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**A LITERATURE REVIEW
OF PUBLIC FOOD
DISTRIBUTION IN
BANGLADESH**

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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**THE PUBLIC FOOD DISTRIBUTION SYSTEM IN BANGLADESH:
A REVIEW OF PAST IMPACT STUDIES AND A PLAN FOR FURTHER ANALYSIS**

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FOREWORD

In early 1989, the International Food Policy Research Institute entered into a contract with the U.S. Agency for International Development (USAID), Dhaka (under Contract No. 388-0027-C-00-9026-00) to conduct research on food policies and to extend technical assistance to the Ministry of Food, Government of Bangladesh. The Bangladesh Food Policy Project is the basis for a tripartite collaboration between IFPRI, the Government of Bangladesh, and USAID, Dhaka. This project consists of four subprojects and a large number of well-defined research topics. The subprojects together constitute a comprehensive approach for addressing the food policy problems of Bangladesh. The subprojects include the following studies: a price stabilization framework encompassing public and private marketing, evaluation of the effects of targeted distribution of foodgrains on consumption and nutrition, diversification of agriculture as a source of sustained growth of production, and capacity building in food policy analysis.

Since the project includes a nutrition and consumption component, we thought it necessary to survey past studies on this component before designing a work plan. Jeffrey Alwang, currently working as an assistant professor at the Virginia Polytechnic Institute and State University, was hired as a consultant to visit Bangladesh and prepare a report. This report reviews existing literature on nutrition issues in Bangladesh, examines ongoing research on nutrition policies in various organizations, and formulates an approach for research on nutrition and consumption issues under the project.

The report by Alwang provides a starting point and an inventory of what has been studied and what needs to be done. It is the first working paper in a series of papers under the Bangladesh Food Policy Project. We believe that this documentation will enrich the stock of information on food policy in Bangladesh.

Raisuddin Ahmed

Series Editor and Project Director,
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1. INTRODUCTION

Bangladesh is an extremely poor country, with large numbers of families living below the poverty level and high rates of malnutrition. There have been numerous studies of nutrition at the national, regional, and local levels, and many programs have been designed to alleviate malnutrition. Some of these programs are part of the Public Food Distribution System (PFDS). It is an important element of the food economy of Bangladesh, ostensibly designed to improve access to and consumption of foodgrains by certain target groups. In addition, some components of the system are used to moderate fluctuations in food prices.

Given the large quantities of grains moving through the PFDS, its effectiveness is an important concern. The U.S. Agency for International Development (USAID) contracted with the International Food Policy Research Institute (IFPRI) for a three-year study of the PFDS, which is currently under way. The explicit goals of the study are to produce a flexible model to determine the optimal stock of grains and to provide policymakers with a tool to evaluate stock levels on a real-time basis; to develop a system to intervene in local food markets using prices rather than quantities as the targeting mechanism; and to provide a detailed study of the effects of the various PFDS programs on the consumption and nutrition of the rural poor.

This paper presents the plan of work for achieving the third goal. Chapter 2 describes the various PFDS delivery programs; chapter 3 then reviews a number of past studies of PFDS effectiveness and of nutritional status in Bangladesh. An outline of the plan of work for the IFPRI consumption/nutrition team is presented in Chapter 4. A major component of that plan is a field study to measure the impact of the PFDS. Chapter 5 then provides details on the design of the field study. Some conclusions are presented in Chapter 6.

2. AN OVERVIEW OF THE PUBLIC FOOD DISTRIBUTION SYSTEM

Since its inception in 1943, the PFDS has provided foodgrains to certain target groups at reduced or zero cost. In 1986 there were eight monetized and four nonmonetized programs under the PFDS. The monetized programs included: Statutory Rationing, covering six urban centers; Essential Priorities, aimed at the armed forces, police, and other "essential" forces; Other Priorities, covering government employees outside of the Statutory Rationing areas; Large Employers, providing food subsidies for targeted people working for employers of more than 10 employees; Modified Rationing, providing subsidies for the poor outside the Statutory Rationing areas; Flour Mills, allotting wheat to designated mills at subsidized rates; Open Market Sales, through which the government releases its stocks directly into the rice and wheat markets to mediate any sharp increases in market prices (it is the government's principal means of influencing market prices); and Market Operations. The nonmonetized channels included Food for Work, providing wheat in exchange for labor in mostly rural areas; Canal Digging; Vulnerable Group Feeding, now called Vulnerable Group Development, providing grains for mothers and children in certain designated groups; and Gratuitous Relief, providing free grains in emergencies.

Tables 1 and 2 present a picture of the size of the PFDS relative to the total availability of foodgrains in Bangladesh and of the relative importance of each program. As a whole the PFDS is significant: it accounted for 10-17 percent of the total offtake from 1979/80 to 1984/85 and currently accounts for roughly 15 percent (Ministry of Food 1986). The quantity delivered through the PFDS reached 2.49 million metric tons in 1988 (World Food Programme 1989).¹ The nonmonetized channels grew steadily in importance after 1983/84: in 1988/89, 56 percent of public distribution went through these programs, with Food for Work and Vulnerable Group Development receiving 44.5 percent of the total PFDS offtake (World Food Programme 1989).

As a result of a continuing effort to reduce the subsidies in the monetized programs, the importance of the Statutory Rationing and Modified Rationing channels (the most important subsidized monetized ones) has declined since the 1960s (Ministry of Food 1986). A Ministry

¹ Throughout this report "tons" refers to metric tons.

Table 1--Public Food Distribution System offtake and total availability of rice and wheat, 1979-89

Year	Public Food Distribution System Offtake		Total Availability	
	Rice	Wheat	Rice	Wheat
(1,000 metric tons)				
1979/80	702	1,738	14,326	14,246
1980/81	515	1,031	13,919	14,319
1981/82	770	1,297	16,042	15,259
1982/83	496	1,441	12,718	15,663
1983/84	504	1,548	15,750	15,796
1984/85	407	2,173	16,958	16,588
1985/86	373	1,168	n.a.	n.a.
1986/87	495	1,624	n.a.	n.a.
1987/88	464	2,031	n.a.	n.a.
1988/89(p)	596	2,195	n.a.	n.a.

Source: For Public Food Distribution System: World Food Programme, "Bangladesh Foodgrain Forecast, 4/89" (Dhaka, April 10, 1989, Mimeographed); for total availability: Ministry of Food, "Report on the Existing System of Public Food Distribution in Bangladesh and Proposal for Restructuring," paper prepared by BECON Consultants, Dhaka, 1986, Mimeographed.

Note: n.a. indicates that the data were not available.
(p) indicates data is a projection.

of Food report noted that reduction in the subsidies would not adversely affect the total consumption of foodgrains.²

Partly because of the well-documented failure of the Modified Rationing channel to provide consistent supplies (Ministry of Food 1986; Institute of Nutrition and Food Science 1979, 1980), and partly because of large quantities estimated to have leaked out of the system, the program was discontinued in 1989 and was replaced with a new Rural Rationing scheme.

The Statutory Rationing Program, which the government initiated in densely populated cities, is now operating in Dhaka, Narayanganj, Chittagong, Rangmate, Khulna, and Rajshahi. Since 1974, employees of government, semi-government, and autonomous bodies have been eligible for a ration card. The weekly quota for cardholders is 500 grams of rice, 1,500 grams of wheat, and 200 grams of sugar. The ratio of rice to wheat has changed over the years, with wheat steadily gaining a

² A 7.7 percent cut in the distribution of rations resulted in less than a 1 percent decline in the per capita consumption of food grains. However, this aggregate conceals distributional effects. More vulnerable groups would have had to be protected from these subsidy cuts.

Table 2--Structure of Public Food Distribution System (PFDS) offtake, 1973-84

Program	1973/74- 1975/76	1976/77- 1979/80	1980/81- 1983/84
	(percent of total PFDS offtake)		
Essential Priorities	5.3	5.5	5.0
Other Priorities	12.7	19.5	19.6
Large Employers	5.1	4.3	3.1
Flour Mills	8.2	10.0	6.6
Open Market Sales/Market Operations	0.5	2.6	5.1
Statutory Rationing	24.5	32.1	15.5
Modified Rationing	34.5	18.4	18.7
Food for Work	2.6	13.9	20.0
Vulnerable Group Feeding	6.5	2.7	4.9
Other	...	4.0	...

Source: Ministry of Food, "Report on the Existing System of Public Food Distribution in Bangladesh and Proposal for Restructuring," report prepared by BECON Consultants, Dhaka, 1986.

Note: The ellipses indicate negligible amount, if any.

greater share. The number of eligible cardholders has declined: in 1980, 67 percent of the urban population had cards, while in 1985, 49 percent were eligible (EUREKA 1986). In addition, the Statutory Rationing subsidy decreased through the 1980s; currently for wheat, it stands at 6 percent of the Open Market Sales initial price, and is expected to fall to zero within the next few months.

Under the Other Priorities Program, offtake increased in the early 1980s to the point where 5.1 million people withdrew 387,000 tons in 1984/85. Other Priorities prices are expected to equal Open Market Sales initial prices in non-Statutory Rationing areas within the next few months.

For both the Other Priorities and Statutory Rationing programs it is expected that cardholders will continue to hold cards, although not necessarily to draw rations, even as the subsidies disappear. The possession of cards may help guarantee access to foodgrains during times of local shortages.

The Modified Rationing Program, begun in 1949, was operated in areas without the Statutory Rationing Program. Eligibility was restricted to the poorest families, determined by the rolls of *chowkidar* (tax collector). People who paid less than 10 taka (Tk) per year in taxes were eligible. Cardholders could acquire allotted rations of wheat and rice at subsidized prices. The Modified Rationing Program was discontinued in 1989 and was replaced by the Rural Rationing system, which was to be designed to avoid many of the well-documented problems with the Modified Rationing Program (see the specific study descriptions below).

The Essential Priorities Program is the only monetized channel (except for the new Rural Rationing Program) from which the subsidies have not been eliminated. The subsidy has tended to be very large: in 1985, Essential Priorities, prices averaged Tk 48 per maund³ and Tk 58 per maund, respectively, for wheat and rice, while the Statutory Rationing prices for the same goods were Tk 167 and Tk 262 per maund. Offtake from the Essential Priorities Program has been constant, averaging about 4.5 percent of the total PFDS offtake.

Under the Flour Mills Program, automatic and compact flour mills (*chakkis*) are provided allocations of wheat that they mill and sell to any customer. The millers usually sell the flour to dealers in the local bazaars who in turn pass some price savings on to consumers (BECON 1986). The flour mill operators are charged the price under the Open Market Sales Program, which traditionally was higher than the Statutory Rationing price but no longer is since the elimination of the Statutory Rationing subsidies.

In the BECON Consultants' report (1988) on the Modified Rationing Program, the authors urged the "chakkization" of all Modified Rationing wheat. They felt the *chakki* operators were a better means of ensuring local distribution of the flour and that the *chakki* system was beneficial to poorer consumers, who often needed credit or had sufficient funds for only a small purchase. Modified Rationing dealers rarely extended credit and were unlikely to sell the extremely small quantities the poor desired.

Open Market Sales are initiated through grain dealers when retail market prices for rice and wheat are higher than 15 percent above the officially announced procurement prices in Statutory Rationing areas and are higher than 10 percent above the officially announced procurement prices in non-Statutory Rationing areas. As retail prices rise above the Open Market Sales initial prices, Open Market Sales stocks are released at a price equal to the initial Open Market Sales price plus 50 percent of the excess of the market price over the initial Open Market

³ One maund is approximately 36.4 kilograms.

Sales price. Open Market Sales does not, then, have a fixed ceiling price: the price follows the market price as it moves upward.

The Open Market Sales Program was started in 1979/80 to halt the price rises attributable to consumer apprehension over a foodgrain shortfall. It was originally intended for use during the brief periods before the aman and boro/aus harvests when prices rose. Many authors (Ministry of Food 1986; BECON 1988) have noted its potential effectiveness as a price stabilizer and have urged its more frequent use. As Table 2 shows, the program has been applied more frequently in recent years.

The Modified Rationing Program operated only rarely when the market price suddenly rose. Under this program, foodgrains were sold through shops at Statutory Rationing program prices, and no ration card was needed to make purchases. During 1984/85, 8,000 tons were distributed; since 1987/88, virtually no grain has moved through this channel (World Food Programme 1989).

Under the Large Employer Program, workers are allotted 31.25 kilograms of wheat per month. They are able to obtain rice when it occasionally becomes available. A total of 242,000 workers were eligible for this program in 1984/85. In that year, 63,000 tons were drawn (EUREKA 1986), for an average allotment of 5 kilograms per week per worker. Thus, those eligible either did not participate regularly or were not allocated their statutory amount. No studies of leakage from this program are known to have been conducted.

Under the Gratuitous Relief Program, assistance is distributed ad hoc in cases of natural calamities, with households receiving a special free allotment of grains for a short period. The volume distributed depends critically on the perceived extent of the damage caused by the calamity. In 1984/85, a year of heavy flooding but questionable damage to agriculture, 100,000 tons of grains were distributed to selected areas.

The Food for Work Program, introduced in 1973, is designed to provide work for poor households during the periods of slack employment that followed the end of the aman harvest in February. Additional goals include the development of rural infrastructure and the promotion of rural institutions and their ability to plan and administer. Food for Work projects include rural road (footpath) construction, embankment and other flood control projects, and construction of helicopter pads. The program tends toward self-targeting of poor families because workers are paid in wheat at a rate of 80 percent of the average agricultural wage rate. Official wages are 52.57 seers of wheat per 1,000 cubic feet of earth moved (1 seer is 0.93 kilogram) (Institute of Nutrition and Food Science 1981); in practice, lower rates of pay have been common.

Administration of the Food for Work Program was designed, in part, to improve the planning capability of local governments. Project Implementation Committees of upazila and union officials were set up to plan and design the Food for Work schemes and to administer the projects to completion. There has been some criticism of the upazila- and union-level planning arrangements, since a large proportion of the Food for Work projects have produced structures that are unusable for one reason or another (CARE International 1988).

The Canal Digging Program, which presently is not in operation, was similar to the Food for Work Program in that grain was paid to workers for digging canals.

The Vulnerable Group Feeding Program (now called Vulnerable Group Development) is designed to provide distressed families--those with young children and pregnant and lactating women--with supplementary food for a two-year period. The objectives are as follows: income transfers, creation of income-generating activities, increased income-earning capacity, and communication of basic health and food-related information to its recipients (World Food Programme 1988). Eligible households are entitled to 32 kilograms of wheat per month, although in practice they receive 66 percent of this amount on average (World Food Programme 1988). Eligibility is determined by upazila Project Implementation Committees, with beneficiary cards distributed to each upazila by the Ministry of Relief and Rehabilitation and the Directorate of Relief and Rehabilitation. The cards are distributed based on a stress rating compiled by the World Food Programme. Upazilas are put into four categories--most distressed, moderately distressed, slightly distressed, and average or least distressed--with the cards going to 6.5 percent, 4.0 percent, 2.5 percent, and 1.5 percent of the population in these categories, respectively. The government recorded a total of 455,000 beneficiary families in 1986/87, with 170,000 tons of wheat allocated to the program (World Food Programme 1988).

During emergencies, such as periods of heavy flooding, the number of beneficiaries of the Vulnerable Group Development Program can be increased temporarily. In September and October of 1988, 1,564,112 families received 148,390 tons of emergency wheat. The program can be expanded quickly in an emergency, since the Ministry of Food generally has sufficient stocks in local supply depots; however, donors must promise to replenish the stocks. At the national level, the director general of food controls the orders to move and release grain. Regional and district controllers can also issue orders, but in general these are slow to arrive.

In summary, the quantities of grains moving through the nonmonetized channels of the PFDS have increased in recent years, mostly at the expense of the Statutory Rationing and Modified Rationing channels. The share of wheat in PFDS offtake has increased steadily

over the last decades, while the share of rice has declined. The reasons are a desire to make the channels more self-targeting and the upsurge in distribution through the Vulnerable Group Development and Food for Work programs, which only deliver wheat. Bangladesh has completed the elimination of the subsidies from the Statutory Rationing and Other Priorities programs, as urged by various studies. The leaky Modified Rationing system was discontinued and will be replaced by a new Rural Rationing Program.

3. LITERATURE REVIEW

This chapter reviews the findings of various studies on PFDS effectiveness and outcomes and on nutritional status in Bangladesh.

THE PUBLIC FOOD DISTRIBUTION SYSTEM

Foodgrain interventions are common throughout the world. One often-used intervention is the consumer price subsidy, either general or targeted, which has been effective in increasing the food consumption of the poor. In Egypt, food subsidies accounted for 12.7 percent of the food expenditures of the bottom income quartile in urban areas and 18 percent in rural areas (Alderman and Von Braun 1984). In Sri Lanka 20 percent of the total calorie consumption of low-income families was attributed to a food ration. Similar results were found in Pakistan and in Kerala, India (Alderman, Chaudhry, and Garcia 1988; Kumar 1979).

Little research has been conducted on the link between the price subsidies and increased intake of nutrients (although presumably increases in food intake will lead to increases in nutrient intake) and changes in the intrahousehold distribution of nutrients. There is also very little information linking subsidy schemes empirically to measurable individual nutritional outcomes. Similar problems exist in determining whether positive nutritional outcomes have occurred among the beneficiaries of supplementary feeding programs.

Beaton and Ghassemi (1982) conducted a broad review of the nutritional consequences of supplementary feeding programs and generally found no measurable (anthropometric) benefits even though many of the programs were linked to a fairly large proportion of household consumption of nutrients. Kumar (1979) found an association between the level of a family's intake of calories (induced by a food subsidy) and growth among children. However, many other studies of food subsidies found no measurable anthropometric benefit (Kennedy and Alderman 1987).

In the case of Bangladesh specifically, numerous evaluations of the PFDS have been conducted over the years, and the system has been modified following many of the recommendations of these studies. However, there are still formidable gaps in knowledge about the program, as this literature review highlights. Some of the studies have looked at the entire PFDS, while others have focused on individual programs under it.

The evaluations fall into two broad categories, although some of the studies encompass both. One is process evaluations, which seek to determine how the system is running in terms of leakage, targeting, and forms of payment. These evaluations address how much grain is actually delivered to intended recipients. The other category looks at outcomes on how the program affects the welfare of its beneficiaries. In the evaluations of the Food for Work program, the outcomes include the viability of the project and its impact on the community.

Brundin (1979) evaluated the Food for Work processes for USAID in 1979. He found high rates of leakage yet could not estimate the amount of wheat actually reaching workers. He claimed that as much as 30 percent of Food for Work wheat might have been misappropriated.

An evaluation of the Food for Work program by the Institute of Nutrition and Food Science (1981) reported serious problems with administration of the projects. The study, conducted on a random sample of 2,308 workers from 42 Food for Work sites, found severe underpayments to workers, commissions commonly demanded for the privilege of working, irregular payments to workers, and overestimates of the total employment generated. Workers received 76.6 percent of the wage due them.⁴ At the same time, in many cases teams working exceptionally hard received daily wages exceeding the agricultural wage. Fourteen percent of the workers reported paying a "commission" to an "agent." The study concluded by noting that very few workers knew what rate was due them, whether they had to pay commissions, or that they were to be paid extra for additional work.

During the period 1981 to 1983, the Bangladesh Institute of Development Studies (BIDS) and IFPRI conducted an evaluation of the effects of the Food for Work Program. There were two parts: a short-run evaluation conducted while Food for Work projects were underway, and a long-run evaluation of the effects of the improved infrastructure on the project sites.⁵

The short-run study involved a household survey at five project and five "comparable" nonproject sites (controls). A total of 246 project and 245 control households that expressed a willingness to participate in Food for Work (labor-selling) were surveyed. The following questions were asked: who participates in the Food for Work Program?; what factors affect participation?; and what factors affect the intensity of participation?

⁴ Allotments averaged 40.27 seers per 1,000 cubic feet, while the official rate was 52.57.

⁵ By accepting that infrastructure is a key ingredient of economic development, it becomes necessary to evaluate whether the Food for Work program produces useful infrastructure.

The results showed that the Food for Work participants were overwhelmingly poor. Thus the program is effectively self-targeting. Household employment was greater for Food for Work households, and Food for Work employment tended to substitute for home production. A measurable gain in income was attributed to the Food for Work wages (Osmani and Chowdhury 1983). On the other hand, few differences in consumption were found between the control and project households; however, the authors did not adequately control for differences in income among groups nor for the effects of selectivity (why households participated).⁶ Those who participated more intensively consumed more grain than did casual participants. The performance of Food for Work participants in repaying the loans was better than that of the control groups (Osmani and Chowdhury 1983).

The share of wheat in consumption was very high for both the control and participating households. The project resulted in lower local wheat prices relative to rice, a shift that encouraged the consumption of wheat. The nutrition effect of this price change may be high since both Pitt (1983) and Ahmed (1979) showed that subsidies on wheat prices may go the farthest toward improving the nutrient intake of the poor.

Analysis of the long-run impact in terms of infrastructural improvements and of nutrition is ongoing. Four project sites have been selected (representing four types of projects); each site contains two pairings of villages--one pair consisting of a project and control village with good infrastructural development and one pair with poor--for a total of 16 villages. Forty households were surveyed within each of the 16 villages. For the nutrition study, two project sites (eight villages) were selected.

The longer run effects attributable to the Food for Work Program included increased value of agricultural production, slight increases in cropping intensity, and higher yields. These effects were noticeably less for the smaller farms. Income was higher in the project areas, but agricultural wages were lower. The control areas showed much more income from home activities. The rates of investment were higher in the project sites.

On the other hand, there were few differences in consumption between the control and project sites. Whereas the short-run indicator of nutritional status (weight/height) was significantly higher in the project group, the long-run indicator (height/age) was not affected (Ahmed et al. 1985). This evaluation specifically measured the effects of infrastructure by comparing developed versus underdeveloped sites.

⁶ The authors speculated that the low income elasticity of food demand may be attributable to the lumpiness of Food for Work payments. More sustained payments over time might improve food consumption (Osmani and Chowdhury 1983).

CARE International (1988) evaluated its Food for Work projects as part of its normal auditing procedures. It randomly visited upazila⁷ sites to compare outcomes with submitted records to assess their accuracy. CARE found numerous irregularities, including underpayment of workers, overreporting of work, unserviceable schemes, and payments in cash. In 1988 only 28.6 percent of the total programmed Food for Work budget resulted in economically viable construction schemes.⁸ Thus the Food for Work Program in general has not produced viable infrastructure.

On average the project committee planned to pay workers 8-10 percent less than the fixed rate. On occasions where Food for Work wheat was sold and workers were paid in cash,⁹ the rates were found to be 76.4 percent of the official scale. Rates of pay tended to be much closer to the official rates when the Project Implementation Committees used signboards to post the rate.

A 1987 Helen Keller International study evaluated the coverage and effectiveness of both the Vulnerable Group Development and Food for Work Programs (Darton-Hill 1987). Of the 260 households interviewed, 130 participated in the Vulnerable Group Development Program and 130 in the Food for Work Program. The study concluded that both programs were exceptionally well targeted; the average participant in the first program had energy intakes below 50 percent of their required daily allotment. However, there must have been leakage, since participants received only 54 percent of the intended Vulnerable Group Development ration.

Both the Vulnerable Group Development and Food for Work rations accounted for substantial proportions of the total household income for these households. Although these proportions were not measured precisely, nor was the income displaced by the Food for Work Program examined, it was inferred that the nutritional consequences of these programs were significant.

In 1989 the World Food Programme analyzed both programs (World Food Programme 1989). The results showed that both were well-targeted. The Vulnerable Group Development effort covered roughly 455,000 women per year; the average weekly nonprogram income of the participants was Tk 17. Sixty-one percent were heads of households, and 20 percent were married but had husbands who were unable to work. Eighty-eight percent of the Vulnerable Group Development participants were landless, and only 8.7 percent could write their names. The beneficiaries reported

⁷ A total of 315 upazilas in 44 districts had active Food for Work projects.

⁸ The rates of performance were significantly poorer in 1988 than in 1987, with large decreases in economically viable schemes and increases in the rates of overreported work.

⁹ Workers were paid fully or partially in cash in 30 percent of the 1988 projects.

spending 91 percent of their total expenditures on food (World Food Programme 1986).

A random survey of 1,000 Vulnerable Development Group recipients showed that average allotments of wheat were 20.71 kilograms, or 66 percent of the ration entitlement.¹⁰ No respondent reported receiving a full ration. The availability and distribution of wheat was irregular: only 73 percent reported receiving a regular ration.

The rations under the Vulnerable Group Development Program displaced market purchases of both wheat and rice: households bought 24 percent less wheat and 17 percent less rice after entry into the program. Of the participants, 12.9 percent reported selling some or all of their rations. The program thus might exert some downward pressure on prices by decreasing demand and increasing supply. However, given the small quantities this group would normally buy and the small amounts sold, it is not likely this pressure would be significant.

The study concluded that the Vulnerable Group Development Program transferred significant income to its small group of recipients but did little to enhance their long-term ability to earn income (World Food Programme 1986).¹¹ In later years, projects designed to enhance income-earning potential were added, including savings schemes, women's training centers, and poultry-raising projects (World Food Programme 1988a, 1988b).

These studies of the two large nonmonetized channels indicated that they have been well targeted but extremely leaky. Estimates of the leakage from the Food for Work Program range from 50 percent to 10 percent, the smaller figure does not include the losses from mismanaged projects but only the underpayments to workers. Because program participation (why people participate) has not been adequately addressed, it is difficult to conclude that the programs have raised the consumption of participants. Little can be said conclusively about the ultimate effects of these programs on the intended beneficiaries. Although the programs seem to raise participants' income, the studies did not take into account displaced income in general.

In 1979 and 1980 the Institute of Nutrition and Food Science conducted a study of the Statutory Rationing, Modified Rationing, and

¹⁰ The upazila Project Implementation Committees were queried about why full rations were not delivered to the participants. Several reasons were noted. Some rations were transferred to needy women who held no card. Many times the local supply depot did not provide the committee with its full allotment. The study speculated that since the government paid no handling costs, the local supply depots diverted grain to cover these costs (World Food Programme 1986).

¹¹ Only 3.4 percent of respondents felt the program enhanced their ability to earn income (World Food Programme 1988b).

Gratuitous Relief components of the PFDS. The study examined the determinants of participation, the amount of rations received, and the ration's share in a household's total grain intake (Institute of Nutrition and Food Science 1979, 1980).

The rations were very small, on average only 10 percent of the official quantity specified for urban rations. In addition, only 2.4-7.4 percent of the total household income of participants could be traced to the program. Even with these smaller amounts many beneficiaries (25 percent) drew less than the full ration. The rural households were thus very dependent on the open market for meeting their cereal needs.

Only one-quarter to one-third of eligible users drew rations in any one month. Many reasons were given for nonparticipation: news of available grain did not reach many remote rural areas; the quotas (rations) were too small to make it worthwhile going to the shops; meals were taken at work; and the supply of rations was extremely irregular. On many occasions people who intended to purchase rations found no grain when they reached the shops.

The urban Statutory Rationing system benefited its participants to a much greater extent, providing 55-62 percent of the cereals purchased by middle-class consumers, representing an increment in income of 19.6 percent.

In 1985 and 1986 the Ministry of Food contracted with BECON Consultants to analyze the effectiveness of the PFDS (BECON 1986). The study did not explicitly examine nutritional outcomes, focusing instead on coverage and delivery of foodgrains. Only 3.6 percent of the eligible rural poor in 1978/79 were able to draw their full Modified Rationing quota. Generally the government treated this program as a residual effort and was unable to deliver significant quantities of grains. Because it was treated as residual, it was by far the most variable PFDS channel. On average the program did not deliver significant quantities of grain to its beneficiaries (only 50 percent of eligible households, or Class A, the poorest, possessed a ration card); less than 2.2 percent of the grain consumption of Modified Rationing households came from ration shops. The inference is that the Modified Rationing program had little if any impact on the nutritional status of the poor.

The 1986 report for the Ministry of Food, prepared by BECON, included an economic model to show that the PFDS could be used to moderate some of the wild fluctuations in consumer and producer prices. In years of bad production, although market prices may rise dramatically, the increased offtake of rations should lead to only

slight declines in food consumption.¹² Decreases in the ration quotas would lead to large rises in market prices, as consumers sought alternative grain sources.

The study showed that the Statutory Rationing program created a 7.05 percent income transfer (to middle-class urban consumers) in 1973/74; this subsidy fell to 3.21 percent in 1984/85.¹³ The review advocated abolition of the Statutory Rationing effort, even though it was much more effective in reaching the urban middle classes than was the Modified Rationing system in reaching the rural poor. It noted that the Food for Work and Vulnerable Group Development Schemes were effectively targeted, with the beneficiaries of these programs generally being among the most needy.

The authors of the BECON study were able to show that in the aggregate the PFDS contributed effectively to overall food security. However, they stated that a disaggregated analysis would show large variations in coverage. The effective channels were Open Market Sales, Vulnerable Group Development, and Food for Work, whereas Modified Rationing was extremely ineffective. The Statutory Rationing Program reached people of dubious need. The authors urged the use of a famine map to better target interventions by geographical area. In addition, they pressed for more effective use of the Open Market Sales channel to mitigate seasonal and geographical swings in retail prices.

BECON produced another report in 1988, an evaluation of the Modified Rationing Program (BECON 1988). In it the authors advocated wholesome reform of this system. They showed that the subsidy it provided was small, with rice under the program priced at more than 90 percent of the market price and wheat at more than 95 percent. Total Modified Rationing grain amounted to about 2 percent of the foodgrain consumption of the participants. Only 3.8 percent of the landless poor received any ration in 1986/87. Once again, the cardholders were needy; an analysis of the distribution priority list showed that only poorer households held cards.

The leakage from the Modified Rationing Program was a key element in its ineffectiveness; the authors estimated that up to four-fifths of the wheat and three-fifths of the rice allotted to Modified Rationing dealers leaked from the system. The proceeds of this leakage were often seen as political entitlements used to secure advantages in local elections (BECON 1988).

¹² It was assumed that imports would increase to maintain the availability of the rations.

¹³ These figures are quite different from those of the Institute of Nutrition and Food Science studies. Based on evaluations of the methodologies it can be concluded that the BECON (1988) figures are more likely to be reliable.

The report ended with the following recommendations. All Modified Rationing wheat should move through the very effective *chakki* system, under which wheat was sold to local millers at a reduced price. Wheat deliveries through Modified Rationing should be suspended. If the Modified Rationing shops were to be continued, then the authors called for more of them; many cardholders did not participate because of the long distances they had to travel to draw their rations. Finally, they recommended better regional targeting of the Modified Rationing distribution so that distress-prone regions receive larger allotments.

At about the same time EUREKA (Bangladesh) Ltd. undertook a study of the subsidies in the PFDS system overall (EUREKA 1986). The authors tried to track the losses of grains in different parts of the system (transportation and storage). They found that the highest percentage of losses occurred at the port of entry into the country and that the total average loss up to the local supply depots was 3.81 percent. The study also showed that the Food for Work and Vulnerable Group Development programs were well targeted; the Modified Rationing channel was also well targeted but very thin in its coverage and not very effective. A large percentage (31.8 percent) of poor rural households had no access to the PFDS; most of the others had access only to the Modified Rationing system. Participation in that program was very sporadic. Another finding was that the urban middle classes benefited the most from the PFDS.

Other evaluations of the PFDS abound. Some have examined the impact of the system on producer prices and hence on production incentives (Nelson 1979)¹⁴ and its impact on the government budget (Ahmed 1979). However, no study has comprehensively examined the nutritional impact of the PFDS.

There is clearly a large gap in knowledge. The PFDS could account for a significant part of the income of a small group of well-targeted individuals. However, problems in the system's operations prevent this outcome. The extent of poverty in Bangladesh makes it extremely unlikely that any expansion of the PFDS programs will make anything but a small dent in the level of poverty. The Ministry of Food estimated that 44 million out of the total population of 110 million are vulnerable (in Ministry terms belonging to class A).¹⁵ By using

¹⁴ The outcome was a very small disincentive effect that can be ignored. However, seasonal dimensions were not investigated.

¹⁵ Using the World Food Programme's estimate that 2.495 million tons in 1987/88 went through the PFDS, and subtracting all nontargeted aid (Statutory Rationing, Essential Priorities, Other Priorities, Large Employers, Open Market Sales, Market Operations, and Flour Mill programs), 1.425 million tons are left for the targeted groups. Assuming no leakage, the allotment would be 0.089 kilogram per needy person per day. Recipients under the individual programs do much better than this amount; family members participating in the Vulnerable Group Development program receive an average allotment of 146 grams per day (using 20.7 kilograms per month and an average recipient family of 4.8 people).

estimates of 2 million beneficiaries for the Vulnerable Group Development Program, 4.6 million for Food for Work, and 3.5 million for Rural Rationing, the number of beneficiaries is 10.1 million, or less than 25 percent of the truly needy. This figure is surely an overestimate, since many Food for Work workers may also belong to either of the other two programs. Thus the PFDS must be considered as a small, but important, component of food policy and, more broadly, of development policy.

Much of the budgetary subsidy from the PFDS was directed toward urban consumers, who were generally less needy than other potential beneficiaries. This urban bias was widely documented, and the government reacted by reducing and eventually eliminating most of the middle-class subsidies.

Much less is known about the effectiveness of the rural channels. They appear to be very well targeted. Both the Vulnerable Group Development and the Food for Work programs, however, have high rates of leakage. The sources of this leakage were almost always traceable to local problems: either the local *godowns* did not release the appropriate amount of grain or the union officials and Project Implementation Committees did not run the projects effectively (World Food Programme 1988a; CARE International 1988). In addition, most Food for Work projects did not produce viable infrastructure.

The focus of many of these studies on quantities delivered shed light on the divergence between the published ration amounts and those actually delivered. However, because the analytical frameworks have not included the determinants of program participation, very little can be said about the net effects of the program, and virtually nothing is known about its effect on individual nutrition.

NATIONAL STUDIES OF NUTRITIONAL STATUS

Five nationwide nutritional surveys have been conducted in Bangladesh: the Nutrition Survey of East Pakistan (1962-64), the National Nutrition Surveys of 1975/76 and 1981/82 (conducted by the Institute of Nutrition and Food Science of the University of Dhaka); the Helen Keller International Survey of 1982/83; and the Nutrition Module of the Household Expenditure Survey (conducted by the Bangladesh Bureau of Statistics) of 1985/86. Comparison of the results of these surveys may be found in Bangladesh Bureau of Statistics 1987 and Chowdhury 1989. Table 3 contains a summary of the results from the last four of the surveys.

Table 3--Comparison of results from national nutrition surveys for rural Bangladesh

Indicator	Institute of Nutrition and Food Science		Helen Keller International,	Bangladesh Bureau of Statistics,
	1975/76	1981/82	1982/83	1985/86
Stunting (percent)	73.7	57.3	42.0	57.6
Wasting (percent)	21.6	20.0	6.0	8.2
Sample size	430	510	4,443	1,500
Age range (months)	0-59	0-59	3-71	6-71
Reference Standard	Harvard	Harvard	National Center for Health Statistics	National Center for Health Statistics

Source: Omar Haider Chowdhury, "Analytical Bibliography on Rural Development: Studies on Nutrition," Bangladesh Institute of Development Studies, Dhaka, 1989, mimeographed; Bangladesh Bureau of Statistics, Report on the Child Nutrition Status Module, Bangladesh Household Expenditure Study, 1985-86 (Dhaka: BBS, 1987).

The studies produced very different estimates of the prevalence of malnutrition, although in all cases the estimated rates were high compared with other countries.¹⁶ The rates of wasting for the first two studies seem extremely high, even considering that the first study occurred immediately after the 1974 famine. Moreover, the large variation in the proportion of stunted children across the studies makes comparisons difficult.

Some of the differences may be explained by sampling error, use of different reference standards, and, most likely, nonsampling error. The sample sizes of the first two studies were extremely small; this limitation, combined with their unreasonably high rates of wasting, discount their findings. Very little of the differences can be attributed to the use of different standards, however, since the age and height-specific means of both standards are virtually identical.¹⁷ The different age groupings contained in each study make the results difficult to interpret; the studies with higher proportions of vulnerable children (6-24 months) may be expected to have higher rates of wasting. However, the same phenomenon should lead to a higher measured rate of stunting in the two latter studies, which was not the case.

¹⁶ See Kumar 1987 for a comparison with countries in Sub-Saharan Africa.

¹⁷ All studies used less than 90 percent height for age and 80 percent weight for height as the stunting and wasting cutoffs, respectively. Therefore similar means would have to lead to nearly identical prevalences.

The differences in the rates of wasting between the Helen Keller International and the Bangladesh Bureau of Statistics surveys can in part be explained by their timing. The former was conducted during the December-April post-aman harvest period, during which time the rates of wasting usually fall. The Bangladesh Bureau of Statistics survey was conducted four times during the year. When the results were broken down by season, the January and February round produced a wasting rate of 4.1 percent and the April round, 9.1 percent. Thus the overall rates are fairly close, with the Helen Keller Institute on average showing a higher rate of wasting (Chowdhury 1989).

The large observed difference in the prevalence of stunting reported by the studies is much more difficult to explain. They cannot be attributed solely to changes in population incidence, and some evaluation of the confidence intervals is necessary. Nevertheless, it does appear that chronic malnutrition is increasing in rural Bangladesh.

Chowdhury (1989) used the results of the 1975/76 and 1985/86 studies to conclude that the severity of malnutrition among rural children has decreased. There does not, however, seem to be enough evidence to support this conclusion given the reservations expressed earlier. The lack of evidence points to a need to continue standardized survey instrument and sample design so that these types of comparisons can be made. On the other hand, there is concrete evidence that per capita consumption of nutrients increased slightly in the past decade (Chowdhury 1989), although inequality also increased.

The Bangladesh Bureau of Statistics study presented some information on an issue of continuing interest in Bangladesh: gender bias. Table 4 presents a summary of the different indicators for the rural areas by gender. Although no information is presented in the Bureau's report on the statistical significance of the differences, the general picture is that girls are worse off than boys. This finding confirms some of the observations on intrafamily food and resource distribution by Chen, Huq, and D'Souza (1981) and the results of nutrient adequacy studies (see Chowdhury 1989 for a review of dietary assessment studies).

The report of the Bangladesh Bureau of Statistics study (1987) also compared mean indicator values by age group, sample season, income group, expenditure group, food and medical expenditure group, maternal education, maternal hand cleaning, toilet and water source type, breastfeeding, and morbidity. The results were consistent with prior expectations. The higher income and expenditure households generally had lower rates of malnutrition.¹⁸ Mother's education, tubewell

¹⁸ As measured by the mean prevalence of wasted and stunted children.

Table 4--Comparison of nutritional status indicators, by gender, for rural Bangladesh

Indicator	Male	Female
Weight/age (means)	71.8	72.4
Height/age (means)	89.0	88.6
Weight/height (means)	89.9	89.4
Stunting (percent)	54.8	57.6
Wasting (percent)	6.8	9.8

Source: Bangladesh Bureau of Statistics, "Report on the Child Nutrition Status Module, Bangladesh Household Expenditure Study, 1985-86" BRS, Dhaka, 1987, mimeographed.

water,¹⁹ length of breastfeeding, and absence of morbidity were all positively correlated with nutritional status.

The analysis of the survey data ended there and was thus extremely limited. Only point estimates were presented so that the statistical significance of the differences is unknown. Further, no multivariate analysis was conducted so that there was no statistical control.

The corresponding analysis of the Helen Keller International survey data was also incomplete. It included a comparison of nutritional status across geographical areas but aggregated at the division level.²⁰ These results are presented in Table 5. The rates of malnutrition were highest near weaning age, and, contrary to the Bangladesh Bureau of Statistics analysis, there was no evidence of gender differentials in nutritional status.

Table 5--Nutritional status from the Helen Keller International xerophthalmia prevalence survey, by division

Division	Severe Malnutrition (less than 12.5 centimeters)	Moderate Malnutrition (12.5-14.0 centimeters)	Normal (over 14.0 centimeters)
Dhaka	10	37	53
Chittagong	10	38	52
Khulna	13	47	40
Rajshahi	7	37	56
TOTAL	10	40	51

Source: Helen Keller International, "Bangladesh Nutritional Blindness Study 1982-83, Key Results," Helen Keller International and the Institute of Public Health and Nutrition, Dhaka, 1985, mimeographed.

¹⁹ As opposed to surface water or unprotected open wells.

²⁰ Helen Keller International 1983 contains some district-level disaggregations.

Several other points must be made about the results of these national surveys. First, standardization of the survey and sample methodologies is needed. Because the study results are incompatible, no dynamic national comparison of nutritional status in Bangladesh emerges. Second, the two surveys having sample sizes adequate for causal analysis offer a wealth of information that has not been sufficiently analyzed.²¹ Finally, none of the survey results was sufficiently disaggregated geographically to permit examination of different sub-areas of the country.

MICRO STUDIES OF NUTRITIONAL STATUS IN BANGLADESH

There have been numerous attempts to measure nutritional status in specific areas and project sites. These studies have used indicators such as mortality rates, dietary intake, and anthropometry. Many have evaluated the effectiveness of nutritional interventions in certain areas. Some of these studies and their findings are reviewed below.

An important and widely used indicator of nutritional status is the infant mortality rate.²² There have been several studies of the infant mortality rate in Bangladesh. The World Bank (1979) estimated it to be 140; the International Statistics Institute (1979) estimated the rate at 150, saying that 45 more die in the second year. Other estimates range from 110 (United Nations International Children's Fund 1978) to 186 (ICED 1977). The higher end of the range of estimates is found in rural areas (ICED 1977; Islam et al. 1986). All these estimates are extremely high when compared with other developing countries.²³

The World Bank (1981) estimated the child mortality rate²⁴ at 19 in 1979, a marked improvement from 1960, when it stood at 25. Rahman et al. (1984), who measured the death rate attributable to malnutrition in rural Bangladesh, found an extremely high correlation between size of the landholding and rates of death: landless children died because of malnutrition at a rate of 50 per 10,000, while children from families with more than 1 acre died at a rate of 9.5 per 10,000.

²¹ Particularly the Bangladesh Bureau of Statistics survey, which contains observations from the Household Expenditure Survey for every household where anthropometric measurements were taken.

²² Defined as the number of children who die between the ages of 1 and 5 years per 1,000 live births.

²³ According to the United Nations Children's Fund a country with a rate over 100 has "very high infant mortality." In 1981 seven countries had rates above 150 (UNICEF 1984).

²⁴ Defined as the number of deaths between 1 and 5 years per 1,000 1-year-olds.

There have been no studies of household conditions using mortality data as an indicator, mainly because generating precise estimates with these data requires prohibitively large sample sizes. However, the mortality studies do confirm that the rural areas are worse off and that landless households are particularly vulnerable.

Studies of birth weight are also grim for rural Bangladesh. The World Health Organization (1980) estimated that the weight in 50 percent of the births in rural areas were below 2,500 grams, which is usually taken to be the cutoff for malnutrition. There was no investigation of the causes of the low birth weights, but the authors speculated that maternal nutrition and education were key factors.

There have been numerous studies of nutritional status in Matlab Thana in the Comilla District, the field station of the International Centre for Diarrheal Disease Research, Bangladesh. They show high prevalences of malnutrition, gender biases in intrafamily food distribution (Chen, Huq, and D'Souza 1981), high seasonal variations in nutritional status (Chen, Chowdhury, and Huffman 1979), an association between landlessness and malnutrition (Chen, Chowdhury, and Huffman, 1979), and the unimportance of mother's education as a cause of malnutrition when income levels are very low (Chowdhury 1988). Many investigations of the relationship between diarrhea, feeding habits, malnutrition, and death rates have resulted from the center's efforts. Additional studies have examined the relationship between nutritional status and physiological changes such as menarche in young women (malnutrition delays menarche, according to Chowdhury, Huffman, and Curlin 1977) and postpartum amenorrhea (Huffman, Chowdhury, and Sykes 1980; Huffman, Chowdhury, and Mosley 1978), and the relationship between malnutrition and mortality (Chen, Chowdhury, and Huffman 1978).

Nutritional anthropometry has been widely used to measure the effectiveness of nutrition interventions in Bangladesh. In general, the studies have reported positive nutritional effects. Kielman, Ajello, and Kielman (1980) conducted an evaluation of a UNICEF project in Companiganj Thana, Noakhali District. The project was designed to study the effect of a subsidized food supplement on child growth and mortality during famines. The authors concluded that the intervention had a significant positive effect on growth but that a better design would have led to greater effectiveness.

Some results from other intervention evaluations are presented in Table 6. These studies, which have all been summarized elsewhere, paint a generally grim picture of nutritional status in Bangladesh. As noted, it is difficult to make cross-study comparisons, since the projects involved different interventions, age groupings were not equal, and the standardization, measurement techniques, and sample designs varied. However, these interventions generally seem to have worked in terms of improving nutritional status.

Table 6--Summary of the findings from micro-level studies of nutritional status in Bangladesh

Project	Year	Indicators	Findings
River Project	1979	Height/age, Weight/age, Weight/height, MUAC	Malnutrition lower in project area than in rest of Bangladesh. Still bad.
Concern Mirpur Camp	1979	Height/age, Weight/age, Weight/height, MUAC	Fewer well-nourished people; no significant difference in severe malnourishment compared with rural Bangladesh
Muyiarchar	1978/79	Dietary adequacy	General inadequacy of calorie intake for preschoolers; no intrafamily bias; income important

Sources: Data on River Project and Concern Mirpur Camp are from Save the Children Fund (United Kingdom), "Bangladesh: River Project, Nutrition Survey Report 1," Dhaka, September 1979, mimeographed; data on Muyiar-char are from Rafiqul H. Chowdhury, "Determinants of Dietary Intake and Dietary Adequacy for Pre-school Children in Bangladesh," Food and Nutrition Bulletin, 6(4), 1984.

SUMMARY AND CONCLUSIONS

The broad picture that results from these studies is that malnutrition is extremely prevalent and that the PFDS, although designed in part to alleviate malnutrition, has had only limited success in reaching this goal. This review also shows the broad gaps in knowledge. Filling the gap is a precondition for effective policy design.

Some immediate conclusions result from the literature review.

- The programs designed to alleviate rural hunger are small relative to their pool of intended beneficiaries. The Vulnerable Group Development, Food for Work, and Rural Rationing programs cannot be relied on to relieve more than a relatively small percentage of the households that suffer from hunger.
- The Vulnerable Group Development and Food for Work programs are well targeted but extremely leaky. Estimates of how much grain is delivered through these channels cannot be made on the basis of the amount of grain that enters the system. Instead, beneficiaries must be surveyed and the results aggregated. The Food for Work Program may not in general produce economically viable infrastructure.

- The Statutory Rationing and Other Priorities programs have been effectively reformed so that they no longer provide subsidies to the middle class.
- No broad dynamic picture of malnutrition emerges from the literature, and what does emerge cannot be effectively tied to the coverage of the PFDS. Thus the overall impact of the PFDS on malnutrition is unknown. Declines in the infant and child mortality rates since the 1960s cannot be attributed to any program without further analysis.
- While nutritional anthropometry has been used extensively to evaluate the effectiveness of nutrition interventions, it has not been widely used to measure the impact of the PFDS. The study that included nutritional anthropometry (Ahmed et al. 1985) provided evidence that infrastructure did lead to better short-run nutritional indicators but that there was little evidence that participation in the Food for Work program had any positive nutritional impact.
- None of the explicit nutrition studies focused on the effects of the PFDS. The Bangladesh Bureau of Statistics Household Expenditure Survey could be used to conduct such an analysis, but this study has not yet been done.

The studies of the PFDS have not adequately focused on consumption and nutrition outcomes, and the nutrition studies have not covered the role of the PFDS. More work is needed to determine how the PFDS is tied to improved nutrition and consumption.

4. THE IFPRI PLAN FOR STUDYING NUTRITION AND CONSUMPTION

This section describes the proposal underlying IFPRI's work plan. Several questions are being addressed by the IFPRI study. What effect does the PFDS have on the intake of nutrients at the household level, and do changes in the nutrient consumption of households affect observable indicators of nutritional status? How does nutritional status affect labor supply and productivity? How does the PFDS enhance or hinder the achievement of broader development goals? Satisfactory answers to these questions in turn necessitate investigation of a number of subissues, including: the determinants of participation in the PFDS and how these affect normal relationships; how PFDS coverage affects the intense seasonal swings in consumption observed in Bangladesh; and how PFDS grain transfers affect market prices and producer incentives. Finally, an evaluation of the PFDS use in developed versus less developed regions is needed.

This chapter is organized as follows. The use of nutritional anthropometry as a broad development indicator is discussed first. The data are available from the Nutrition Module of the 1985/86 Household Expenditure Survey conducted by the Bangladesh Bureau of Statistics. The institutional framework in which the analysis is being conducted is identified. Next, a possible early warning system using easily collected indicators is outlined.

NUTRITIONAL STATUS AS A BROAD DEVELOPMENT INDICATOR

The PFDS is the result of a desire to protect the most vulnerable sectors of Bangladesh society from fluctuations in real purchasing power and to increase their mean levels of grain consumption. At the same time, economic development, if it is broadly based, can achieve the same ends over a longer period with fewer costs. Thus an important consideration is to determine the role and effectiveness of the PFDS, the relationship between PFDS and the country's economic development goals. One way is to compare indicators of development, one of which can be nutritional status, over different regions of the country over time.

The Nutrition Module of the Household Expenditure Survey provides a good opportunity to use nutritional anthropometry along with other household-level measures of economic status as indicators of development. The most recent version of the module contained 240 primary sampling units, each containing 16 households, and a total

sample size of 3,283 children from 6-71-months old. The survey was conducted four times during 1985/86 (September/October, January/February, April, and July), covering the approximate range of seasonality in Bangladesh.

The information sought by the Nutrition Module includes: anthropometry (height, weight, and arm circumference) for all children; individual characteristics (age, gender, relationship to household head, birth order, breastfeeding history, and illness history); parental characteristics (education, literacy, employment, and ownership of assets), which come in part from the expenditure survey; and household characteristics (source of drinking water, sanitation, and number of household members).

Two questions must be answered before the validity of these data is accepted. First, were the children's ages measured accurately? Inaccuracy in ages was mentioned overwhelmingly as an endemic problem in Bangladesh. A source at the International Center for Diarrheal Disease, Bangladesh, was skeptical of any age data not collected using detailed demographic surveillance. A quick look at age clustering (around 6 and 12 month intervals) will address this issue. Some clustering should be expected, but extremes should raise suspicions.

Second, how diligent were the survey enumerators? The USAID economic statistics advisor attached to the statistics bureau was uncertain about the quality of data collection in Bangladesh. He was, however, very enthusiastic about the Nutrition Module, and since the Household Expenditure Survey was conducted simultaneously, his doubts about whether the households were really contacted were assuaged. However, outlier inspection and consistency checks are necessary.

If the quality of the anthropometric data is accepted, what new information can be obtained by using them? UNICEF, the chief source of funding for the Nutrition Module (funding that is to continue through 1992) has expressed an interest in seeing more causal analysis of the data. At the same time, it expressed concern about the Statistical Bureau's ability to conduct the analysis, about obtaining free access to the raw data, and about the slow turnover of data. A representative of UNICEF has suggested that IFPRI provide technical assistance to help the bureau deal with these problems.

An interview with the Director of the Statistics Division of the Bangladesh Bureau of Statistics suggested that the bureau would be amenable to this kind of arrangement. If in-house access to the raw data on a personal computer is permitted, as is likely to be the case, then IFPRI could provide technical support and suggestions for the modeling. It is recommended that IFPRI do so.

The proposal to use the data of the Bangladesh Bureau of Statistics falls naturally into two parts. Presuming that access to the data is limited to requests for different summary statistics at different levels of aggregation (this access is guaranteed, with certain delays and with adequate funding), then the following plan can be made operational. If access to the raw data (with the household identifiers deleted) is granted, then a complete household-level analysis is possible, using indicators of nutritional status linked to the full Household Expenditure Survey. (The analysis would proceed along the lines proposed for the field study in the following chapter.)

Disaggregation of the data into geographical units beyond the rural/urban breakdown presented in the bureau's write-up (Bangladesh Bureau of Statistics 1987) is necessary. The analysis should be conducted at the district level. If district-level aggregation proves impossible, some other broad geographical disaggregation is needed.

To match these nutrition data with regional indicators of economic development, additional data should be assembled at a similar level of aggregation. These data should include measures of PFDS effectiveness and coverage, such as the number of ration cards per capita, composition of the rations, and per capita delivery of foodgrains from monetized and nonmonetized channels. These data are all available at the upazila level from the World Food Programme and the Ministry of Food. Measures of infrastructural improvements should be made, including road coverage (with some measure of quality), percent of households served with electricity, water, and schools, and health centers per capita. Indicators of agricultural performance such as use of inputs, yields, and total acreage planted should also be included. All these data can be collected easily and should match the same level of aggregation as the Nutrition Module.

These databases, when combined, will provide the following information over time:

- Which divisions are improving with respect to nutritional status and other standards of living and which are falling behind,
- Measures of infrastructure and PFDS performance that can be matched in a causal analysis with the variables mentioned in the first bulleted point, and
- Causal investigations regarding the relationship between determining variables and nutritional outcomes.

Much of the analysis of the coverage of the PFDS and its effect on nutritional outcomes can only be conducted after a period of time passes. At this point the aggregate analysis can be used to measure the

effectiveness of targeting: are the areas that are nutritionally the worst off receiving the most food?

IFPRI'S ROLE WITH NUTRITION STATUS DATA

Before the statistical bureau's data set (and future data collection with the Nutrition Module) is dismissed, an attempt should be made to verify its usefulness. If the data are of reasonable quality, then IFPRI could take a lead role in producing descriptive statistics and slowly working to improve the analytical skills of the bureau. If the data are not reasonable, then IFPRI should consider ways to improve the techniques for collection and accuracy for the next round of the survey.

The collection of additional secondary data will be an easy and effective way to begin. The two ministries involved in collecting these data (Food and Agriculture) should be brought into the process. The possibilities for merging and analyzing the data may foster a desire to improve and coordinate their collection.

If IFPRI can work with analysts in the bureau to link the Nutrition Module data with the data from the Household Expenditure Survey, then an analysis of expenditure behavior and nutrition outcomes can be conducted. The data set from the 1985/86 round of the survey is rumored to be good (better than the round used by Pitt to estimate nutrient elasticities), containing both consumption and recall data.

IFPRI currently possesses a copy of the survey instrument. At a minimum the survey can provide detailed data on household expenditures, household characteristics and demographics, income sources, and labor activities.

MONITORING STRESS THROUGH NUTRITIONAL SURVEILLANCE

Concurrent with its efforts to evaluate the nutrition/consumption effects of the PFDS, IFPRI was asked to help construct a mechanism for monitoring nutritional status in rural areas. The goal is to provide more information to policymakers so that nutritional interventions to alleviate short-term fluctuations in nutritional status can be designed. In addition, information is needed that permits monitoring the progress of different areas in recovering from a disaster.

This section looks first at the complexity of poverty, famine, and consumption and their link to measurable policy variables. This description suggests two ways to approach a monitoring system. First, data on easily collected variables that are in some way linked to changes in poverty and household consumption can be analyzed to

establish a predictive model. However, as will be seen, this type of system is of only limited usefulness and accuracy because of the country's complexity. Therefore, a more ambitious, household-level monitoring plan is proposed that would overcome many of the problems of the more centralized system.

Another factor argues for a household monitoring system. The system should not be overly sensitive so that every downturn leads to an intervention. At the same time, a degree of specificity is needed that permits the planning of proper interventions. In some cases the problem is not shortages of foods in the market; rather, it is a decline in the entitlements of the poorest people. Shipments of grain at wholesale prices into the affected area will not solve this problem. Instead, a program to generate income may be needed. The more limited system would probably be more sensitive and certainly less specific than the household monitoring system.

Nutritional anthropometry is of limited use in an early warning system, since the results of changes in nutrient intake appear slowly. The anthropometric data are also not very specific, so that downturns in anthropometry may not be associated with short-run changes in the availability of household food. Given these limitations, to forecast downturns requires leading indicators rather than anthropometry. In Bangladesh, there are two major causes of downturns: floods and droughts. Neither of these is either a necessary nor a sufficient condition for increased hunger and destitution.

LEADING INDICATORS

Rising rural landlessness in Bangladesh has led to increased dependence on market wages as a source of earnings (Rahman 1986). Today a large majority of households depend on exchanges for their food needs, a trend that is increasing over time (Murshid 1987). This increased dependence on exchanges leaves many small farmers extremely vulnerable, especially to seasonal swings in food prices and earnings. These farmers tend to sell any gross surplus during the peak sale (postharvest) periods and buy later when grains are scarce and prices are high.²⁶ Concurrent with high grain prices may be slack periods of demand for labor that means fewer wage earnings.

²⁶ This pattern was suggested by Ahmed (1981), Murshid (1987), Muqtada (1981), Rahman (1986), Rahman and Islam (1987), and Quasem (1987), among others. The reasons behind this phenomenon (selling at low prices and later repurchasing at high prices) include a lack of storage facilities, the difficulty of storing high-moisture boro rice, and short-run liquidity constraints. This pattern has the strongest adverse impact on small farmers.

Because the majority of people are so close to extreme poverty and many crops have poor storage qualities, formal saving during the good months is difficult. When downturns occur, small declines in employment may have a large effect because so many small farmers depend on secondary employment to make ends meet. These farmers survive by drawing on informal household reserves, by borrowing, and perhaps by selling assets.

There is a well-documented seasonality in prices and a corresponding seasonality in consumption. Expectations about prices are also very important to consumption decisions: events such as a serious flood may cause hoarding and delays in transportation that lead to price increases. If food prices fall out of line with their seasonal norm, the resulting expectations of high prices may precipitate a famine (Muqtada 1981). During the famine of 1974 the initial trend in prices was markedly upward, but they crashed subsequently after the loss of exchange entitlements.

Short-run speculative deviations must be separated from long-term trends that may indicate stress. Speculative grain sellers or consumers can cause short-run peaks and valleys in prices. Consumers may react to their expectations of high prices by purchasing larger quantities as a hedge. Their resulting stocks at home will depress future demand and lead to a precipitous fall in prices.

Studies of famines in Bangladesh have led to the conclusion (see Muqtada 1981; Currey 1978; and Ravallion 1987) that the following factors are evident during or prior to a period of famine. Earnings for some groups decline relative to the purchase prices of goods, particularly grains. Wages may fall until, at some "subsistence wage," unemployment results, leading to a failure of employment entitlements. Thus, although wages may be stable (albeit low), decreases in exchange entitlements may be manifested as lower earnings caused by unemployment, a situation that is not easily measured. Generally food prices rise during the initial periods. Increased consumption of inferior substitutes ("famine foods") is also observed (Currey 1978). Sales of assets increase.²⁸

In addition, the following phenomena have been identified. The traditional support network within the extended family breaks down (Currey 1978). The use of institutional and noninstitutional forms of credit increases: as exchange entitlements fall, many people rely on borrowing to sustain themselves. This borrowing is difficult to

²⁸ These include nonland productive assets and land, although selling land is difficult in Bangladesh (Muqtada 1981). Currey (1978) observed marked increases in land sales and land mortgages during the 1974 famine. Several authors stress a focus on these secondary markets as indicators of problems (Muqtada 1981; Murshid 1987; Rahman 1986).

observe, however, since institutional credit accounts for only a small portion of rural borrowing.²⁷

Noninstitutional forms of credit are extremely important forms of implicit entitlements, which go a long way toward determining the ability of a household to avoid disaster. A rise in food prices may not be indicative of a failure of exchange entitlements. Quite the contrary: the pattern of a sudden rise in prices and then a sudden fall (without a measurable change in supply) is an indication of extreme entitlement failures.

This review produces two important observations. First, extreme stress does not automatically follow from a single disaster, whether flood, drought, or crop failure. To determine the likelihood of extreme stress, it is important to measure how exposed the poorest households are to financial disaster. The informal markets may offer them insurance that they can draw on in times of stress. This assistance may occur through informal credit arrangements, community goodwill, or other informal transactions. To predict the stress resulting from changes in the physical and economic environment, this household resiliency must be measured.

Second, *relative trends* in different variables are extremely important indicators of stress. High prices and low wages in and of themselves may be poor predictors. There are certain times when labor sales are very important sources of income for small farmers and landless households. If, during these periods, wages are low relative to prices, then the household's ability to "recharge" its resiliency is hindered, and stress will result in the future. The best possible early warning system would provide early information about household resiliency.

It is recommended that the IFPRI project focus on two complementary objectives. In the short run, predictive models of stress should be developed that rely on indicators that are collected regularly and are available in timely fashion. In the long run, the goal should be to establish a comprehensive, geographically dispersed household monitoring system. This system would assess the resiliency of households and their ability to recover from disaster-related downturns and combine this information with indicators from the economy.

²⁷ Of total borrowed funds, 3.6 percent come from institutions, compared with 29.8 percent from friends, 38.8 percent from moneylenders, and 27.8 percent from rich farmers (Muqtada 1981).

SHORT-TERM PREDICTIVE MODEL

A stylized model for early warning should have the following form:

$$Y_t = f(E_{t-1}, P_{t-1}; R_{t-1}, S_{t-1}), \quad (1)$$

where

- Y_t = outcome of interest (possibly unacceptable rates of malnutrition, increased poverty, hunger, or household stress) at time period t ,
- E_{t-1} = earnings in the previous period,
- P_{t-1} = market prices (food) in the previous period,
- R_{t-1} = resiliency in the previous period, and
- S_{t-1} = seasonal component of the previous period.

The entire functional relationship is conditioned on the latter two variables. The relationship is specific to geographical areas; the concepts are all defined on an aggregate (area-wide) level.

To make equation (1) operational, the concepts must be defined. Measurement of E_{t-1} and R_{t-1} on a timely basis is impossible without conducting a detailed household survey. This approach is advocated for the long-run project, but in the short run, proxy variables have to be defined and used. Two criteria should be considered when selecting these proxies: similarity to the underlying concept and ease and timeliness of measurement.

Prices (P_{t-1}) can easily be measured on a geographical basis. The Division of Marketing of the Ministry of Agriculture has a monthly report of wholesale grain prices from 56 agricultural stations around the country. This data series exists for a long historical period, and current prices are available immediately after the end of a month. The accuracy of these data is reportedly very good.

Earnings are the product of hours worked times wages. Both wages and hours are determined in a large part by the seasonality of crop cycles. Demand for labor is high during periods of sowing and harvesting, while supply varies in a similar fashion (as home demands and contracts change). Prior to periods of potential stress, the supply of labor can only shift outward, because more people are clamoring for work. Wages may fail to be a good proxy for earnings when high levels of unemployment exist; this phenomenon is most likely during periods of stress.

An unresolved question in Bangladesh is the existence or nonexistence of surplus labor and high rates of unemployment. Muqtada (1975) found virtually no excess labor during peak periods of agricultural labor demand. He noted that on average there is surplus labor but that it disappears during brief periods of peak demand. Islam

and Rahman (1978) contend that Muqtada's analysis was fatally flawed, and that there is a 10 percent surplus even during peak periods. Rahman (1986) found that only very small holders were fully employed during the peak (demand) period; otherwise a very large surplus existed.

Ahmed provided a plausible explanation by showing substantial "voluntary" unemployment and underemployment. He noted that during peak periods virtually everyone wishing to work is employed. The overall impression is an extremely inelastic supply of labor during a one or two month peak period followed by an elastic supply for the time remaining.

This issue is important for the following reasons. Data on agricultural wages are available on the same basis as the price data through the Department of Marketing. If unemployment is nonexistent, then wages will provide information about household earnings. During periods of high unemployment, however, wages provide little information. If unemployment is high, it is presumed that the wage gravitates to a floor represented by subsistence; a man will not supply any labor below a subsistence wage. Thus in times of high unemployment, agricultural wages say nothing about household earnings.

There are alternatives to wages as a proxy for earnings. The generation of wealth in all rural sectors is extremely dependent on agriculture. Labor sales, crop sales, input purchases, and secondary markets are all driven by the cycles and success of agricultural production.

Land prices are available through the 485 field offices of the Bangladesh Bureau of Statistics. However, there is at least a two month delay for processing, and there is some question about the quality of the data. Crop acreage is estimated by the Statistical Bureau in its survey of "prices paid and received by farmers." The bureau's field agents count the number of plots (in a prespecified area) planted with each crop. The Bangladesh Agricultural Development Council (BADC) collects data on the use of inputs (seeds for high-yielding varieties and fertilizers).

As a measure of total grain availability, the World Food Programme produces a monthly table of storage capacity for foodgrains at the district level and the position of stocks. This information is available 15 days from the end of the month.

WORK PLAN FOR AGGREGATE DATA

Collection of historical data will be important to assist in estimating trends. For this, a mechanism to organize and record incoming data will need to be established, standardizing the data according to geographical area. For example, if 56 rural prices and

wages are available on a monthly basis (from the Directorate of Marketing), then other data should be matched to provide rough geographical congruence. Average monthly prices, wages, and wage/price ratios should be computed for all areas for the historical period. At the outset, it should be understood what the analysis limitations of such data will be. This type of surveillance system, as envisaged, is not amenable to econometric estimation. It is also not intended to serve as a trigger for policy action. It can be used to evaluate incoming information in a historical context to identify potential problems. More information would be required prior to action.

In addition to data on rural prices and wages, data on land prices (land sales are not available), use of inputs, and formal loans requested and accepted may also be collected and monthly means computed. The World Food Programme data on stocks should also be incorporated and monthly means produced. In addition, data on the weather, including rainfall and soil moisture, should be collected. This type of information is probably easy to find.

"Normal" use of agricultural labor by geographical area should also be computed. This task can be accomplished by using a cropping calendar to determine when agricultural tasks are performed for each crop and how much labor is used per acre, and multiplying by acreage of that crop to obtain total use of labor by crop. These data will provide a monthly profile of the use of agricultural labor by region.

When compiled and graphed, this information will be useful in and of itself. Current levels and trends can be compared with historical ones to see if there is a substantial deviation. The schedule of labor use can be compared with the wage schedule to identify "normal" demand. A labor supply schedule can then be approximated that will help determine the point in each region when the labor supply becomes highly elastic and hence where unemployment is likely to become important.

The next step might be to determine what the different trends mean. Known periods of stress must be identified to see which anomalies surface in the data trends. The sensitivity and specificity of the variables in predicting stress periods should be assessed. It is important to trace patterns of recovery from known floods and droughts. If the floods did not cause major stress, then how the variables behaved must be determined so that similar patterns can be identified in the future.

A NOTE ON AN ALTERNATIVE SURVEILLANCE SYSTEM

UNICEF, in conjunction with the International Centre for Diarrheal Disease Research, Bangladesh, and various nongovernmental organizations, is currently involved in establishing an informal surveillance system to

provide anthropometry and subjective assessments in the different areas where the agencies are involved in field work. The intent of this system is to provide standardized information about the nutritional situation in each region and eventually to compare current with historical trends. It is hoped that the anthropometry, when combined informally with the additional information, will provide information about which areas are improving and which ones may be undergoing stress.

One of the true benefits of this system is that each of the nongovernmental organizations has a demographic surveillance project, so that the ages of the children are known with certainty. It might be argued that when comparing changes, age bias is less important, but this consistency is still beneficial when using anthropometry.

It is recommended that IFPRI not get involved in this system. The quality of the data will vary greatly across nongovernmental organizations that are also located randomly, and very little (if any) standardized socioeconomic information will be collected. It is appropriate for USAID to continue its support of the system. This system may be well suited for its short-run needs, and the funding is minimal. However, it is strongly urged that USAID evaluate the historical specificity of disaster predictions made by many of the nongovernmental organizations. Anthropometry may not increase this specificity.

LONG-TERM SURVEILLANCE PROJECT

The preceding section presented the following picture. First, household stress is not something that can be measured on an abstract basis from Dhaka. The predictive models outlined above may have exceptional sensitivity but very poor specificity. The quality of the data is suspect, particularly during periods of natural disasters. The reliability and timeliness of the wage and price data are not known with certainty. Because of the dynamics of labor supply and demand, measurable wages at many times may be a poor proxy for actual earnings. Given these problems it is proposed that a determination be made when agricultural wages are a good proxy for earnings. When the wage/earning linkage breaks down, alternative measures of income are needed, although they are extremely difficult to determine and quantify.

Information on household resiliency is needed for an accurate measure of stress. The short-term system described here is the best that can be provided using currently available data. The potential seriousness of the effects of floods and droughts is determined in large part by the ability of households to maintain their exchange entitlements by selling labor, borrowing, and other means. This household resiliency can only be measured by household surveys, which will also provide the longer-term ability to assess stress. The

following describes a system that will produce reliable indications of household resiliency and, hence, of stress.

The Bangladesh Agricultural Research Council is forming a network of research stations to investigate farm management practices, the adoption of agricultural technology, and other aspects of the changing farm in Bangladesh. Included on the agenda for these stations will be ongoing surveys of nearby farm and nonfarm households to assess the impact of environmental and socioeconomic variables on household resiliency and on decisions about consumption, production, and labor supply and demand. There are currently 23 sites; the strategic plan proposes one site for every agro-ecological zone in the country.

The research council is assembling a data analysis/research team in Dhaka, where the data from the different sites will be centralized. The idea is to construct a network for analyzing the effects of changes on agricultural production practices, to organize the data analysis efficiently, and to produce relevant policy information.

Anthropometric data can be collected along with socioeconomic/farm data at less frequent intervals. The resulting database and network would have a number of applications:

- Examination of the relationship of human nutrition with the other aspects of farm household behavior and decisionmaking, including labor supply, farm production, and time allocation, are possible. The effects of commodity prices and PFDS interventions on behavior and nutrition could be evaluated in a dynamic context. There are numerous benefits to having panel data for these types of analysis.
- The geographical diversity of the proposed sites would provide a perfect opportunity for early warning and rehabilitation surveillance. Prior to and after floods, the overall resiliency of these households can be assessed on a real-time basis, providing a picture of vulnerability and recovery. The effects of other disasters, such as drought, could be monitored on an ongoing basis in all areas of the country.
- Geographical diversity would also permit the analysis of decisions on production, labor supply, and other household matters for different regions. Some of these regions will presumably be progressing economically at a more rapid pace than others. Having these data will provide answers to questions such as the following: how occupations in rural industries change as growth progresses, how labor makes decisions, how labor markets are affected, and how food policy interacts with the changes that occur. The relations

and behavior of the landless and of farmers (prosperous and poor) can be compared in the two broad types of regions.

IFPRI'S ROLE

The network described above is far from reality. USAID and IFPRI should, however, realize the potential benefits of this system and make a long-term commitment to encourage and support its formation. IFPRI's involvement should take the following forms:

- Provide or seek financial support for the inclusion of anthropometry in the data collection.
- Provide technical support for the data analysis. If nutritional anthropometry is to be collected, then IFPRI should ensure that the appropriate analytical models and techniques are in place. This assistance will also encourage the collection of appropriate variables.
- Work to construct the institutional framework to ensure use of the information from the analyses. This framework would include liaison with the Food Ministry (via the Food Planning and Monitoring Unit), the Bangladesh Bureau of Statistics, and the Bangladesh Agricultural Research Council network so that nutritional considerations are built into planning and policy discussions.
- Encourage the inclusion of landless laborers and small farmers in the household survey panels.

SUMMARY

This chapter outlined two parts of the IFPRI project. It proposes the use of the Statistical Bureau's Nutrition Module and the Household Expenditure Survey to provide a broad picture on economic development and nutritional status. Two levels of analysis are suggested, depending on the availability of raw data. In addition, it proposes a system for monitoring nutritional status during periods of stress. Once again, two routes of analysis are indicated. A limited plan would emphasize collection and centralization of data and analysis of the relationships between data trends and household/regional stress. The more ambitious long-term plan recommends that IFPRI promote the formation of a system to measure household resiliency so that the effects of disasters on stress can be predicted reliably.

5. DESIGN OF A FIELD STUDY

The review of the studies of the PFDS and nutritional status in Bangladesh showed that if the PFDS' effectiveness in improving the consumption of the rural poor is to be evaluated comprehensively, some unanswered questions must be addressed. The majority relate to the effect of participation in the PFDS on households. A microlevel field study of household behavior is recommended to answer the questions.

This chapter looks at the design of a field study. It first presents a conceptual model that outlines the variables and forms of analysis that economic theory requires. Second, it discusses the issues and data requirements involved in the study. Discussions of the sample design and sample size are next, followed by a look at the variables and types of analysis needed. Finally, some supplementary analysis is discussed.

CONCEPTUAL MODEL

Economic theory says that consumption of foods is a function of relative prices, income, assets, and the demographic characteristics of households. A reduced form demand equation for, say, aggregate food would be expressed as follows:²⁸

$$q_{ik} = f(P, M_k, A_k; C_k) \quad (2)$$

where

- q_{ik} = quantity of good i consumed by household k ,
- P = vector of the prices the household faces,
- M_k = income of the household,
- A_k = its assets, and
- C_k = vector of demographic characteristics.

The theory of the farm household (see Strauss et al. 1986) extends this expression: M_k is endogenous, and changes in food prices affect farm profits. A recursive farm household model²⁹ would produce a reduced-form demand equation as follows:

²⁸ Note that income is assumed to be exogenous. This assumption is inappropriate in Bangladesh, where "income," if properly defined to include transfers from the PFDS and borrowing, is a choice variable.

²⁹ The model assumes that the separability conditions are met (see Strauss et al. 1986, chapters 1 and 2).

$$q_{ik} = f(P, Pr_k, M_{nfk}, A_k; C_k) \quad (3)$$

where Pr_k is farm profits ($= S_k * P_s$, where S_k is a vector of marketed surpluses and P_s is its corresponding price vector) and M_{nfk} is nonfarm income. Thus, there is an added price effect: changes in the prices of farm-produced and marketed goods have the same substitution and income effects as posited by normal demand theory, as well as an added profit effect. This profit effect should include the effect of changes in prices on marketing decisions, as well as their effect on profits.

By assuming that households maximize utility with respect to the nutritional status of their members, equation 2 can be rewritten in a number of ways. First, the dependent variable can be specified as the household consumption of specific nutrients. The resulting price and income parameters will provide information about nutrient elasticities, or the percentage change in a household's consumption of nutrients produced by a 1 percent change in prices or income. Second, the dependent variable can be specified as individual consumption or nutrient intakes; the resulting estimates will show how exogenous shifts affect individual intakes of nutrients. Finally, individual anthropometric outcomes can replace q_{ik} so as to show how exogenous changes affect them. In all of these cases the vector of demographic household characteristics should be expanded to include the variables affecting household growth technologies, that is, how households convert nutrients into observable anthropometric outcomes. This growth technology would include all variables affecting how households distribute food among their members, those affecting disease and infections, and anything that influences how nutrients are used to produce growth.

An additional estimable set of equations relates to the growth technology itself--how the nutrients consumed affect growth. In all cases careful attention should be given to which variables are subject to household choice and which are not. The following equations can be estimated:

$$q_{ik} = f(P, Pr_k, M_{nfk}, A_k; C_k) \quad (4)$$

$$q_{ik} = f(P, Pr_k, M_{nfk}, M_{pik}, A_k; C_k) \quad (5)$$

$$n_{mk} = f(P, Pr_k, M_{nfk}, M_{pik}, A_k, NT_k; C_k) \quad (6)$$

$$n_{mlk} = f(P, Pr_k, M_{nfk}, M_{pik}, A_k, NT_k; C_k) \quad (7)$$

$$g_{ik} = f(P, Pr_k, M_{nfk}, M_{pik}, A_k, NT_k; C_k), \text{ and} \quad (8)$$

$$g_{ik} = g(N_i, NT_k, NT_l) \quad (9)$$

where

- n_{mk} = amount of nutrient m consumed by household k ,
- q_{ilk}, n_{mlk} = respectively, the quantity of good i and nutrient m consumed by individual l , a member of household k ,
- g_{lk} = growth (height change and weight change) of individual l , a member of household k ,
- M_{pfk} = income from public food distribution received by household k (an endogenous under variable),
- NT_k = generic nutritional-status technology shifters for household k (water source and latrine, which might be modeled as endogenous), and
- N_l = vector of nutrients consumed by individual l .

There are a number of missing equations, such as the determinants of PFDS participation and of household income.³⁰ Further, suitable instruments must be identified for nutrient consumption in equation 9, although these equations represent the general format of the models that will be used to answer the previous questions.

Given this background, the natural question is how the PFDS affects these relationships and, ultimately, child nutrition. There are four plausible ways:

- It can change household income and the source of income;
- It can change relative prices;
- Participation in the PFDS can interact with the vector of demographic attributes, the result being an extra-income effect; and
- Participation can change the nutrition technology of the household through its effect on the intrahousehold distribution of resources or by changing the efficiency of growth production (use of nutrients).

The latter two items acknowledge that the programs can have different effects than those produced by normal price and income shifters. The food received through any of the PFDS channels may be viewed differently from normally purchased foods because of differences in quality or simply because program participation affects the way families behave. In the case of the Food for Work Program, another possibility is that the lumpiness of the payments makes people treat the income differently. The marginal propensity to consume from PFDS income

³⁰ Given the discussion of household resiliency in the previous chapter, "income" could include borrowing, dissaving, and so forth.

may be different from that of normal income, something that has policy relevance and is easily tested.

All these factors make it worthwhile to examine not only how relative prices change, but also how participation in the program (which is a choice variable) affects consumption, the allocation of food, and, eventually, nutritional outcomes. Whether the PFDS increases income or changes relative prices depends on the type of the program and the size of the quota.

If the ration quota is inframarginal, that is, less than the amount that a family normally consumes in a given period, then the ration price has no effect on prices. In both the monetized and nonmonetized programs, theory says that the transfer is a pure income shift: in the nonmonetized channels the income shift is equal to the price of the good times the quantity, while in the monetized case it is equal to the quantity provided times the difference between the market and ration prices. In both cases it is interesting to see whether households treat this income differently from other income (the latter two questions above).

If the household was consuming less than the quota before the PFDS (extramarginal effects), then the relative price of the good in question is changed. In the nonmonetized case the price of that good is no longer relevant for consumption decisions, except that it (the market price) determines the amount of the subsidized good sold (and the income from the sale), that is, the leakage. In the rationing case the price that should enter the demand (for commodities or nutrients) is the ration price of the good. In both cases added income is calculated as before.

If the quantity is extramarginal, then in the rationing case the relative price of the good in question changes. For these extramarginal households it is necessary to determine whether the ration price affects the amount of agricultural surplus the household sells (assuming, of course, it is a producer). If PFDS grains substitute for home-produced grains, then rationing will increase the marketed surplus, independent of the change in the selling price induced by the quantities available through the PFDS. In addition, the PFDS will increase the aggregate supply of grains (assuming, as is the case, that PFDS grains are mostly obtained through donors at concessionary prices), a shift that will cause some decrease in market prices. In sum, the effect of the PFDS on production decisions must be measured.

The studies mentioned earlier lead to the conclusion that, in the case of ration shops (the Rural Rationing Program), the quantities allotted are likely to be all inframarginal. Thus, the focus should be on income shifts and production decisions (resulting from the changes in expected farm prices). In the case of the Vulnerable Group Development

and the Food for Work Programs, the amounts of wheat provided are almost surely extramarginal, and the focus should also be on the income provided by the foods, since no purchase price is changed.

SUMMARY OF THE MODEL AND THE LITERATURE

The literature review and the conceptual model raise several questions that have to be answered in a review of the impact of the PFDS on nutrition. The answers may have broad policy implications and will help focus the discussion: how can the PFDS be altered to improve the nutritional impact, and how do nutrition and the PFDS enter into the broader development picture?

In the context of the above issues the following questions are of interest:

- What determines the decision to participate in the PFDS? Specifically, the focus would be on the Rural Rationing program and the nonmonetized channels (Food for Work and Vulnerable Group Development):
 - What characteristics of the system's design affect participation?
 - What kinds of individuals are most likely to participate? This information will permit construction of a profile of participants and the drawing of inferences about total program coverage and effectiveness.
 - What factors affect the frequency and intensity of participation?
 - How do seasonal factors affect participation?
- How does added income from the PFDS channels affect the intake of nutrients by households and individuals?
 - How large an effect does the PFDS have on household income at various times of the year?
 - Is PFDS "income" treated differently?
- How does the PFDS affect nutritional status?
 - Does PFDS grain contribute to the consumption of nutrients during the lean season so as to improve anthropometric indicators? Is less seasonality, holding income constant, better?
 - Is the measured nutritional status of PFDS households higher than it would be if they were not participating?
 - Has the nutrition effect of increased grain consumption by these households been masked by problems with the technology of nutrition production?

Interesting policy-related information would result from an examination of the effect of sanitary water sources and latrines on nutritional status. If these conditions were found to be important or to interact with nutrient intake, then a policy would be to increase their coverage. Food for Work is a plausible instrument to attain this objective.

- How do PFDS-induced changes in prices affect decisions on the production and sale of PFDS grains and marketed surpluses?
 - Does PFDS grain inhibit local production?
 - Do changes in market prices affect the consumption of nutrients?
- Does the PFDS effectively reduce the huge seasonal swings in food consumption observed in Bangladesh? How can this aspect of the program be enhanced? Do the effects of seasonality diminish as more growth in agriculture and employment occurs? That is, are the seasonal consequences dependent to a large degree on the overall level of poverty?
- Does nutritional status affect decisions on the supply of labor and wages received? Are better nourished workers more productive, and do they tend toward different occupations?

On a broader scale, the relationship between food policy, nutritional status, and economic growth must be examined. First, are people in areas that experience more economic growth better off nutritionally? Does the PFDS become less important to income across areas (as reflected through declining rates of participation even among the worse off)? How does the nutrition and labor supply relationship determine employment patterns and occupations across areas of low and high growth?

To answer the questions raised above, a microlevel study of farm/household behavior is necessary. The study would be aimed at assessing the effects of the new Rural Rationing Program and the nonmonetized relief channels.

SAMPLE DESIGN AND SAMPLE UNIVERSE

This study can be designed in one of two broad ways--it can be nationally representative or not. For a nationally representative sample, a two-stage sampling procedure might be used. In the first stage a number of clusters are chosen at random from a national universe. These clusters might be, for example, upazilas or unions. In the second stage the sampling universe would be defined as all

inhabitants of these clusters. A random sample of these would then be drawn for each cluster. The results could be aggregated at a national level and would be representative of the nation.

Alternatively, during the second stage the universe might be defined as all members of a certain group, such as participants in a PFDS program. This approach was followed in the World Food Programme's study of the Vulnerable Group Feeding Program. The results can then be aggregated to be nationally representative of all participants in that program.

For nonnationally representative samples, particular villages or areas could be identified on the basis of a particular characteristic. For example, flood proneness might be assessed, with one village chosen for being flood prone and another not. The IFPRI-Bangladesh Institute of Development Studies assessments of the Food for Work program were conducted in villages selected for being low versus high technology and for having developed versus underdeveloped infrastructure. In the present study, during the first stage, lists of flood- and nonflood-prone clusters could be drawn up and the sample clusters chosen at random from those lists. At the second stage, the universe would then be all village inhabitants or some subset of them. The results would not be nationally representative if the number of clusters chosen was small, but the random selection at the second stage would mean that the results would be representative of each broad type of village.

The following discussion of these methods is confined to the effects which the sampling has upon the ability to draw inferences concerning specific populations and the nation as a whole.³¹ To draw inferences about the national population, a national probability sample, either simple random or cluster, is needed. The National Nutrition Surveys and the Household Expenditure Survey of Bangladesh³² used national probability samples to draw inferences about Bangladesh. If the intent is to draw inferences about a national population of program participants, the first stage of the cluster selection must occur randomly from a national list.

In the second case, inferences cannot be made about the national population. If the villages are selected at random from a comprehensive

³¹ Different methods, including one- versus two-stage sampling, can be justified on a number of grounds, including cost.

³² It has been determined that the Household Expenditure Survey is not nationally representative, since many of the more inaccessible districts are not included. There is doubt about whether this exclusion occurred by chance.

list of villages belonging to a certain type, then inferences can be made only about the national population of these village types.³³

This discussion is particularly relevant to the IFPRI study, which has two conflicting goals. The first is to draw inferences about the effectiveness of the three major PFDS programs (Rural Rationing, Food for Work, and Vulnerable Group Development), including an evaluation of the amount of grains received relative to the amounts programmed. This component calls for a random selection from a national list of clusters and a universe at the second stage that includes all participants in the three programs. At the same time, the IFPRI project should include nonparticipants as well as participants.³⁴ Given the extremely small coverage of the PFDS programs, an economically viable sample size might not include any or enough participant households.³⁵ Oversampling of the participant groups is necessary.

The next issue is the national representativeness of the sample, which is basically a matter of cost versus inference. The study goals include the examination of a number of factors related to nutrition and consumption: the effects of seasonality; effectiveness (coverage and adequacy) of the PFDS; comparison of high development versus low development areas; and optimal delivery of PFDS services. Examining these factors requires intensive household interviews that include various degrees of recall, weighing and measuring of household members, and careful elicitation of the sources of income.

If the first stage (selection of clusters) is designed to ensure adequate variation in these factors while still retaining national representativeness and conducting intensive household interviews, then the sample size will have to be very large and the cost of the survey prohibitively high. It is recommended that the first stage focus on achieving adequate variation in these factors and not on national representativeness.

If the leakage, coverage, and adequacy of the Rural Rationing shops is an important concern,³⁶ then a national probability sample could be designed to look specifically at these issues. It could be conducted in a manner similar to that of the World Food Programme's

³³ Assuming that n , the number of villages chosen from the total village universe, is sufficiently large.

³⁴ It is difficult to evaluate the determinants of participation without the knowledge of people who do not participate, as well as those that do.

³⁵ The universe will be all households, not just participants.

³⁶ The results of this survey will suggest the probable magnitudes of these problems and may help determine whether another sample is needed.

survey of the Vulnerable Group Development program. Both the Vulnerable Group Development and the Food for Work programs have been adequately studied in this regard; they are very leaky, and the problems occur mostly at the local level. There is no need to design an additional study to determine with more accuracy the amount of leakage from the two programs. The universe (after the villages are chosen) will include all households, although an oversampling of PFDS participant households is necessary.

Two broad village types may be studied: those with and without permanent Rural Rationing shops. This approach will permit an investigation of the effects of shop placement on rates of participation and of the calculated benefits. There are certainly beneficiaries in villages without the shops (the shops are intended to serve more than one village); examining rates of participation among people outside the village will provide information about the merits of establishing additional ones.

It is expected that flood-prone villages will exhibit more seasonal variations in consumption, employment, and nutritional status and, in addition, will have higher coverage by the nonmonetized relief channels, mainly the Vulnerable Group Development and Food for Work programs. Therefore flood-proneness would be used to identify highly seasonal villages. For each broad type of village, one will be selected that is flood-prone and the other not. The villages can be identified by using the World Food Programme's stress map. Nonmonetized relief is allocated according to this stress map, with the more stress-prone areas receiving higher per capita allotments of Vulnerable Group Development rations and Food for Work services.

Two areas should be selected based on the levels of certain development indicators: one area that seems to be progressing and another without much growth. Selection of these areas will be difficult since many of the economic statistics from the interior are suspect. One criterion for selection could be productive infrastructure: if one area can be located with a high concentration of surfaced roads or a high index of infrastructure, it can be compared with a backward area whose infrastructure is much more poorly developed. Similarly, developed villages can be identified as those close to a major road.

Finally, two large market centers of fewer than 50,000 people would be selected from a list. Inclusion of these market villages will permit a comparison of the labor linkages between rural developed and underdeveloped and urban areas and the changing role of the PFDS as urbanization increases. Thus, there will be 10 major survey villages selected on the basis of the characteristics presented in Table 7.

Table 7--Criteria for 10 sample villages

Villages	Economic Progress	
	High	Low
Villages with ration shops		
Flood prone	x	x
Not flood prone	x	x
Villages without ration shops		
Flood prone	x	x
Not flood prone	x	x
Large market villages	x	x

The data collection must be designed with seasonality in mind, and the information on labor supply and agricultural production should be crop-specific. The surveys would be conducted following the three major crop harvests corresponding to distinct seasonal periods: during the September-October lean season (which precedes the aman harvest), after the aman harvest, and following the boro harvest. Nutritional surveys have shown that the September-October period usually produces the worst anthropometry, the January-February (post-aman) period the best, with the May-June (post-boro) months being a swing period. Thus, the cropping periods correspond roughly to the seasonality of consumption. The universe for the study would be all households in the village. Lists can be obtained at union headquarters.

SAMPLE SIZE

In rural areas the share of beneficiaries of the Vulnerable Group Development, Food for Work, and Rural Rationing programs in the population is approximately 2.5 percent, 5.0 percent, and 4.0 percent respectively.³⁷ A random sample of all village households³⁸ that would guarantee an adequate proportion of each household type would have to be very large. If the four variables were used to stratify the sample (non-PFDS, Vulnerable Group Development, Food for Work, and Rural Rationing households), the entire sample population would still be prohibitively large. Thus it was decided to oversample participant households in the three PFDS channels.

³⁷ Assuming 89 million rural residents, there are 2.2, 4.5, and 3.5 million beneficiaries in the Vulnerable Group Development, Food for Work, and Rural Rationing programs, respectively.

³⁸ Villages will be preselected according to the previously mentioned criteria.

Determining the sample size for a complicated design is not straightforward. Cochran (1964) gives the following broad guidelines: the stratum sample proportion should be larger if the stratum is larger, the stratum is more variable internally, or sampling is cheaper in the stratum. The third guideline can be eliminated. In terms of internal variability and size, the non-PFDS households should make up the largest stratum, followed by participants in the Food for Work, Rural Rationing, and Vulnerable Group Development programs.³⁹

Based on the above concepts, the stratum sample sizes are selected in the following way. Household food consumption is thought to be the most important variable, and the criterion used is to have an estimate of mean household grain consumption within 5 percent of the population mean with 95 percent certainty.

Since there is very little information about the standard deviations in the population, the following assumptions are made: for non-PFDS, Food for Work, Vulnerable Group Developments, and Rural Rationing households, respectively, the per capita grain intakes are 500, 450, 350, and 350 grams per day, with coefficients of variation of 0.4, 0.33, 0.285, and 0.285.⁴⁰

Based on these criteria and assumptions, the optimal sample sizes are 256, 177, 130, and 130⁴¹ for non-PFDS, Food for Work, Vulnerable Group Development, and Rural Rationing households, respectively. To be conservative, these numbers are increased to 300, 200, 150, and 150. Given 10 villages, 80 households should be sampled from each.

There may be two main questionnaires. The first relates to the household's assets and liabilities, agricultural production, use of inputs, and crop sales, with the agricultural data referring to the previous crop cycle. The second questionnaire focuses on consumption (and expenditures), income (including relief and other forms of PFDS), credit, and anthropometry and health. In addition to these items, permanent household characteristics may be measured, such as sanitary facilities, water, distance to markets, roads, ration shops, household size, ages, adult educational attainment, and literacy.

³⁹ Here internal variability corresponds directly to stratum size.

⁴⁰ The IFPRI/Bangladesh Institute of Development Studies document has a coefficient of variation for per capita grain consumption of 0.4 for the entire sample.

⁴¹ Computed using the simple formula $n = (ts/d)^2$ from Cochran (1964). If household means are used with the same coefficient of variation, the stratum samples will be slightly smaller if the average household is thought to consist of two adults and three children who consume an adult equivalent grain value of 0.66.

A final, smaller questionnaire would measure community characteristics, including permanent ones (infrastructure) and those that change (commodity prices and agricultural wages).

The following sections discuss the variables to be collected and their measurement. The variables are related to the conceptual framework and the models to be estimated. A discussion of the overall survey framework follows.

DETERMINANTS OF PROGRAM PARTICIPATION AND INTENSITY OF USE

The first question raised was the extent of program participation and its determinants. The variables hypothesized to affect a decision to participate and the frequency of participation are

- Individual level: education (husband and wife), literacy (husband and wife), occupations, and ages of household members;
- Household level: landholding, household size, total income and sources of income, lagged participation, possession of ration (or Vulnerable Group Development) card, distance to ration shop, distance to Food for Work and Vulnerable Group Development sites, and migration status;
- Community level: grain prices (ration prices and market prices--subsidy), wages, existence of permanent ration shop, ration quota (wheat/rice in the quota), regular availability of ration quantities, infrastructure (permanent grain market, and access to roads), and recent flooding. For the nonmonetized channels quotas and composition of relief are also relevant.

These variables are easily identified and collected, except for the regular availability of ration quantities. Several earlier studies mentioned nonavailability as a reason for the frequent nonparticipation. These questions should be asked of participants: are rations distributed regularly? and do you sometimes visit a ration shop and find no grain? Variations of these questions (with more detail, such as how frequently do you visit a Rural Rationing shop and find no grain?) should be considered in consultation with Food Planning and Monitoring Unit personnel.

Probit analysis of these decisions is needed. Participation in the program (yes/no) would be the dependent variable, with the other variables, or some subset of them, the independent variables. Sequential testing is needed to see whether the seasonal regimes are different or can be explained by dummy variables. Similar sequential

testing should be conducted for the decisionmaking patterns across the different villages sampled. Are participation decisions made in similar ways across varying community and economic characteristics?

The resulting information will provide a profile of users across project areas. It should indicate which factors significantly affect the probability of participation. These will include individual and easily manipulated program characteristics.

Intensity of use of the Rural Rationing and Food for Work programs can be split into two categories: used intensively or used sporadically. Then a bivariate probit problem can be set up. In the first stage the household decides to participate, whereas in the second stage the household decides to use the programs intensively or sporadically.

A final issue that can be identified is bias in the distribution of the Rural Rationing and Vulnerable Group Development cards. This point has not been addressed in previous studies, so that it may not be a matter of contention. However, an analysis of who receives cards (comparing them with people with similar incomes who do not receive them) is possible. Some thought needs to be put into identifying possible explanatory variables.

CONSUMPTION, EXPENDITURES, AND LABOR SUPPLY

The first issue that should be addressed is the measurement of consumption. There is some evidence that measuring expenditures creates a bias in the resulting estimates of elasticity because wealthier families have more leakage from their expenditures than do poorer ones. Some of this bias is eliminated by explicitly asking the quantities consumed.

Both expenditures and quantity recall should be measured. To frame the questions properly, an early visit should be made to each household, possibly to record household characteristics or decisions about farm production. Subsequently, the expenditure question can be framed, "since my last visit, how much have you spent on XXX outside the ration shops?" The expenditure data should be combined with quantities consumed from home production and their approximate value. The price paid per unit can also be solicited. A two-week interval between visits is appropriate. If the period is longer, a question should be asked relating to usual purchases of the good in question, for example, "how often do you usually purchase this commodity?" To measure leakage the number of meals fed to nonhousehold members over the same timeframe as the expenditure portion should be asked. Finally, expenditures on all nonfood goods should be recorded, along with frequency of purchase.

Twenty-four-hour recall of household consumption by quantity should be collected. The International Centre for Diarrheal Disease Research, Bangladesh, can provide guidance on the best recall methodology (that is, whether weights or quantities are better remembered). The information solicited should include the source of the grain in question (Rural Rationing, Vulnerable Group Development, Food for Work, or home produced). Meals consumed outside the home should also be covered. If individual consumption is desired (equations 5 and 7), then the instrument should be designed to elicit 24-hour recall of individual consumption. Considerable detail is needed on qualities consumed, including grades of rice and other grains consumed. Because the errors inherent in individual recall are enormous, training of enumerators and the questionnaire's design are critical.

Next, a detailed description of participation in the PFDS should be obtained, including quantities acquired and use of these quantities. The identity of the person who normally receives the goods should be solicited. Questions specifically related to ration quotas, Vulnerable Group Development quotas, and Food for Work quotas (days worked, average hours per day, and payments received) should be used to gauge the amount that people draw relative to the official amounts. The reasons for drawing less than the full quotas should be investigated. These data will be essential in determining program leakage.

Information on labor and employment, along with hours and wages, covering the time between visits and the previous month should be recorded for all economically active members. Information on wives' employment, including sales of home produced goods, is needed.

Other income sources, such as rent, borrowing, sales of goods, and remittances from Dhaka and abroad, should be obtained. The Bangladesh Agricultural Research Council may be able to assist with questions regarding sources of nonfarm income.

NUTRITION AND HEALTH INFORMATION

Anthropometry (height and weight) should be collected for all children under six years old. In addition, their illness and immunization history should be recorded, along with the incidence and severity of diarrhea (the International Centre on Diarrheal Disease Research, Bangladesh, should be consulted on the design of this part of the questionnaire). Breastfeeding history might be included. During one survey round the weight and height of all family members should be recorded. This information, along with data on wages and farm production, will allow the effects of nutritional status on wages and productivity to be tested. Information on doctor's visits and related expenditures should be recorded for all family members for the past month and year.

FARM PRODUCTION AND USE OF INPUTS

This portion of the survey should ask questions relating to the last major crop season. Use of inputs, including seeds, fertilizer, fuel, and pump repair costs, hired labor, exchange labor, own-labor, and all family labor, should be measured, along with land under crops, including land rented in and rented out (and rental fees/receipts). Loans received and repaid should be recorded.

Crop yields, as well as quantities sold, quantities paid in kind, and quantities given away, should be covered. Any losses resulting from flood damage or cyclones are important.

ADDITIONAL ISSUES

It is recommended that the farm production survey, along with the household roster be completed during the first round (which should be September-October of the year⁴²). Two weeks later the survey team would return and complete the consumption, labor supply, and anthropometry components of the survey. A similar pattern should be followed during the other two survey rounds.

The survey on market prices should be conducted during both visits by collecting the prices of key consumption goods from a local retail outlet.⁴³

If each survey team has two members and each questionnaire is kept to an hour, then four teams of two interviewers each can complete the survey of a village in a week per round. In each two-month interview period a four-person team can cover four villages. Two four-team squads and one two-team squad will be needed.

One supervisor per four-person team is important. Thus a minimum of 23 individuals is needed. If money becomes a constraint, then it is advisable first to reduce the numbers of households per village and then the number of villages. Supervision is absolutely necessary to maintain enumerator quality.

⁴² In this case the farm production survey would refer to the previous aus paddy and jute harvests.

⁴³ A list of these goods can be obtained by looking at food budget shares in the consumption data from the Household Expenditure Survey (Bangladesh Bureau of Statistics 1987).

FURTHER INFORMATION

Some additional information is needed to meet the data needs. As currently drawn up, the teams will be conducting the questionnaires for six months out of the year. The remaining six months are unprogrammed. Some time could be spent on entering the data, but a substantial portion would still have time not accounted for. There are three possibilities:

- Their time could be spent conducting large sample interviews of occupations and labor use within the study areas. This information would provide a detailed picture of how occupation patterns vary seasonally across the design criteria and as development progresses.
- Their time could be spent conducting a national probability sample to determine the extent of the leakage in the Rural Rationing, Vulnerable Group Development, and Food for Work programs and its determinants.
- Additional rounds could be added to the current survey. These rounds would examine consumption, income, and labor behavior, as well as some small-scale agricultural activity. A set of additional rounds that almost certainly should be added would straddle the Food for Work season. In the first visit anthropometric measurements of all children should be taken; on the second visit, after the Food for Work Program ends, anthropometry should once again be measured. The appropriate questions on consumption, labor, and income would also be asked. It is recommended that free enumerator time be used for the third option.

A number of additional issues have not been fully developed in putting this document together:

- Gender of the respondent--should one questionnaire be designed for men and another for women?
- Timing--when will men be home to answer questions?
- Ages of children--a lot of time should be spent discovering how best to elicit accurate responses.
- Intrafamily allocation of nutrients--these can be examined closely using the IFPRI/BIDS Food for Work data base.
- Food for Work--the survey rounds have to be timed correctly to measure income from this program.

- Questionnaire design--the IFPRI/Pakistan instrument seems very well designed.
- Supervision, transport, and logistics.
- Location of actual areas--there will be two Rural Rationing shops in every union, so that the study can be located in any area where the other criteria are met.

SUPPLEMENTARY ANALYSES

The large number of household surveys conducted in Bangladesh in the past afford a unique opportunity to confirm the results of this survey in different areas and different times. The ability to use alternative studies depends on the availability/compatibility of the dependent and independent variables, the timing of the data collection (do the seasonal periods correspond?), data quality, and the willingness of the proprietor of the data to allow supplementary analysis. Two data sets are recommended for supplementary analysis: the IFPRI/Bangladesh Institute of Development Studies (BIDS) study of the Food for Work program and the Currey data from Chilmari.

The IFPRI/BIDS Food for Work Study

Both the short- and long-run versions were described in detail in the section on the literature review. The short-run data base can be used to estimate calorie and food (wheat and rice) consumption at the household level as a function of income, demographic characteristics, and the contribution of the PFDS to income. Price data from a secondary source should be incorporated. Careful attention should be paid during estimation to the endogeneity of the decision to participate in the Food for Work Program. O.H. Chowdhury at the BIDS has expressed an interest in being involved in the further analysis of these data; he is particularly interested in examining the effects of improvements in household sanitation on nutritional status.

Chowdhury also expressed interest in revisiting the villages in question to see what effect the seven years of infrastructure has had. It might be possible to conduct a scaled-down version of the earlier study, which looked exclusively at sources of income and employment, participation in the Rural Rationing Program, and nutritional status (anthropometry).

The long-run data base can be exploited to estimate individual nutrients and anthropometry-dependent equations. If individual consumption is not measured during the field study, this step will provide a link between household and individual consumption.

Endogeneity should be carefully controlled for. Shubh Kumar at IFPRI is the contact person for this purpose.

Bangladesh Agricultural Research Council/Winrock Data

These data are derived from an ongoing intensive household survey of Chilmari, Rangpur Division, in northern Bangladesh. The village is located at the confluence of the Tista and Bramaputra rivers and is one of the most disaster-prone areas in the world. Currently 168 households are being surveyed twice weekly. The data series extends back four years, with the first year containing a sample of 30 households.

The variables collected include employment (hours, wages, and form of remuneration) for all economically active members; income and credit (including detailed farm production and input information, and credit sources); and food transfers (from the PFDS). Detailed household consumption data, based on a half week recall, along with visitors' meals and when members ate away from home are all available. Individual health and morbidity are included. Household characteristics and community level information such as market prices are also available.

These data could be used to estimate the effects of income and participation in the PFDS, including the Vulnerable Group Development, Gratuitous Relief, and Food for Work programs, on food and nutrient consumption at the household level. Shares of PFDS income in total household income in any seasonal period are readily available from this data base.

Bruce Currey, project manager, indicated that retrospective analysis of this data is possible. He indicated that, prospectively, he would like to add an anthropometry component to the data collection and needs help doing so. Discussions with him could lead to IFPRI's analyzing his past data or contracting for someone to do so, and at the same time provide support for anthropometry. If IFPRI were willing to provide technical and some financial support, use of the data base might be arranged.

These three sources of data can be exploited independently of the field study. Pursuit of these analyses will require varying degrees of supervision or collaboration. Quality control and standard diagnostics are necessary.

The output of these collaborative projects should be tables of the following types:

- Share of the PFDS in total household income for PFDS participants, by season, for each study.
- Share of total household food expenditures.

- Elasticity of the calorie intake by households with respect to income. Is PFDS income treated differently? Standard functional form and independent variables should be encouraged.
- Individual calorie elasticities for each study where available. Is PFDS income treated differently?
- Income and PFDS coefficients for anthropometry-dependent equations, for each study where available.

Other Data Sets

Because of the large number of studies of Bangladesh, there are numerous data sets that might, on the surface, seem appealing. The following sets were examined and rejected:

- Bangladesh Rural Action Committee's data set is not suggested for the supplementary analysis. Although large, with some 2,000 households, it contains no measurement of income, insufficient detail on household consumption, and incomplete market prices.
- World Food Programme's studies of the Food for Work and Vulnerable Groups Development programs provide very little information on income.
- Save the Children (United States) data set supported a detailed control group study of women's empowerment. It does not have any details on income, and the income data are from the 1986 census; the nutrition data are current.
- Helen Keller International data set has a large sample and offers good health and nutrition data, but contains very little socioeconomic data relating to sources of income.

SUMMARY

A comprehensive field survey methodology is proposed here to investigate the links between food policy, household production, consumption, and labor supply issues. The study would focus on the determinants of participation in the PFDS and the effects of the PFDS on consumption and, ultimately, on child nutrition. Questions relating to the optimal placement of PFDS services, the effects of varying the composition of PFDS foods, whether grain transfers are more effective than income transfers in increasing nutritional status, and effects on seasonality will be addressed. Estimates of program leakages will be

made by comparing implied quotas, Vulnerable Group Development rations, and Food for Work wages with the official program numbers.

There is an inherent conflict in the goals of the IFPRI study, as noted. If national representativeness is desired, then a focus on specific programs and their impact cannot be achieved within a reasonable sample size. Thus the first stage of the sampling involves selection of a stratification based on the key conditions of program effectiveness. However, national representativeness is lost in the process. The comparisons between published and actual Vulnerable Group Development, Food for Work, and Rural Rationing rations will not be representative of the nation as a whole. However, these types of comparisons have already been made for the first two programs, and an additional study is proposed to evaluate the administration of Rural Rationing.

An additional choice has to be made regarding the measurement of intrahousehold distribution patterns. Although it is clear they are important determinants of nutritional status, measurement is expensive and fraught with errors. Part of the problem can be addressed by measuring individual nutritional status. However, a choice has to be made whether to collect data on individual consumption of nutrients or not.

6. CONCLUSIONS

This paper provides a review of a number of studies of PFDS effectiveness and nutritional status in Bangladesh. It then outlines a plan of work for the IFPRI consumption/nutrition study in Bangladesh. A key part of the work plan is a field study, discussed in detail in Chapter 5.

Chapter 3 showed that nutritional status is generally very poor, especially in rural Bangladesh. Since malnutrition is so closely linked to poverty and inadequate food consumption, the PFDS can be an important means of addressing the problem. Several of the PFDS programs were designed expressly to improve nutritional status among vulnerable groups. These channels have been studied in detail and have been shown to be poorly administered and very leaky. Further, no study has conclusively found a link between program participation and improved nutritional status.

The IFPRI study is designed to investigate these links. Chapter 4 presents the work plan for the IFPRI project. It shows that the goal of monitoring nutritional status using economic variables that are readily collected and available in Dhaka can have only limited success. Participation in an intensive household monitoring project is advocated.

Chapter 5 outlines a field study designed to investigate the linkages between participation in the PFDS program and improved consumption and nutritional status. Additional analyses of other data sets are proposed and described in detail.

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