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**Assessment of USAID's
Fertilizer Market Privatization
Program:
Bangladesh**

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ACRONYMS AND DEFINITIONS

ATDP	Agribusiness and Technology Development Project
Aman	The agricultural season for paddy grown during the monsoon rains (planted in June and harvested from November to January)
Aus	The agricultural season for paddy planted in April and harvested from June to August
BADC	Bangladesh Agricultural Development Corporation
BCIC	Bangladesh Chemical Industries Corporation
BDG	Bangladesh Government
Boro	The agricultural season for paddy grown during the dry season (planted from November to January and harvested from April to June).
C&F	Cost and freight
CCP	Commercial Credit Program
CIP	Commodity Import Program
DAP	Diammonium phosphate
DD&T	Dealer development and training
DTW	Deep tubewell
FDI-I	Fertilizer Distribution Improvement - Phase I
FDI-II	Fertilizer Distribution Improvement - Phase II
FLFUS	Farm-level Fertilizer Use Study
HYV	High-yielding variety
IFDC	International Fertilizer Distribution Center
IFPRI	International Food Policy Research Institute
IRR	Internal rate of return
LLP	Low lift pump
LV	Local variety
MIS	Management information system
MLR	Minimum lifting requirement
MOA	Ministry of Agriculture
MP	Muriate of potash
NMS	New marketing system, FDI-I
OMS	Old marketing system, pre-FDI-I
PDP	Primary distribution point
SSP	Single superphosphate
STW	Shallow tubewell
TDP	Transport discount point
TSP	Triple superphosphate
USAID	U.S. Agency for International Development

BACKGROUND

COUNTRY SETTING

Bangladesh is one of the world's poorest countries, with a per capita income of \$180.¹ The population is about 110 million, which represents 741 people per square kilometer, and population is growing at 2.1 percent per year. Income distribution is highly skewed, with the top 5 percent of the population receiving 21 percent of national income, and the bottom 40 percent receiving 18 percent. About 47 percent of the people live below the poverty line, with 27 percent being in extreme poverty.

In 1971, when Bangladesh emerged as an independent nation, it was predominantly an agrarian economy, with 60 percent of its GDP coming from the agricultural sector. Since 1971, the rate of growth in GDP has averaged 4.5 percent (4.9 percent in the 1970s, 4.3 percent in the 1980s), and the share of agriculture, which has grown at a rate of 2.3 percent, has dropped to 38 percent.

Bangladesh's consistently modest rate of economic growth, which compares unfavorably with growth rates for other countries in the region, can be attributed to low rates of saving and investment, both in the public and private sectors. Total investment declined from 16 percent of GDP in FY 1980 to 11 percent of GDP in FY 1991. Public investment declined as current expenditures took an increasing share of overall budget expenditures, and private investment remained stuck at around 6 percent of GDP. This percentage contrasts with an average private investment of 10-11.5 percent of GDP for 40 developing countries surveyed by the International Finance Corporation. Domestic savings as a percentage of GDP decreased from 3.4 percent in FY 1981 to 1.6 percent in FY 1990, which is one of the lowest such ratios of any developing country.

The external sector has seen some improvement over the past decade, attributable mainly to the rapid rise in nontraditional exports (other than jute, leather, and leather products), especially garments. Exports of ready-made garments rose from \$3.2 million in FY 1981 to \$869 million in FY 1991. Nontraditional exports as a whole increased at a rate of 24.5 percent a year during FYs 1981-1991, reaching \$1.148 billion. Traditional exports, meanwhile, declined at an annual rate of 0.2 percent, to \$569 million in FY 1991. The combined effect of these trends was a modest improvement in the exports/GDP ratio from 7.4 percent in 1985 (earlier figures are unavailable) to 9.4 percent in FY 1991. The improvement in commodity exports has, however, been approximately offset by a leveling off of wage earner remittances from the Middle East, as a result of the Gulf War. Import dependence, meanwhile, has remained roughly unchanged, with an imports/GDP ratio of 16-18 percent, fluctuating with the annual food aid requirement and changes in the annual bill for oil imports. The net of these trends has been a continuing heavy reliance on foreign aid. Allowing for the fact that aid flows for the past few years have been swollen by higher-than-normal food aid requirements as a result of natural disasters, Bangladesh appears to have a normalized aid requirement of \$1.5-\$1.6 billion per annum.

¹ The exchange rate for the Bangladesh currency, the taka, has averaged about 39 takas = \$1 over the past several years. To facilitate calculation, this report uses an exchange rate of 40 takas = \$1.

THE AGRICULTURAL SECTOR

The agricultural sector's importance lies not only in its sizable share of GDP but also in the fact that it accounts for two-thirds of all employment in Bangladesh. Even if growth in agriculture should continue to lag that in industry and services, agriculture will still have the greatest employment creation potential, at least for the foreseeable future.

The total cultivated area of the country is about 8.7 million hectares, with an average farm size of 0.9 hectares. The landownership pattern is highly skewed. Small farms (up to 1 hectare) constitute 70 percent of total farms and account for 29 percent of total farm area. The corresponding ratios for large farms (above 3 hectares) are 4.9 percent and 26 percent. About 55 percent of the rural population are landless, and 39.8 percent of the total agricultural households are labor households.

In terms of land use, 4.3 million hectares are single cropped, with 3.7 million hectares double cropped and 730,000 tripled cropped. About 30 percent of the cultivated area is irrigated, with 85 percent of the irrigated area using modern methods and tools such as tubewells and low lift pumps.

Some 80 percent of agricultural output is in foodgrains, of which rice accounts for 96 percent and wheat 4 percent. Rice is grown during three seasons — aus, aman, and boro — corresponding roughly to the early monsoon, late monsoon, and winter (dry) seasons. Wheat is principally a dry season crop. Other key crops, listed in order of published acreage, are pulses, oilseeds, jute, sugar cane, potatoes, and vegetables. Maize and sorghum are also grown in some quantity, though they are not shown in the official statistics.

In the decade ending 1992/1993, total paddy production increased by 30 percent (2.6 percent per annum), from 14.1 million to 18.3 million tons, with aus production falling from 3.1 million to 2.1 million tons; aman production increasing from 7.5 million to 9.7 million tons; and boro production rising from 3.5 million to 6.6 million tons. (See Statistical Annex, Table 4.) Wheat production rose from 59,000 tons in 1970 to 823,000 tons in 1980, and has now leveled off at about 1 million tons. Production of pulses, oilseeds, and vegetables was essentially flat during the 1980s.

PROGRAM RATIONALE

Fertilizers were not introduced to Bangladesh on a significant scale until the early 1950s. During the following 10 years, all of the fertilizer was imported by the Directorate of Agriculture and distributed by the agricultural extension service. In the early 1960s, the East Pakistan Agricultural Development Corporation (EPADC), later renamed the Bangladesh Agricultural Development Corporation (BADC), was established to procure and distribute to the farm level fertilizer, seeds, and irrigation equipment and services. Soon after its inception, EPADC introduced a limited commercial concept in the distribution of fertilizers by using a national network of appointed retail dealers. This has since become known as the old marketing system (OMS).

Under the OMS, BADC remained the country's fertilizer purchaser and distributor, but did not sell below the wholesale level. Retailing was carried out by private dealers, who handled about 75 percent of the fertilizer, and cooperative stores that handled the remaining 25 percent. This system, which was supported by high government subsidies, resulted in sustained rapid growth in fertilizer use, with sales increasing from 73,000 tons in 1962 to 725,000 tons in 1977/1978. In 1978, the number of

registered fertilizer dealers totaled 43,000, of which about half were active. Although 75 percent of the retailers were in the private sector, the market was heavily controlled. BADC appointed all of the retail dealers and controlled their number in each local area. The dealers received commissions in the form of a discount from the official retail price to cover transportation, storage, handling and other costs, and a profit margin.

This system had major limitations. First, with its monopoly on the procurement and distribution of fertilizers, BADC had no incentive to cut costs. Between 1973 and 1978, BADC's operating costs increased by 240 percent, while its sales volume increased 90 percent. Second, the retailers, by operating on fixed commissions, were limited in their ability to take advantage of changing markets and optimize their operations. Third, neither BADC nor the private retailers promoted fertilizer use effectively. BADC was responsible for providing technical information to retailers for passing on to farmers, but even this limited amount of marketing was ineffective. Recognizing these limitations, the Government of Bangladesh and USAID agreed to undertake a program to improve the fertilizer distribution system. This led to two Fertilizer Distribution Improvement Projects over a 16-year period: FDI-I, which began in 1978; and FDI-II, which began in 1987 and is coming to a close this year.

PROGRAM DESCRIPTION

FERTILIZER DISTRIBUTION IMPROVEMENT - I

FDI-I's development goal was to increase agricultural production (4 percent annual overall growth, and 6 percent annual growth for holdings of less than one hectare), and its project purpose was to increase fertilizer use (15 percent annual growth overall and 22 percent annual growth for holdings of less than one hectare). The project had three components: \$142 million to finance 527,000 tons of fertilizer imports, \$60 million to finance the construction of BADC fertilizer warehouses, and \$33 million for technical assistance and training in fertilizer marketing policy and marketing systems. The local currencies generated by the fertilizer imports were used for general government support.

The first two components addressed two serious constraints to increased fertilizer supply — the lack of foreign exchange and the lack of storage capacity — but the main thrust of the project was to improve the fertilizer supply system by replacing the old marketing system with the new marketing system (NMS). This involved reorienting the government's fertilizer marketing policy toward liberalization and privatization, increasing BADC's efficiency and market orientation in the distribution of fertilizers, and increasing the role and marketing effectiveness of the private dealers. The FDI-I project sought to achieve these objectives mainly by providing technical assistance to BADC under a contract with the International Fertilizer Distribution Center (IFDC).

Under the OMS, BADC distributed fertilizers through three levels before they reached a network of 20,000 appointed retailers. BADC procured the fertilizer at the factory (urea) or imported it (triple superphosphate or TSP and muriate of potash or MP), shipped it to intermediate warehouses, and then shipped it to a network of 423 thana sales centers where the fertilizer was purchased by the private retailers. Under the NMS, BADC withdrew from the thana level, and the intermediate warehouses changed into primary distribution points (PDPs). Fertilizer marketing below the PDPs was deregulated in phases, with private dealers becoming wholesalers, buying from PDPs and selling to subdealers. Initially, dealers were allowed to sell anywhere for any price up to a limit set by the government for retail prices charged to farmers, and BADC increased marketing margins to encourage more aggressive marketing by the private sector. This was followed by the complete decontrol of prices and marketing margins below the PDP level.

These changes occurred slowly, and at times with considerable difficulty. The government was concerned that price decontrol would result in private dealers increasing prices to farmers, and BADC employees resisted the closing of the thana sales centers. The intermediate warehouses were converted to PDPs early in the project and private dealers started buying directly from these warehouses, making the sales centers redundant. By 1980, 72 percent of BADC sales to private dealers were through PDPs but very few of the thana sales centers had been closed. This effectively prevented many of the savings that should have been achieved by the change. The sales centers were not closed until 1985. Price decontrol, which was a much more controversial policy change, occurred more rapidly than privatization. Prices were decontrolled in selected locations on a pilot basis in 1981 and were fully decontrolled in 1983, when it became evident that decontrol did not put upward pressure on prices. In 1987, the ratio of fertilizer price to paddy price was 15 percent lower than it had been in 1982.

The end result of these changes is that BADC was primarily responsible for fertilizer procurement and distribution down to the PDP level, and the private sector assumed primary responsibility for all fertilizer marketing and sales below the PDP level. The FDI-I technical assistance component included

activities to strengthen both BADC and the private dealers. Advice was provided to BADC on inventory control, least cost routing, and the use of high-volume transactions as a means of cutting costs and passing the savings on to the private wholesalers. Advice and training were also provided to private dealers on how to promote fertilizer use and how to increase demand by disseminating information on optimal fertilizer use.

At the end of FDI-I in 1987, the project was considered a major success. The NMS had halted the increases in BADC's distribution costs, mainly by reducing warehouse and port costs and by consolidating sales outlets; it completely privatized fertilizer distribution below the PDP level; and it deregulated fertilizer retail prices. However, several shortcomings remained, mainly relating to BADC operations and dealer policies. Distribution costs remained high due to BADC mismanagement. Dealers reported that products were consistently in short supply, especially during periods of peak demand. Dealers also complained that BADC staff interfered with and delayed liftings, and dictated the product mix that could be purchased. Taken together, these shortcomings amounted to a lack of market orientation in BADC, and indicated that the shift to free and open markets was not yet complete.

FERTILIZER DISTRIBUTION IMPROVEMENT - II

To overcome the shortcomings of the NMS and expand private sector investment in fertilizer marketing, the Bangladesh government and USAID agreed to a second Fertilizer Distribution Improvement Project (FDI-II), which got under way in 1987. FDI-II's development goal (increased agricultural production) and purpose (increased fertilizer use) remain the same as FDI-I's, but the project outputs have focused less on strengthening BADC and more on expanding and strengthening the role of the private sector. As described in the project design document, the key components are: a \$44 million fertilizer Commodity Import Program (CIP) with the local currencies generated by the sale of the imports used to create a fertilizer credit fund; \$6 million for construction of storage, bagging, and handling facilities; and \$5 million of technical assistance and training under an IFDC contract. Including \$10 million for contingency and inflation, total USAID funding for FDI-II is \$65 million. This budget was revised significantly as the project was implemented. The technical assistance component, including all local costs, was increased to about \$20 million, and the fertilizer import program is unlikely to exceed \$25 million. The full \$44 million of funding for fertilizer imports is no longer needed, mainly because fertilizer importers now have unrestricted access to foreign exchange and are able to purchase fertilizers at lower prices from sources other than the United States.

The IFDC team consists of three expatriate long-term advisors: the chief of party, who is also the fertilizer marketing policy advisor; a dealer development and training specialist; and a credit specialist. In addition, a sizable local staff of advisors are responsible for implementing FDI marketing, training, credit, and management information system (MIS) activities. During the seven years of the project, implementation has proceeded on four tracks: reforming the Bangladesh government's fertilizer marketing policies, improving the BADC/private sector distribution and marketing system, improving the marketing and technical knowledge of private dealers, and increasing access to credit for fertilizer traders.

FDI-II's implementation shows a steady path toward the full disengagement of the government from fertilizer distribution. This was a step-by-step process — essentially spearheaded by the Ministry of Agriculture (MOA) — that was greatly facilitated and expedited by sustained policy dialogue between USAID and the government, and by technical advice, analysis, and information provided by the FDI-II technical assistance team to key government officials, especially in MOA.

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During FDI-II's first year, 1987/1988, the technical assistance team recommended that private wholesalers be allowed to purchase directly from a small number of strategically located transport discount points (TDPs), bypassing the PDPs. The wholesalers would be buying in larger quantities (84 ton minimum lifting requirement, or MLR) from facilities that were closer to the factory or port, thus encouraging the entry of larger private sector distributors and further reducing BADC's role. Experimentation with this system during FDI-I showed that the discount provided to wholesalers to induce them to buy from the TDPs was significantly less than what it was costing BADC to distribute fertilizer to the PDP level. This new system started functioning during 1988/1989 and, by mid-1989, BADC was able to close 12 of its 75 PDPs.

The next year, 1889/1990, was critical for FDI-II. During FDI-I, the main objective had been to strengthen BADC's effectiveness in the distribution of fertilizers, and FDI-II was intended to continue the process. However, as FDI-II implementation got under way, it became apparent that maximizing the efficiency and effectiveness of the fertilizer distribution system meant minimizing, and possibly eliminating, BADC's role. Under FDI-I, privatizing fertilizer distribution below the PDP level had removed BADC from retail sales, but did not threaten the organization's distribution role. Allowing private dealers to purchase in large quantities from TDPs, however, was the first step in privatizing distribution. When private dealers quickly took advantage of this opportunity, BADC immediately recognized that its distribution network would be reduced from 75 PDPs to about 10 TDPs nationwide. Its reaction was to obstruct the use of TDPs, forcing private wholesalers to continue using the PDPs. This, however, only served to expedite the privatization process. With private distributors unable to purchase from the TDPs, MOA decided to allow private distributors to bypass the TDPs altogether and lift directly from the factories and ports.

Once private distributors started lifting fertilizers directly from the factories and ports, the only remaining role for BADC was the importation of fertilizers. The main obstacles to privatizing imports were, first, that most of the fertilizers were funded by donors under government-to-government aid programs, and, second, most imported fertilizers continued to be subsidized by the government. In April 1990, IFDC carried out a study of fertilizer imports to identify modalities for transferring the imports to the private sector. The government accepted the study's recommendations, and imports were fully privatized in 1992/1993.

Beginning in 1990/1991, FDI-II shifted its focus from increasing the private sector's role (and reducing BADC's role) in fertilizer marketing to increasing the effectiveness of the private sector, mainly by training distributors and helping to increase the availability of bank credit. First, the project provided training to the large distributors in the technical aspects of fertilizer importation. This activity was important in helping to ensure that the transition from BADC imports to private sector imports would be as trouble-free as possible. The project has also continued to provide training in market development and marketing techniques. Private distributors are now organizing and conducting their own training of dealers and retailers at their own expense, with FDI-II supplying trainers as necessary. Recent farmer surveys indicate that fertilizer dealers have become the most important source of technical advice for farmers, far outpacing the agricultural extension service. In the last two years, the project has provided short-term training to more than 1,000 distributors and dealers on a wide range of subjects dealing with fertilizer marketing. The project is also doing critical on-the-job training by providing direct assistance to individual distributors in solving day-to-day problems.

Credit requirements became important in 1989 when private distributors started making fertilizer purchases of millions of dollars. FDI-II helped to address these needs with the Commercial Credit Program (CCP). Between 1989 and 1992, USAID created a \$24 million refinance window in the Bank of Bangladesh to make funds available to commercial banks wishing to make short-term loans to fertilizer

traders. After the fund was created, FDI-II conducted training to inform banks about fertilizer trade and advise fertilizer traders on the use of credit. Several hundred distributors and bankers have gone through these training programs. In 1990/1991, commercial bank loans to fertilizer distributors totaled 1 billion takas (\$25 million), of which the USAID-financed share was 56 percent. Two years later, commercial bank loans totaled 5 billion takas, of which the USAID share was 31 percent. The USAID share declined mainly because banks in Bangladesh currently have excess liquidity.

Finally, in 1991/1992, FDI-II started working with the Bangladesh Chemical Industries Corporation (BCIC), which produces all of the urea used in Bangladesh, to introduce private sector management and marketing practices. FDI-II studies show that, by shifting from fixed to variable pricing and improving inventory management, BCIC will improve the supply of urea to farmers while at the same time reducing costs. BCIC has agreed to make some of the recommended changes, but they have not yet been fully put into effect.

PROGRAM OUTPUTS

The \$235 million FDI-I project generated the following outputs:

- The \$142 million fertilizer import program financed 527,000 tons of fertilizer imports, 13 percent of total fertilizer imports during the FDI-I implementation period. The local currency generated by the sale of these fertilizers to the private sector was used for general budget support.
- The \$60 million warehouse construction component increased BADC warehouse space by 165,000 tons. BADC fertilizer warehouse capacity at the end of the project was 400,000 tons.
- The \$33 technical assistance component produced numerous marketing studies aimed at improving the BADC fertilizer distribution system; farm-level surveys generating data on fertilizer use and its impact on farmer incomes; and an MIS generating monthly data on fertilizer distribution, prices, and availability.
- The training component created a Dealer Development and Training Unit in BADC. FDI-I staff trained BADC trainers, who then conducted dealer training in the regions. Most fertilizer dealers received technical and marketing training under this program.

The \$65 million FDI-II project has generated the following outputs:

- Prior to the full liberalization of the foreign exchange regime, FDI-II financed fertilizer imports. These imports generated local currency that was used to finance the \$24 million revolving credit fund USAID provided for fertilizer marketing. With foreign exchange liberalization, the fertilizer financing component became unnecessary. Tied USAID-funded fertilizers were too expensive for importers who now had unrestricted access to foreign exchange and could buy their fertilizers from any source. It is likely that the remaining funds in the fertilizer financing component will be de-obligated.
- The revolving credit fund financed by the fertilizer sales is available to commercial banks to make working capital loans to fertilizer distributors. At the same time these funds were made available, FDI-II staff provided training to banks and fertilizer distributors in the use of bank credit for

fertilizer marketing. The result is that commercial banks are now making short-term loans for fertilizer distribution.

- The technical assistance component has produced policy and marketing studies for MOA, and an expanded MIS that generates detailed and timely information on the privatized distribution and marketing system for government officials and private businesses. This component also provides ongoing ad hoc policy advice to MOA and marketing advice to private distributors. FDI-II is MOA's de facto staff for all matters dealing with fertilizer, including policy formulation, market monitoring, and long-range planning.
- The training component has provided training to government officials in fertilizer policy and market-based fertilizer distribution; to private distributors in fertilizer marketing; and to bankers and distributors in the use of bank financing for fertilizer marketing. The private distributors have in turn provided marketing training to dealers with support from FDI staff.

Except for the FDI-II fertilizer import component, the two projects have achieved or exceeded all of their output targets. It might seem incongruous that FDI-I aimed at strengthening BADC for fertilizer distribution and FDI-II has aimed at eliminating BADC from fertilizer distribution. However, as a practical matter, attempts to increase BADC's effectiveness were a necessary intermediate step in the privatization process. As will be discussed later, a key factor in the success of this program has been the priority put on demonstrating the effects of the policy changes at every stage of the reform process. It would have been impossible to remove BADC from fertilizer distribution without being able to show conclusively that the private sector would be able to distribute fertilizers more effectively and at less cost.

PROGRAM PERFORMANCE

The program outputs have led to three major accomplishments in improved fertilizer distribution in Bangladesh: liberalization and privatization of the fertilizer market; growth in the number and effectiveness of private fertilizer importers, distributors, and dealers; and a more efficient fertilizer marketing system. These accomplishments were in fact the FDI program's main objectives.

LIBERALIZATION AND PRIVATIZATION OF THE FERTILIZER MARKET

The most direct outcome of FDI I and II program activities has been the liberalization and privatization of Bangladesh's fertilizer market. In 1978, when FDI-I started, BADC distributed all fertilizers through a network of 20,000 private retailers who were all appointed by BADC and were allowed to sell only within prescribed areas and at set prices. The entire system was government controlled from the port and factory down to the final consumer. The liberalization process began in 1978 and, through a step-by-step process, eventually led to the complete disengagement of the government from the fertilizer market. The complete decontrol of prices, complete privatization of marketing, and complete elimination of subsidies are unique in the Bangladesh development experience. The chronology of major events that took place under the two projects is presented in Table 1.

GROWTH OF PRIVATE SECTOR AGRIBUSINESS FIRMS

FDI's liberalization measures created the opportunity for increased agribusiness activity, and the agribusiness sector responded. In 1977/1978, BADC sold 725,000 tons of fertilizer to 20,000 private dealers through thana sales centers, usually in lots of well under one ton. By 1985, the role of private agribusinesses had increased dramatically. The thana sales centers had been closed, and private dealers were purchasing directly from PDPs in lots of 3 to 10 tons. The network of 20,000 dealers (retailers) has been replaced by 5,000 dealers (wholesalers), with each dealer selling to an average of 12 subdealers (retailers).

The next major step in the privatization of fertilizer distribution took place in 1988, when the government allowed private dealers to purchase minimum lots of 84 tons from nine TDPs, including the six urea factories. The introduction of TDPs was followed in 1989 with unrestricted direct purchases by private distributors from ports and factories, and in 1991 with direct private sector imports. Although between 1989/1990 and 1991/1992, fertilizer sales remained constant at about 2 million tons, the number of private distributors increased from 276 to 1,271, and the number of dealers and subdealers increased from 55,000 to 110,000 (10,000 dealers and 100,000 subdealers).^{2, 3}

² Source: Charles J. Heureux, "FDI-II Mid-term Evaluation," Final Draft, November 1992. p. III-8.

³ The present privatized system has four levels. First, private distributors purchase from private importers at the port or from BCIC factories. Second, the distributors sell to dealers from their warehouses in the fertilizer market towns. Distributors are large wholesalers, and dealers are small wholesalers who sometimes also sell retail. Third, dealers sell to subdealers. These subdealers are either part-time fertilizer retailers or retail establishments that also sell other agricultural and consumer products in local markets. Fourth, the subdealers sell to farmers. The nomenclature for each level of marketing can be confusing because wholesaling occurs at several levels and the smaller wholesalers also sell retail.

TABLE 1

**CHRONOLOGY OF FERTILIZER LIBERALIZATION AND
PRIVATIZATION UNDER FDI-I AND FDI-II**

<p>Prior to 1978: All fertilizers were distributed by BADC through 423 thana sales centers to appointed retailers, whose marketing areas and marketing margins were controlled.</p>
<p>1978: Start of FDI-I.</p>
<p>1982: Controls were removed on retail prices, retailer marketing margins, and retailer marketing areas.</p>
<p>1982-1985: The 423 BADC thana sales centers were replaced with a smaller network of 75 BADC primary distribution points. All sales below the PDP level were privatized and decontrolled.</p>
<p>1986: The subsidy on urea was officially eliminated.</p>
<p>1987: -Start of FDI-II. -The first six transport discount points were opened, enabling private wholesalers to bypass PDPs and buy larger quantities (minimum lifting requirement, 84 tons) at a discount from the PDP price.</p>
<p>1989: -Private dealers were allowed to purchase urea directly from the factories. -Private dealers were allowed to purchase triple superphosphate and muriate of potash directly from ports. -Twelve BADC PDPs were closed.</p>
<p>1990: Fourteen PDPs were closed.</p>
<p>1991: -All PDPs were closed. -All fertilizers were sold directly to private distributors at the factory or the port. -Private sector began to import directly. -Phase-out of 50 percent subsidy on TSP and MP began.</p>
<p>1992: -Private sector took over 100 percent of fertilizer imports. -December: phase-out of subsidies on TSP and MP was completed. -All fertilizers were purchased, distributed, and sold to farmers by the private sector on a full-cost basis, with no government restrictions.</p>

The growth of Bangladesh's private fertilizer distribution industry has been gradual and systematic. When BADC sales shifted from the thana sales centers to the PDPs in 1982, dealers started purchasing larger quantities and most switched from retailing to wholesaling. These dealers were located throughout the country. Some owned small warehouses, but most rented warehouse space and purchased transport services. When sales shifted from PDPs to the factories, TDPs, and the port, some dealers became distributors who purchased thousands of tons per year. Today, distributors are located in

fertilizer market cities, which are close to factories or the port and have adequate infrastructure and services to support the large-scale storage, transport, and marketing of fertilizers.

Although Bangladesh has more than 1,000 registered distributors, there are probably no more than 300 owners. Most distributors own more than one distribution business for tax purposes and in order to maintain a low profile. The volumes handled by the distributors range from 500 to 50,000 tons. (For distributors, the average lifting is about 300 tons, whereas for dealers the average lifting is about 30 tons.) The largest 20 percent of distributors are likely to own their own warehouses and, in some cases, barges, trucks, and tractors for transportation. The others rent warehouse space and purchase transportation services. Typically, distributors have fewer than 10 full-time employees, and hire temporary labor as needed. The size of individual distributors is determined mainly by their access to working capital. In practice, smaller distributors with annual sales of less than 5,000 tons have very limited access to bank financing.

Bank financing for fertilizer trade has increased dramatically as a result of the FDI-II CCP. Prior to 1989, the relatively small dealers purchasing from PDPs did not qualify for bank credit. However, when larger, more established businesses started buying larger quantities of fertilizer, bank financing became both a need and a possibility. The commercial credit fund and associated training under FDI-II resulted in more than 1 billion takas (\$25 million) of credit to fertilizer traders in 1990/1991, of which 56 percent was USAID-financed. By 1992/1993, total bank loans under the CCP had increased to 5 billion takas (\$125 million), of which only 31 percent was USAID-financed. These loans, which were provided by 13 participating banks through 384 branches nationwide, financed more than 50 percent of the fertilizer trade.⁴ Ninety-four percent of the credit went to distributors, 5 percent to dealers, and only 1 percent to retailers, reflecting the fact that only the distributors were large and established enough to meet normal bank lending criteria. It should be noted, however, that distributors provided supplier credit to dealers, dealers in turn provided credit to subdealers, and some subdealers provided credit to farmers. Thus, part of the bank credit provided to distributors found its way down the marketing chain to businesses and farmers who would not qualify for direct bank loans.

In contrast to the BADC system, the present privatized system is clearly based on market responsiveness, customer service, and intense price competition. Distributors succeed by meeting dealers' needs, including reliable and timely deliveries, and dealers succeed by providing the services needed by subdealers and anticipating farmer needs and demand. Competition is strong at all levels of the marketing chain and in all regions of the country. Margins are small and all distributors and dealers are constantly seeking ways to minimize costs. This has resulted in a more efficient marketing system and lower delivered costs to the farmer.

INCREASED MARKET EFFICIENCY

The improvements in the marketing system that have resulted from the two FDI projects can be summarized as follows:

- Direct purchases of fertilizers from the factories for urea and from the port for TSP and MP have resulted in major cost savings all along the marketing chain. First, BCIC is now being paid cash

⁴ Source: FDI-II Annual Report — 1992-1993, IFDC, p. 21.

for its fertilizers, thereby greatly improving its cash flow. (BADC currently owes 1.2 billion takas [\$30 million] in accumulated arrears, which will probably never be repaid.) Second, private distributors are paying much less than BADC for barge transport, which is the major form of transport from the port and factories to distributor and dealer warehouses. Third, private distributors and dealers have adopted more efficient inventory management by purchasing in more economical lots and locating their warehouses so as to minimize storage and transport costs and facilitate access for subdealers and farmers. These improvements have made it possible for the private sector to move fertilizers from the factory or port to dealer warehouses (the equivalent of the former BADC PDPs) for 400 takas per ton instead of the BADC cost of 1,200 takas per ton.

- Direct imports by the private sector in 1991/1992 resulted in an 8 percent reduction in the cost and freight (C&F) price. The price reductions were \$16 (640 takas) per ton for TSP and \$11 (440 takas) per ton for MP.
- Since 1989, competition has kept the margin between the issue price at the factory or TDP and the farm at under 20 percent for urea and TSP, and around 25 percent for MP, which is sold in smaller quantities (see Statistical Annex, Table 1). When there is an unexpected increase in the issue price, private distributors and dealers generally absorb part of the increase (TSP in July 1991, and MP in January 1993, for example) and then gradually increase the margins back to competitive but profitable levels. Unlike BADC, which was usually unable to make these adjustments without incurring large losses that had to be made up by the government, the private sector is now adjusting to changes efficiently and with its own resources.
- The private distributors and dealers have been more responsive than BADC to market forces. Under the BADC system, the fertilizers available at any given location often were not the ones the farmers demanded, and BADC's inability to anticipate future demand from one season to the next and in the different regions resulted in spot shortages, even when supplies were adequate at the national level. FDI-II surveys have found that farmers feel overwhelmingly that they now have much better access to the fertilizers they need.
- As part of their marketing efforts, private distributors, with assistance from the FDI-II staff, have provided training to dealers and subdealers in the technical aspects of fertilizer use. FDI-II surveys have found that more than 50 percent of farmers using fertilizers cited fertilizer dealers as their source of technical advice. Under the BADC system, most fertilizer retailers had little or no technical knowledge of how fertilizers should be applied on farmers' fields.

Increased market efficiency has made fertilizers more affordable and more widely available. The result has been continued rapid growth in fertilizer sales (see Statistical Annex Table 2). Between 1982/1983, when FDI-I measures started having an effect, and 1992/1993, fertilizer sales grew by 8 percent per year, from 958,000 tons to 2.1 million tons. Fertilizer sales grew by 9 percent per year between 1972/1973 and 1982/1983, but this growth was from a small base (400 tons) and was achieved at a high government cost (subsidies averaging more than 60 percent). Data on paddy production show that fertilizer use is now relatively well distributed throughout the country. During the boro season, remote and nonremote regions show the same percentage of high-yielding variety (HYV) area fertilized — 9 percent — and application rates are not much different at 313 kilograms/hectare versus 390 kilograms/hectare. During the aman season, 90 percent and 96 percent of the HYV area is fertilized in remote and nonremote areas, and the application rates are 153 kilograms/hectare and 212

kilograms/hectare, respectively.⁵ FDI-II surveys show that the slightly lower application rates for the remote areas reflect lower purchasing power and more primitive farming practices rather than the unavailability or high price of fertilizers.

An important effect of the increased availability has been that fertilizer prices have stayed in line with agricultural prices. The key crop is paddy, which accounts for 80 percent of fertilizer use in Bangladesh. Although, as will be discussed in a later section, the rice price adjusted for inflation has been dropping steadily since the early 1970s and fertilizer subsidies have gradually been eliminated, the fertilizer price relative to the rice price is lower in 1993 than it was in 1980. As can be seen from Table 2 below, since 1986/1987 the ratio has remained under 1.0 for all years except 1992/1993, when there was a paddy bumper crop and the rice price plummeted.

TABLE 2
CHANGES IN FERTILIZER PRICE RELATIVE TO PADDY PRICE
(takas per ton)

Year	Paddy	Fertilizer	Ratio
1980/1981	2,938	2,994	1.02
1981/1982	3,404	3,605	1.06
1982/1983	3,618	3,943	1.09
1983/1984	4,864	4,007	0.82
1984/1985	4,633	4,749	1.03
1985/1986	4,523	4,995	1.10
1986/1987	5,671	4,931	0.87
1987/1988	5,543	4,924	0.89
1988/1989	5,869	3,639	0.62
1989/1990	5,533	4,648	0.84
1990/1991	6,312	4,725	0.75
1991/1992	6,265	5,004	0.80
1992/1993	5,190	5,390	1.04

MINIMAL INSTITUTIONAL STRENGTHENING

Although the USAID fertilizer distribution improvement program has had a major impact on agribusiness growth and market efficiency, it has had virtually no impact on supporting institutions in the public sector. The main institutional target was BADC. FDI-I's objective was to increase BADC's efficiency and effectiveness in fertilizer distribution. This was a slow process. Although the thana sales centers had become redundant in 1982, they were not closed until 1985. Also, although IFDC had recommended larger liftings at the PDPs to reduce costs, the recommendations were not accepted. Finally, the FDI-I recommendation that BADC shift from a large number of PDPs to a smaller number of TDPs was not accepted because it implied a major reduction in BADC's role in fertilizer distribution.

⁵ Source: FDI-II Farm-level Fertilizer Use Surveys for Boro 1990/91 and Aman 1991/92. IFDC, February and June 1993.

The situation has not improved under FDI-II. TDPs were finally established in 1988 over BADC's objections and never did function properly because of BADC's lack of cooperation. In the end, the Bangladesh government decided to bypass BADC completely and allow private distributors to purchase directly from factories and ports.

Despite its almost complete removal from fertilizer distribution, BADC has retained all of its 400,000 tons of fertilizer warehouse space (although about half of the space has been leased for food storage) and most of its fertilizer distribution staff. There is now general agreement that BADC's fertilizer wing should be streamlined, restructured, and given different responsibilities; the government has appointed a high-level committee to make recommendations. With technical advice from the FDI-II technical assistance team, the government should have been able to set up a domestic version of IFDC to carry out technical studies of fertilizer use in Bangladesh, monitor the fertilizer market, and advise the government on fertilizer policy. This new institution would have been able to assume many of the policy analysis and program support functions currently being performed by FDI-II. The government is now addressing these issues without the help of the FDI-II technical assistance team, mainly because BADC would strongly resist any recommendations perceived as coming from the FDI-II project. At the present time, it appears that BADC fertilizer wing will be continued, but there are no definite plans for transferring FDI-II functions to the organization.

There also has been no institutional strengthening of MOA as a result of USAID's fertilizer program. MOA has a continuing interest in fertilizer availability, prices, and use as part of its overall responsibilities for agricultural and food production. Since the start of FDI-I, MOA has depended on the USAID FDI program to provide the data and analysis needed to make program and policy decisions. None of this project capacity has been transferred to the ministry, and the availability of technical and analytical expertise in the FDI projects has probably resulted in less MOA capacity in these areas than would have been the case without the projects.

The lack of fertilizer policy analysis expertise has important sustainability implications because, although MOA has been the main supporter of the fertilizer liberalization and privatization reforms within the government, the reforms could not have been adopted or implemented without the data and analysis provided by the two USAID projects. In the absence of effective data gathering, analysis, and policy advocacy, the government could succumb to political pressures and backtrack in some of its privatization and liberalization measures.

ECONOMIC AND SOCIAL IMPACT

The FDI program's economic and social impact stems entirely from its impact on fertilizer use. Between 1972/1973 and 1982/1983, fertilizer use in Bangladesh grew by 9.4 percent per year, mostly due to the high government subsidy. However, by 1978, when FDI-I started, the subsidy had already become unsustainable, and there was general agreement in the government as well as among donors that it had to be greatly reduced, if not eliminated. Another issue at that time was the cost and effectiveness of the BADC fertilizer distribution system. Unit marketing costs were increasing at a rapid rate and spot shortages were becoming increasingly frequent. Under FDI-I and FDI-II, all subsidies were eliminated and BADC was removed from fertilizer distribution.

As noted previously, between 1982/1983 and 1992/1993, the period roughly corresponding to the FDI program, fertilizer use in Bangladesh grew by 8 percent per year to a level of 2.1 million tons. Two factors made this continued growth possible. The first was the reduction and eventual elimination of the subsidy. Although removing the subsidy caused the fertilizer price to go up, the net effect on fertilizer use was positive because, in Bangladesh at this time, fertilizer use depends more on availability than on price. Fertilizer accounts for only 12 percent of the total cost of the high-yielding production package. The largest cost is labor, second is land rental (or the opportunity cost of not renting the land to someone else when it is owned), and third is irrigation (during the boro season, which accounts for 40 percent of all fertilizer use). (See Statistical Annex, Tables 6 and 7.) An FDI-II study of the effects of subsidy removal found that increasing the retail price of fertilizer by 30 percent would have an insignificant effect on the profitability and therefore the use of fertilizer.⁶ Also, when fertilizer is subsidized, the supply is limited by the availability of subsidy funds. The government sets the subsidy rate and allocates funds to pay the subsidy. However, in situations of severe budgetary constraints, such as in Bangladesh, the funds are never adequate to meet demand, so there are constant supply shortages. This leads to the rationing of subsidized fertilizers and the emergence of a parallel market at prices that are higher than they would have been in a completely open market.

The second factor in the controlled growth of fertilizer use from 1982/1983 to 1992/1993 was the improved distribution system that helped keep the growth in fertilizer price below the growth in paddy price. More important, under the privatized system, fertilizer was actively marketed and efficiently distributed. All of the participants from the distributor down to the subdealer gave top priority to maximizing sales, and with few exceptions, the private sector was able to meet the effective demand for fertilizers in all regions of the country. This is in sharp contrast to BADC, which did almost no marketing and had a grossly inadequate distribution system. At the start of FDI-I in 1978/1979, when fertilizer sales were only 736,000 tons, the full delivered cost was rising rapidly and fertilizers were often in short supply. FDI-I introduced major improvements (increased competition at the retail level and the shift from BADC sales centers to PDPs), but when it ended in 1987, BADC distribution costs were still excessive (triple what it would have cost private distributors) and spot shortages were still widespread and frequent. Prior to the FDI-I project, the government was having problems financing the subsidies and BADC was having problems distributing 736,000 tons of fertilizer. At the end of FDI-I, despite the removal of the subsidy on urea and improvements in the BADC marketing system, the subsidy costs had increased and BADC was inefficiently distributing 1.5 million tons and incurring heavy losses.

⁶ Carlos A. Baanante et al., *Fertilizer Subsidy Removal in Bangladesh: An Assessment of the Impact on Fertilizer Use, Crop Yields, and Farmer Profits*, Muscle Shoals, Alabama: IFDC, 1993.

Under FDI-II, all remaining fertilizer subsidies were eliminated, and BADC was removed entirely from fertilizer distribution and marketing. The end result is that, in 1993/1994, fertilizer sales will total about 2.3 million tons and will be readily available throughout the country at no budgetary cost to the government. If the system had remained as it was in 1978, it is very likely that government funding constraints and BADC inefficiencies would have kept fertilizer sales at least 1 million tons lower than they are currently. The FDI program's economic impact, then, is based on the 1.6 million ton increase in fertilizer use that has occurred over the life of the program.

INCREASED AGRICULTURAL PRODUCTION

Most of the FDI program's impact has been on paddy production. Between 1972/1973 and 1982/1983, paddy production grew by 42 percent, including a 10 percent increase in area and a 30 percent increase in yields (see Statistical Annex, Table 4). During the following decade, production grew by 30 percent, including a 3 percent increase in area and a 26 percent increase in yields. The rice price has declined steadily since the early 1970s and, in 1992/1993, Bangladesh became self-sufficient in rice. The importance of fertilizer in making this growth possible over the past 10 years is best understood by looking at each paddy growing season separately.

As previously noted, there are three paddy growing seasons: the early rainy season (aus), the monsoon season (aman), and the dry season (boro). Production trends for each season are shown in Statistical Annex Table 4. Aus production, which accounts for only 9 percent of total production, has been declining by 3.8 percent per year over the past decade.

The main paddy season is aman, which accounts for more than half of total production. Since 1982/1983, aman production has grown by 2.6 percent annually, with no increase in total area and very little increase in irrigation (see Statistical Annex, Table 5). Production increases have been due entirely to the increased use of HYVs and fertilizer. The HYV production response to fertilizer use is very high (about 1 ton per hectare at present application rates) but, without fertilizer, HYVs do not yield much more than the local varieties. The availability of fertilizer has made it possible for HYVs to increase from 4 percent of total cultivated area in 1980 to 40 percent in 1993. Ninety-five percent of the aman HYV area is fertilized; the average application rate is 192 kilograms/hectare, and the average yield is 3.3 tons per hectare. The corresponding figures for the local varieties are 68 percent fertilized, application rate of 76 kilograms/hectare, and average yield of 2.3 tons per hectare. HYVs now account for two-thirds of aman paddy production. If fertilizer use had leveled off at 1 million tons, as the analysis above suggests might have happened without the FDI program, aman production would have been around 8 million tons instead of the current 9.7 million tons.

The most dramatic growth has been in boro production — a sustained 6.4 percent per year over the program period. During the five years ending 1984/1985 (see Statistical Annex, Table 4), production grew by 10 percent per year and, in the subsequent five years production grew by 9 percent per year.

Boro paddy is a dry season crop depending almost entirely on irrigation. The high investment and operating costs of the irrigation systems (mostly shallow tubewells) dictate that farmers obtain maximum yields. With 90 percent of the area under HYVs, and a fertilizer application rate of 363 kilograms/hectare, the average paddy yield has reached 4.2 tons per hectare. For the boro season, even more than for the other two seasons, the key factor in fertilizer use is availability, not price. As can be seen from Statistical Annex Table 7, a 100 percent increase in the fertilizer price would reduce the return per hectare by only 14 percent, from 13,195 takas/hectare to 11,335 takas/hectare. Had fertilizer

availability remained at the 1 million ton level, the boro season would have been the most affected. The critical period was the mid- to late-1980s, when the importation and sale of irrigation equipment (pumps and engines) were liberalized. Because fertilizers were readily available, farmers were willing to make the necessary investment. Without dependable fertilizer supplies, farmers could not have taken the risk. In the three-year period ending 1989/1990, the total irrigated paddy area increased by 40 percent and the area under HYVs increased by 39 percent. In 1990/1991, boro paddy, with only 25 percent of cropped area, accounted for 54 percent of fertilizer use. Looking at the growth trends for boro paddy, if fertilizer supplies had stayed at 1 million tons, boro production in 1992/1993 would most likely have been about 3.5 million tons instead of the current 6.6 million tons.

The conclusion to be drawn is that paddy production is now about 5 million tons greater than it would have been had there been no growth in fertilizer use since the early 1980s. Without increased fertilizer use, rice prices would have risen, and the country would still be a major rice importer. This difference, of course, cannot be attributed fully to the FDI program. The availability of HYV seeds and irrigation has also been critical. The seeds are available mainly because of USAID-funded research conducted in the 1960s, and the irrigation equipment became available and affordable in the mid- and late-1980s because of policy reforms supported by the World Bank and the Asian Development Bank. The FDI program, however, has been a critical element without which BADC's overall efforts to increase Bangladesh's rice production program could not have had their intended impact.

IMPACT ON INCOMES AND EMPLOYMENT

The starting point for assessing the FDI program's impact on agricultural incomes and employment in Bangladesh is the additional crop area under the high-yielding technical package that would not have been possible under the fertilizer distribution system that existed in 1978. Based on the analysis in the previous two sections, there are about 2 million more hectares in the aman season and 1.7 million more hectares in the boro season in high-yielding varieties.

For the aman season, it can be calculated from Statistical Annex Table 6 that 26 more days of labor (8 family and 18 hired) are needed per hectare for HYV paddy than for LV paddy. At 36 takas per day, this amounts to 1.9 billion takas (\$47 million) for 2 million hectares. For boro HYV paddy, 187 days are needed to cultivate 1 hectare. However, since LV paddy production would not be a viable option during the dry season, and there is a lack of alternative employment during the dry season, a more useful approach is to assume that at least half of this rural employment would not have been available without the high-yielding technical package. Using the same calculation as for the aman season, the value of the increased employment in the boro season totals \$144 million. Applying the same assumption (50 percent increased use) to the other factors of production (land and draft animals) employed during the boro season, farm households are earning an additional \$103 million return on their land, and \$24 million from the use of their draft animals. This brings the total increased income to factors of production for the boro season to \$271 million, and the combined increase for the boro and aman seasons to \$318 million.

Statistical Annex Tables 6 and 7 also show the net profit to the farm enterprise after deducting all costs of production. For the aman season, the difference in net return between the HYV paddy and the LV paddy is about 4,000 takas per hectare. Applying this to the 2 million hectare increase in HYV area that would not have occurred without the FDI program, total increased profits amount to \$200 million for the aman season. For the boro season, it is again appropriate to assume that half of the farm enterprise profits constitute an increase over what they would have been without the high-yielding

technology. Applying this increased profit (2,076 takas/ha) to 1.7 million hectares results in increased total farm profits of \$88 million. The total for the two seasons is \$288 million per year.

The combined increase in income resulting from the FDI program, then, amounts to about \$600 million per year for paddy production. Assuming that similar increases are obtained from the 20 percent of fertilizer used on other crops, the total increased income is about \$750 million. There are also off-farm increases in income and employment, but these are much smaller. For example, the privatized fertilizer distribution system employs 90,000 workers: 1,000 distributors with an average of 10 full-time equivalent (FTE) employees; 10,000 dealers with an average of 3 FTE employees; and 100,000 subdealers (retailers) employed half-time, on average, in selling fertilizers. Assuming that in the absence of the FDI program, the volume of fertilizer sales, and therefore employment, would be half of what it is now, the jobs attributable to the program total 45,000. At 40 takas per day, these jobs generate an annual income of 450 million takas (40 takas/day x 250 days/year x 45,000 jobs), or \$11 million. As in the case of the increased production, this increased income is not due solely to the FDI program, but the increase could not have happened without it.

Particularly notable about the Bangladesh experience is that the farm-level impact has been as equitably distributed as possible given the skewed land distribution. Table 8 in the Statistical Annex shows that fertilizer use increases as farm size drops. Farms of under 0.4 hectares have the highest percentage of cropped area fertilized and the highest application rates. Thus, in general, the FDI program has had a large and widely distributed impact on the incomes of all farmers, including the landless and small and marginal farmers.

Moreover, the impact of increased paddy production on the rice price has especially benefited the poorest segments of the population. The drop in the rice price since the early 1970s (approximately 30 percent in real terms between 1972/1973 and 1992/1993) has had the effect of increasing real incomes of the poor, who spend a large portion of their income on basic staples, especially rice. A recent IFDC survey showed that when the price of rice drops by 20 percent, 10 million people move from inadequate to adequate daily caloric intake. The same survey also found that the additional real income is spent on improved nutrition. Meat consumption increases by 75 percent (from a very low base), consumption of lentils increases, adult body weight increases, and the number of malnourished children declines.⁷ Also, because much of the increased production has occurred in the boro season, which previously had been the lean season, the rice price has become more stable over the course of the year. Stable supplies and prices are especially beneficial to the poor because they are the ones most likely to have to buy rice during the lean season when prices are at their peak.

One equity consideration, impact on women, could not be satisfactorily assessed as part of this evaluation because of lack of data. FDI-II data indicate that none of the private agribusinesses involved in fertilizer distribution in Bangladesh are owned by women. As far as the farm-level impact is concerned, the only data collected by the FDI projects concern women's participation in the different types of production activities. Men are predominant in field work, and women are predominant in postharvest work. For instance, the percentage of person-days accounted for by women is 96 percent for winnowing, 92 percent for drying, and 98 percent for parboiling. Women do 100 percent of the home gardening. Overall, the survey found that only 10 percent of agricultural work is performed by

⁷ Source: International Food Policy Research Institute, "Consumption and Nutrition Survey, 1991-1992," Bangladesh: 1993.

women, and their daily wage rate is less than 50 percent of the rate for men.⁸ No information was available on decision-making responsibilities or on control over family income, including income earned from gardening.

⁸ Source: FDI-II, "Farm-level Fertilizer Price and Availability Survey in Bangladesh." December 1993, Dhaka/IFDC: January 1994.

BENEFIT-COST ANALYSIS

The benefit-cost analysis of the FDI program is based on the program's impact on paddy production, because this is the crop on which 80 percent of Bangladesh's fertilizer is used and for which the most data are available. With no increase in crop area during the period covered by the program, all of the growth in production is due to the increased use of yield-increasing new technologies — HYV seeds, fertilizer, and irrigation. However, in the absence of fertilizer, these seeds do not yield much more than the local varieties.

For the aman season, fertilizer and seeds have combined to obtain the higher yields; for the boro season, irrigation has also been needed. For the aman season, the improved technology increased yields from 2.3 tons per hectare to 3.3 tons per hectare, resulting in an overall growth rate of 2.6 percent per year for the decade ending 1992/1993 (see Statistical Annex, Table 4). Without the increased use of fertilizer attributable to the FDI program, there would have been very little growth in the use of HYVs and production would have most likely stabilized at around 8 million tons.

For the boro season, seeds and fertilizer have to be accompanied by irrigation, and, because of its high cost, irrigation is not possible without HYVs and fertilizer. Moreover, with the high degree of water control that is possible with irrigation, the yield response to fertilizer is higher, making its use more profitable. This has caused farmers to use more fertilizer and achieve higher yields. In the 1990/1991 boro season, farmers applied 363 kilograms of fertilizers per hectare and achieved an average yield of 4.2 tons per hectare. As a result, boro paddy production grew by 6.4 percent per year during the decade ending 1992/1993, accounting for 72 percent of the total growth in paddy production during this period.

By 1992/1993, the increased production attributable to the increased availability of fertilizer totaled at least 5 million tons, with a market value of about \$775 million (6,200 takas, or \$155, per ton). To calculate the benefit stream, it is necessary to make two adjustments in this figure. First, the cost of inputs and the opportunity costs of the factors of production (labor, land, and draft animals) must be deducted (see Statistical Annex, Tables 6 and 7). Second, although the increase in boro paddy production would have occurred without the increased availability of fertilizer, increased fertilizer availability had to be accompanied by irrigation. For this reason, in the calculations, only half of the increase in boro value added is attributed to the FDI program.

Statistical Annex Table 9 shows the benefit-cost calculation for the FDI program, taking into account all of the factors and assumptions discussed above. This calculation shows an internal rate of return (IRR) of 22 percent for the entire \$287 million FDI program. This is a surprisingly low IRR for a program that has had such a large impact on the Bangladesh economy. Table 9A in the annex shows the effects of additional benefits. In addition to making the increased paddy production possible, the FDI program has reduced the delivered cost of those fertilizers that would have been available and used even if there had been no program. The marketing savings had reached 800 takas per ton by 1989, when the private sector was allowed to purchase directly from the factories and the ports, and increased by another 400 takas per ton when the private sector was allowed to import directly. These marketing savings reduced the full delivered cost of fertilizers, thus increasing the value added from the paddy production. A second adjustment to the benefit stream is to consider the fact that only 80 percent of the fertilizer is used for paddy production. If fertilizer use on the other crops is as productive as on paddies, paddy will account for only 80 percent of the total increase in value added. Making these two adjustments increases the IRR to 28 percent.

Another adjustment that should be made involves deducting part of the \$142 million in fertilizer import financing costs under FDI-I. Although fertilizer financing was necessary for USAID to become a participant in the policy dialogue on fertilizer distribution, the funds that financed the fertilizer imports did not contribute to the improvements in the fertilizer distribution system. Fertilizers were sold by the government to farmers, and the proceeds from these sales were used for general budget support. The only part that stayed in the agriculture sector was the subsidy component (the difference between the full value of the USAID-financed fertilizer and the price paid by the farmer), which averaged 60 percent during the FDI-I implementation period. The remaining funds were provided by USAID mainly as macroeconomic balance of payments and budgetary support. If only 60 percent of the fertilizer financing is included in the cost column, this increases the IRR in Table 9A further, to 33 percent.

Regardless of how the IRR is calculated, the results show this to be an extremely successful USAID program. Even counting all of the nonproject assistance and technical assistance, the return on the United States investment is highly positive. Furthermore, these calculations only consider direct production impact and marketing savings of the program. When other important benefits such as food self-sufficiency, foreign exchange savings from lower food imports, the consumer surplus generated by the long-term drop in rice prices, and the multiplier effect of spending the increased agricultural income are taken into account, the program stands out as one of the most significant development successes in Bangladesh.

CONCLUSIONS

FACTORS AFFECTING PERFORMANCE AND IMPACT

The FDI program in Bangladesh is considered by some to be USAID's most significant privatization effort. The program's major accomplishments, one building on the other, have been as follows:

- The fertilizer market has been fully privatized and liberalized, including price decontrol, the removal of government subsidies, and the disengagement of BADC;
- The private sector response to the changed environment has been strong, competitive, and effective. Fertilizer supplies have more than doubled, and all government costs associated with the distribution of fertilizer have been completely eliminated; and
- Fertilizer use has increased, resulting in increased agricultural production, increased rural incomes, and food self-sufficiency.

The national economy is significantly and measurably stronger, and the large majority of Bangladeshi, urban as well as rural, are significantly better off because of this one program.

FDI's success can be attributed to four key factors, two of which were within the control of the program and two of which were not.

1. *The vision underlying the program was simple, consistent, and strongly felt.*

This factor was critical because the program's objectives were controversial and the program has been implemented over a 15-year period. First, there was the USAID Mission's vision, which was to increase the availability of fertilizer at a lower delivered cost. The Mission had no preconceived ideas on how this was to be achieved, but it knew that the place to start was BADC. Then there was the IFDC chief of party's vision. Most of his previous experience had been in the private sector, and his primary objective was to make the fertilizer distribution system as efficient and market responsive as possible. He also recognized BADC as the place to start, but had a strong bias toward privatization.

The overall vision provided the basis for a step-by-step process that experienced numerous setbacks and delays — some lengthy — but eventually led to the complete privatization of the fertilizer distribution system. The first step was to liberalize retailing by decontrolling prices and removing the restrictions on the number of retailers. This posed no serious problems. The next step was to replace the thana sales centers with a smaller number of distribution points in order to reduce BADC's unit costs. This action was taken, and unit costs dropped, but BADC did not want to close the sales centers because it would have meant reducing its work force. Finally, at USAID's insistence, the sales centers were closed. Then, the FDI program made a series of recommendations to BADC that would have cut costs further but would also have reduced staff. With BADC resisting each recommendation, the USAID Mission and the IFDC chief of party provided data and analysis to MOA that enabled it to overrule BADC management.

Although the program has been ideologically driven to some extent (in USAID as well as in IFDC), its data and analysis have always had the same objective: to demonstrate to government decision makers that changes will increase the availability and lower the delivered cost of fertilizers. BADC has strongly opposed most changes, and the process could have been derailed on many occasions, but the strong and clear vision of the USAID Mission and the IFDC team have kept things moving forward.

2. *The program was well conceived and has been implemented effectively.*

The program has four components: nonproject assistance that financed fertilizer imports and has generated local currency to fund program-related activities, financing of BADC warehouses, technical assistance and training in privatization policy, and technical assistance and training in fertilizer marketing. Fertilizer import financing for the two projects, FDI-I and FDI-II (about \$175 million), helped fill a serious foreign exchange gap, especially in phase I, and was important in giving USAID a seat at the table for formulating fertilizer policy. The financing of BADC warehouses (\$60 million) turned out to be unnecessary when BADC was completely removed from fertilizer distribution but was probably essential in initiating the dialogue between USAID, BADC, and MOA. The marketing technical assistance and training has been beneficial to businesses entering the fertilizer market.

All of these activities have been important, but the key component of the FDI program is the technical assistance and training to the Bangladesh government in fertilizer marketing policy. This activity was spearheaded by the chief of party and supported effectively by the USAID Mission. As issues have surfaced, the chief of party has brought in short-term experts from the United States, and generated data and analysis through the MIS. As the marketing system became privatized, he and his staff would maintain close contact with private businesses to obtain firsthand information on how the system was working. The objective has been to provide government decision makers with the most complete and accurate information possible. Changes have been made only when the government understands and supports the changes. Many have been tried first on a pilot basis to determine their effect. At times, institutional or political opposition, usually from BADC, has required that the USAID Mission intervene at high levels to provide additional impetus, but the key to the program's overall success has been its dependence on data, analysis, and demonstrated results rather than on USAID-imposed conditions. As a senior government official put it, "The reform process was not slow, it was gradual, and this is what assured its acceptability."

An important design issue in programs like this one is the impact of direct assistance to agribusinesses. Both FDI-I and FDI-II have included large training components for private distributors and dealers, and FDI-II also has had a sizeable credit component. In addition, FDI staff have always been available to help individual businesses deal with day-to-day problems that are inevitable with the newly privatized system. The recipients of the assistance are almost unanimous in their appreciation and positive comments, and the close contacts with those who were in the real world of fertilizer marketing have given the FDI staff a better understanding of the issues and, therefore, increased effectiveness in dealing with the government. The key factor in the success of the private distribution system, however, appears to have been the improved policy environment. Even with little or no direct assistance from FDI staff, private businesses would have entered the fertilizer market in response to profit opportunities. With the assistance, some perhaps have been able to enter more quickly and perform more effectively, but, in general, most of the businesses would have survived in the fertilizer market just as they survive in marketing other consumer, intermediate, and capital goods.

3. *The overall policy framework has been supportive of the program's privatization objectives.*

First, the government was wrestling with severe budgetary problems, and was eager to reduce its subsidy programs. Second, there was a growing, although by no means unanimous, consensus among technocrats in the Bangladesh government that the country needed to move away from socialism toward free markets. This meant removing government controls and disengaging the government from direct participation in economic activities. At the macroeconomic level, the key liberalization policies were balanced budgets, low inflation, and a market-determined exchange rate. In agriculture, the key policies were free market rice prices and privatized input supplies. The World Bank and the Asian Development Bank were financing structural and sectoral adjustment programs that required the government to carry out these liberalization policies, and the World Bank also had a large National Minor Irrigation Project that required the government to privatize and decontrol the importation and distribution of irrigation equipment. Thus, at the same time that USAID was supporting the liberalization and privatization of fertilizer markets, other donors and certain elements of the government were advocating similar policy changes in other sectors of the economy.

Often during the FDI program, different donor programs have directly complemented each other. For example, the government's relatively rapid, some might say disruptive, removal of all subsidies on imported fertilizers happened when it did (between July 1991 and December 1992) because of conditionalities imposed by the World Bank and the Asian Development Bank. In the government, MOA has been a strong advocate of economic liberalization measures. Indicative of the importance of the right overall policy thrust is that opposing political elements are currently advocating the return of fertilizer price controls, fertilizer subsidies, and government-owned buffer stocks. MOA is successfully resisting these pressures, partly because the political leadership has the political will to pursue liberalization measures, but also because the FDI-II project has provided the facts and analysis to counter the political arguments. It is likely that had there been no overall movement toward economic liberalization in Bangladesh, political pressures would have prevented the full removal of fertilizer subsidies and BADC would have successfully resisted the full privatization of fertilizer distribution.

4. *The liberalization and privatization of fertilizer distribution have had a major and far-reaching economic impact because an economically viable technical package existed that made fertilizer use profitable and greatly increased agricultural production, particularly of rice.*

In some countries, fertilizer distribution is privatized but agricultural production does not increase. In many countries privatization and subsidy removal are accompanied by reduced fertilizer use and reduced agricultural production. However, in Bangladesh, the conditions were ideal for an increase in both fertilizer use and agricultural income. First, a market existed for the increased production. Between the 1960s and the early 1990s, the percentage of paddy production marketed increased from 15 percent to 50 percent, making rice the country's major cash crop. This evaluation did not study the reasons why demand has grown as it has, but it must be based on increased off-farm income, probably from employment in the garment industry and repatriated earnings from the Middle East. Without a major cash crop, farmers would have had no way to purchase the fertilizer and there would have been no increase in production.

Even with the effective demand for an agricultural surplus, there had to be a high-yielding technical package. In Bangladesh, high-yielding rice varieties had been widely available since the early 1970s. The response of these varieties to fertilizer is sufficient to make fertilizer use profitable during the aman season, when water is not a constraint. Farm households using fertilizer on HYVs in the aman season have earned 40 percent more per hectare than households that grow local varieties without

fertilizer. The incentives are even greater in the boro season. When the distribution of irrigation equipment was liberalized, the irrigated area in the boro season increased dramatically. However, the cost of irrigation was so high that without assured access to fertilizer, the investment could not have been profitable. Thus, with fertilizer available there occurred a major increase in boro production; without fertilizer, the investment in irrigation would not have occurred and production would not have increased. It cannot be overemphasized how important the availability of a full technical package is in determining the production impact of interventions affecting only one agricultural input, no matter how successful those interventions might be.

LESSONS LEARNED

1. *It is important to build support within the government and affected institutions before bringing about policy changes that significantly affect the private and parastatal sectors and imply basic changes in government social and economic agendas.*

In the FDI program's case, the policy change was the privatization of fertilizer distribution. The first step was to carry out a sound analysis that correctly identified the problem and the solution. This analysis increased the government's confidence in the objectives of the program and ensured that the changes did not turn out to be ill advised. The next step was to conduct close, ongoing consultations with the key government agencies as well as with the private sector. As changes occurred, the impacts were monitored and discussed with all interested parties. These consultations provided the basis for further changes that eventually led to the full privatization of fertilizer distribution. It is unlikely that these changes would have been as successfully implemented without these close consultations. The experience also shows that building support for far-reaching changes takes time. In this case, the final privatization measure took place 14 years after the start of the program.

2. *Changing government policies affecting agribusiness requires highly qualified technical assistance that is effective in dealing with the government and the private sector.*

In this case, the policy reforms relate to fertilizer marketing. The government sought increases in marketing efficiency that would, first, make it possible to reduce greatly or eliminate subsidies while maintaining fertilizer prices at affordable levels, and, second, make fertilizers more widely available, especially to paddy farmers. The key to the program's success has been the availability of highly competent fertilizer marketing experts. IFDC has provided advisors with extensive direct experience in private sector fertilizer marketing who have been able to build credibility with both the government and the private sector. This is particularly important in Bangladesh, with its long tradition of promoting agricultural production through parastatals.

3. *The FDI program provides strong evidence that the private sector responds efficiently and effectively to undistorted open markets.*

At every step of Bangladesh's fertilizer privatization process, private businesses have expeditiously replaced BADC, with resulting cuts in distribution costs and more timely delivery to farmers. This response has occurred with little direct assistance from the government or the FDI program.

4. *The FDI program reconfirms the difficulty of bringing about institutional change in the public sector, even in the context of highly successful policy change.*

The greatest resistance to privatization of Bangladesh's fertilizer distribution system has come from BADC, despite the fact that it was the implementing agency for FDI-I and most of FDI-II. Except for the initial privatization and liberalization of fertilizer retailing, all changes have had to be implemented over BADC's objections. BADC has resisted these changes mainly because the changes would have reduced BADC's role in fertilizer distribution with consequent reductions in staff. The resistance became so strong in 1990 that the program was transferred from BADC to MOA. Even with privatization now complete, BADC has not yet sold its fertilizer warehouses and has retained most of its fertilizer distribution staff.

The FDI program has not succeed in strengthening MOA's capacity to support the privatized fertilizer distribution system. As long as the FDI program has remained in existence, MOA has been able to rely on FDI staff to provide data and analysis on fertilizer markets, and promote fertilizer use. Now that the program is approaching its end, it has become clear that MOA has neither the staff nor the financial resources to perform the functions being carried out by the FDI staff. This experience is consistent with many other institution-building efforts in support of agribusiness. Host country governments simply do not have the resources necessary to continue the support provided by USAID projects.

5. *Privatization efforts are greatly facilitated when they are implemented in a context of overall economic liberalization.*

In this case, the difficulty of overcoming BADC and political resistance to privatization indicates that the effort probably would have failed had there not been high-level government and widespread donor support for economic liberalization. At the same time that fertilizer distribution was being privatized, controls on imports of irrigation equipment were being eliminated, and, at the macroeconomic level, monetary, fiscal, and trade policies were being liberalized. Hence, the FDI program has been part of a major government policy thrust, and not an isolated program diametrically opposed to the government's prevailing development policies.

STATISTICAL ANNEX

Table 1: Average Issue and Retail Prices of Chemical Fertilizers -
July 1989 to January 1994 (takas per 50 kg. bag)

<u>Month/Year</u>	<u>Issue Price</u>	<u>Retail Price</u>	<u>Margin</u>	<u>Margin as % of Issue Price</u>
UREA				
7/89	201	243	42	21%
1/90	201	227	26	13%
7/90	201	229	28	14%
1/91	203	233	30	15%
7/91	188	244	56	30%
1/92	216	244	28	13%
7/92	219	260	41	19%
1/93	233	268	35	15%
7/93	204	252	48	24%
1/94	202	235	33	16%
<hr/>				
1/94 as % of 7/89	100%	97%		
TSP				
7/89	216	252	36	17%
1/90	216	249	33	15%
7/90	216	256	40	19%
1/91	216	262	46	21%
7/91	250	267	17	7%
1/92	275	320	45	16%
7/92	300	341	41	14%
1/93	343	402	59	17%
7/93	343	404	61	18%
1/94	366	403	37	10%
<hr/>				
1/94 as % of 7/89	169%	160%		
MP				
7/89	166	226	60	36%
1/90	166	210	44	27%
7/90	166	214	48	29%
1/91	166	208	42	25%
7/91	183	215	32	17%
1/92	212	267	55	26%
7/92	237	285	48	20%
1/93	324	353	29	9%
7/93	283	355	72	25%
1/94	249	369	120	48%
<hr/>				
1/94 as % of 7/89	150%	163%		

Note: For urea, the issue price is ex factory; for TSP and MP, the issue price is the BADC TDP price.

Source: GOB, Min. of Agriculture, Handbook of Agricultural Statistics, Jan

Table 2: Chemical Fertilizer Sales, by Product
(thousand metric tons)

Year	Urea	TSP	MP	Total	Growth Rate
1972/73	281	90	19	390	
1973/74	272	95	19	386	-1%
1974/75	177	76	18	271	-30%
1975/76	317	112	22	451	66%
1976/77	359	128	23	510	13%
1977/78	488	195	42	725	42%
1978/79	476	215	45	736	2%
1979/80	542	251	47	840	14%
1980/81	560	257	45	862	3%
1981/82	519	256	45	820	-5%
1982/83	629	279	50	958	17%
1983/84	708	354	63	1125	17%
1984/85	832	346	69	1247	11%
1985/86	825	307	63	1195	-4%
1986/87	947	376	78	1401	17%
1987/88	1050	402	86	1538	10%
1988/89	1322	449	94	1865	21%
1989/90	1369	480	119	1968	6%
1990/91	1321	513	146	1980	1%
1991/92	1533	457	137	2127	7%
1992/93	1547	407	126	2080	-2%
Annual Growth (%)					
1972/73-1982/83:	8%	12%	10%	9%	
1982/83-1992/93:	9%	4%	10%	8%	

Sources: IFDC, FDI-II Fertilizer Distribution Reports

Table 3: Fertilizer Use by Major Crop, 1989 - 1991

Name of Crop	Area (000 ha.)			Fertilizer Consumption						% of Total
	1989	1990	1991	Avg. use (kg/ha)			Total Use (000 MT)			
				1989	1990	1991	1989	1990	1991	
HYV Paddy										
Aman	1762	1966	2108	178	215	191	314	423	403	18%
Aus	361	365	415	206	212	217	74	77	90	4%
Boro	2154	2266	2334	316	327	363	681	741	847	39%
LV Paddy										
T.Aman	2998	2873	2746	73	75	76	219	215	209	10%
B. Aman	943	938	839	4	27	4	4	25	3	0%
Aus	1902	1743	1501	74	71	68	141	124	102	5%
Boro	300	282	301	-	54	31	0	15	9	0%
Wheat	592	599	575	231	237	225	137	142	129	6%
Potato	117	124	128	1243	877	1118	145	109	143	7%
Tobacco	45	38	37	341	307	456	15	12	17	1%
Sugarcane	186	191	187	229	395	282	43	75	53	2%
Jute	543	583	588	75	73	66	41	43	39	2%
Mustard	338	339	340	184	271	251	62	92	85	4%
Vegetables				261	199	301	44	33	52	2%
TOTALS							1919	2126	2182	100%

Sources: Figures of national area by crop have been taken from MOA Handbook of Agricultural Statistics, 1994, and from other BBS reports. Fertilizer use per unit of land were taken from the IFDC/FLFUS.

Table 4: Total Paddy Production by Season (thousand metric tons)

Year	Aus	Aman	Boro	Total	Growth Rate
1972/73	2272	5587	2071	9930	
1973/74	2801	6699	2220	11720	18.03%
1974/75	2859	6000	2250	11109	-5.21%
1975/76	3230	7045	2286	12561	13.07%
1976/77	3010	6906	1650	11566	-7.92%
1977/78	3104	7422	2239	12765	10.37%
1978/79	3288	7429	1929	12646	-0.93%
1979/80	2809	7303	2427	12539	-0.85%
1980/81	3289	7964	2630	13883	10.72%
1981/82	3270	7209	3152	13631	-1.82%
1982/83	3067	7516	3546	14129	3.65%
1983/84	3222	7843	3350	14415	2.02%
1984/85	2783	7930	3909	14622	1.44%
1985/86	2828	8542	3671	15041	2.87%
1986/87	3130	8267	4010	15407	2.43%
1987/88	2993	7690	4731	15414	0.05%
1988/89	2856	6857	5831	15544	0.84%
1989/90	2475	9202	6033	17710	13.93%
1990/91	2261	9167	5357	16785	-5.22%
1991/92	2179	9269	6807	18255	8.76%
1992/93	2075	9679	6586	18340	0.47%

Annual growth (%):

1972/73-1982/83:	3.05%	3.01%	5.53%	3.59%
1982/83-1992/93:	-3.83%	2.56%	6.39%	2.64%

Source: GOB, Ministry of Agriculture, Handbook of Agricultural Statistics, January 1994.

Table 5: Area, Technology, and Paddy Production, by season

	<u>1979/80</u>	<u>1984/85</u>	<u>1989/90</u>	<u>1992/93</u>
Aman				
Total area (000 ha.)	5974	5711	5703	5844
Irrigated area (000 ha.)	129	186	214	N/A
HYV (000 ha.)	359	1080	1762	2331
Paddy Prod. (000 tons)	7303	7930	9202	9680
Ann. Growth Rate (%)		1.66%	3.02%	1.02%
Boro				
Total area (000 ha.)	1149	1575	2454	2600
Irrigated area (000 ha.)	1008	1285	2050	N/A
HYV (000 ha.)	600	1230	2154	2351
Paddy Prod. (000 tons)	2427	3909	6033	6586
Ann. Growth Rate (%)		10.00%	9.07%	1.77%
Aus				
Total area (000 ha.)	3057	2938	2263	1735
Irrigated area (000 ha.)	92	141	142	N/A
HYV (000 ha.)	415	466	361	372
Paddy Prod. (000 tons)	2809	2783	2475	2075
Ann. Growth Rate (%)		-0.19%	-2.32%	-3.46%
Total				
Total area (000 ha.)	10159	10224	10421	10179
Irrigated area (000 ha.)	1229	1582	2406	N/A
Annual growth rate (%)		5.18%	8.75%	
HYV (000 ha.)	1998	2776	4277	5054
Annual growth rate (%)		6.80%	9.03%	3.39%
Fertilizer sales (tons)	840	1247	1968	2080
Annual growth rate (%)		8.22%	9.55%	1.11%
Paddy Prod. (000 tons)	12539	14622	17710	18340
Ann. Growth Rate (%)		3.12%	3.91%	0.70%

Table 6: Farm Budget per Hectare for
Aman HYV and Local Paddy - 1991

	HVV Cash	HVV Full	LV Cash	LV Full
Human labor				
Quantity (pers.days)	71	144	53	118
Cost	2759	5540	1929	4277
Animal Labor	122	1308	82	1132
Tractor/power tiller	251	251	160	160
Seeds	151	946	142	873
Fertilizer				
Quantity (kg.)	191	191	76	76
Cost	1015	1015	402	402
Manure	3	70	2	36
Pesticides	64	64	5	5
Irrigation	49	49	1	1
Land rental	-	4858	-	4858
Other costs	41	94	19	51
Interest	-	223	-	137
Total Cost	4456	14419	2741	11932
Return:				
Yields (MT)	3.3	3.3	2.3	2.3
Main crop	20323	20323	14188	14188
By-products	1380	1380	987	987
Total return	21703	21703	15175	15175
NET RETURN	17247	7284	12434	3243
Plus:				
Family labor		2781		2348
Owned animal labor		1186		1050
Land rental		4858		4858
TOTAL RETURN TO FARM HOUSEHOLD		16109		11499

Source: K.K. Sanyal, Farm-Level Fertilizer Use Study, Aman 1991-92,
FDI-II, June 1993.

Table 7: Farm Budget per Hectare for
Boro HYV and Local Paddy - 1990/91

	HYV Cash	HYV Full	LV Cash	LV Full
Human labor				
Quantity (pers.days)	95	187	65	121
Cost	3463	6678	2451	4487
Animal Labor	142	1112	10	905
Tractor/power tiller	240	240	3	3
Seeds	279	1075	157	791
Fertilizer				
Quantity (kg.)	363	363	31	31
Cost	1860	1860	162	162
Manure	3	321	-	-
Pesticides	232	232	36	36
Irrigation	3935	3935	203	203
Land rental	-	4858	-	4858
Other costs	82	143	15	36
Interest	-	546	-	202
Total Cost	10235	20998	3035	11697
Return:				
Yield (MT)	4.2	4.2	3.1	3.1
Main crop	23671	23671	13848	13849
By-products	1479	1479	497	497
Total return	25150	25150	14345	14345
NET RETURN	14915	4152	11309	2649
Plus:				
Family labor		3215		2036
Owned animal labor		970		895
Land rental		4858		4858
TOTAL RETURN TO FARM HOUSEHOLD		13195		10438

Source: Ishrat Jahan and K.K. Sanyal, Farm-Level Fertilizer Use Study,
1990-91 Rabi/Boro Season, FDI-II, February 1993.

Table 8: Fertilizer Use on Paddy by Farm Size - Percentage Distribution

	<u>Landless</u>	<u>Marginal</u>	<u>Small</u>	<u>Medium</u>	<u>Large</u>	<u>Very Large</u>	<u>Total</u>
<u>Boro 1990/91</u>							
Percent of operating farms	11	28	33	19	6	4	100
Percent of total cultivated area	9	15	25	21	13	17	100
Percent of area fertilized	99	97	93	87	76	66	86
Fertilizer use per hectare (Kg)	364	346	331	333	277	219	311
<u>Aman 1992/93</u>							
Percent of land ownership	0	8	25	29	16	22	100
Percent of operating farms	10	31	32	18	5	4	100
Percent of total cultivated area	8	17	26	26	11	13	100
Percent of area fertilized	77	88	82	82	83	84	83
Fertilizer use per hectare (Kg)	124	131	130	118	126	120	125

Note:

Marginal: less than .4 hectare
 Small: .4 hectare to 1 hectare
 Medium: 1 hectare to 2 hectares
 Large: 2 hectares to 3 hectares
 Very large: over 3 hectares

Sources:

IFDC Dhaka, Farm-level Fertilizer Use Survey, 1990/91 Rabi/Boro Season, February 1993
 , Farm-level Fertilizer Use Survey, 1991/92 Aman Season, June 1993

Table 9: Benefit-Cost Analysis for the FDI Program

Program	Aman Season		Boro Season		Total V.A. (\$ thous.)	V.A. Attrib. to FDI (\$ thous.)	Net Benefits (\$ thous.)	
	Costs (\$ thous.)	Hectares (thous)	V.A. (\$ thous.)	Hectares (thous.)				V.A. (\$ thous.)
1978/79	50000	0	0	0	0	0	-50000	
1979/80	50000	0	0	0	0	0	-50000	
1980/81	50000	0	0	0	0	0	-50000	
1981/82	50000	0	0	0	0	0	-50000	
1982/83	10000	5	500	50	8250	8750	4625	-5375
1983/84	5000	10	1000	100	16500	17500	9250	4250
1984/85	3000	20	2000	200	33000	35000	18500	15500
1985/86	2000	40	4000	300	49500	53500	28750	26750
1986/87	2000	50	5000	600	99000	104000	54500	52500
1987/88	12000	60	6000	1000	165000	171000	88500	76500
1988/89	12000	150	15000	1100	181500	196500	105750	93750
1989/90	12000	600	60000	1250	206250	266250	163125	151125
1990/91	12000	800	80000	1300	214500	294500	187250	175250
1991/92	4000	1000	100000	1400	231000	331000	215500	211500
1992/93	4000	1300	130000	1500	247500	377500	253750	249750
1993/94	4000	1500	150000	1600	264000	414000	282000	278000
1994/95	3000	1600	160000	1700	280500	440500	300250	297250
1995/96	1000	1700	170000	1800	297000	467000	318500	317500
1996/97	0	1800	180000	1900	313500	493500	336750	
1997/98	0	1900	190000	2000	330000	520000	355000	
1998/99	0	2000	200000	2100	346500	546500	373250	
1999/00	0	2100	210000	2200	363000	573000	391500	
2000/01	0	2200	220000	2300	379500	599500	409750	
2001/02	0	2300	230000	2400	396000	626000	428000	
2002/03	0	2400	240000	2500	412500	652500	446250	
2003/04	0	2500	250000	2600	429000	679000	464500	

Internal Rate of Return: 22%

Notes to Table 9:

1. The cost stream assumes that the fertilizer import financing and warehouse construction under FDI-I took place during the first six years of the project and that disbursements over remaining years were mostly for technical assistance. Under FDI-II, it is assumed that the fertilizer financing was disbursed over the first four years and that disbursements over the remaining years were mostly for technical assistance. In fact, fertilizer funds have not yet been fully disbursed, and some may be de-obligated. This would have the effect of increasing the IRR.
2. The benefit stream assumes that, without the FDI program the area under HYV paddy would have levelled off in the mid-1980s at one million hectares for the aman and the boro seasons. The growth in area is taken from the MOA, Handbook of Agricultural Statistics, 1/94.
3. The increased value added is calculated from Tables 6 and 7. For the aman season, the value is equal to the difference in net returns to the farm enterprise between HYV and LV production. This is based on the assumption that all of the factors of production would have earned the same income producing LV paddy, but the farm's profits would have been less. For the boro season, the assumptions were different because LV production is not economically viable without irrigation and fertilizer. The basic assumption, therefore, is that farm enterprise profits (4,152) and income to factors of production – land, labor, and draft animals– (9,043 takas) would be half of what they are producing HYV paddy.
4. The farm budgets in Tables 6 and 7 are based on surveys carried out in 1990-92. To adjust back for inflation over the 1982/83-1992/93 period, the value added in takas is converted to U.S. dollars at the constant exchange rate of 40 takas = \$1, instead of the actual rate which increased gradually from 30 takas = \$1 to 40 takas = \$1 over this period.
5. The total increase in value added in the aman season is attributed to the FDI program. Because the increase in the boro season required both irrigation and fertilizers, only one half of the increase was attributed to the FDI program.

Table 9A: Benefit-Cost Analysis for the FDI Program

Program	Aman Season		Boro Season		Total V.A.	Marketing Savings	V.A. Attrib. to FDI	Net Benefits	
	Costs (\$ thous.)	Hectares (thous)	V.A. (\$ thous.)	Hectares (thous.)					V.A. (\$ thous.)
1978/79	50000	0	0	0	0	0	0	-50000	
1979/80	50000	0	0	0	0	0	0	-50000	
1980/81	50000	0	0	0	0	0	0	-50000	
1981/82	50000	0	0	0	0	0	0	-50000	
1982/83	10000	5	500	50	8250	8750	0	5781	-4219
1983/84	5000	10	1000	100	16500	17500		11563	6563
1984/85	3000	20	2000	200	33000	35000		23125	20125
1985/86	2000	40	4000	300	49500	53500	10000	35938	33938
1986/87	2000	50	5000	600	99000	104000	15000	78125	76125
1987/88	12000	60	6000	1000	165000	171000	15000	125625	113625
1988/89	12000	150	15000	1100	181500	196500	15000	147188	135188
1989/90	12000	600	60000	1250	206250	266250	20000	218906	206906
1990/91	12000	800	80000	1300	214500	294500	20000	254063	242063
1991/92	4000	1000	100000	1400	231000	331000	20000	289375	285375
1992/93	4000	1300	130000	1500	247500	377500	35000	337188	333188
1993/94	4000	1500	150000	1600	264000	414000	35000	387500	383500
1994/95	3000	1600	160000	1700	280500	440500	35000	410313	407313
1995/96	1000	1700	170000	1800	297000	467000	35000	433125	432125
1996/97	0	1800	180000	1900	313500	493500	35000	455938	455938
1997/98	0	1900	190000	2000	330000	520000	35000	478750	478750
1998/99	0	2000	200000	2100	346500	546500	35000	501563	501563
1999/00	0	2100	210000	2200	363000	573000	35000	524375	524375
2000/01	0	2200	220000	2300	379500	599500	35000	547188	547188
2001/02	0	2300	230000	2400	396000	626000	35000	570000	570000
2002/03	0	2400	240000	2500	412500	652500	35000	592813	592813
2003/04	0	2500	250000	2600	429000	679000	35000	615625	615625

Internal Rate of Return: 28%

Notes to Table 9A:

1. This table is based on the same assumptions as Table 9, except that the benefits from increased market efficiency are added, and the increased value added is increased by 20 percent.
2. The reduced marketing costs are applied to the one million tons of fertilizers that would have been used with no FDI program. The reduced costs are increase gradually to a level of 1,200 takas per ton in 1992/93.

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