Unfortunately, in these figures the gender breakdown is absent (8).

These general statistics are useful to a limited degree, both for current analysis and future projections. There are discrepancies in official sources. In general, the role of women is understated. And time series data are not readily available. Nevertheless, some basic conclusions can be drawn.

The occupational structure of agri-business is heavily skewed towards basic agricultural production. Food manufacturing or agro-industry and agricultural service sectors are still in their infancy with the largest employers in several basic industrial categories of food, beverage and tobacco processing.

The main organized agro-processing industries in Bangladesh are public sector enterprise in the jute, cotton, sugar and paper industries.

The employment figures available in the latest statistical yearbooks are, however, old and misleading (9). The jute mills, for example, have experienced declining employment levels in recent years. According to January 1989 figures supplied by the Bangladesh Jute Mills Association (BJMA), the number of registered workers at public and private sector mills is approximately 250,000. The number of those actually employed is probably less than 200,000 (10). According to official USAID documents, "a gradual restructuring of industry is taking place with the share of labor intensive industries increasing from 40% to 60% since FY74, mostly at the expense of older industries such as jute, paper, cotton textiles and tobacco (11).

Number of workers in major industries

	78	79	80	81	82	83
Jute Mills	200765	210847	234585	270555	286788	303995
Cotton Mills	66299	74491	75392	77070	80923	84969
Sugar Mills	23888	17848	15554	23109	24264	25477
Paper Mills	8530	9332	7860	7384	7605	8027

The main organized agro-processing industry in the mixed sector is the tobacco industry. The Bangladesh Tobacco Company (BTC) (65% British American Tobacco and 35% Bangladesh Chemical Industries Corporation - BCIC) is the largest of the tobacco companies commanding at least 80% of the market. It contracts with 33,000 farmers on 22,000 hectares of land. Taxation of the BTC provides an estimated Taka 400,000,000 or 10% of the total domestic government revenues per annum. The BCIC is also a joint venture partner with Ciby-Geigy in the first pesticide formulating plant in the country.

In the private sector, the main organized agro-processing industries are the 33 recently privatized jute mills. Rice mills, flour mills and soybean oil mills are also predominantly private. These mills are operating at low levels of utilization and Ministry of Industry investment schedules have placed automatic rice mills on the discouraged list.

One study on the impact of the BDG economic policy has calculated the rates of expansion in employment for Bangladesh industry as a whole during the 14 year period from 1972-1986. The heaviest growth in employment, according to these figures, occurred in the wood, cork (18.69% per annum), wooden furniture (17.57% per annum), bamboo products (16.70%), pan (betel) and cigarettes (14.64%) and tea (12.64%) categories (12).

Concerns about the future of the forests in Bangladesh are echoed in these statistics. More positively, growth in employment is well above population growth rates. Exactly what this growth means, however, is unclear. The absolute numbers of employment were not readily available for this study, although employment in the wood and wood products related industry did start at a relatively low level. The fruit, vegetable and tea categories refer to retail and wholesale selling, not agro-industry.

2. Enterprise

Agri-business in Bangladesh is organized into various levels of structural complexity. These levels of organizational complexity are often interdependent. The linkages vary according to production volume and market size. In the section below several examples from the micro to the large scale enterprise are discussed.

a. Micro-Enterprise: production, processing, marketing and servicing as a family enterprise

The basic unit of agricultural production in Bangladesh agri-business is the individual farmer. The individual farmer is not often considered a businessperson, but he or she is.

Understanding the farmer as a profit-oriented man or woman in the field is a pre-requisite to understanding how the Bangladesh agricultural system works. Farmers do not choose or inherit their primary occupation with philanthropy in mind. Their basic impulses are accumulation of wealth and expansion of area of control. While the notion of philanthropy is present and active in Islamic and Hindu social systems in Bangladesh, this is a secondary concern which is invoked when appropriate and possible. Farmers are survival tough, first, and welfare generous, second.

At the village level, production, processing and marketing as well as maintenance, is taken care of within the family. Differentiation of labor along gender lines is practiced, although in some situations both men and women perform the same tasks. In the case of the marketplace it appears that men are the dominant force.

The complexity of agro-business at the village level is really extraordinary. The Womens' Entrepreneurship Development Project (WEDP) financed by AID and implemented by the Bangladesh Small and Cottage Industries Association (BSCIC) with the assistance of the Bangladesh Krishi Bank (BKB), has identified 23 separate part-time occupations in food processing, 6 part-time occupations in farming related and 49 part-time occupations in cottage industries; that is, 78 separate business ventures occurring in one economic unit.

Several occupational activities dominated the structure. In the food processing field these included rice husking (270 out of 514 loans), oil extraction (135 out of 514), food processing (32 of 514) molasses processing (25 of 514), beekeeping (19 of 514), and tobacco processing (13 of 514). In the farming related group, goat raising (142 of 316), poultry raising (112 of 316) and cow raising (57 of 316) were major occupational groups. In cottage industry, net making (154 of 631), cane and bamboo manufacture (133 of 631), mat making (116 of 631) and coir products (115 of 613) were

preeminent. Womens' involvement in agricultural production and processing is impressive (13).

The involvement of women in agri-business at the level of micro-enterprise has implications for higher levels of agri-business organization and will be an important part of agro-industrial development in Bangladesh. This has been recognized by CIRDAP which has recommended the establishment of women owned rice mills in each of 23 upazilas in Bogra, Noakhali and Moulvibazar zilas (14).

NGOs have been instrumental in developing income-generating rural industries of this type at the village level. In addition to those described above, these initiatives have included water users groups, pisciculture, shrimp farming, weaving, mechanic training, sericulture, nurseries, apiculture and cattle rearing (15). This has been part of a broad-based change in NGO philosophy characterized by a shift away from pure relief work to an emphasis on building commercially viable enterprises (16).

b. Small and medium scale enterprise: new corporate arrangements

Small and medium scale industry (large scale as well) in Bangladesh is also frequently organized around the family as a management team, although partnerships between non-family members are organized and hired labor is necessary to supplement the labor pool. In agri-business the structure of this organization allows for larger-scale farming and for more sophisticated mechanized processing. Marketing becomes a more distinct occupational role driven by larger transactions between buyers and sellers of goods and services.

Government-sponsored cooperative organization in Bangladesh at the village level has been tried extensively, but has not provided a successful corporate model. While it has been convenient and even necessary for donor groups to work with cooperatives rather than individuals, it may not be a viable form. The chairman of one of the most successful farm cooperatives in Bangladesh has flatly rejected the promotion of BDG-driven cooperatives on a nation-wide basis (17). A noted USAID authority on Bangladesh agriculture, whose family comes from a long line of cooperative activists in the USA, echoes this sentiment, stating that the cooperative movement in South Asia is a failure (18). Recent expert work has further reinforced this opinion (19).

Attempts to work with landless groups through cooperative owning schemes in areas such as water users groups has had limited success. Observers note that once NGO participation retreats, ownership patterns shift and the already slim profit margins are no longer equitably distributed as shares are exchanged for other

forms of equity (20). However, informal, non-government sponsored WUGs do seem to work without much help from anyone but themselves (21).

Small and medium scale agri-business in Bangladesh includes players in both input (fertilizer, pesticides, irrigation equipment, seeds) and output (agricultural raw materials and processed goods) related enterprise with players from both the public and the private sectors. This is different from micro-enterprise which is entirely private. At the small and medium scale of agri-business in Bangladesh, private farmers, processors and marketing organizations also begin to compete with the government for both domestic and export markets.

i. Inputs

The handling of inputs into the agricultural production system is divided between public and private sector institutions and companies. Until quite recently the Bangladesh Agricultural Development Corporation (BADC) had exclusive rights of import for irrigation equipment, certain types of seed and certain kinds of fertilizer (TSP). It also had exclusive distribution rights for BCIC-produced urea. BADC still has exclusive distribution rights for BARI-researched and BARC-certified HYV rice seeds. However, privatization of BADC's trading monopolies in fertilizer, irrigation equipment and seed distribution has been moving along very rapidly in recent months under pressure from donor agencies. An Asian Development Bank (ADB) structural adjustment loan scheduled for this year virtually guarantees that BADC's monopoly over certain imports will be ended. And a private lifting of fertilizer by a national wholesaler this past month marks the first time a commercial agent has been able to buy urea from a government plant at BADC prices.

BADC's involvement in the distribution of fertilizer has been one of the major bottlenecks to expanded fertilizer use. Farmers have access to multiple suppliers so can compare prices between competing agents. But the basic supply itself is often short (22). These shortages are artificially created and are the main reason retail fertilizer prices remain high and farmer applications low. Despite this shortage of supply BADC has been exporting urea.

Privatization efforts in other agri-businesses have had similar problems; the jute industry remains only partially and ineffectually disinvested; the sugar industry is still owned and operated by the Bangladesh Sugar and Food Industries Corporation (BSFIC); and the paper industry is still owned and operated by the Bangladesh Chemicals Industries Corporation (BCIC). Disinvestment of some of the paper mills is, however, being discussed (23).

BCIC, which owns and operates the five urea plants in Bangladesh, is a joint venture partner with Ciby Geigy and the

British American Tobacco Company in local enterprise as well. The Freedom Fighters Welfare Trust, which is the Coca-Cola agent in Bangladesh, also owns a "multi-juice" plant where tomato paste and pineapple concentrate is manufactured. It plans to establish a 6,000 acre pineapple plantation to feed its supply (24). In all four cases the government still controls important investment decision-making that competes with the inclination of private enterprise.

Unfortunately, because the government has historically depended on these exports (jute) to earn hard currency, it finds itself locked in a debate over the political expediency of market intervention. It must use the power base of a conveniently located urban work force in state factories to hold onto positions of authority within party structures, while at the same time attempting to enforce export-oriented growth. So far this dynamic has led to a situation where the cost of production of jute manufactured goods is now higher than foreign buyers are willing to pay.

For the small and medium scale agri-business the involvement of government in these select areas is a mixed blessing. For some farmers it may mean guaranteed prices for certain crops (jute). But it also may mean for the food processor that input prices are unacceptably high. These higher cost inputs, in turn, impact negatively on export promotion policies. The jam and jelly industry, which is dependent on sugar as an ingredient, is one such example.

On the input side there are alternatives to BADC monopolies in fertilizer, seed and irrigation equipment. Relaxation of control over import licenses for diesel driven pumps, for example, has led to a boom in sales of Chinese-made diesel engines in recent months and a dramatic drop in prices. It has been an important observation of experts that many of these diesels and pumps are being paid for by cash.

BADC still holds a monopoly on the marketing of HYV rice and wheat seed. Seed Certification Boards at Bangladesh Agricultural Research Institutes, coordinated through BARC, also exert considerable control over the release of improved seed varieties. It has been estimated that it takes ten years to get a BARI seed variety from research to the market place, three times what it could be (25). The Mennonite Central Committee (MCC) has been waiting for years for certification of an Indian soybean variety which is proving to be ideally suited to Bangladesh (26). And farmers in border areas are adopting Indian wheat varieties without seed certification (27).

Private traders are supplying vegetable seeds to farmers, but the vast majority of seed (95%) is generated on the farm itself. In 1987 60 seed traders were registered with the National Seed Traders

Association, including 12 importers of vegetable seeds. The Association reported that the total number of major wholesalers in the country was 105 at that time. At mid-year 165,200 kilograms of seed had been imported valued at Tk 6 crore. BADC during the two year period from 1986-87 imported 4,000 kilograms annually (28).

Only one commercial seed farm operates in Bangladesh currently. USAID, through MIDAS, is financing its expansion.

ii. Outputs: Local raw vs imported materials based agro-industry

Some fruits and vegetables in Bangladesh are being exported and some raw materials are being used in a fledgling food processing industry in jams, jellies, pickled chutneys, tomato ketchup, and certain local pastries and breads. Peanut butter has made its appearance in the 10,000 member ex-patriate market.

The export of fruits and vegetables is a controversial topic given the chronic shortages of food in Bangladesh (29). But it is the arrival of a small domestic raw material based food processing industry which the UNDP ASR report has singled out as offering the greatest potential benefit from crop diversification and intensification strategies (30).

Very little is known or published about the food processing industry based on local raw material inputs in Bangladesh, despite reports which emphasize growth and potential in this sector (31). Neither "do statistics record the widespread increase in the number of rice mills, sawmills ... and roadside workshops" (32). According to one food processor, there are 400 small-scale food processors in Bangladesh (33). There is no trade association built on this constituency and no lists have been located. One specialized study has been commissioned to develop inventories of food manufacturers at the medium and large scale level (34). According to the author of this study, tremendous growth has been registered at this level of enterprise during recent years (35). These businesses are all private sector.

In Bangladesh imported commodities form the raw material base for the biscuit, snack food, ice-cream, soybean oil, and flour milling industries. The soybean oil mills and the flour mills form strong lobbies for increased importation of soybean oil and wheat. Secondary processors like biscuit manufacturers add weight to this interest group. Over-capacity in the rice milling and flour milling sector has led the BDG to place rice-milling on its "discouraged" list of industries (36). Flour millers complain privately of heavy competition from the increased number of units in the country.

3. Market Structure: Domestic and Export

From the point of view of potential growth, agriculture in Bangladesh can be seen moving in two directions: domestic and export market development. On the one hand, Bangladesh is struggling to achieve domestic food self-sufficiency, primarily through the expanded production of high yield varieties of foodgrains. On the other hand, it is struggling to achieve international economic independence through export of goods made from domestically produced agricultural raw materials. The dynamic between the drive to supply domestic food demand by increasing production and the drive to satisfy hard currency demands by expanding exports is a central feature of the evolution of the country's agro-industrial base.

The development of domestic self-sufficiency in food grains is one of the BDG's most clearly articulated economic goals. Considerable intellectual and material effort has gone into this drive. Scientists have concentrated, however, primarily on developing new high yield varieties of rice. Millions of dollars have been spent delivering these HYVs along with the additional inputs of irrigation equipment and fertilizer. This delivery system has been built with determination through production, processing and marketing in both the public and private sector.

The development of export markets has also been focused on commodities. Jute, shrimp, and wood form the raw material base for export oriented agro-industry. While jute exports have been in decline for a number of years, shrimp export has shown dramatic increases. Leather has also shown strong gains in export markets. Paper export has been on the upswing (37).

There has been a change in the pattern of exports during the past decade. The share of agriculture and related activities in exports fell sharply from 88% in 1980 to slightly above 60% in 1987. Jute and tea fell 75% and 40%, respectively, but were partly offset by the rapid rise in the value of leather and strength in the fish and shrimp sub-sectors (38,39).

a. The structure of domestic markets

The marketing systems in Bangladesh can be divided into two: an extensive and well developed commodity marketing system for rice and jute and a newer marketing network of distributors from production centers largely in urban areas. This second marketing system includes agricultural inputs such as fertilizer, seed, and irrigation equipment as well as soda pop, pesticides, ice cream, snack foods, bottled goods. It appears that these two systems are largely independent of one another, because of different sources of raw material input.

There are several kinds of markets with different levels of assembly. Rashid makes a distinction between 6 market types: "hat" (open village markets meeting on specific days of the week), mela (village fairs), puja (village religious festivals), "bazaars" (daily fresh produce market of semi and permanent dwellings), markets (permanent shops), and commercial centers. The weekly "hat" is the primary market of which there are an estimated 8,500 (40).

At these markets part-time grain traders known as "kuttiab" (landless) and "farias" market paddy bought from farmers. Full-time secondary grain traders known as "beparis" carry the commodity to major collection points where "arathdars" coordinate buying and selling at the terminal market. In the case of jute mills, appointed agents will buy from the arathdars who are generally long-standing members of their community with positions of respect and authority earned over many generations of trade activity (41).

The structure of the marketing system appears to be consistent across a variety of commodities, including jute, rice and potato crops. The market structure for higher value added perishable fruits and vegetables are less well studied, but at first glance it appears to be simpler. Because of the perishability of fruits and vegetables this market is more oriented towards direct retail.

A number of studies have been done on the traditional domestic commodity market system. The general conclusion is that this system is efficient. Rice farmers, for example, are getting nearly 80% of the retail price at the farmgate. In the words of one of the more recent studies on rice marketing, "The exploitation of farmers by middlemen so often bruited in developing countries is almost totally absent in Bangladesh." (42)

The domestic marketing systems of the agro-chemical, agro-processing and agricultural service (credit) industries are relatively newer additions to the structure of agricultural markets in Bangladesh.

The fertilizer industry with an estimated 8,000 wholesalers and 50,000 retailers is probably the best studied system (43). Pesticide firms have also established an extensive and responsive sales network throughout the country (44). These firms conduct dealer training in subjects such as pest identification and safe use of chemical pesticides. The services these firms provide have a direct impact on the farmer. They maintain constant contact with their customers with a vested commercial interest in improving product delivery, quality and applicability. They are constant carriers of new technology.

A marketing network of sales representatives of beverage, tobacco and processed foods has also expanded nationwide in recent years. Poor transportation infra-structure forced the beverage and tobacco industries to decentralize plant locations. Small-scale

food processors, notably in the jams, jellies and pickles industries are also localized, owing to high rates of perishability in the raw material base of their products.

The expansion of agricultural credit has added one more dimension to the agricultural marketing system. The number of branch operations tripled during the first half of the eighties (45). Secondary credit institutions formed by NGOs also contributed to the growth in the availability of these services.

b. The structure of export markets

Export markets have been developed in Bangladesh through historical ties to external markets first established in the jute, tea and leather industries. The presence of Bangladesh in international markets has recently been enhanced by the expansion of the shrimp industry. Bangladesh does export some fresh fruits and vegetables in limited amounts. Export of processed foods from Bangladesh is also still limited, hampered not only by technical packaging problems, but costly inputs. Both the availability of basic ingredients and quality control are constraints on expansion in this sector. Adulteration remains a problem.

In the cases of jute, tea and shrimp, buyers regularly visit Bangladesh to make purchases for their markets overseas. Major trading houses like Louis Dreyfus (London) and Bunge (Argentina) have maintained offices in Dhaka for many years for the express purpose of purchasing commodities in the local market. Louis Dreyfus used to buy up to 50% of the Bangladesh jute supply, but has diminished its market presence in recent years. World buyers regularly visit the public tea auctions held in Chittagong. Shrimp buyers from the United States and Europe place orders through local processing plants which they visit on an individual basis. Shrimp processors attend international fairs individually or in delegations organized by the Export Promotion Bureau. Leather is a more established market and purchases are primarily handled through local buyers' agents who purchase hides and skins in the local market through tanneries. Jute, skin and hide prices are published daily in the local newspaper.

The development of export markets in Bangladesh is officially handled by the Export Promotion Bureau under the Ministry of Commerce. However, some commodity associations have developed their own market promotion network. The public sector Bangladesh Jute Mill Corporation (BJMC), for example, promotes jute through several overseas offices one of which is located in Brussels. The private sector Bangladesh Jute Mills Association (BJMA) has no similar overseas representation and relies on intermediaries to promote their product. Other associations, like the Bangladesh Frozen Food Exporters' Association (shrimp, fish and froglegs) actively seek information on market opportunities for their membership.

Diplomatic officers stationed overseas in the Bangladesh foreign service are called upon to handle commercial affairs, but there is no formal commercial attache network in the Bangladesh government. The public sector's Trading Corporation of Bangladesh (TCB), which is a kind of BADC equivalent in terms of its trading function, partially fills this function.

The TCB has exclusive rights to organize counter-trade deals in Bangladesh. The control of the public sector over counter trade is a constraint to the expansion of international agricultural trade because it takes the incentive away from any private firms interested in developing their own trading capability.

4. Investment

Another way to get at the broad structure of agri-business in Bangladesh is to use economic growth data. These can be divided into planned and real investment.

a. Planned investment: Agro-Industry

The Bangladesh Ministry of Industry is mainly responsible for developing agro-industrial policy. It establishes priorities and through its Department of Industries sanctions medium and large scale projects up to TK 30,000,000. It has assigned authority for small-scale projects to the Bangladesh Small and Cottage Industry Corporation (BSCIC) which sanctions projects up to Tk 15,000,000.

Recent changes in Bangladesh law have "decentralized" this sanctioning authority to include public and private sector banks. Now Development Financing Institutions (DFI's or specialized public sector banks) and Commercial Banks have sanctioning authority as well. The DFI's (BSB, BSRS, BKB, IPDC and SABINCO) have authority to sanction projects up to TK 60,000,000; Commercial banks have sanctioning authority for projects up to TK 30,000,000 (46).

Major projects up to TK 300,000,000 and those projects "requiring imported raw materials more than 50% of the total requirements" or involving foreign investment need the sanctions of other organizations, including the "Standing Committee of the National Committee for Industrial Development", the Investment Board, and the Bangladesh Export Processing Zone Authority (BEPZA).

Both the Ministry of Industries and the Bangladesh Small and Cottage Industry Corporation print "Industrial Investment Schedules" in which detailed lists of "priority" and "discouraged" industries are printed. Agro-industry is an important part of both the priority and discouraged investment schedule lists.

Agro-based industries including leather goods for export only, manufacture of basic pesticides, wooden furniture for export,

fruits and vegetable processing and canning, dairy farming and dairy products, fishmeal and fish oil are included in the Ministry of Industries' "indicative list of industries in which foreign investment will be encouraged" (47). BSCIC's investment schedule has a slightly different investment structure. In agro-based industry BSCIC's priority sectors include: (1) Agro-based Industries of dairy farming and dairy products (excluding cream), packet tea for export, fish meal, frog oil and frog pituitaries for export, cattle, poultry and fish feed, and processing and canning of agricultural products; (2) Tannery, Leather and Rubber Products including, finished leather, industry based on scrap leather, and export oriented leather products; (3) Chemicals, Pharmaceuticals and Allied Industries, including drug and pharmaceuticals including veterinary medicines for intermediate/basic manufacture, and fertilizer (for export only); and (4) Engineering Industries including agricultural machinery, tools and equipment, jute and textile mills machinery and equipment, hand tools, electric motors above 20 hp and turbine pumps (48).

Discouraged industries "due to over capacity or underutilisation of capacity" include the following: automatic rice mills, cigarettes, cold storage, distilleries, edible oil, refining and hydrogenation, jute yarn and twine, sugar mills, jute carpets, wooden tea chests, tanneries (for wet blue) and safety matches. Exceptions are granted for investments in less and least developed areas of the country (49).

In addition to these priority and discouraged industry lists, both the MOI and BSCIC lay out more detailed investment guidelines for projects in all areas - priority or discouraged - including very specific production limits (50).

The investment schedules are clearly intended to be guidelines for investment, not regulatory. However, the priority lists do theoretically bear upon the willingness of a lending authority to take risk and are important criteria in investment-decision making.

b. Real investment

According to an analysis of Economic Census data taken in 1986 of newly established industries, it was found that "Small industry expansion predominated in agri-based food manufacturing (although this industry has medium and large units also, especially in vegetable oils and grain and rice milling); Wood products and furniture. Large plants were built in the Tobacco Industry. And at the medium scale "commercial crop-based industries" in tea, coffee and edible salt and cotton textile, silk and synthetic textiles predominated. Fish, seafood, rice milling, etc. were industries in which all sizes - small, medium and large flourish or survive" (51).

This observation is restated elsewhere by the same authors, "The industries that responded positively to the NIP82 and have shown, by and large, a consistent growth since, are 3 or 4 out of 290 studied..." (52). Of these 3 were agro-industrial, namely Tanning and Finishing, Wooden furniture and Bakery products (53).

Purely from the point of view of numbers of industries, medium scale investments in fruit and vegetable processing were important contributors to the growth of industry during the 1976-1986 period (54). Unfortunately, this contribution may have been overstated. In the USAID's HIID/ESEPP investment study, for example, investments (\$US .501-1.0 million) in fruit and vegetable processing were said "to have soared to the ranks of the top 5 ranking industrial sub-sectors for 7 times in 10 years". Actually, this growth occurred in only 2 years and was among those industries with a "high percentage of foreign component of investment" (55).

Nevertheless, during the 1980-85 planning period provisional targets of investment were exceeded by actual sanctioned investment in large/medium scale investments in food and allied industries and tanning, leather and rubber. Small and cottage industry-scale investment in food and allied industries was well below the target (56).

During this same period gross value added in agro-industrial sectors fell from 29% to 27% of total gross value added (57) and despite a 27% increase in the number of registered, reporting factories in the food and allied products businesses, there was only a 6% increase in the average daily employment with over a 100% increase in industrial production costs between 1978 and 1983 (58, 59, 60). The trend is neither towards increasing labor intensity nor productivity.

c. The Historical Structure of Lending to Agri-Business

The main agricultural credit bank in Bangladesh is the Bangladesh Krishi Bank. However, other banks and development agencies are also involved in commercial and non-commercial lending to agri-business. The most famous bank for micro-enterprise is the Grameen Bank. This bank has one of the highest rates of loan recovery in the Bangladesh credit system and has developed an internationally renowned management system recognized for its integrity.

The rural credit system saw a dramatic increase in cash availability during the early eighties, but has drawn back after unusually high default rates threatened the system with collapse. While the UNDP Agricultural Sector Review notes that "The share of agricultural credit in total credit remains low...it was as high as 15% in 1983-84 but slumped to less than 6% in 1986-87," it neglects to point out that "bank advances to agriculture as a percentage of agricultural GDP were 11.3 percent in FY86, up from 2

percent in FY78 [due largely] to a "three-fold increase in branch banks occurring principally in the period 1977-1981..." (61, 62).

As Navin adds, "This expansion took place so rapidly that the branch banks and cooperatives did not properly screen the loanees with the result that dismally low rates of loan recoveries now jeopardize the entire banking system and will continue to do so. The President's personal program of FY87 of interest forgiveness on the repayment of crop loans, as opposed to term loans, succeeded in increasing recoveries among the poorer segments of the population, but his program did not even attempt to address the problem of large loans that are overdue in the agricultural sector, nor even the poorer recovery performance in the industrial sector" (63).

The coming years will most likely see a tightening of credit as lenders are called to task and bad debts are collected. This could have a dampening effect on the expansion of agro-industry. The jute industry, in particular, continues to face losses despite large cash infusions to public sector jute mills and subsidized lending to private jute mills. As the largest agro-industrial employer these losses also eat into the availability of credit for other agri-business enterprise.

The effectiveness of this lending in terms of its impact on increased productivity in the agricultural sector is questionable. If increased lending is correlated with production increases, it does not fully explain why lower lending to the shrimp industry results in higher growth, and higher lending to the jute industry results in lower growth. Welfare lending, in this case, has not built national wealth. It has drained it of capital resources. Planned future credit allocations, it is hoped, will be very carefully assessed in the light of recent experience.

5. Summary

From four sources of data on agri-business in Bangladesh - employment figures, descriptions of firm level enterprise, market structure and investment patterns - a fuzzy picture emerges.

From 1981-1986 there has been strong growth in employment levels in some agro-industries. Wood and bamboo products were the lead sub-sectors, followed by pan (betel) and cigarettes. Grocery stores, grocery and other food items, confectionery shops, fruit and vegetable industries also saw increased rates of employment. All of these sub-sectors averaged above 10% annual rates of employment growth during this period.

In terms of investment in two critical subsectors, there has been an overstatement of actual growth by comparison to other industrial subsectors in the one serious analysis undertaken. Thus, in only two years since 1976 (1979-80 and 1980-81) has the "fruit and vegetable" industry registered sizeable growth in rates of

investment, once at the large scale and twice at the medium-scale investment level.

In select years the pulp, paper industry (1976-77), the tanning industry (1976-77), the seafood industry (1980-81), the agricultural machinery industry (1981-82), the leather products industry (1982-83), the hydrogenated vegetable oils industry (1983-84) and the leather finishing industry (1986-86) registered comparatively high levels of investment in large-scale enterprise.

In summary, while one can see an overall employment trend in certain agribusinesses, one cannot see an overall investment trend; that is, there has been an increase in employment in some agribusiness subsectors averaging above 10% per annum between 1981 and 1986, but the actual investment in similar subsectors, according to the data used, has been spotty.

In current development planning, food processing is being placed in a hallowed position. Emphasis on the inevitability of a unilinear development path by which the Bangladesh economy will move from an agricultural to an industrial base is no more clearly stated than in the recent UNDP Draft Agricultural Sector Review (ASR), where it is suggested that " Bangladesh could develop agro-processing of fruits, vegetables, mushrooms and spices for export. Such processing and, even more field production of these goods are highly labor intensive activities. Increasing labor costs in SE and East Asian countries which now dominate regional markets for such products suggest that Bangladesh might try to capture part of these markets" (64).

While Bangladesh currently exports fruits and vegetables valued during the 1987-88 fiscal year at TK. 60 crore, it faces many obstacles to achieving this goal, not the least of which is a tremendous need for building a nutritional base at home (65). In fact, the BDG's Investment Centre has found mushroom production infeasible and Bangladesh is currently a heavy importer of spices (66,67).

It is much more likely that the export of raw shrimp and raw and processed jute will continue to lead export earnings in the agricultural sector. The small amount of raw fruits and vegetables exported will probably not grow as domestic markets are opened up. The expansion of shrimp and fish culture in Bangladesh may have a significant impact on domestic food availability and nutrition in the coming decades.

Very few of the major donors have directly tackled the issues involved in developing a food-processing industry. Some of the NGOs, however, have approached this development problem with innovative solutions to a resource scarce environment. Some of these innovations are described below.

III. Models of Agri-Business Growth

There have been many studies written on models of growth in both broad economic terms and specific industrial sub-sectors. The case of the agricultural sector in Bangladesh is no exception. In Bangladesh a great deal more attention has been focused on micro-enterprise and cottage industry, especially by NGOs, than on medium and large scale industry. Micro-enterprise has been the focus of concern because it has direct impact on the poorest segments of the rural population. But development agencies have also been involved in working as sub-contractors to medium and large-scale agri-business in Bangladesh.

Successful agribusiness enterprise has not come easily. But it has come in important ways. A tangential benefit of success for development agencies has been the realization that investment in market development activities is a critical component of continued growth in income-generating projects. This realization has carried with it a whole new set of needs for practical business skills and attitudes which have not been readily available in the past.

The implications of the realization within the development community that market development is essential for change are just being recognized. But, similar to the notion of "Integrated Rural Development", which recognized the importance of a multi-disciplinary approach to promoting change in rural society, the introduction of appropriate technology in income generating projects is leading to the emergence of what could be termed "Integrated Product Development" in new markets.

The examples described below are illustrations of the role markets play in demand creation by linking different kinds of enterprise to one another at different levels of organizational complexity.

A. Integrated Product Development: The Example of the Soybean

The Mennonite Central Committee began seriously introducing the soybean to Bangladesh in 1983. After several years of slow growth, the expansion of acreage has now reached the point where MCC's resources can no longer continue to fuel the growth and it must turn to the BDG in hopes the Agricultural Extension Service will carry the ball further.

The MCC introduced the soybean through its own extension service. A North American bean was discarded as poorly adapted to local environmental conditions and an Indian bean, with characteristics well-suited to the local climate, was eventually chosen.

200 acres of soybean production four years ago has grown to 1000 acres of production this year. The target is for 2000 acres

next year. An INTSOY representative has been contracted by the MCC to conduct a feasibility study on a soybean oil extruder and expeller.

As MCC farm agents succeeded in introducing the soybean they discovered the need for creating market demand. MCC worked on several fronts to remove this barrier to diversified cropping. First, it employed food technologists to develop soybean products for human and animal consumption. Demonstrations were carried out in home kitchens. A local dahl, baby food biscuits and other products were introduced. Simultaneously, the MCC worked with wholesale commodity buyers to encourage them to buy soybeans from farmers. It established a credit guarantee fund to ensure brokers against losses. On a third front, the MCC developed linkages between producers, wholesalers and market outlets in urban areas.

MCC is planning an EXPO on the soybean later this Spring. According to the MCC Director this is not a traditional MCC project, but it has discovered the importance of promotion in insuring the creation of demand for this new product(s) (68).

The model presented here of extension, food product development and marketing is a good example of integrated product development. The introduction of maize as a feed could follow a similar pattern.

This delivery system is relevant to concerns raised by major donors on the problems of crop diversification. Following the UNDP Draft Agricultural Sector Review, "...the low level of diversification is primarily a consequence of the pattern of domestic demands, which is highly food grain oriented because of low income levels" (69).

In this regard, it is heartening to note that the introduction of the soybean is occurring in one of the most depressed agricultural regions of Bangladesh (70).

B. Appropriate Technology: The Example of the Treadle Pump

One of the most outstanding examples of market success through the introduction of an appropriate technology in Bangladesh has been the treadle pump. 238,000 treadle pumps have been sold to date. 20-25 new manufacturers and an association focused on improving the technology have been formed.

Several NGOs have been involved in the promotion of this technology. Initially, one of the NGOs involved in the introduction of this technology acted as a wholesale buyer of the pump from local manufacturers. This function is now being gradually discarded as buyers are going directly to local manufacturers (71).

C. Subcontracting: Handicrafts, shoes, poultry, tobacco, sprayers and ice cream boxes

Subcontracting is a form of agribusiness production organization which has been successfully introduced in many developing countries. In Bangladesh the main example of contract farming is in the tobacco and seed industries. The sugar industry does not really rely on a classical subcontract farming model, although, because by law most (80%) sugar cane farmers must sell only to publicly-owned sugar mills, they have been incorporated into a kind of production contract. There are some cases of subcontracting in the handicraft industry. MIDAS, for example, has successfully introduced a bamboo handicraft industry through sub-contract arrangements at the village level linked through small scale urban business to export markets (72).

The mixed sector Bangladesh Tobacco Company (BTC) works exclusively with contract farmers to assure its raw material supplies. The BTC does its own research and development which is carried to the farmer for field application on a regular basis. The BTC provides a variety of inputs including seed and fertilizer.

Phenix Poultry has its own plans to develop a contract farming system to help expand the supply base for its market network (73). Biman Poultry advises small farmers on ways of improving their productivity. MIDAS is currently promoting a similar sub-contracting model which links village poultry producers to urban markets (74).

Finally, there are several examples of small-scale industries which have grown up out of a need by large agro-industrial firms for locally manufactured products. During its early days in Bangladesh Ciby Geigy, for example, faced a shortage in the market for pesticide sprayers. It discovered that the BDG had forbidden the importation of sprayers in an attempt to force their local manufacture. However, importers of the brass needed for the product sold 90% of the brass and only manufactured a small number of sprayers. Ciby Geigy turned to CARITAS to help it develop the manufacturing capability to supply the market. Today CARITAS has built a small agri-industry around sprayer manufacture (75).

Polar Ice Cream, which has established the first major ice cream plant in Bangladesh, has promoted its products through local manufacture of bicycle-drawn refrigerated carriers (76).

D. The Issues of Labor Intensity, Capital Intensity, Value-added and Growth

The debate on models of growth in agriculture in Bangladesh have become fixated on the problem of the relationships between labor intensity, capital intensity, value-added and growth. This debate has become acute because of the observation of measurably

higher productivity on smaller plots of land and on better rates of return from lending to smaller investors. The relationships between labor intensity, capital intensity, value-added and growth, however, have not been dealt with in a conceptual framework that tolerates flexibility in assistance planning. This has implications for the current emphasis on crop diversification and intensification in Bangladesh.

Because Bangladesh has a labor surplus, one of its main comparative advantages lies in the low cost of human capital in the manufacturing process. Under similar circumstances around the world the advice of developmental specialists has traditionally been to recommend policies which encourage labor intensive agro-industries. By labor intensive agro-industry is meant an industry which can absorb many workers. "Value-added" often means the same thing. You want to have many people adding value through their work to a given product. But it also means profitability for those many persons. The higher the profitability the higher the value added can potentially be. In country after country one can locate lists of these labor intensive industries at a variety of investment promotion institutions.

In Bangladesh the problem of rural industrial development is approached with the same concerns. The need is to find employment for the increasing numbers of people seeking work in agriculture or agricultural-related occupations. The answer to this problem in Bangladesh has usually been to create employment through the expansion of rice production. However, the expansion of rice production in Bangladesh is approaching its theoretical limit. The imperative of diversification and intensification of crop production has thus been identified.

At the farmer level, the relationship between value added and labor intensity in Bangladesh is clearly portrayed in Gisselquist's study on minor irrigation. In field trials he found that for certain crops - bananas, for example, - the highest price return was coterminous with the highest labor intensity (77). This is obviously the mix one wants to achieve in Bangladesh under current labor market conditions, but because markets are dynamic this may not always be possible. The crop might even change. And here lies the need for more flexibility on the part of policy makers. One can attempt to create the environment for growth, but one cannot create the growth itself.

In certain agro-industries, like fertilizer and pesticide production, capital intensity leads to a smaller and more highly skilled workforce, but this does not mean investment in these activities should be discouraged. Importantly, while the production workforce may decline in absolute numbers, the sales force required to reach consumers with the product may increase.

This is particularly relevant to the subject of agri-business because as food processing of any type is introduced marketing and sales become more prominent features of the enterprise. The need is for a much more service-oriented attitude on the part of salesmen who recognize the value of consumer demand. This attitude has been recognized by the Grameen Bank in the development of its corporate culture built on honest community service

Unfortunately, however, one can also have high labor intensity with high value added, but low profitability for either the producer (farmer), the processor or the marketer. The jute industry is one of those industries. In general, it is these kinds of industries where government intervention in the form of subsidies has upset the market's drive to find comparative advantage through its own trial and error method.

There are some nuances involving the relationship between capital and labor intensity in larger enterprise which should be noted here. We described several models of agri-business growth in Bangladesh above which do not fit into the preferred emphasis on labor intensive investments. These models, instead, also build on capital intensive investments. This is because a large scale capital intensive industry may rely upon small and medium-scale industry to provide critical inputs. The issue of sub-contracting is apropos. In Bangladesh Bata Shoe Company uses sub-contractors to supply it with leather made shoes (78). Polar Ice Cream relies on local manufacturers to produce refrigerated push carts (79). The tobacco industry works with contract farmers to supply it with raw material. And Phenix Poultry has a plan to use sub-contract growers to supply birds for their marketing system (80). Again, capital intensity may create ancillary industries of interest to development agencies or stimulate demand for expanded crop production.

There are many ways to support agri-business. Diversification and intensification into higher value-added crops may create opportunities for larger investments in more capital intensive agro-processing. This is not pejorative. Policy makers need to encourage private investors, from the farmer to the urban manufacturer, to activate the process. At this point, it is at the production level where most attention must be focused. If crop diversification and intensification are to take hold, however, food product and market development problems must also be addressed.

IV. Potential growth: Industry Profiles

There is a wonderful Bengali saying which goes "Don't oil your mustache before you eat a jackfruit" (Gache Kathal Gophe Tail). The English equivalent is "Don't count your chickens before they hatch". This is an appropriate epithet for the following section. Prediction is not a science.

A. Raw Commodities

Bangladesh exports a number of raw commodities. Among them are jute, shrimp, tea, leather and wood products. A brief description of the potential for growth in each of these agro-industries as gleaned from secondary literature is given below.

1. Jute

Once the leading earner of hard currency, jute sales abroad have declined in recent years. Although part of this decline has been due to natural disasters, a great deal can be attributed to mismanagement. Public sector mills, including the largest mill complex in the world, are over-staffed and highly politicized. It has been said that 30% of the Adamjee Mill workforce does not show up for work and that some of those on the payroll are fictitious. Jute sales still are, however, a leading export earner and considerable effort continues to be expended on that industry's revival.

The Bangladesh jute industry has been described at great length by many writers. It is worth reemphasizing, however, that the intervention of the government into this industry has been so pervasive for so long that it has almost destroyed the potential for a free market revival. The perception amongst some private jute mill owners now is actually that jute has never been a viable industry. They argue that although exports of jute were larger in previous years, profitability came to depend on government guaranteed export bonus vouchers whose sale in the secondary market became a structural feature of the business.

In recent years, largely because of a lack of reliability, jute buyers are turning away from Bangladesh as a supplier and jute as a material. Unless the jute industry can develop a consumer-oriented attitude, it will continue to decline even with all the best innovations product and design engineers can provide.

The only way to assure a halt to the decline is to fully privatize the industry as soon as possible.

2. Shrimp

The emergence of shrimp as a major export item is a new phenomenon in the history of Bangladesh export market development. The potential for growth is enormous. The markets for Bangladesh shrimp have been created entirely by initiative of the private sector through the development of cold storage processing plants located near the major port of Chittagong and in the Khulna region.

Processors are generally not in the production end of the business. Like the rice industry, farmers reach markets via

middlemen. Farmers are commanding good prices for their shrimp. Whereas ten years ago processors were able to earn 40% profit margins on sales, today a 5% margin is considered good (81). This is largely attributed to the rise in farm cost of shrimp.

A study done in 1984 stated that 5,000,000 potential acres of shrimp farming was possible in Bangladesh (82). The World Bank privately estimates only 90,000 acres of shrimp farms are currently in place (83). This potential acreage coupled with potential growth in shrimp productivity represents an exciting potential food growth area, both for export and domestic food markets.

The main concern of development agencies is the continued availability of shrimp fry. Towards this end the World Bank and the Asian Development Bank have been heavily involved in financing the establishment of government hatcheries. The privately owned shrimp processing industry is currently worried about BDG-owned hatcheries because they expect the cost of fry will increase and put additional pressure on profit margins. The harvesting of naturally grown fry is still the least costly method of developing production on the input side. And one ADB hatchery project has had difficulty in gearing up for operation (84).

With regional production on the increase producers also expect to be squeezed on the demand side as well (85). According to industry sources this may lead to a fall in world prices. If output from countries like Thailand, India, the Philippines and Bangladesh, where huge shrimp culture potential exists, picks up, Asian farmed shrimp production, which already accounts for more than 80% of the world's cultured shrimp supply, could total some 800,000 MT by the year 2000. Importantly, "this is an enormous amount which could not be absorbed by the traditional markets - Japan, U.S.A., Europe - alone, but which could find a market, provided prices fall substantially, in culturing countries themselves" (86).

There exists, therefore, an important potential for increased domestic consumption of shrimp in Bangladesh. The impact on nutrition could be substantial.

3. Tea

The tea industry suffered less disruption during the post revolutionary period, although its earnings have also fluctuated according to world market demand. A number of multi-national firms (Lever Brothers, for example) operate tea estates in Bangladesh and it was the presence of these firms which created stability after Liberation. Continuity in management allowed for gradual rather than radical institutional change. The future of this industry appears secure.

4. Leather

The leather industry, which has seen good growth in recent years, has been driven by high international demand for hides and skins. It is unlikely the observed trend will continue because growth is limited by the availability of domestic hides and skins. This sector is dependent upon the smuggling of cattle from border areas in India.

An increase in the volume of this smuggling is unlikely because the cattle being traded are old. A trip of more than 3 days (from further in the interior of India) would be required to increase the supply and the stamina of these cattle is too weak to withstand the additional time required for transportation to the main markets in Dhaka where most of the tanneries are located.

The BDG has recently banned the export of wet blue hides in an effort to stimulate the leather handicraft industry, but this may have only limited impact. The Institute of Leather Technology continues to have low enrollments, owing to perceptions of low status in the field of vocational education (87).

5. Wood and wood products, including paper

One of the strongest growth sectors in recent years is the field of wood, wood products and paper. The expansion of this sector has ecological limitations and further growth is unlikely to be supported by planners.

Similar to problems faced by the jute industry, the publicly owned paper industry is facing serious financial problems and is being proposed for privatization.

B. Food Processing

Traditional and newly introduced food processing techniques are practiced in rural and urban environments in Bangladesh. A range of technological complexity is also visible in both the primary and secondary processing industries.

1. Primary Processing

At the village level traditional rice husking is practiced. The Engelbert miller is widely used in cottage industry. The modern mechanized milling industry in rice, wheat and soybean oil is currently underutilized.

2. Secondary Processing

Processed food is beginning to appear in urban areas in Bangladesh. This will likely grow in quantity and quality as grocery stores, restaurants and hotels continue to expand. These

service sector businesses need food with longer shelf life and provide an outlet for fresh animal, fruit and vegetable produce.

Aside from grocery store selection and farmers markets for fresh produce, street vendors of agricultural goods are a common sight in Dhaka. Coconut milk, kamranga (star fruit), bananas, sugar cane juice, oranges, pond, various kinds of nuts, potatoes and freshly cut melon are amongst items hawked on the sidewalk. Street vendors can be a dynamic group and improvement of their condition could be the focus of an interesting project. They are close to the market and are bound to increase in number. No studies have been done on this occupational group.

Bangladesh cuisine is an important part of Bengali culture. A great deal is known about traditional food processing in the country, but this has not been consolidated. Cookbooks do exist, and could be analyzed for dishes suitable for pre-processing.

Simple plastic bagging of fried foods and pulse cakes are available (parpar). Snack foods using the potato have made their appearance. Rice is puffed traditionally and in some cases gur rice balls are sold. Chanachur is now packaged. Partially prepared foods, notably, soups, have entered the diet in processed form. Peanut butter and peanut powder is sold.

There should be opportunities for developing food processing for urban markets along these lines, especially in the area of dehydration.

The bakeries subsector is almost wholly dependent upon foreign inputs, namely wheat and sugar, but it has shown steady growth in recent years.

C. Agri-Chemical

One of the most dynamic agri-business subsectors in Bangladesh has been the agri-chemical industry. Aside from the public sector fertilizer industry, the expansion of pesticide production and trading in the private sector has witnessed rapid growth. These firms have some of the strongest marketing departments in the country. They are very competitive and consumer-oriented. Production wages are the highest of any agribusiness.

D. Agri-Engineering

Manufacture of a variety of pumps and assembly of diesel engines is occurring in Bangladesh. Some of it is done with local talent. Some of it under license, especially Japanese. One Bangladesh company, Eastern Manufacturing Company, manufactures bottling machines used in the local food processing industry. Farm implements are manufactured as well.

Growth in this sector will be forced by several factors. One factor is the inevitability of mechanization of agriculture, most likely through the introduction of increasing numbers of power tillers. Pressure will also come to reduce recurrent costs through dependence on local spare parts manufacture and maintenance.

Bangladesh does not lack skills in manufacturing. The author of this paper visited a jute mill which, in its own foundry employees were making fly wheels to repair metal lathes on which it was tooling parts for the mill's looms.

V. Constraints to Growth

A. Policy

1. Government is in and continues to get into agro-processing: jute, sugar, pineapple concentrate, tomato paste, paper and chemicals. This discourages the private sector and burdens government with unnecessary costs. The Bangladesh Chemical Industries Corporation (BCIC) owns five paper mills and the rate of export of newsprint produced at these mills has been increasing in recent years. This, combined with the brisk business being done at roadside saw mills around the country, does not augur well for the future of the nation's forests.
2. The Trading Corporation of Bangladesh enjoys a monopoly on counter trade. This discourages the development of private trading companies whose establishment, ironically, has been encouraged by the BDG.
3. The domestic cost of sugar is a major cost constraint to expanded exports of jams and jellies (88). As processing grows this cost component must be reduced to compete internationally.
4. The current food processing industry needs clearer focus in credit institutions. One processor tried to obtain credit from major industrial banks, but was told that their industry does not have a legitimate "cell" in the banking system. This is a problem of lending by prescription. According to this same source, the absence of a cell for the food industry in the Export Promotion Bureau as well as at the Board of Revenue means no XPL or XPB can be assigned to local producers, if they could export.
5. Import duties on packaging material discourage agro-processing. The UNDP Agriculture Sector Review states that customs duties on packaging materials are prohibitively high, ranging between 67% and 145%.

B. Technology

1. Constraints on the production side restrict growth in food processing. Vegetable and fruit diversification and intensification

is necessary to increase the availability of local raw material produce for processing.

2. The ability to identify commercially viable food processing industry investments is hampered by a lack of knowledge on how to introduce new foods into the market. The relationship between the food research community and the food product development needs to be strengthened. Knowledge of methods of introducing appropriate, cost-effective food product technology is lacking.

3. In the existing food-processing industry adulteration is a major problem and needs to be addressed if Bangladesh wants to get into export markets.

4. Another constraint to export of currently processed foods in Bangladesh is the quality of glass. According to the industry, the alkaline content in glass jars made available to the processing industry is high due to the sodium content of the manufacturing process. This allows for product life of 1 year only.

VI. USAID Programs and Agri-Business

Program	T/A	Training	Credit	Policy Dialogue	Infrastructure
WEDP			X		
MIDAS	X		X		
FD II	X	X	X	X	
USBBC	X				
RCP/FSP	X		X	X	
ARP II	X	X			
Title II & III					X

USAID's portfolio contains a number of projects which have either explicitly or implicitly affected the growth of agri-business in Bangladesh. These projects have addressed issues of policy, technology and market access at the national and firm levels.

A. Policy

In the area of policy USAID has played a leadership role in the field of privatization. It will likely continue this leadership role, but with diminished resources in the coming years.

1. Privatization

One of USAID's main policy initiatives in the agri-business arena in Bangladesh has been in the privatization of the fertilizer

distribution system (8,000 wholesalers and 50,000 retailers) at the Bangladesh Agricultural Development Corporation (BADC). This intervention has had a measurable impact on the expansion of fertilizer use by farmers at reduced cost with resulting increased yields of food.

Other donors are now furthering this cause with major structural adjustment loans aimed at opening up not just fertilizer, but pump equipment and seed sales through private marketing networks. USAID still plays an important role in the privatization effort in fertilizer at BADC. Without its presence the process would probably not continue to maintain its momentum. However, other donors (ADB and World Bank) are beginning to play a bigger financial role and may do so in the future. USAID's impact can be expected, therefore, to diminish in proportion to overall donor assistance levels. The question today is when should USAID leave fertilizer behind and how.

B. Technology Access

USAID/Dhaka has improved the accessibility of agri-business to new technology in Bangladesh with a dual purpose. It has supported the research system as well as assisted in the organization of effective, technically-oriented lending to start-up agro-industry. In the research system the focus has been on providing training and technical assistance in the development of new high yield varieties of rice and wheat for distribution through the public sector to the farming community. In credit institutions the focus has been on developing sustainable lending programs staffed by personnel capable of analyzing the viability of commercially oriented micro and small enterprise.

1. Research and Training

USAID has supported research training at the Institute of Postgraduate Studies in Agriculture (IPSA) and provided technical assistance at the Bangladesh Agricultural Research Center (BARC). It has not generally supported training in the private sector. Most of the technical assistance in research and graduates go into public sector. However, the results of this research may eventually reach the private farmer.

2. Entrepreneurship Development

In the Womens' Entrepreneurship Development Project (WEDP) USAID has set up lending facilities to effect the needs of rural women for credit. WEDP has made 10,549 loans to a total of 8,918 women in food processing, farming related business and cottage industry. These businesses have largely been part-time employment. The loan recovery rate has been estimated at 74%. A 74% recovery rate is low, but far better than many banks in Bangladesh. This

recovery rate must be improved, however, or the loan fund will be decapitalized.

USAID's Enterprise Development Project (EDP) supports the Micro-Enterprise Development Assistance Society (MIDAS) which provides a package of engineering and business development skills to small-scale enterprise. It conducts feasibility studies and provides credit.

In the field of agri-business MIDAS has financed projects in treadle pumps, shrimp farming, fast food, commercial seed production and leather glove manufacture.

MIDAS' rate of recovery is said to be 85%. This recovery rate must be improved or the loan fund will be decapitalized. It has developed some 80 projects and financed 40 since 1983, creating 6500 new, largely full-time jobs.

3. Market Access

USAID has indirectly promoted agri-business by its support of electrification, road construction, flood control, bridges and drainage projects through the use of Title II and Title III funds.

Employment under the Food for Work Program has meant jobs for the rural poor and helped to accelerate the development of rural-urban market linkages through the provision of better infrastructure.

More directly USAID has supported the United States Bangladesh Business Council which has a promotional role to play in developing greater international trade and investment between the U.S. and Bangladesh.

VII. Concluding Remarks and Recommendations

USAID priorities for agri-business in Bangladesh in the coming decade should be approached in three dimensions, involving a program refocus at the policy and firm levels.

A. Integrated Product Development: New Program Focus

USAID has been involved in the support of research and business development projects. This support has occurred in separate programs within the USAID portfolio. The research focus has been located in the Office of Food and Agriculture and the private sector focus has been located in the Project Development and Engineering Office. Although both programs have been complementing one another, this complementarity is inchoate, and needs to be better articulated.

In the next decade one of USAID's challenges will be to integrate these two development initiatives. This is as important for USAID's program management structure as it is for agri-business in Bangladesh. Research is not being delivered quickly enough to the farmer, the processor or the salesman in Bangladesh.

The merging of research and development activities is made more urgent by the current emphasis placed on diversification and intensification of crop production. These are two of the most often pronounced words in Bangladesh agriculture today. It is likely that they will be echoed in the Fourth Five Year Plan as major development objectives in the agriculture sector.

Very few donors have really gone into the how of this policy initiative, except to suggest the goal of expanding export markets. Farm level, factory level and market level interventions have not been organized.

The how is, however, very important. We have suggested a model taken from the Mennonite Central Committee's work with the soybean which combines extension, food technology and market assistance in what we call an "integrated product development" strategy. If major donors like USAID want to take steps to promote diversification and intensification, this might prove to be a useful part of the project evaluation process.

It has taken the Mennonites a long time to carry the soybean this far, but, in combination with policies supporting crop diversification and intensification, it has achieved the impact desired. Exactly how USAID can promote this kind of strategy through existing projects or in future allocations is not known. It may be that this could be used as a thematic approach to restructuring the research system in order to link the development of new seeds, cropping patterns, fertilizers, irrigation techniques, etc. into the commercial food processing industry through commercial marketing channels.

In the field of food technology the current state of Bangladesh agri-business is very low. What is known about food processing is also very little, other than adulteration is a problem. Although some analysts are asserting strong growth in the food manufacturing level, we remain to be convinced. There has been some growth in the food manufacturing sector but exactly what kind of growth and how much is unclear. Projecting the employment generation potential also requires too much guessing. If food processing is going to be a priority, a great deal more research needs to be done before appropriate technical assistance can be provided. Perhaps more importantly, food production levels must increase to provide the surplus needed to drive agro-industrial growth.

The United States economy is a recognized world leader in the fields of agro-processing, agro-chemicals, agricultural engineering and agricultural services. It is a leader in the field of agricultural education and research. We have a great deal to offer in the way of a practical integrated product approach.

B. Policy Reform

Within the context of a programmatic refocusing on integrated product development aimed at building linkages between the research community and agri-business, there are two main policy areas on which USAID should focus in the coming decade: privatization and trade.

1. Privatization

As divestiture of public enterprise continues, USAID can continue to play an important developmental role at the policy level. During the next program period USAID should consider shifting resources from its main effort on privatization of the fertilizer marketing system to different privatization emphases in the fertilizer industry or to other areas outside of the fertilizer industry altogether. Some areas of consideration could be the privatization of fertilizer production or privatization of other government owned agro-industries.

USAID's future role in fertilizer will depend on potential changes in the role of the Bangladesh Chemical Industries Corporation (BCIC) and the BADC. USAID will have to monitor the privatization process through its Fertilizer Development II Project at BADC to see how events play themselves out.

If USAID and the Government of Bangladesh (BDG) agreed to work together to privatize fertilizer production, it would probably take another ten years, at least, to accomplish. Getting the BCIC to agree to that goal may itself be problematic (85).

USAID's possible role in furthering the privatization process in other government owned agro-industries would be a qualitatively and quantitatively different obligation from past privatization initiatives. Qualitatively, the privatization of the publicly owned jute, sugar, paper and cotton industries could not be implemented with the same kind of broad impact that privatization of the fertilizer industry has had on agriculture. These are specific industries with specific problems reaching particular groups of farmers, processors, and markets. Whereas the fertilizer industry's product cuts across sub-sectoral boundaries these industries do not.

From the point of view of quantitative impact, USAID involvement in a more broad-based privatization effort might be

cost effective. On the one hand, USAID would probably not have the same magnitude of leverage over industry it has had through the provision of the kinds of mini, structural adjustment loans offered to coopt the BADC into the privatization. On the other hand, technical assistance in the process of privatization would not be as costly, if hard currency grants were not necessary.

The direction privatization of Bangladesh agro-industry will take is, as of yet unclear; however, divestiture of unprofitable public enterprises is likely to continue. If past government policy is an indication, this divestiture will be a partial privatization of the greatest failures of public enterprise with continued government ownership of some marginally profitable milling operations. This strategy of partial privatization is probably politically expedient, but it does not promote the kind of structural change, which is the desired goal of the divestiture process. What has happened in the jute industry, for example, is that the private sector mills are still not weaned from public sector largesse or influence; largesse in the form of subsidized loans, and influence in the form of public sector wage hikes which are, by default, accepted in private industry as a fait accompli for their workers, is the norm.

Unless the BDG fully divests itself of the jute industry, the process of structural change will be delayed or, perhaps, never achieved. The same principle holds for the other publicly owned agro-industrial sectors of cotton, sugar and paper.

The desirability of an expanded USAID role in privatization centers on the issue of inevitability. Privatization of some of these industries is already taking place or being considered. The jute industry is already, but only partially privatized and the divestiture of some paper mills is being publicly discussed. The sugar mills cannot compete with local gur manufacture. In short, the BDG may be forced to continue to move the country in this direction for economic reasons without anyone's assistance.

The viability of an expanded USAID role in the privatization process centers on the question of comparative advantage. The US does not have extensive corporate experience in the jute industry and it would be hard to find a US sugar industry executive who does not believe in subsidies. Similarly, while the US may have some comparative advantage in the paper industry, in Bangladesh it may be neither an economically nor an ecologically viable business.

In the field of privatization policy the US does, however, have some strengths. USAID has sponsored the establishment of the Center for Privatization which has been developing considerable experience in this whole area. Over the next decade a concerted USAID/Dhaka focus on privatization as a technical process could be a valuable contribution to the development of healthy agro-industry in Bangladesh.

2. Trade Policy

Another policy area which needs attention, especially as it relates to agro-industry, is the area of export market development. Historically, Bangladesh has looked to agro-industry, primarily jute, as the basic source of its hard currency earnings. The more recent emergence of shrimp as an important export earner is another reason agro-industry is in the forefront of hard currency debates. As long as overseas markets are found for raw agricultural goods or processed products and as long as other non-agricultural sectors cannot generate enough hard currency to meet the needs of the country, the agricultural sector will be turned to for earnings.

The preeminence of agro-industry in export policy is clearly stated in many expert papers, including the UNDP's Agricultural Sector Review where Bangladesh is encouraged to get into the export targeted production and manufacture of processed foods. This relates to the whole emphasis on crop diversification and intensification.

Currently, Bangladesh does export some fruits and vegetables and may be exporting some very limited supplies of processed food. However, this export of food is a rightfully controversial subject in a food poor environment. While it is encouraging to read of the planned export of 1800 metric tons of pineapple concentrate by the year 1991 from a publicly owned concentrate plant, for example, it would seem to make economic sense to let local private industry use these products to develop the domestic market. The potential nutritional and employment impact is not insignificant.

If overseas markets pay top dollar for Bangladesh food and food products, there is little that can stop this outflow without strong government intervention which USAID would not support. On the other hand, under the current conditions of food scarcity, public investment in the development of a BDG-owned, export oriented fruit and vegetables industry is not a wise allocation of resources.

Using reverse logic, if the expansion of the private sector shrimp industry continues, international prices are likely to fall. This is expected to lead to increased opportunities for growth of the domestic market.

USAID can work with the BDG to analyze trade policy as it relates to resource allocation. This would be a new area in which no donors are currently active.

C. Firm level: Job Creation

At the firm level the development of agri-business, especially in the fledgling food manufacturing industry, will need assistance in technical areas.

USAID supports the development of local agri-business through its funding of the Micro-Industry Development Assistance Society (MIDAS). MIDAS is able to deal with concrete investment problems through its staff of engineers and business analysts. In some ways this can be likened to the business development department of a U.S. corporation.

MIDAS serves as a practical link between technological, financial and marketing components for the investment community. In this regard, it is one of the most successful investment banks in Bangladesh, although it needs to be strengthened further to develop its financial viability.

Currently, MIDAS maintains informal links to the university and research institutes. It believes informality is much more dynamic than formalizing an institutional arrangement. It uses professorial talent in its consultant work.

D. Specific Recommendations

PROGRAM

1. USAID should explicitly promote an INTEGRATED PRODUCT APPROACH thinking in project design and between projects. For example, MIDAS could be linked to Fertilizer II and the ARP II in an effort to develop a delivery mechanism that packages technical assistance with policy dialogue (privatization) and training. (Example: Seed farm at MIDAS, seed privatization at BADC and research and training at BARC)

POLICY REFORM

1. USAID should develop a long-term strategy to work with larger business groups to achieve full privatization in the following industries: jute, sugar, paper, fertilizer, agro-chemical and agricultural credit. The Center for Privatization is a logical choice for assistance in this area.

2. USAID should work with the government to define more closely the relationship between trade policy, agricultural production and private versus public sector investment priorities. Example: The country is exporting pineapple concentrate, but has no local juice industry. If Pepsi and Miranda can get into rural areas so can a local tetra pak. The impact on nutrition is higher. Example: The Trading Corporation of Bangladesh should relinquish its monopoly on countertrade.

3. USAID should explore ways to work with the Bangladesh Standards and Training Institute to assist in the development of a better grading and labelling system (low, high grade) to help consumers differentiate between products.

TECHNOLOGY ACCESS

1. MIDAS should be strengthened in 3 areas: (1) financial management, (2) entrepreneur identification and (3) agri-business project identification skills. Currently MIDAS has a stated 85% loan recovery rate. In Bangladesh this is a very high recovery rate, but it needs to be improved to make MIDAS sustainable. Resources need to be expended in the area of entrepreneur identification. A recent GTZ project has developed a model of screening and training which should be supported by USAID and institutionalized within MIDAS. One of the foci of future IESC assistance should be on agri-business identification at MIDAS.

2. USAID should request the Employment and Enterprise Policy Analysis Project or the Enterprise Policy Reform project to undertake a survey of the food-processing industry, including traditional cottage-industry and more newly mechanized processes of food transformation. The purpose of this survey would be to establish a benchmark for growth.

3. USAID should bring out Project Sustain on a reconnaissance visit to look at the private food industry by targeting several food industry groups (jams, jellies). No major donors are working in this area of processed foods. The US has a comparative advantage in this field.

4. USAID should encourage the organization of a seminar or a series of seminars on food processing opportunities through MIDAS using PRIP resources with coverage in the ADAB Newsletter. Demonstrations of different kinds of food popular in the Bengali household could be prepared. First an inventory of basic ingredients, primary processed ingredients and then more complex pre-processed ingredients. This could be followed by a series of home economic workshops in secondary towns organized by womens' cooperatives. The knowledge of womens' role in food processing gathered through the WEDP project is relevant here. Themes such as pride in Bengali culinary tradition should be linked to developments of new processing industries.

5. USAID should explore ways to work with the Packaging Association to address the problem of adulteration. MIDAS' work in the area of packaging technology might be relevant. An IESC volunteer might look at the capping industry to devise ways to assure quality control through improved capping procedures.

Z TRAINING

1. USAID should commission a study on agricultural product dealer training currently practiced in Bangladesh. The purpose of this study would be to develop an understanding of opportunities for transferring new techniques through private markets. Targets include USAID's own fertilizer dealer training, the pesticide industry, the irrigation industry, the seed industry and agricultural machinery manufacturing industries.

2. USAID should explore ways it can assist the Institute of Business Administration in developing a course on agri-business.

3. USAID should explore ways it can promote the acquisition of agricultural credit analysis skills at the local level. Rapid Rural Appraisal techniques need to be added to the skills portfolio of extension agents and lending agencies in Bangladesh.

FOOTNOTES

1. Humphrey, Clare, Privatization in Bangladesh - Volume I, Center for Privatization, August 1988
2. Office of Project Development & Engineering, "Private Sector Strategy - Constraints Analysis and Strategy Elements", USAID, 21 December 1988
3. Trade Associations provide an additional institutional form for private business to lobby for better government policy. Among these are at least eight separate dues-based and voluntary agri-business related trade associations, including the National Fertilizer Distributors Association, the National Seed Traders Association, Frozen Food Exporters' Association, the Bangladesh Oil Mills Association, and the Bangladesh Jute Mills Association (private jute mill owners). Other associations include the Packaging Industries Association of Bangladesh, the Vegetable and Refiners Association, the Bangladesh Cold Storage Association and the Bangladesh Tanner's Association.
4. Humphrey, Op. cit.
5. Navin, Kevin "Institutional Credit in Bangladesh Agriculture" (Draft) USAID, August 1987
6. Ibid
7. 1987 Statistical Yearbook of Bangladesh, p. 103

EASC	Description of industry	Total	Male	Female
11	Agr., livestock, fishing	16169	15938	231
12	Forestry and logging	27	22	5
13	Fishing	508	508	0
31	Manufacture (food, beverage & tobacco)	580	403	177
32	Textile, wearing apparel, leather	1208	907	301
33	Wood and wood products	118	87	31
34	Paper and paper products	56	56	0

8. Report on Labour Force Survey 1984-1985, February 1988, p. 69

BSIC CODE	INDUSTRY DESCRIPTION	EMPLOYED PERSONS ('000)
111	Agricultural production	16014
621-622	Groceries and other food items	1976
130	Fishing	454
311-312	Food	328
314	Tobacco	252
631	Restaurants, cafes	251
391	Handicrafts	155
114	Livestock, poultry rearing	147
611	Raw materials (agricultural)	122
617	Food	100
331	Wood and cork products (ex. furn)	79
624-625	Furniture, home furnishing, appliances	40
121	Forestry	27
613	Lumber & Construction material	26

The figures are misleading in that livestock and poultry rearing, fishing, wood, tobacco, and raw materials are not full-time occupations of the large numbers of people designated as members of these occupational groups. BSIC Code 311-312 covers activities primarily relating to the preparation, processing and preserving of all food items except beverages and tobacco. BSIC Code 617 covers activities primarily relating to the resale at wholesale of foods such as fruits, vegetables, groceries and provisions, poultry and meat, dairy products, fish and seafood, confectionery and bakery products, etc. "Arot" of food items is also included here.

8. (continued) In the "1987 Statistical Yearbook of Bangladesh", p.101

BSIC	Description of Industry	Total	Male	Female
6	Ag., Forestry, Fisheries	16708	16471	237
61	Cultivators	5871	5809	62
62	Persons engaged in specialized	10306	10137	169
63	Persons engaged in animal husbandry	24	18	6
64	Other non-cultivating agriculturalists	507	507	0
73	Wood preparers and paper makers	23	23	0
77	Food and beverage procedures	302	184	118
78	Tobacco preparers and cigarette makers	216	152	64
80	Shoemakers and leather goods maker	42	41	1
81	Cabinet makers and related wood workers	37	37	0
91	Paper and paper board products	9	8	1
92	Paper and paper board makers	25	25	0

8. (continued) In the "Report on Labour Force Survey 1984-1985", February 1988, pp. 64-65. Note the discrepancy between BSIC Code 77 above and BSIC Code 311-312 in the previous footnote.

BSCO Code	Description of Industry	Employed Persons
621	Farm crop workers	10156
611	Agricultural crop farmers	5871
641	Fishermen	507
452	Street vendors and door-to-door salesmen	215
789	Tobacco preparers and tobacco product makers	212
771	Grain millers and related workers	182
942	Basketry weaver and brus makers	141
624	Livestock workers	124
776	Bakers, Pastry and Confectionery makers	60
531	Cooks	38
811	Cabinetmakers	35
779	Food and beverage processors not elsewhere classified	30

9. 1987 Statistical Yearbook of Bangladesh, Bangladesh Bureau of Statistics, July 1988, p. 110

10. Mimeographed monthly data sheet, BJMA. A brochure prepared by the Bangladesh Jute Mills Corporation (BJMC), the representative organization of public sector jute mills, states there are 600,000 employees in the jute industry. It is not known whether this figure includes farmers producing jute as well as industrial workers. It does appear high.

11. Private Sector Strategy Op. Cit. p.6

12. Sahota et al, An Identification of Dynamic Sectors and An Assessment of the Impact of Policies - Further Evidence from the Economic Census, 1986 (HIID/ESEPP Project, 15 January 1989, Table 5, p. 27)

Industry Code	Industry Name	<u>Mean Annual Growth Rate</u>		
		Epoch 1 1972-75	Epoch 2 1976-81	Epoch 3 1982-86
3112	Dairy products	3.04	10.84	10.90
3311	Saw and planning mills	8.61	9.93	11.60
3315	Str. products of bamboo	1.49	4.67	16.70
3319	Wood, cork	6.39	15.37	18.69
3321	Wooden furniture	9.83	11.78	17.57
6131	Lumber and timber	9.28	9.78	10.77
6173	Tea	3.79	1.36	12.64
6211	Grocery Stores	8.17	8.84	11.89
6216	Fruits	6.19	9.03	10.30
6217	Vegetables	7.67	7.57	11.12
6218	Milk or milk products	2.70	2.61	6.76
6219	Sweetmeats	8.52	5.97	11.01
6221	Pan and cigarettes	7.48	9.48	14.64
6222	Confectionery Shops	7.10	8.96	12.61
6229	Grocery & Other food items	6.29	7.60	11.34
6261	Timber and lumber	7.32	7.58	12.09
6296	Hay fodder and animal feeds	8.29	6.23	8.76
6297	Traditional fuels	10.48	9.69	12.27
6313	Tea stalls	8.34	7.53	11.87

13. Rashid, Raka "Expansion of Women's Participation In Rural Markets and Rural Commercial Areas - A Feasibility Study", March 1987.

14. Centre on Integrated Rural Development for Asia and the Pacific. (CIRDAP) "The Role of Women in Rural Industries Volume 1 - Scope and Executive Summary of the Regional Study", August 1988, p. 13

15. ADAB News, May-June 1987
 16. Shamsul, Khawja, "The Development of NGO's in Bangladesh", ADAB News, May-June 1988, pp. 1-6
 17. Mohamad Yeasin, Chairman, Deedar Total Village Development Cooperative Society, Comilla, Bangladesh
 18. Meeting with Chuck Antholt, Agriculturalist, World Bank 13 February 1989.
 19. Agriculture Cooperative Development International, Inc. "Private Sector Agribusiness Cooperative Development in Bangladesh - A Concept paper" USAID, June 1988
- See also Foch's "Review of the Livestock Sector in Bangladesh" Ford Foundation, Dhaka, p. 14
- "The Bangladesh Milk Producers' Cooperative Union Limited (BMPCUL) was set up in 1974 to supply Dhaka with milk by organizing milk collection in the country's milk pockets. BMPCUL is a two tier cooperative organization with about 32,000 members organized into 265 Village Milk Producer's Cooperative Societies. The organization operates in Pabna, Faridpur, Tangail and Manikganj and maintains milk processing facilities there as well as in Dhaka. Besides milk collection services the organization provides its members with veterinary and extension services and maintains a crossbreeding programme.
- BMPCUL has been set up with significant foreign technical and financial assistance and is under the administrative control of the Ministry of Local Government, Rural Development and Cooperatives. The Cooperative has been a loss-making enterprise during most of its history and is so now. The processing facilities are under utilized and about 40 percent of the village level cooperatives are not functioning. An extension of the scheme to areas around Chittagong and Khulna, originally envisaged for the second five year plan, has not materialized."
20. Discussion with Dr. Tony Garvey, Deputy Project Director, ISPAN, 30 March 1989, Dhaka
 21. Ibid
 22. Renfro, Dr. Ray "Bangladesh Fertilizer Marketing and Subsidy Policy Options" Internal AID Study. Undated, p. 21
 23. The Bangladesh Observer, 5 April 1989, p. 9. "Ten more public sector units are likely to be transferred to the private sector within the current year...Paksi Paper Mills alone incurred a loss of Taka 10 crore last year. Similarly,...Karnaphuli Paper Mills and Khulna Newsprint run on perpetual loss. The govt subsidy is the

only means for them to get going, said Prime Minister Moudud Ahmed while addressing the members of Chittagong Commerce and Industry recently."

24. Meeting with Fazlul Haque, Freedom Fighters Welfare Trust, Dhaka, Bangladesh, 14 March 1989

25. Discussion with Dr. William Judy, Team Agronomist, Agricultural Assessment Analysis. Dhaka.

26. Discussion with Frank Wiebhe, Director, Mennonite Central Committee, Dhanmondi, Dhaka, Bangladesh, 2 April 1989

27. Ray Morton, USAID Officer

28. Agro-Industries and Industries Ltd. "Feasibility Study on Commercial Seed and Dehydrated Fruit and Food Manufacturing Plant" July 1987, p.32

Import of some vegetable seeds for part of 1987 are listed below:

Product	Quantity (kg)
Radish	114,000
Cabbage	9,100
Cauliflower	8,600
Tomato	2,300
Carrot	1,800
Lady's Finger	20,000
Watermelon	8,000
Brinjal	1,000
Beans	400

These seeds are imported from Japan, India, Taiwan, Holland, U.K., Korea, Denmark.

29. The Bangladesh Observer 4 April 1989 pp 1,10.

Bangladesh has exported agricultural products worth Taka 30 crore in eight months till January last. The target set for export of such items during the current fiscal year (1988-89) is Taka 86 crore.

The export earning through export of agricultural products during 1987-88 was Taka 60 crore against the target of Taka 86 crore.

Vegetables occupy a major share in the export earning of agricultural products. The export earning through export of vegetables alone in the last eight months was Taka 21 crore as against export earning of Taka 25 crore in 1987-88, according to Export Promotion Bureau sources.

All types of vegetables are being exported to some European and Middle East countries. The items now being exported include gourd, pumpkin, beans, cucumber, karalla, luibba, brinjal, puishak, aram, mukhi, aram leaves, patshak, barbati, data, green chilli, patal, potato, jhinga, etc.

Exorbitant price of most of the items of vegetables persists in country due to short supply. The production of vegetables suffered a serious setback following unprecedented floods and cyclone last year. Some items maintained a high price.

Concerted efforts to boost country's vegetables production is lacking. With utter disregard to the local needs, the concerned authority appears to have concentrated on export of vegetables, fish and eggs. This has resulted in prohibitive prices of the items in the local market. These items are now almost beyond the reach of the common man.

While promoting exports of vegetables, fish and poultry birds the authority must also take steps side by side for increasing production."

30. UNDP op. cit. p. 47

31. Ibid

32. Ibid I-6

33. Discussion with Mohammad Ahmad, Managing Director, Ahmad Food Products

Ahmed Food Products has been in business in Bangladesh since 1983. The owner currently employs about 100 persons in his factory. Three-quarters of the labor force are women.

Ahmed has financed his growth from his own resources. He tried to secure credit at a local industrial bank, but could not because banking officials were unable to identify his business as eligible for a loan. Food processing did not fall into one of the categories for lending.

Ahmed complies with Bangladesh labelling and standards regulations. But he admits many do not. Adulteration is a problem for him because less expensive, adulterated varieties compete with his product.

35. Discussion with Dr. Shamsul Haque, Institute of Business Administration, Dhaka University, 2 April 1989

36. Price Waterhouse Asia Pacific, Op. Cit. p.43

37. Export Promotion Bureau, "Export From Bangladesh During the Fiscal years 1972-73, 1983-84, 1986-87, 1987-88"
38. UNDP op. cit. I.1
39. UNDP op. cit. I-2
40. Ibid, p. 31
41. Discussion with Kamran Rahman, Managing Director, Pubali Jute Mills, 10 March 1989
42. Price Waterhouse Asia Pacific, "Foodgrain Storage and Marketing Study Project," June 1988, p. 37

One of the strongest themes to run through literature describing rural markets is the undesirability of the Middleman. Characterized as an unscrupulous exploiter of the farmer. This Middleman is universally excoriated in Bangladesh by financial institutions, village cooperatives, foreign donor groups, the Bangladesh government, and processors. This is not unusual. In many societies the scapegoating of this informal service sector is one of the most constant features of the debate on social welfare. It is rare, however, to find a rational analysis of the services middlemen perform. It is even rarer to find an appreciation of the beneficial aspects of this informal marketing, credit and technical assistance roles.

The dislike of middlemen by the outside observer is due to his or her belief that the farmer is being unfairly denied the higher profit margins he could obtain if he directly marketed his goods in distant areas. The consumer, who cares to think about it, dislikes the middleman because he believes he could pay less for his food without him. The local government official dislikes the middleman for these same reasons and because he generally may not understand that profit is the middleman's salary. The non-profit, private voluntary organization does not appreciate the middleman because profit is not a philanthropic motive. Unfortunately, middlemen do not receive salary checks at the end of the week with guaranteed earnings and vacation.

In Bangladesh profit has also become synonymous with exploitation. The notion of profitability in a non-exploitative environment is difficult for members of the emerging urban middle class to conceptualize. And it is the middleman who embodies this exploitation-for-profit principal.

As C. Peter Timmer has pointed out the attitudes of the urban middle class, two or three generations removed from the rural areas, has a powerful impact on policy. While they may abhor middlemen for ideological reasons, it is precisely from this occupational base they probably earn their living. Contrarily, in

rural areas, middlemen are viewed with some envy. In one of the best AID/Dhaka market analyses potential women entrepreneurs in rural areas 34% of respondents expressed their strong interest in becoming wholesalers.

In countries where a formal, urban commercial banking system has been introduced as the result of a demand for international banking services, traditional credit institutions have generally been ignored rather than incorporated into new lending practices. Bangladesh fits this pattern.

These informal credit facilities are, at any rate, unlikely to disappear until a favorable alternative is introduced. Charges that middlemen exploit small borrowers with high interest rates ignore the high risks these lenders take. USAID's Rural Finance Project calculated that borrowers could bear 36% lending rates with no hardship. If the banking system had coopted money lenders more completely, it may have been avoided the large losses it has experienced in recent years.

Because agricultural trade depends so heavily on credit as a means to produce and transport goods in a largely rural society, it is critical to have services available which meet demand. Moneylenders or creditors from among the trading community meet that demand where formal banking institutions cannot.

There are different middleman structures in different commodities in Bangladesh. Importantly, middlemen in the Bangladesh economy are involved in all commodity marketing systems. Almost every crop, livestock sector and service institution (credit) of concern here is affected by their activity. Middlemen are being incorporated into the banking system and are relending money obtained from local banks at higher rates to their own clientele. While government policy can try to discourage this practice, it is more salutary for the banks to coopt these lenders by bringing them into the banking system as market extensions.

As an economy expands and becomes more complex it creates a demand for services. The issue of development of the service sector is rarely considered as a major constraint on economic change in donor work. But it is often in this sector where the greatest impediments to efficient production, processing and marketing occurs. Middlemen form the labor pool by which this service sector grows.

43. Renfro, Op. Cit

44. Discussion with Saeedul Alam, Marketing Manager, Ciby Geigy (Bangladesh) Ltd.

45. Navin, Op. Cit.

46. Ministry of Industries "Industrial Investment Schedule for the Third Five Year Plan (1985-90) For Private Sector (Large and Medium Industries)", p. v.

47. Ibid. iv.

48. BSCIC, "Small Industry Investment Schedule 1985-90", Feb 1987, unpaginated, first several pages in volume.

49. Ibid.

50. Ministry of Industries and BSCIC, op. cit.

51. Sahota et al. Op cit. Study No. 16, pp. 9-10.

Mean Annual Expansion Rate

Industry Code	Industry Name	Epoch 1 1972-75	Epoch 2 1976-81	Epoch 3 1982-86
3241	Leather footwear	6.12	5.40	15.17
3311	Saw and planing mills	9.66	10.68	13.14
3315	Bamboo products	4.42	14.64	16.43
3319	Wood, cork products	4.39	7.30	16.16
3321	Wooden furniture	9.69	11.32	19.50
6143	Ag machinery & supplies	5.09	3.09	24.57
6171	Fruits & Vegetables	2.53	8.29	12.36
6173	Tea	11.15	1.39	18.06
6217	Vegetables	6.72	7.62	11.00
6221	Pan and cigarettes	6.93	8.90	15.16
6222	Confectionery Shops	5.75	9.94	15.11
6263	Timber and lumber	8.66	8.18	13.83
6313	Tea stalls	7.18	7.63	12.79

52. Sahota et al. Op Cit. Study No. 18, p. 26

53. Ibid. p. 11

54. Ibid. p. 20

55. Ibid. p. 35 and p. 46

56. Planning Commission, "The Third Five Year Plan - 1985-1990"
December 1985, p. 221

Industry Groupwise Provisions and Investment
Sanctioned During the Second Plan Period (1980-1985)
(Taka in Crore)

Industry Group	Provisions			Sanctioned		
	Large/ Medium	Small	Cottage	Large/ Medium	Small	Cottage
Food & Allied Industries	273.76	57.70	13.75	564.595	43.944	4.903
Forest Products & Allied Industries	11.70	11.76	14.37	13.878	4.846	3.988
Paper, Board, Printing & Publishing	36.57	28.42	1.75	72.035	9.588	0.101
Tannery, Leather & Rubber	95.06	38.80	4.38	91.546	9.622	0.346

57. Planning Commission, op. cit. p. 273

Gross Value Added of Industrial Products
by Major Industrial Groups (million taka)

	80/81	81/82	82/83	83/84	84/85
Food Manufacturing	1483	1879	2415	2540	1861
Beverage	138	163	156	388	300
Tobacco	1750	2043	2497	2647	2830
Leather & products	275	212	253	122	135
Leather Footwear	62	95	118	79	81
Wood & Cork Products	47	75	58	88	96
Wooden furniture	23	28	35	13	14
Paper & products	352	396	433	595	666

To calculate the total gross value added contributed by these agro-industries, I summed the yearly columns and divided by the gross value added of all industrial sectors in that year. In 1980/81 the equation was $4130/14129 = 29\%$, in 1981/82 the equation was $4941/15711 = 31\%$, in 1982/83 the equation was $5965/18832 = 32\%$, in 1983/84 the equation was $6472/20077 = 32\%$, and in 1984/85 the equation was $5983/21923 = 27\%$. 1984/85 was the beginning of serious problems in the international jute industry.

58. Ministry of Planning, op. cit. p. 261

	Number of Reporting Factories by Major Industrial Group				
	80/81	81/82	82/83	83/84	84/85
Food Manufacturing	479	490	517	549	611
Beverage	5	6	6	6	6
Tobacco	29	29	28	27	23
Leather & products	118	117	119	125	133
Leather footwear	6	3	6	5	5
Wood & cork products	22	24	22	32	33
Wooden furniture	17	16	15	17	18
Paper & products	30	29	29	31	26

59. Ministry of Planning, op. cit. p. 268

	Average Daily Employment by Major Industrial Group				
	80/81	81/82	82/83	83/84	84/85
Food Manufacturing	28062	27151	27020	28941	29875
Beverage	260	309	358	435	515
Tobacco	4671	4684	5038	4709	4370
Leather & products	1816	1846	2167	1906	1936
Leather footwear	140	664	692	723	754
Wood & cork products	1175	1506	1297	1638	1707
Wooden furniture	895	850	856	766	727
Paper & products	5780	5725	5569	5615	5560

60. Ministry of Planning, op. cit. p. 272

	Industrial Cost Statistics by Major Industrial Groups (million taka)				
	78/79	79/80	80/81	81/82	82/83
Food Manufacturing	2423	2644	3210	4225	4821
Beverage	32	36	56	70	59
Tobacco	648	769	816	1039	1056
Leather & products	1107	1043	921	1109	1368
Leather footwear	70	85	101	172	191
Wood & cork products	28	56	88	88	82
Wooden furniture	18	16	30	33	60
Paper & products	477	616	1022	1186	1256

61. UNDP op. cit. p. III-33

62. Navin op. cit. p. 45
63. Ibid.
64. UNDP, Op Cit. III-7
65. Bangladesh Observer, Op. Cit. 4 April 1989
66. Investment Advisory Centre, This study concluded the export of mushrooms not feasible in Bangladesh
67. Bangladesh also imports large amounts of spices
68. Discussion with Frank Wiebhe, Director of the MCC, 2 April 1989, Dhaka
69. UNDP op. cit. p.
70. The district of Nokahali
71. Discussion with Bob Nanes, Project Manager, International Development Enterprise, DHaka
72. Micro Enterprise Development Assistance Society (MIDAS), "Annual Report 1987-88"
73. Discussion with Phenix Poultry, 3 April, 1989, Dhaka
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76. Discussion with Humayun Kabir, Director Production, Dhaka Ice Cream Inc., Ltd.
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84. Ibid.
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88. The sugar industry is built around 16 mills owned by the Bangladesh Sugar and Food Industries Corporation (BSFIC). They are strategically located in sugar cane growing areas. Farmers within a 10-15 mile radius of the mills must, by law, sell their cane to the mill. The mills produce between 100,000 and 150,000 metric tons of sugar annually which is sold through twenty dealers on a weekly basis. Approximately 80% of sugar cane growing land falls within this scheme.

On the remaining 20% of land and at night when government officials cannot see, sugar farmers produce a lower grade sugar known in the market place as gur (or paragur, khandasweri). Using this method farmers produce 500 - 600,000 metric tons of gur sugar for the local market which pays a premium price for the native variety. This unofficial market is putting sugar cane mills out of business.

Bangladesh also imports between 200,000 and 300,000 metric tons of refined sugar annually to make up for the shortfall it experiences. Currently, the sugar mills produce sugar at an estimated \$400.00 per ton. The world price is about \$240.00 per ton.

This disparity has negative consequences for the development of the jam and jelly processing business because one of its main ingredients, sugar, is so costly. Processors must buy Bangladesh sugar at the high price of Tk. 25 per kilogram when it can buy the same amount for Tk. 11 per kilogram in India. Under the current situation Bangladesh could not compete in international markets for jam and jelly sales competitively in price. Quality of product is another issue.

This is a clear impact of major government owned production distorting the price structure against growth within the food processing industry.

88. One might approach privati of production by suggesting a mixed sector corporation as an initial intermediate step to full privati. BCIC is already an investor in Ciby Geigy (Bangladesh) and the Bangladesh Tobacco Company. It understands the viability of such arrangements. In general, the BCIC is probably not opposed to

discussing divestiture of some of its operations. The troubles at its paper mills have already been widely publicized in the press which appears to be expressing a government desire to privatize these facilities.

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APPENDIX

1. Export of Principal Commodities *
 - a. Jute and Jute Goods
 - b. Leather
 - c. Frozen Food (Seafood)
 - d. Tea
 - e. Ag Products
 - f. Newsprint, paper
2. Treadle Pump Sales: 1979-1989 **
3. Rice Mill Utilization
4. Agricultural Loans Issued by Major Credit Institution
5. Womens' Entrepreneurship Development Program ***
 - a. Loans Disbursed
 - b. Loan Composition
6. Article on Shrimp Culture
7. Estimated Suitable Acreage for Shrimp Farming in Bangladesh
8. Article on Conflict Between Rice and Shrimp Farmers
9. Article on Hatchery Development

* Taken from Bangladesh Economic Survey - 1987/88, p.264 b & c

** Courtesy Bob Nanes, Project Director, International
Development Enterprise

*** Taken from Webster, Russel et al. "Bangladesh Country Draft
Report - Micro-enterprise Stocktaking Project" 18 November
1988

Russ Webster et al

10. Bangladesh Standards and Testing Institute (BSTI)
11. BSTI Test Form

Figure 1 Jute & Jute Goods Export

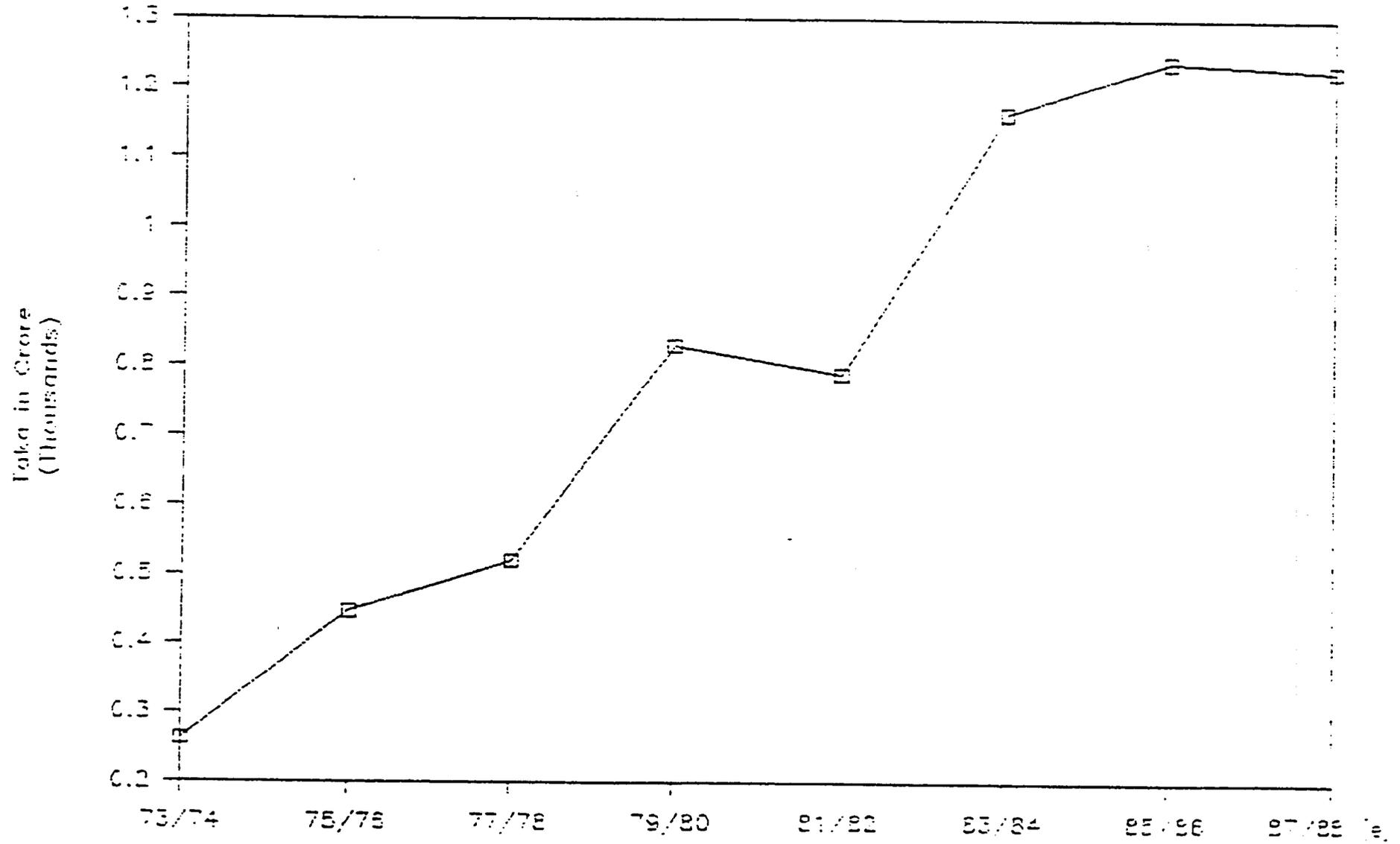


Figure 2

Leather Export

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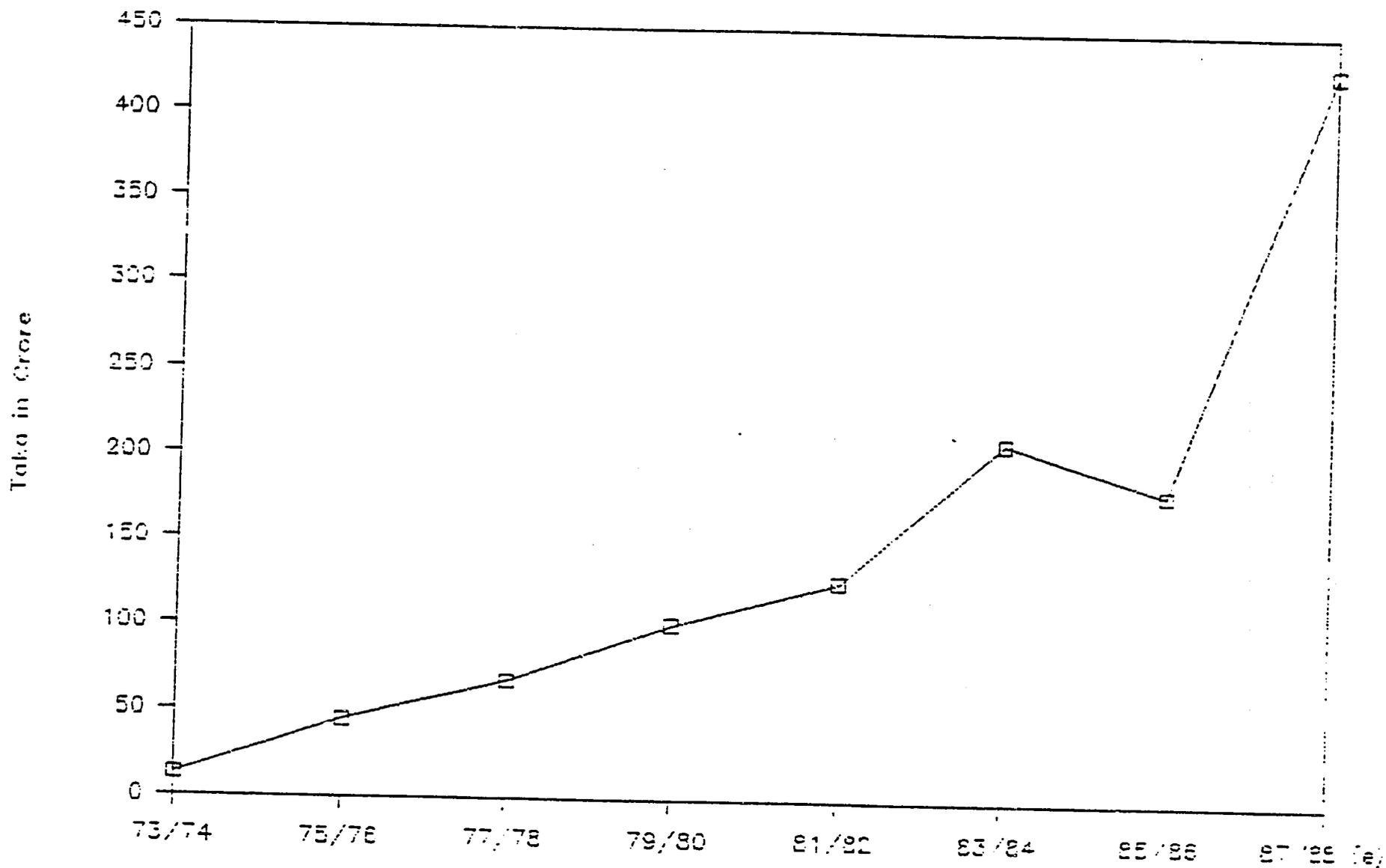


Figure 3

Frozen Food Export (Seafood)

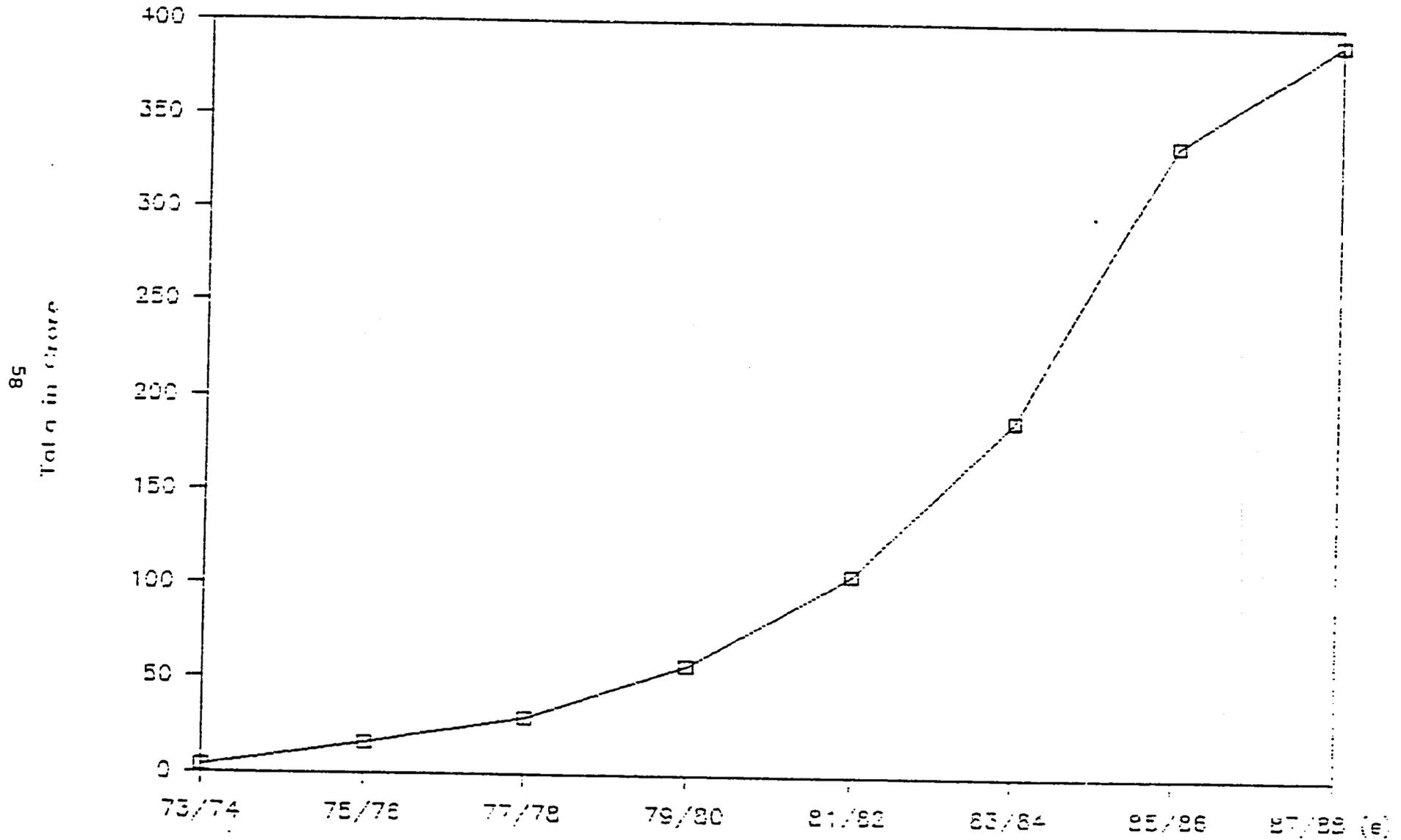


Figure 4

Tea Export

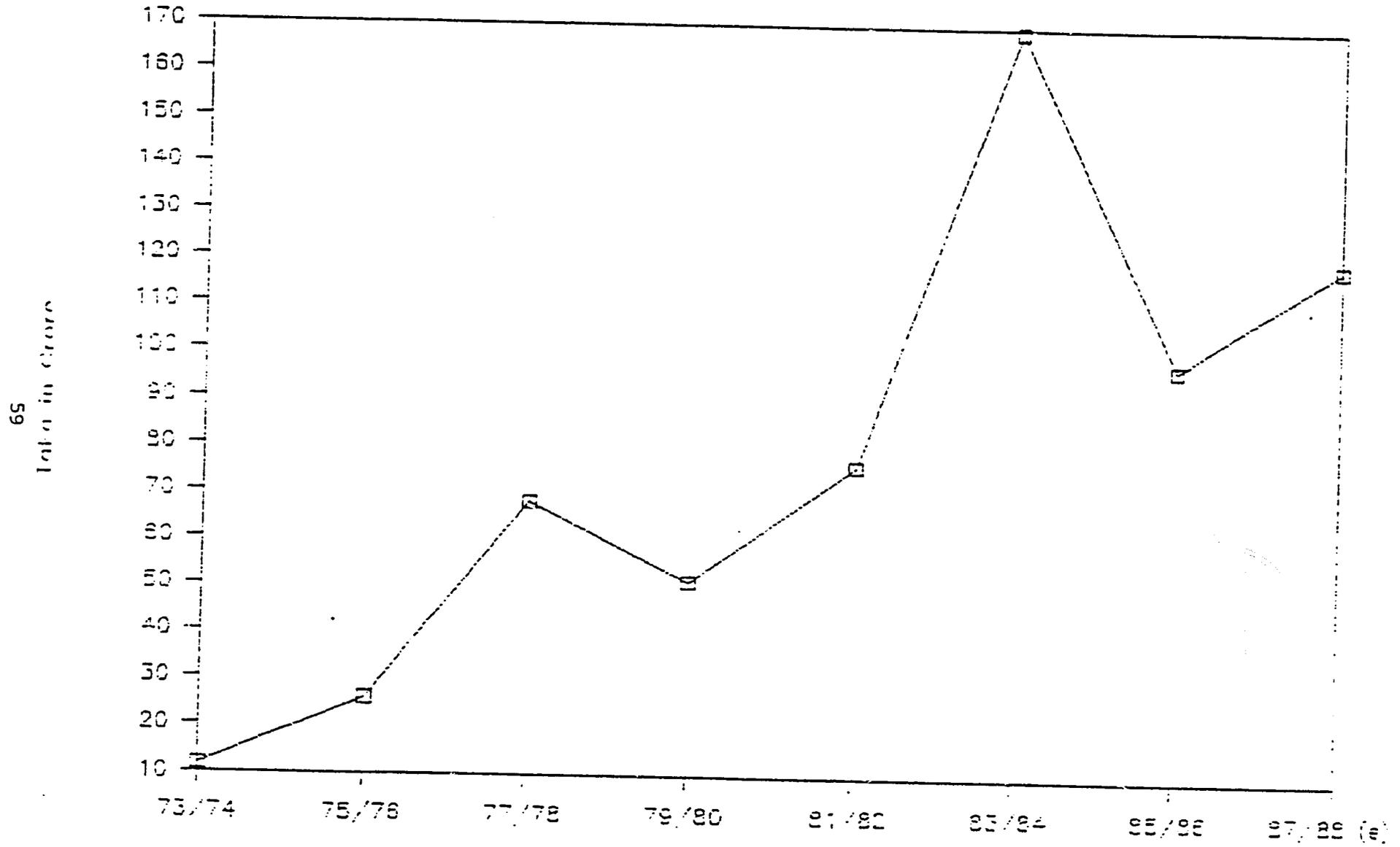
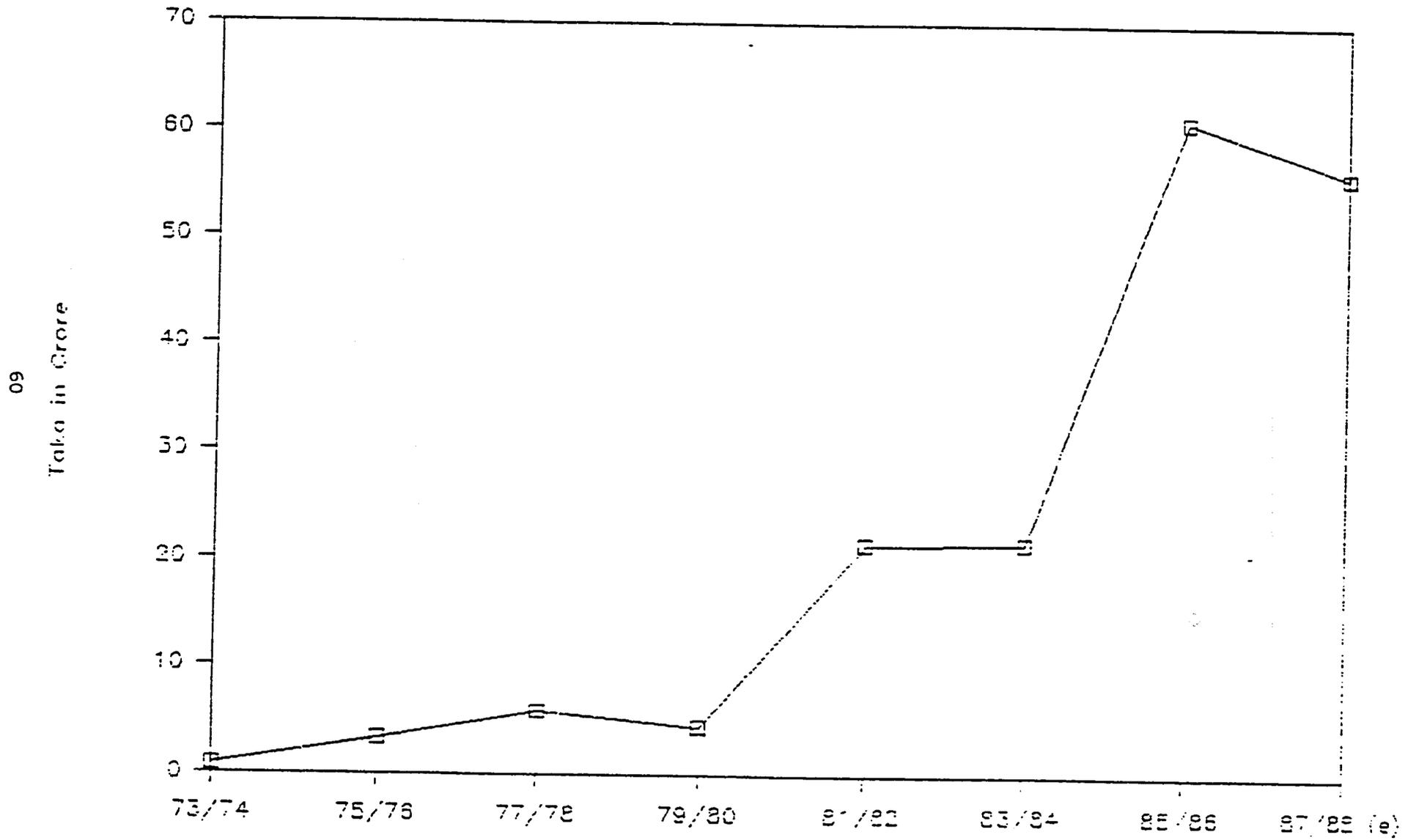


Figure 5 Ag Products Export



Newsprint, Paper Export

Figure 6

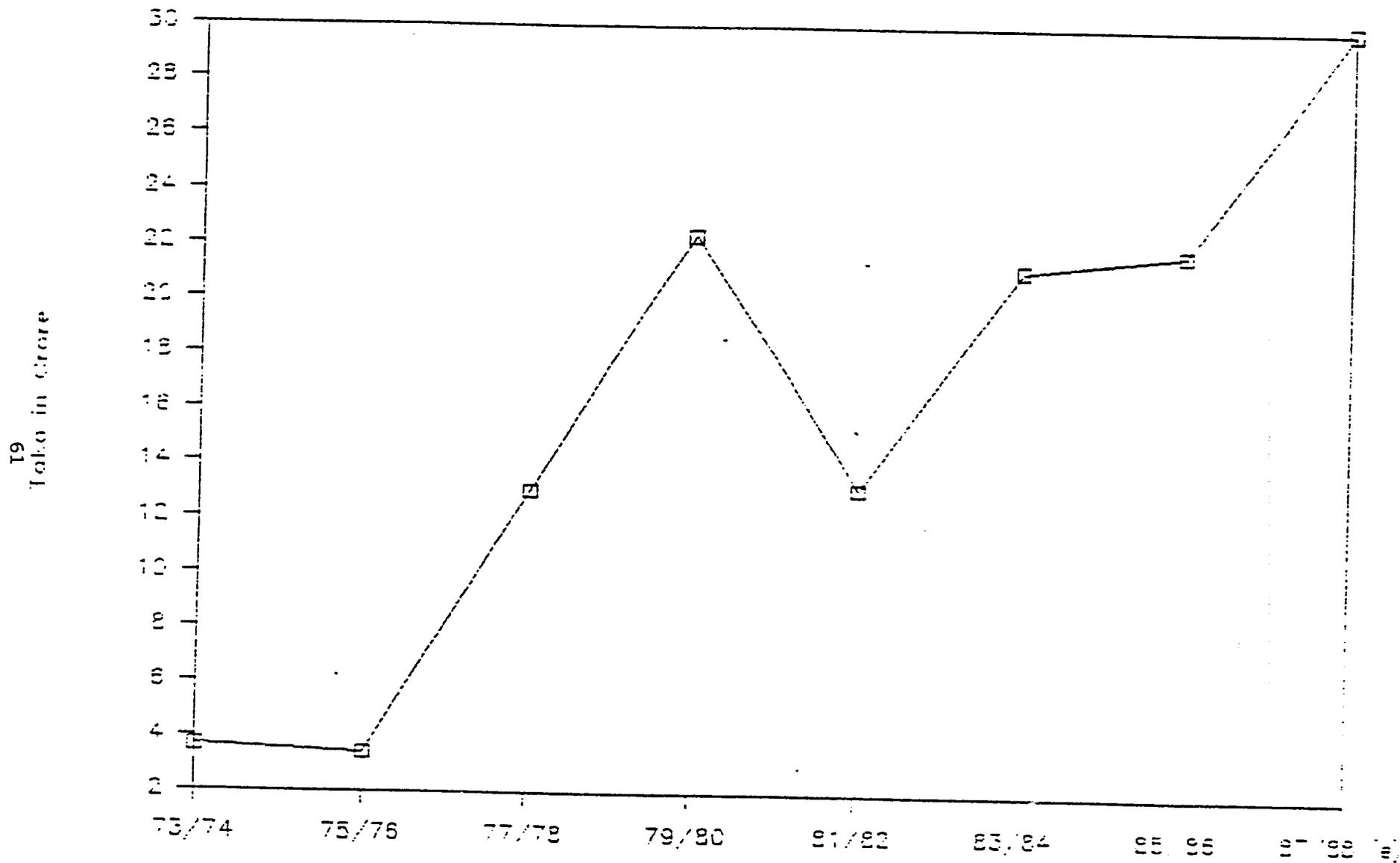
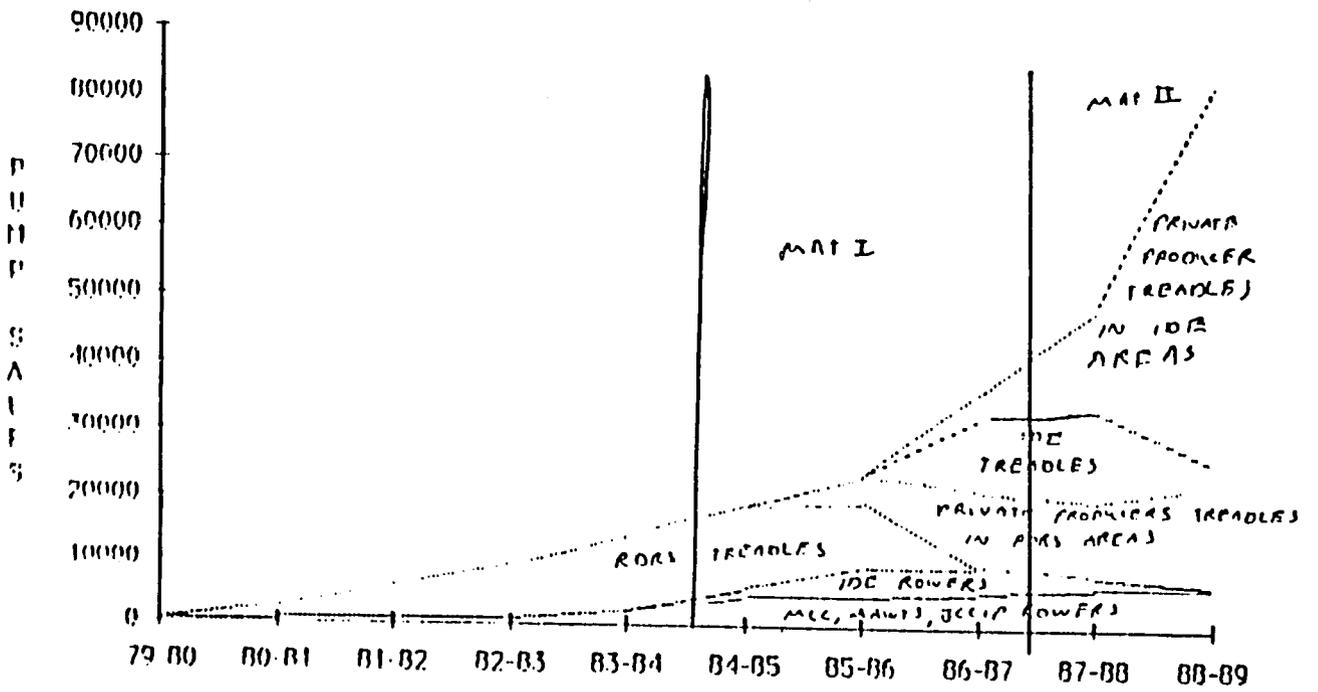


Figure 7

ANNUAL IRRIGATION PUMP SALES IN BANGLADESH 1979-89



Appendix Table 1

Capacity utilization of Rice Mills, 1987

Type of Mill	No. of Mills	Capacity Tons per hour	Annual capacity at 1 shift operation Tons	Paddy Milled in 1987 Tons	Total hours worked in 1987	Equivalent days worked in 1987 (one shift)
Husking Mill :						
With parboiling	20	0.8	1,898	738	934	117
Without parboiling	48	0.6	1,385	479	826	103
Custom Huskers (Diesel operated)	5	0.5	478	131	273	82*
Major rice mills	14	1.8	6,639	1,708	928	77
Modern rice mills	5	3.0	14,880	5,127	1,654	103

Source : ARDICOL Survey Report.

* These are powered by diesel irrigation pump sets and have therefore a part-time source of power.

Appendix Table 2

AGRICULTURAL LOANS ISSUED BY MAJOR CREDIT INSTITUTIONS

[Millions of Taka]

Source\FY	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987/p
COMMERCIAL BANKS: /a	560.1	845.1	777.1	1,013.0	1,170.3	1,172.5	2,547.9	3,908.3	5,068.1	2,526.7	1,302.0
Short-term agr.(crop) loans /b	436.1	767.1	648.2	874.4	1,038.4	949.9	1,937.7	2,765.5	3,390.3	1,423.5	-
Other agricultural financing/c	7.2	5.4	5.0	9.5	57.0	113.5	518.3	877.9	1,271.1	728.2	-
Fisheries financing	0.1	11.1	37.7	27.0	11.2	10.8	25.3	106.3	78.9	181.9	-
Tee prod.& development financing	29.2	35.4	63.3	66.5	27.6	36.3	21.9	35.3	66.7	62.8	-
Cold storage for agri.products	27.5	26.1	22.9	35.6	36.1	62.2	44.7	122.3	251.1	132.3	-
BANGLADESH KRISHI BANK:	388.4	542.3	741.7	1,420.0	2,097.4	2,710.4	4,008.1	5,924.3	6,147.3	3,650.6	4,423.0
Short-term agr.(crop) loans /b	96.9	106.3	173.2	255.4	730.4	1,099.5	1,383.3	2,163.3	1,573.9	384.8	-
Other agricultural financing/c	119.3	160.3	258.4	688.6	667.2	926.9	2,051.1	3,149.5	3,422.9	2,009.5	-
Fisheries financing	0.6	13.7	39.5	47.5	73.7	69.5	56.4	128.8	165.1	103.4	-
Tee prod.& development financing	161.8	179.0	247.5	411.7	579.6	563.0	458.6	323.6	841.3	1,008.4	-
Cold storage for agri.products	9.2	2.4	13.1	16.2	46.5	51.4	58.7	158.6	144.1	144.5	-
BANGLADESH SAMABAYA BANK:	111.8	158.2	201.1	255.8	257.0	174.1	229.5	219.8	283.0	139.9	136.0
Short-term agr.(crop) loans /b	93.6	131.4	165.9	224.5	207.0	137.2	190.1	180.4	229.9	94.6	-
Other agricultural financing/c	18.2	26.9	35.2	31.3	50.0	36.9	39.4	39.4	53.1	45.3	-
ALL MAJOR CREDIT INSTITUTIONS:	1,060.3	1,545.6	1,719.9	2,688.8	3,524.7	4,057.1	6,785.5	10,053.0	11,498.4	6,317.2	6,361.0
Short-term agr.(crop) loans /b	686.6	1,085.4	987.3	1,354.3	1,975.8	2,126.6	3,511.1	5,109.7	5,194.1	1,902.9	-
Other agricultural financing/c	145.3	192.5	308.6	729.4	774.2	1,077.3	2,608.8	4,066.3	4,747.1	2,781.0	-
Fisheries financing	0.7	24.3	77.2	74.5	84.9	80.3	81.7	235.6	244.0	285.3	-
Tee prod.& development financing	191.0	214.4	310.8	478.2	607.2	599.3	480.5	359.4	908.0	1,071.2	-
Cold storage for agri.products	36.7	28.5	36.0	52.4	82.5	113.6	103.4	281.5	405.2	276.8	-
Out of total disbursement: Credits											
Channelled through Coopv.under BRDB	-	108.0	122.0	205.0	256.0	258.0	4,065.0	3,227.0	1,202.0	596.0	-
Paddy	-	102.0	112.0	191.0	237.0	245.0	3,932.0	2,895.0	1,202.0	571.0	-
-T.Aman	-	33.0	34.0	51.0	71.0	73.0	554.0	965.0	1,202.0	185.0	-
-Boro	-	48.0	45.0	95.0	115.0	132.0	1,669.0	965.0	*	331.0	-
-Aus/B.Aman	-	21.0	33.0	55.0	51.0	40.0	1,689.0	965.0	*	55.0	-
Wheat	-	2.0	4.0	8.0	11.0	9.0	96.0	332.0	*	7.0	-
Potato	-	4.0	6.0	6.0	8.0	4.0	37.0	*	*	18.0	-

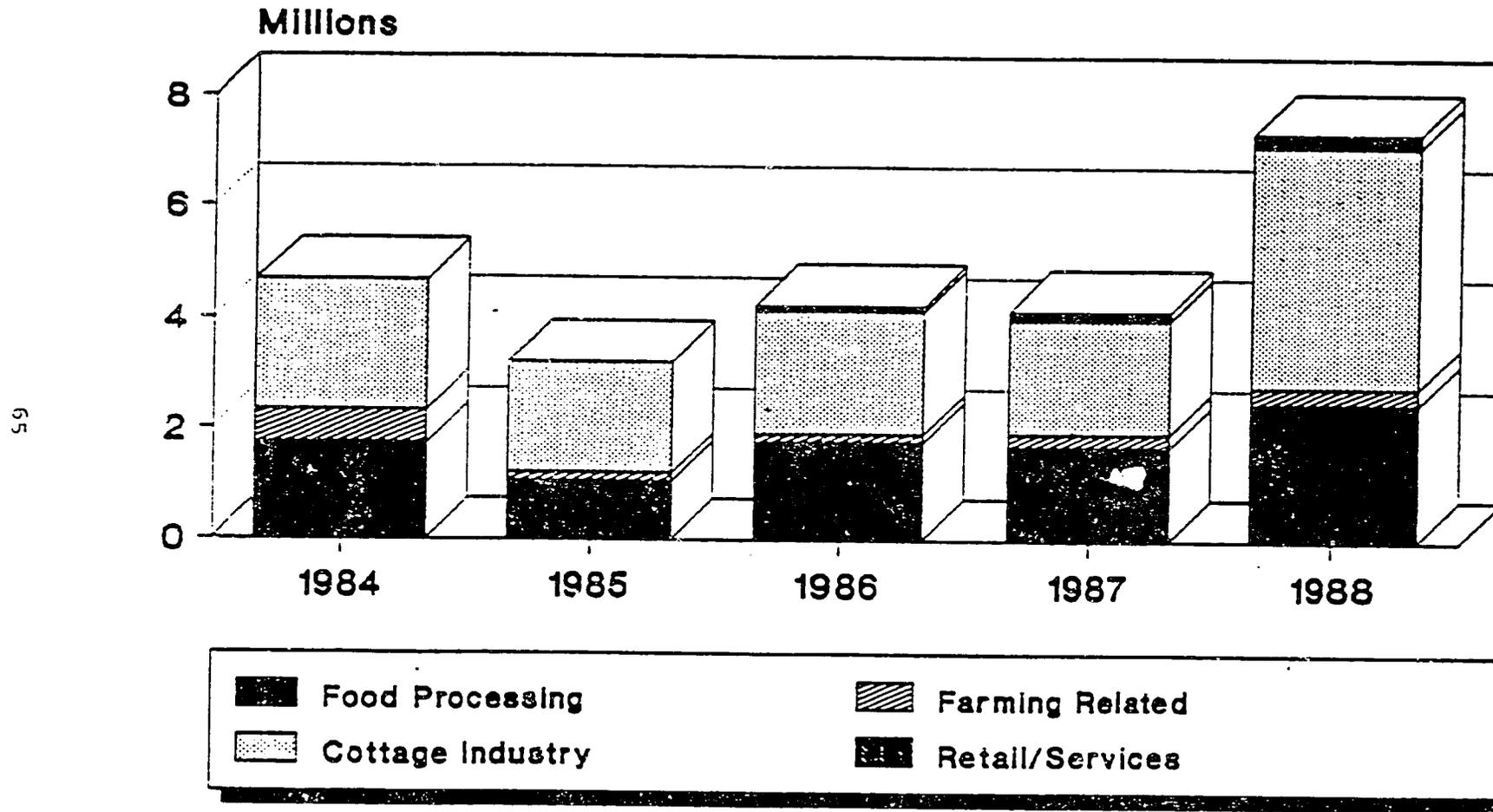
/a Including re-financing provided by the Sonali Bank to co-operatives under BRDB.

/b Crops other than Tee.

/c Including agricultural credit as well as financing for marketing, transport, and agroindustries.

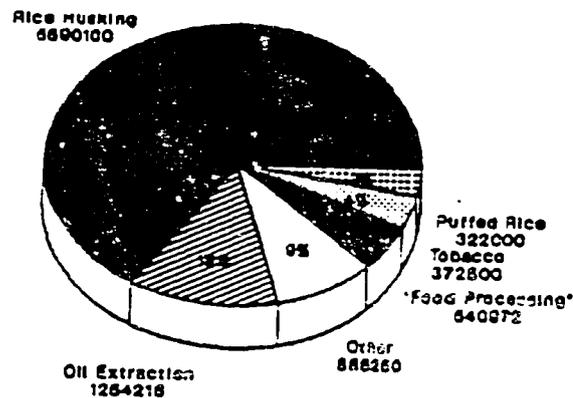
/d Less than 1.0 million.

WEDP Annual Loan Disbursement (Taka)



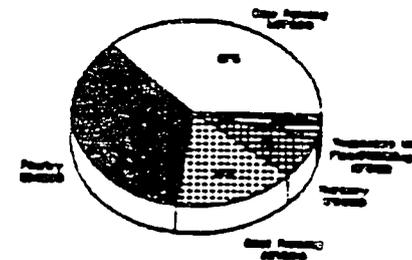
Source: WEDP

WEDP Food Processing Loan Composition (Taka Disbursed)



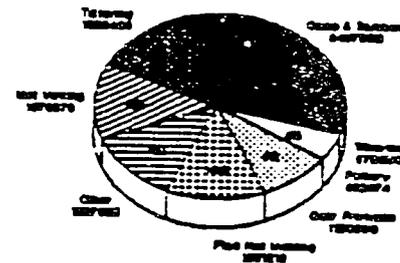
Source: WEDP

WEDP Farming Related Loan Composition (Taka Disbursed)



Source: WEDP

WEDP Cottage Industry Loan Composition (Taka Disbursed)



Source: WEDP

FOCUS Shrimp culture in Asia

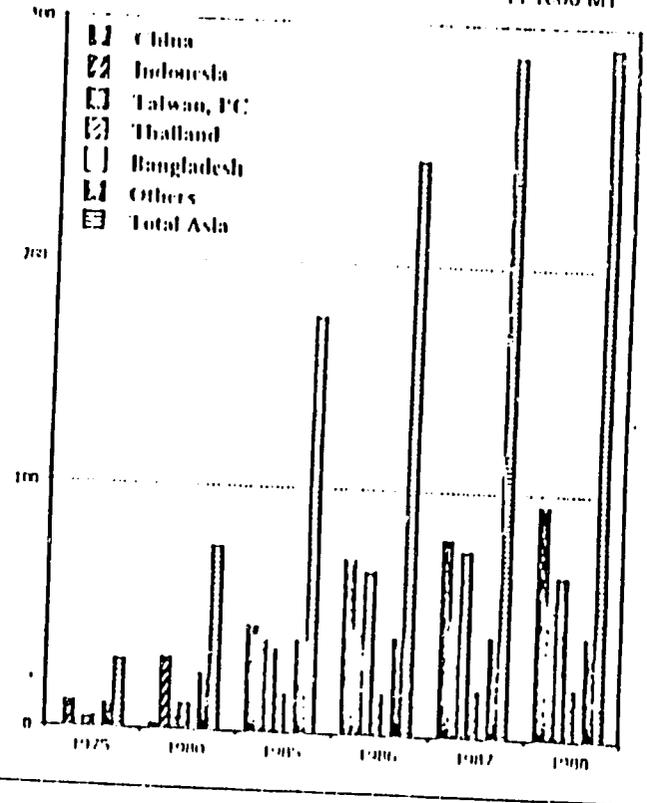
Asian countries were pioneers in shrimp aquaculture and, as a result, their production accounts for more than 80% of the world's cultured shrimp supply. In 1987, the Asian farmed shrimp harvest reached 300,000 MT, four times higher than in 1980 and more than 10 times the 1975 figure.

China is now the world's leading shrimp culturer with an estimated 95,000 MT produced in 1988. The outstanding increase in Chinese production, from the negligible 400 MT in 1975, has gone hand in hand with an increasingly liberal agricultural policy. Small ponds (0.6 ha) are allocated to individual farmers who have to bear all working expenses and risk. The main species cultured throughout China is *Penaeus orientalis*, while in the south some *P. merguensis* and *P. japonicus* are farmed. About 70% of China's production is exported, mainly to the USA and Japan where Chinese cultured shrimp undercuts the prices of other producers. Recently, Chinese shrimp has also found its way into the EEC market.

Production of shrimp in Taiwan (Province of China) expanded exponentially between 1980 and 1986 -- from 5,000 MT to 65,000 MT -- thanks mainly to intensive farming techniques, by the huge number of hatcheries producing post larvae, and a well developed network of feed producing companies. The main species cultured in Taiwan (Province of China) is *Penaeus monodon*. The island became the top supplier of shrimp to Japan for the first time in 1986, and again in 1987. However, shrimp production was disrupted in 1988 by diseases, dry weather and later in the year floods. As a result, the total 1988 production was probably 10,000 MT short on 1987 -- more pessimistic reports talk about a cut of 50% -- and shipments to Japan declined by 16%. Taiwan (Province of China) is expected to recover in 1989, but 70,000 MT-80,000 MT should be the limit for its culture industry.

Up to 1981, Indonesia was the biggest producer of cultured shrimp in Asia, due to its centuries old experience in brackish water aquaculture. The country lost its top

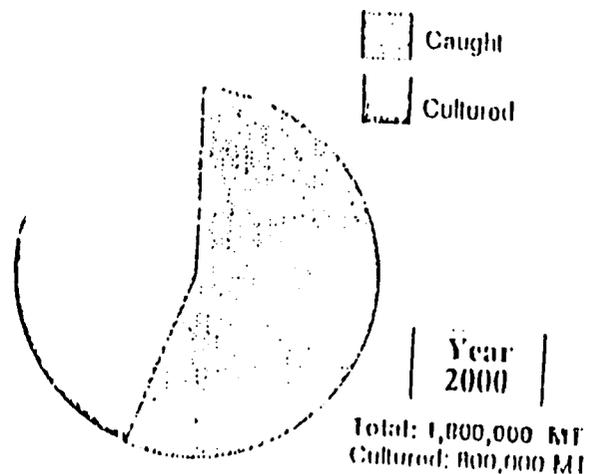
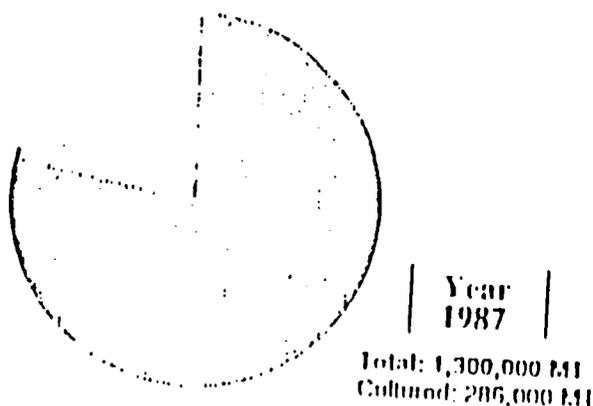
Production
Cultured shrimp : Asia



position in 1985, however, and since then the government has encouraged important private investments into shrimp culture. Some results are already visible and cultured shrimp production in Indonesia is resurging. Main species cultured are *Penaeus merguensis* and *P. monodon*.

Other Asian countries with huge shrimp culture potential, but where production from shrimp farming lags somewhat, are Thailand, Bangladesh, India and the Philippines. If output from these countries picks up, Asian farmed shrimp production could total some 800,000 MT by the year 2000. This is an enormous amount which could not be absorbed by the traditional markets -- Japan, USA, Europe -- alone, but which could find a market, provided prices fall substantially, in culturing countries themselves.

Production
Shrimp : Asian developing countries



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ESTIMATED INTENSITY OF SHRIMP

CULTURE, BY REGION

<u>District</u>	<u>Subdivision</u>	<u>Total Suitable Acreage</u>	<u>Cultured Area 1983</u>	<u>Projected Culture Area 1999</u>
Chulna	Satkhira	400,000	19,600	72,000
	Sadar	300,000	19,200	39,000
	Bagerhat	470,000	12,690	42,300
Barisal		470,000		14,100
Patuakhali		620,000	620	12,400
Joakhali	Laksmipur	320,000		9,600
	Sadar	720,000		21,600
	Feni	250,000		2,500
Chittagong	Sadar	830,000	830	8,300
	Patia	420,000	2,100	8,400
	Cox's Bazar	540,000	45,900	70,200

Source : Arthur D. Little, Inc.

Saline water damages crops on 1700 acres

A Correspondent

NOAPARA, March 3 — Saline water which entered Dohori Kashipur and Gohoriphaona beels under Kesbpur upazila through the seventh sluiceway of 21th polder of WDH, has damaged 1700 acres of land, recently.

It may be mentioned here that a policeman and a school teacher died here in a clash between shrimp traders and cultivators last year. The

cultivators refused the sign lease contract of their land with the shrimp traders who later on made way for saline water to enter the beels through the sluiceway. It is alleged.

As a result, 1700 acres of land have been damaged.

Hundreds of cultivators of the beels and adjoining areas have complained to the local Water Development Board authority. The authority has filed a case with the local police against same persons. The police is investigating into the cases.

TENDER 2/7/89
r-7

Plan to produce 110m Tiger shrimp fries

The country is expected to produce about 110 million fries of Tiger shrimp a year for rising export earnings and broadening shrimp cultivation.

The fries to be produced in 11 hatcheries, will be raised in shrimp farms along the coastal belts, Minister for Fisheries and Livestock Sardar Amjad said.

He told BSS that the plan had been taken up following success in producing Tiger shrimp fries through artificial insemination at a pilot hatchery at Cox's Bazar. He said artificial production of fries would not only boost shrimp cultivation, but also help maintenance of environmental and ecological balance.

The Minister said artificial insemination had become a necessity as natural reserve of fry in the sea was sharply depleting because of fullberillinate catch. He pointed out that the fullberillinate catch of fries from the natural reserve in the sea, was causing alarm not only for shrimp, but for other species also.

Sardar Amjad said to overcome the impending danger of fisheries resources in the sea and also to provide necessary supply of fries to the farms, the government with the assistance of World Bank and UNDP had launched a project for producing shrimp fries artificially. Accordingly, a minko shift hatchery was set up at Cox's Bazar and after two and a half years' effort, the "breakthrough" was achieved early this month.

The fisheries ministry sources said nearly 1300 million fries are caught a year from natural sources. Because of very low survival rate, about 500 to 600 million fries reach the shrimp cultivators. The aim, a said nearly 2000 million fries are needed for economic farming of nearly 87,000 hectares of land now under shrimp cultivation.

Tk 50 lakh loan to each farmer

Disbursing the assistance, Sardar Amjad said Tk 50 lakh would be provided as loan to each of the entrepreneurs to set up such hatcheries. The government has already received a number of applications, he added.

Giving a brief account of the history of shrimp cultivation in Bangladesh, the Fisheries Minister said from an insignificant beginning in the states, it was taken up in a big way by the private sector in the post liberation period when international price shot up. With the passage of time, shrimp cultivation, developed almost entirely

in the private sector and has assumed an important role in the national economy. Of the Tk 532 crore earned as foreign currency from the fisheries during last fiscal year, Tk 437 crore came from shrimp. Export earnings from fisheries sector for the current fiscal year have been fixed at Tk 700 crore.

The sources said out of the 30,000 tons of shrimps which are exported annually, 15,000 tons come from shrimp cultivation farms. The trawler catch accounts for 4000 tons, while catch by net and other means amounts to 11,000 tons, the sources added.

The Minister said efforts are under way to modernise shrimp cultivation to increase yield. The traditional method has an yield of 85 kg per hectare and plans are under way to raise it to 200 to 250 kg per hectare by introducing modern technique and providing necessary support. He said there is a great potential for further expansion of shrimp cultivation, especially in the coastal areas.

Meanwhile, under a programme taken up with IDA assistance, the government has provided training to 1600 shrimp cultivators on improved methodology. The government is working on technology transfer, building infrastructural facilities, lending extension work and providing loan as a package deal to promote shrimp cultivation. Sardar Amjad said soon a survey would be taken up in the coastal areas to find suitable lands for shrimp cultivation from fries produced through artificial insemination.

The Minister hoped with the availability of necessary facilities, including ensuring timely supply of fries, earnings from this sector would rise tremendously leaving a positive impact on the life style of people living in the coastal areas.



FORM NO 11
BANGLADESH STANDARDS AND TESTING INSTITUTION



LICENCE FOR THE USE OF STANDARD MARK

Licence No. BSTI/C/L-94/1988

1. By virtue of the power conferred on it by the Bangladesh Standards and Testing Institution Ordinance (Ordinance No. XXXVII of 1985) 1985 the Institution hereby grants to M/s Ahmed Food Products (Pvt.) Ltd;
M/4/4 Road NO: 7 Section - 7 Mirpur
Shah

(hereinafter called "the licensee") this licence to use the Standard Mark set out in the first column of the First Schedule here to upon or in respect of the article (s)/process set out in the second column of the said Schedule which is/are manufactured in accordance with/conforms to the related Bangladesh Standard (s) referred to in the third column of the said Schedule as from time to time amend or revised.

2. This licence carries the rights and obligations stipulated in the existing regulations. In pursuance of his obligations, the licensee shall pay in due manner and time the scheduled Marking Fee set out in the Second Schedule hereto and maintain to the satisfaction of the Institution the Scheme of Testing and Inspection a copy of which is attached hereto,

3. This licence shall be valid from... 1st April 1988 ... to
31st March 1989 ... and may be renewed as prescribed in the existing Regulations.

Signed, Sealed and Dated this... 24th ... day of October ... 1988 ...

[Signature]

For Bangladesh Standards and Testing Institution
Seal of the Institution
Director (Standards Wing)
Bangladesh Standards & Testing Institution
Tejgaon, Dhaka.

Renewed for

FORM NO II
BANGLADESH STANDARDS AND TESTING INSTITUTION



LICENCE FOR THE USE OF STANDARD MARK

Licence No. BSTI/CM/L-219/1988

1. By virtue of the power conferred on it by the Bangladesh Standards and Testing Institution Ordinance (Ordinance No: XXXVII of 1985) 1985 the Institution hereby grants to M/s. Ahmed Food Products (Pvt.) Ltd.
M/G/4, Road No-7, Sector-7, Mirpur, Dhaka.

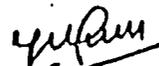
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Signed, Sealed and Dated this 24th day of October 1988

Renewed for


For Bangladesh Standards and Testing Institution
Seal of the Institution
Director (Standards Wing)
Bangladesh Standards & Testing Institution
Tejgaon, Dhaka.

ANNEX 6

Policy Considerations

Prepared by

C. Kenneth Laurent

April 1989

Policy Considerations

There are a number of BDG policies that affect agricultural development. These include policies on farm price supports, consumer subsidies, food security, public enterprises, privatization, interest rates, credit, exchange rates, import and export policies and the level of investment in the agriculture sector versus that in the industrial sector. Six of these policy areas are discussed here: farm price supports, consumer subsidies, privatization, food security, government investment in agriculture, and agricultural credit.

1. Public Sector Investment in Agriculture

The public sector's investment in agriculture and water resources has increased about 6% annually in nominal terms since 1981¹/. However, in real terms, the investment has fallen 31% during this period. There have been large variations in the trend of ADP budget allocations within the various categories as can be seen below:

Sector	Percentage Distribution	
	Fy 81	Fy 89
Crop Agric. (Tk 216cr.)	<u>33</u>	<u>17</u>
Extension	3	2
Research	1	7
Input supply	18	1
Food storage	9	2
Other	2	3
Water Resources (Tk 704cr.)	<u>48</u>	<u>55</u>
Surface water (FCD (FCD&I)	20	41
Groundwater (pumped irrig)	20	14
Forestry (Tk 56cr.)	3	4
Fisheries (Tk 64cr.)	4	5
Livestock (Tk 47cr.)	2	4
Rural Dev. & Inst. (Tk 196cr.)	<u>10</u>	<u>15</u>
Cooperatives	4	6
Rural Infrastructure	6	9
Total (Tk 1284cr.)	<u>100</u>	<u>100</u>

Source: World Bank. Selected Issues in Agriculture Development, April 1989.

Most of the decline in public expenditure was a result of the elimination of fertilizer subsidies beginning about 1983 and ending in 1986. If the fertilizer subsidy is removed from the calculations, the real expenditure index still shows a decline of 21% since 1981. In other words, the agriculture and water sector failed to maintain anywhere near parity with inflation over the period. Normally, the first priority in a situation like this is for salaries. If funds remain, some development may take place. Funding for maintenance and upkeep comes last. The growing backlog of development project funds is a clear indication of the inability of the various implementing agencies to provide adequate funds to move projects forward on schedule.

Although the water sector received 55% of the ADP budget allocation in FY89, three fourths of the amount was allocated to FCD and FCD&I, and only one-fourth to groundwater development. This policy, if continued, will have a direct bearing on how fast small-scale irrigation, based on groundwater, can be developed. The recommendation of this report is that a strong impetus be given to developing small-scale irrigation and that large-scale FCD&I projects be postponed until the small-scale irrigation projects have been developed. The MPO's long range plan follows this scenario. It is a major policy question that has to be addressed, along with the need to increase investments in several areas of the agriculture sector.

2. Producer Price Supports

Producer price supports are designed to provide a measure of price stability and incentive to producers by creating a climate of certainty. If farmers feel they can make a profit at the government's procurement price, they are more likely to invest in modern inputs and to better plan their operations. To provide a measure of price incentive, the government must announce procurement prices prior to planting time and be prepared to purchase at these prices if the products are offered to it.

There has been some measure of price stability at the consumer level through the government's use of open market sales(OMS) to keep prices from rising beyond target levels. However, the government's performance in supporting farm prices has been limited. This is not because there is no mechanism in place to support farm prices. There is a mechanism but it is not functioning for a variety of reasons. Previously the prices set by the government were based on the average market prices for the previous two seasons. Since market prices have been rising in recent years, this resulted in the government's prices being below the open market prices(OMP). Consequently, farmers sold on the open market. The government has changed this system and now uses a cost of production plus a markup, and adjusts prices depending upon OMP levels. In the past, the government often failed to announce procurement prices until after the planting season had begun. Now prices are announced on July 1 in time for the Aman crop. The announced intention of the government is to procure 500,000mt of foodgrains from farmers, or about 3% of the crop. However, it seldom purchases this amount. The maximum purchased has not exceeded 400.000 mt since 1981 when purchases amounted to 1.0 million mt. There are a variety of reasons for this. First, the government is often slow to adjust the procurement price with changes in the OMP. And the government does not have the resources to operate the large number of buying stations that would be convenient to farmers. As a result, farmers sell to dealers who in turn may sell at the government buying centers which may be located some distance from the farm. The dealer is assured of the procurement price (if the government is buying) or he can sell at a higher price if available. The farmer receives a price lower than the cost of transporting to the government's buying center. How much lower has been the subject of many discussions. If the farmer delivers to the government procurement center, he faces further problems in grading and in receiving cash. He is paid by check which means he must go to a bank to receive his money. This is often inconvenient and time consuming. As a result, the government has not purchased much of the domestic crop. The lack of funds may have been the most important reason.

The Ministry of Food has the responsibility to maintain adequate stocks of foodgrains, and between FY 85 and FY 88, imported an average of 2.1 million mt, 1.4 million mt which as donor-aided and 0.7 million mt which was purchased on the open market. In addition, the BDG purchased an average of 0.3 million mt from domestic sources. If the MOF's timing of imports is not carefully adjusted to domestic harvests, the foodgrains it imports may compete for storage space with any domestic purchases. It has been reported that the government's purchasing specifications become stricter during these periods causing farmers and dealers to sell to other outlets.

The price support system is not working as it should and there is an obvious need for the government to seek ways to make it work more effectively. One way would be for the MOF to adjust its import policy to avoid bringing in foodgrains during major harvest periods so as not to depress farm prices. Another way would be to make sure that adequate space is available for storing the amount of local foodgrains that have been targetted for purchase. This is especially important in years of good harvest when the government is likely to reach its purchase goals. The government has a storage capacity of 1.8 mil.mt: 1.1 mil.mt in local supply depots (LSD), 0.45 mil.mt in central storage depots(CSD), 0.23 mil.mt in silos, and a small amount of temporary storage. The average utilization of these facilities is less than 50%, although this fluctuates greatly during the year and between districts. With a 1.8 mil. mt storage capacity, there should be ample space at any time to store the 500,000mt of local foodgrains that have been targetted for procurement. The inability to do this is basically a management problem. The FAO has recently completed a study of the Directorate General of Food(DGP) in the Ministry of Food and has presented a series of recommendations for strengthening of food security and establishing a management informations system (MIS) in the Directorate. If put into operation, these recommendations will go a long way towards strenthening the planning and management capability of the MOF and the operational efficiency and accountability of the DGP. Donors, including USAID, should actively support these recommendations by providing the financial assistance and training opportunities needed by the MOF to implement the recommendations.

3. Consumer Subsidies

Consumer subsidies are effected through the Public Food Distribution System (PFDS) which takes a number of forms as can be seen below:

Statutory rationing (SR) - covers Dhaka, Chittigong, Narayanganj, Rajshahi, Kuhlna and Rangamati. Originally SR covered all inhabitants in these cities but has since been modified and now covers less than half.

Modified rationing (MR) - operates throughout the country in areas not covered by SR.

Essential priorities (EP) - covers the armed forces, police and other law enforcement agencies, the Bangladesh Rifles, patients in hospitals, prisoners in jails and orphans.

Other priorities (OP) - covers all government and semi-government employees, teachers, and students residing in residence halls of universities and colleges.

Large employers (LE) - those having 50 or more employees.

Gratuitous relief (GR) - assistance granted during/after some natural disaster.

Vulnerable group feeding (VGF) - for destitute women, pregnant and lactating mothers.

Food for Work (FFW) - food for the unemployed in rural areas who work on special projects to receive food.

Open market sales (OMS) - introduced in 1979/80 (under agreement with USAID) to help stabilize prices of foodgrains when market prices exceed an agreed upon level.

Test relief (TR) - pre-emergency food distribution (based on a potential disaster situation, e.g., an impending drought or flood)

The importance of these outlets is shown below:

Outlets	Percentage of total distribution	
	1987/88	1988/89(proj.)
Statutory rationing(SR)	10.0	6.0
Modified (MR)	12.1	10.8
Essential priority (EP)	5.6	4.3
Other priorities (OP)	18.3	13.0
Large employers (LE)	1.8	1.4
Open market sales (OMS)	10.2	7.2
Food for Work (FFW)	22.6	21.6
Vul. group feeding (VGF)	8.3	13.0
Gratuitous relief (GR)	0.8	8.4
Test relief (TR)	2.6	10.1
Other(incl. flour mills)	7.7	4.2
<u>total</u>	<u>100.0</u>	<u>100.0</u>

Source: World Food Program. Mar.22, 1989

The total foodgrain distribution in FY 88 was 2.5 million mt, of which approximately 1.1 million mt were for ration sales, approximately 1.1 million mt for vulnerable group programs, and about 0.3 million mt for OMS. The total distribution in FY 88 was about 18% higher than in FY 87 due mainly to an almost 50% increase in distribution to vulnerable groups, including those receiving flood relief food.

The BDG has been slowly reducing the level of subsidies, especially for the SR and MR groups. The ration price of wheat was essentially the same as the open market price (OMP) in 1987/88 (only 1 1/2% below the OMP; it was 4% below in 1983/84). The ration price of rice, on the other hand, was 10% below the OMP, about the same difference as in 1983/84. The government has indicated that it will remove subsidies on distribution channels serving civil servants in FY 1990, improve the targetting of distribution channels serving the poor, and move the financial burden of the EP to the Ministry of Defense. Donor groups have, for some time, been advocating that the government's policy should be the elimination of all consumer subsidies except those targetted to the poor. The cost of the PFDS, as well as the subsidization of the more affluent groups within society when government resources are extremely limited, does not make economic sense.

USAID's position should be to continue to press for the elimination of subsidies except for the very poor. And for this group, a strong effort needs to be made to improve the efficiency and equitability of the distribution system.

4. Food Security

Food security can be defined as the ability of a country to supply its basic food needs in order to maintain adequate nutritional levels. In Bangladesh, where over 80% of the calorie requirements are supplied by foodgrains, adequate supplies become essential. Bangladesh has not been able to produce enough foodgrain for its growing population and has had to import foodgrains to make up the shortfall which was 2.6 mil.mt in 1987 and 3.1 mil.mt in 1988.

Bangladesh is a disaster-prone area which further complicates the government's ability to provide for its citizens. The measures adopted by the government have been to accept donated foods to the extent possible and to buy the remaining requirements on the international market. The question becomes what is the level of stocks required for food security? This is an important question in Bangladesh because of the cost of purchased grain and the further cost of storage of donated and purchased grains. The issue of stock levels has stirred considerable debate within the donor community. The UNDP ASR concluded that "...imports in recent years have been excessive in the sense that scarce foreign exchange has been spent on commercial imports to build up unnecessarily high public stocks". A recent review by a Special Aid Group concluded that recent foodgrain stocks had been too high with excessive costs, and supported recent donor(USAID) assistance aimed at food policy research aimed at trying to answer the question of safe food levels at reasonable cost.

USAID has a direct interest in the food security/stock level question since it is a major donor of foodgrains to Bangladesh. The implications of whether food grain stocks should be at 0.9mil.mt,1.2mil.mt or 1.5mil.mt become very important.

Food aid has been seen by some as a disincentive to domestic production. The ASR stated that such a disincentive was likely to be small since only 30 percent of the farmers have a marketable surplus. Although most farmers (an estimated 75%) sell some grain at harvest time (when the presence of donated foodgrains might depress the market), they become buyers later in the year as their remaining stocks are consumed and would benefit from any downward pressure on prices that might be caused by the donated foodgrains. However, the theme of the effects of food aid still persists when foodgrains are discussed. It has been asserted that much of this aid is pushed by the donors in response to pressures from producers in their own countries. If the current drive towards self-sufficiency is successful, what will be the reaction of the donors of food aid? Will they be willing to provide other commodities or increase development assistance funding? Also, what would happen to the very poor who are provided a "safety net" at the margin of poverty through the donor-provided food aid? In the absence of such food aid, will the BDG have the resources to maintain this "safety net"? These are also important questions for the BDG since food aid provides budgetary support which is badly needed. The USAID-sponsored IFPRI team will address these questions.

5. Privatization

Privatization in some form has been underway in the Bangladesh economy since the late 70s but it has been only in the last few years that the momentum has picked up. Part of the reason for the trend toward increased privatization has been the poor performance of public enterprises (parastatals) producing fertilizers and chemical products, sugar, paper products and jute, and service organizations delivering inputs to farmers. Another reason has been the pressure brought by USAID and other donors on the government to privatize certain segments of the agricultural sector, e.g., fertilizer distribution which has been accomplished at the retail level and is well on the way in the wholesale sector. To date, approximately 40% of the jute milling capacity has been privatized as well as a small portion of the sugar industry.

The Prime Minister of Bangladesh visited the U.S. in mid-April and talked with U.S. businessmen about investment opportunities in Bangladesh and discussed reforms that have been made in the private sector. At a recent meeting in Dhaka, the Secretary of Agriculture cited the surge in private sales of STWs and LLPs when the government freed up the importation of diesel engines and eliminated taxes and other restrictions. He said an estimated 30,000 units were sold by private dealers between July 1, 1988 and the end of January 1989. He also said it is the government's policy to support the development of the private sector in the provision of goods and services.

The cost to the government of operating public enterprises is considerable. In FY 88 losses from these enterprises were Tk 1.4 billion, up from Tk 1.1 billion in FY 87. Losses from the Bangladesh Jute Mills Corp. were Tk 1.04 billion, almost three fourths of all losses from public enterprises.

USAID has played a significant role in the push toward privatization, especially in the agriculture sector. The question for USAID is how far it should go in pushing for further privatization in other sectors that relate to agriculture, e.g., the sugar industry, the fertilizer factories, etc. The fertilizer industry would be good candidate since it needs to be restructured to produce complete fertilizers that have been formulated for specific soils and crops. This is especially important as crop intensification grows and nutrient deficiencies begin to occur which limit production. Would full privatization of all jute mills solve the problems that now exist in that industry thereby assuring farmers of a stable and profitable outlet for their crop?

USAID has used its resources (especially Title III) in the past to leverage policy changes and it should continue to do so. However, an analysis is needed of target industries to determine what is needed, how privatization can be most efficiently and expeditiously carried out, and the impact on the general economy and on the agriculture sector. As was pointed out in the paper on agribusiness, the overall impact of privatization of these industries on the agriculture sector will not have the impact that privatization of the fertilizer distribution system and the STWs have had and will continue to have. The major impact of privatizing the sugar mills, fertilizer plants, jute and paper mills will be the shifting of investment from the government to the private sector and in reducing the outflow of scarce resources caused by subsidized loans and operating losses. These funds could be more profitably spent on other agricultural sectors such as irrigation and improved technology transfer.

6. Credit

The government rural credit policy is extremely important to the agriculture sector since the question of how much credit is available and who gets it affects the growth of the sector and the distribution of benefits. Credit to the agriculture sector can be classified as institutional and non-institutional. Institutional credit is provided by public and private banks, special financial institutions and non-bank institutions such as Proshika, cooperatives, etc. Non-institutional credit is provided by friends, relatives, traders, landlords, money lenders, etc. Non-institutional credit is by far the most important source of rural credit, accounting for an estimated 65% to 75% of the total. And, for small farmers and the landless poor, non-institutional credit probably accounts for 90% to 95%. Medium and large land owners also rely heavily on non-institutional credit but they generally have access to formal credit institutions.

Although a substantial percentage of non-institutional loans are from friends and relatives, who charge no interest or charge relatively low rates (5% to 12%), loans obtained from money lenders, traders and landlords often carry an effective rate of 50% to 100%, and sometimes more. Since access to credit through the formal banking system is essentially limited to medium and large land owners, their ability to obtain interest rates of around 16% means they have a significant advantage over small farmers and the landless who find themselves further disadvantaged. The inability to obtain loans at reasonable rates is one of the reasons the number of landless peasants is increasing rapidly.

The disbursement of formal credit in the rural sector has ranged from Taka 373 crore in 1980/81 to Taka 1150 crore in 1984/85. It declined sharply in 1985/86 to Taka 632 crore and has remained at that general level. The private banking system is essentially not in the agricultural lending business, accounting for less than 1% of the disbursements in 1987/88. The two agricultural banks provided between 60% and 70% of agricultural loans, with BKB accounting for almost 95% of the agricultural loans between 1980/81 and 1987/88.

In 1987/88, the non-agricultural banks disbursed Taka 263 crore and had overdues of Taka 755 crore. The BKB disbursed Taka 336 crore and had overdues of 761 crore. The high rate of overdues, some going back many years, has caused a slowdown in agriculture sector lending. A concerted effort is underway to strengthen the management in the rural banking system so that can be more responsive to the needs of the sector. However, even if the rural banking system can be made more efficient and viable, it is unlikely that it can be restructured to meet the needs of small farmers and the landless. These needs will have to be met through other mechanisms such as Grameen Bank, Proshika and other institutions.

The government needs a policy for providing credit to small farmers. It has tried channeling credit through cooperatives, but the results have been unsatisfactory. NGOs have been successfully lending to small farmers and the landless. The Grameen Bank, a specialized banking institution, has been highly successful in lending to the very poor and landless, especially destitute women. The government should look to ways to channel more funds to these disadvantaged groups while at the same time strengthening the ability of the formal banking system to provide needed credit to the entire agriculture sector.

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