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# Linking Food and Nutrition Security: Past Lessons and Future Opportunities

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**Abstract.** *Traditional food security strategies are reviewed and generally found to have a weak impact on lowering child malnutrition. Unless these programs are properly targeted and linked to employment and micro-credit opportunities for women, they are unlikely to be effective or sustainable. The links between food policy and nutrition security require greater attention to dietary quality through agricultural research and technology, directed to reducing both undernutrition and overnutrition; social security policies that protect poor women and children; and food aid policies that are developmental in intent and impact.*

*One element in the final solution to malnutrition is to provide increased consumption of a range of nonstaple foods. To reach the poor, this will require a relatively large investment in agricultural research and other public and on-farm infrastructure over several decades. In the medium run, a much smaller investment in improving the nutrient content of food staples through plant breeding can make a major contribution to reducing deficiencies in selected micronutrients. The role of women is central to nutrition outcomes through child care, so that policies and programs must consider how to enhance women's decision-making power in the household, how they affect time demands on women, and how to increase women's education and nutritional knowledge. Finally, community-based programs, which are central to the RETA strategy for improved nutrition, should be used to monitor the nutrition effects of agricultural policies and programs and to provide feedback to agricultural policymakers as to how to enhance the positive effects and minimize the negative effects of agricultural policies and programs.*

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## Introduction

A household is food-secure when all of its members have, at all times, access to food of a quantity and quality consistent with an active and healthy life. Household food security on its own cannot guarantee good nutrition status. The standard food-care-health conceptual model

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(FAO/WHO 1992) makes it clear that the provision of adequate care to women and children, together with adequate water, sanitation, and health care systems is needed to ensure good growth and development.

The generation of household food security is dependent on the physical availability of food at the market or community level, the ability of the household to access the available food, the ability of individuals—particularly those especially susceptible to food deficits such as women, infants, and children—to eat the food, and finally the body's ability to process the nutrients consumed.

The physical availability of food is a function of productive agriculture, effective trade infrastructure, and efficient food aid logistics, if necessary. Agriculture, trade, and aid policies are important in influencing the availability of staple and nonstaple foods. The promotion of staple crops that are high in micronutrient status can increase calorie and micronutrient availability simultaneously. Economic access is a function of prices (food and others) and incomes (not only the level of income, but who earns it). Economic growth and social security policies (i.e., social insurance and social safety net initiatives) are important in generating and preserving the entitlements to food (and other nutrition inputs such as health, sanitation, and water). The quantity and quality of the consumption of foods by individuals depends on the mother's decision-making status, her access to information, her time burdens, and her education (Engle 1999; Engle, Menon, and Haddad 1999).

Policies that promote the status of women, provide formal and informal education, and reduce time burdens do much to ensure that women, infants, and children get their fair share of food and nonfood inputs into nutrition. When women control income, a higher proportion of that income is spent on food and other inputs that improve nutrition and health. These policies also promote food production, because they avoid the underutilization of entrepreneurial talent. Finally, diet modification policies can do much to ensure the bioavailability of micronutrients contained in the consumed foods. These policies include the promotion of micronutrient enriched food staples and nonstaple food production, and nutrition education/behavior change, preferably in combination with each other.

The status of women has an important influence on all these four areas. Women occupy a key role because they have food production and child production responsibilities. To undertake these responsibilities effectively, they need to maintain their own nutrition status. In addition, women have claims on multiple duty-bearers to guarantee their own right to food. The dependence of household food security on the nutrition status of women when set against their low status relative to men creates difficult tradeoffs for women. In South Asia these tradeoffs are particularly acute and result in much higher rates of child undernutrition than would be expected based on GDP per capita and national food availability (Haddad 1999).

Malnutrition is the most serious consequence of food insecurity. Adult malnutrition results in lower productivity on farms and in the labor market. In women, it

also results in fetal malnutrition and low birth weights. Fetal and infant undernutrition lead to lower cognitive development and schooling performance. For school-age children, nutritional deficiencies are responsible in part for poor school enrollment, absenteeism, early dropout, and poor classroom performance with consequent losses in productivity during adulthood (ACC/SCN 1999).

Not only does food insecurity in itself have deleterious effects on households and individuals, but efforts at achieving food security may also exact a heavy toll on households if households must spend most of their income on obtaining food. Households may achieve temporary food security at the cost of substantial asset disposal and future indebtedness. In the extreme case, a household that uses almost all of its resources to achieve food security in the present time renders itself highly vulnerable to becoming food-insecure in the future, compared to a household that uses a smaller share of its resources to achieve current food security (Owens and Hoddinott 1998).

The search for food security may also have important implications for a region's demographic situation, especially if it leads to migration (short-term or long-term) by the food-insecure to other areas in search of employment and income and, in the extreme case, of relief food. This out-migration may result in an increase in the number of female-headed households and in the dependency ratio in the sending area as well as changes in the dynamics of the labor market. The receiving areas, mostly urban slums, experience considerable food security strain from the influx of migrants (Ruel et al. 1999).

This paper aims to describe the food security of several countries in the Asian region, analyze the causes, discuss the ongoing program and policy and efforts to combat food insecurity, and identify changes in the program and policy response that are likely to promote food security at all levels. The second section begins with a broad-brush approach and describes national food availability for the countries in the region. What has happened to the composition of available food over the past 25 years? Guaranteeing food security is a much more complex affair than meeting a national per capita food availability target. The third section lays out the conceptual framework behind the promotion of food security. It highlights the links between agriculture, nonfarm income generation, food prices, stock of social insurance and safety nets, household decision making, and community nutrition activities in the generation of food security and nutrition. The fourth section identifies the major causes of food insecurity in the region and describes current efforts to promote food security. It also highlights changes to the program and policy portfolio that would further promote food security at all levels. The fifth section concludes.

### Food Availability Patterns in the Study Countries

As indicated above, food security may be defined as access by all people at all times to the food needed for a healthy life. The concept of food security includes the risk of not having access to needed food. These risks can be associated with variability in household income and food production. Thus, at the household level, *food security is the ability of the household to secure enough food to ensure adequate dietary intake for all of its members*. Two types of household food insecurity, chronic and transitory, can be distinguished, which are closely intertwined (Chung et al. 1997). It is typically the chronically food-insecure (the absolute poor) who are hit hardest by transitory food insecurity problems (crises, shocks).

The financial crisis in East Asia conforms to this general observation, although the impacts on Indonesia have been complex. A general point that emerges from the Indonesian case study—and one that has been observed in other countries in the region—is that the crisis had widespread, but not universal, effects. For example, some regions within the country were hit much harder than others. Moreover, the middle-income groups were hit harder than the poorest in absolute terms, but because the poor have to make more difficult choices, they may suffer more permanent effects than the middle class. But the data show that the hardest hit is a heterogeneous group: poor and nonpoor, consumers and producers, rural and urban, and from many different areas. While a significant percent of the chronically poor were hit hardest by the crisis, a large number of nonpoor households were also hard-hit (ACC/SCN 1999).

Given the multiple dimensions (i.e., chronic, temporary, short-term, and long-term) of food insecurity, *there can be no single indicator* for measuring it (Haddad, Kennedy, and Sullivan 1994; Khan and Riely 1995). Different indicators are needed to capture the various dimensions of food insecurity.

Food security at country levels can, to some extent, be monitored in terms of demand and supply indicators, that is, in terms of quantities of available food versus needs, and net import needs versus import capacity (foreign exchange earnings net of debt service obligations and other necessary foreign exchange expenditures). In this section we describe these data for the study countries.

Ideally, we would like to have a number of additional data sources:

- (i) Direct surveys of dietary intake (in comparison with appropriate adequacy norms) are important but they measure existing situations and not the downside risks that may occur.
- (ii) The level of, and changes in, socioeconomic and demographic variables such as income, real wage rates, employment, price ratios, and migration rates. When properly analyzed, these can serve as proxies to indicate the

status of, and changes in, household food security. Indicators and their risk patterns need to be continually measured and interpreted to monitor food security status at the *household* level.

- (iii) Micronutrient status, which may be measured through the prevalence of clinical signs such as *nightblindness* or Bitot's spots for vitamin A. Sub-clinical measures, which are more useful and involve less subjective interpretations than clinical signs but are more expensive and require a high degree of respondent cooperation, may be obtained through blood samples, e.g., serum retinol, serum ferritin, and hemoglobin.
- (iv) Anthropometric information, which can be useful complements because they are measured at the individual level; yet, they are the outcome of changes in the above indicators, as well as the health and sanitation environment and other factors, and—most importantly—they indicate food insecurity after the fact.

Unfortunately, data are unavailable on a systematic basis in the study countries that would have allowed for an analysis that links food intakes to household income, wages, employment, and micronutrient status. In a few cases where they have been collected, they are of low quality, or not nationally representative.

Nevertheless, in the analysis of food security in the study countries it is useful to have some sense of relative levels of energy consumption and dietary quality across countries and how trends in food consumption relate to conditioning factors (income and food prices) and outcomes (anthropometric status). Per capita food availability data from the Food and Agricultural Organization (FAO) are the only source of information that allows a cross-country treatment. A more detailed discussion of the various factors (in addition to food) which affect nutrition outcomes is provided by Mason, Hunt et al. (1999) in this volume.

FAO maintains a database that allows analysis of energy availability over time (1961-1995) by food group and by country. These data are based on food balance sheet calculations (domestic production adjusted for net international trade and change in domestic stocks divided by total population). Detailed tables are provided in the Appendix from which Figures 1 through 10 have been constructed. Only these figures are discussed here.

In the discussion of the FAO data, foods are disaggregated into three broad groups: (i) cereals, (ii) nonstaple plant foods, and (iii) animal and fish products. Cereals are the primary source of energy in the diet but are not dense in micronutrients. Dietary quality is driven by consumption of nonstaple plant foods and

animal and fish products.<sup>1</sup> Specific nonstaple plant foods can be rich sources of micronutrients. Animal and fish products, although by far the most expensive source of energy in the diet, are the richest sources of bioavailable vitamins and minerals in the diet. In addition, consumption of animal and fish products increases the bioavailability of micronutrients contained in cereals and nonstaple plant foods.

Figure 1 shows the percentage of total energy provided by nonstaple plant foods. Countries fall into two easily discernable groups. For India, Pakistan, Philippines, and Sri Lanka, nonstaple plant foods provide between 25-35% of total energy. For Bangladesh, Cambodia, People’s Republic of China (PRC), and Viet Nam, nonstaple plant foods provide 10-20 percent of total energy. There is some indication of increases in this percentage over time in PRC, Pakistan, and Philippines.

Figure 1: Percent Calories from Nonstaple Plant Foods

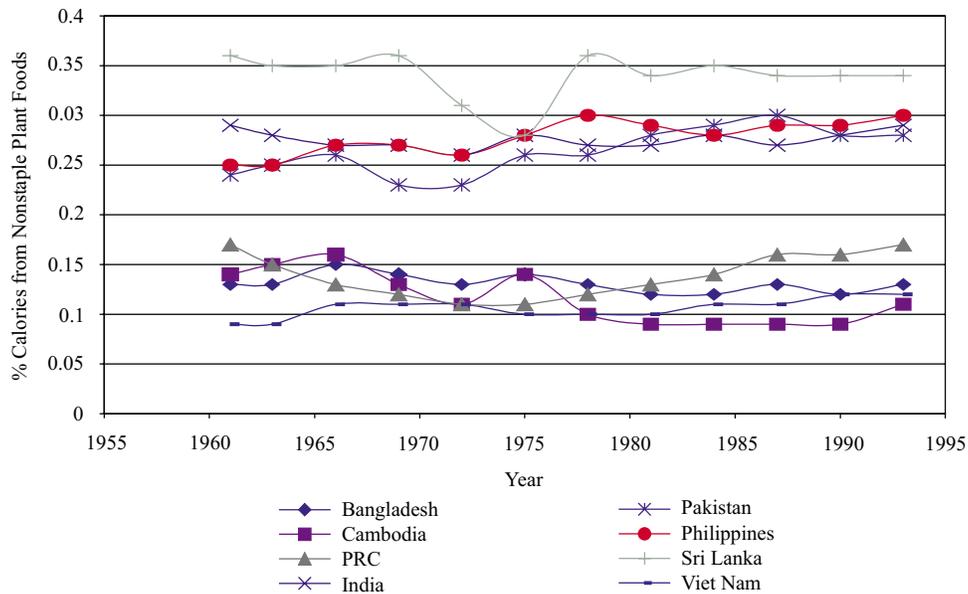


Figure 2 shows the percentage of total energy provided by animal and fish products. Again, two groups are discernable—those above and below 10 percent of the total energy. PRC, Pakistan, and Philippines have high percentages of animal product availability. The PRC, in particular, has witnessed a remarkable increase—from among the lowest percentages at the beginning of the 1960s to the highest by the mid-1990s. Otherwise, percentages have remained fairly stable.

<sup>1</sup>In urban areas of some Asian countries, overconsumption of animal products and obesity has become a serious problem.

Figure 2: **Percent Calories from Animal and Fish Products**

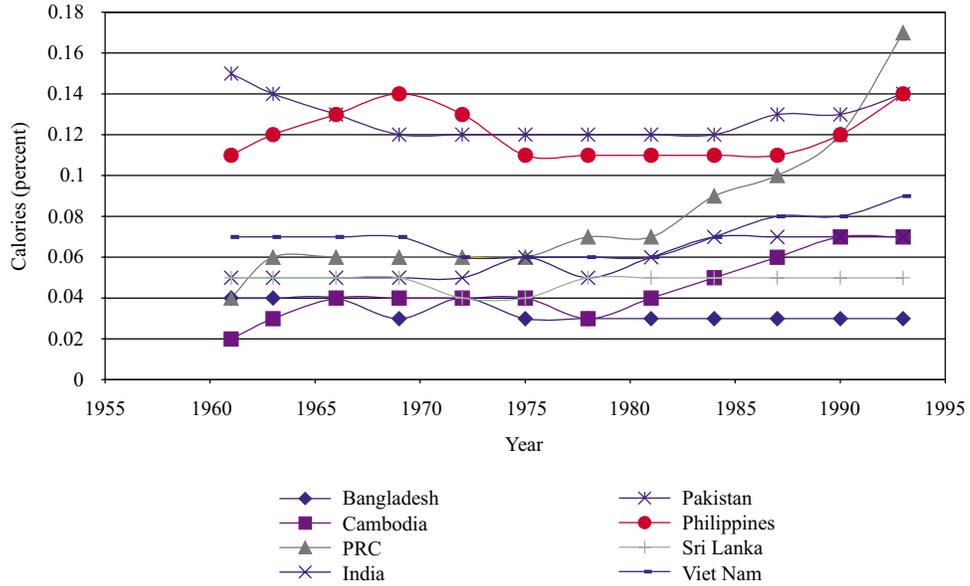
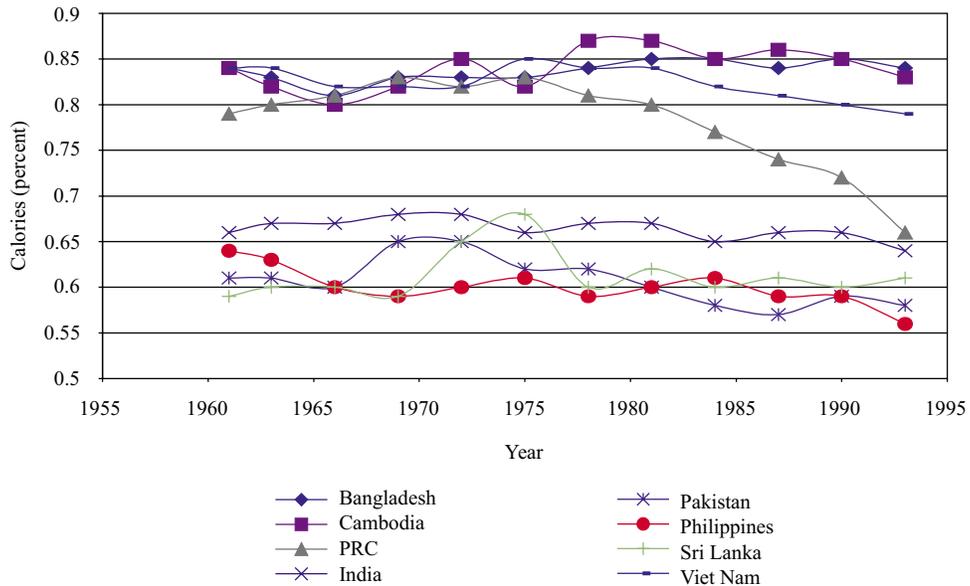


Figure 3 shows the percentage of total energy provided by cereals, which is of course the mirror image of nonstaple and animal and fish product percentages. Here, over time the PRC has moved from the group with low dietary quality to join India, Pakistan, Philippines, Sri Lanka, in the high dietary quality group. Otherwise, percentages have remained fairly stable. Lowest dietary quality is observed in Bangladesh, Cambodia, and Viet Nam, the countries with the lowest per capita incomes.

Figure 3: **Percent of Calories from Food Staples**



With this as background, Figures 4 and 5 show the trends in absolute availability of nonstaple plant foods and animal and fish products, respectively. Availability of nonstaple plant foods is rising in three countries—PRC, Pakistan, and Philippines—and remains about constant in the remaining five countries. Animal and fish availability has risen in most countries, most spectacularly in the PRC. The exceptions to these increases are Bangladesh and Sri Lanka.

Figure 4: Calories from Nonstaple Plant Foods

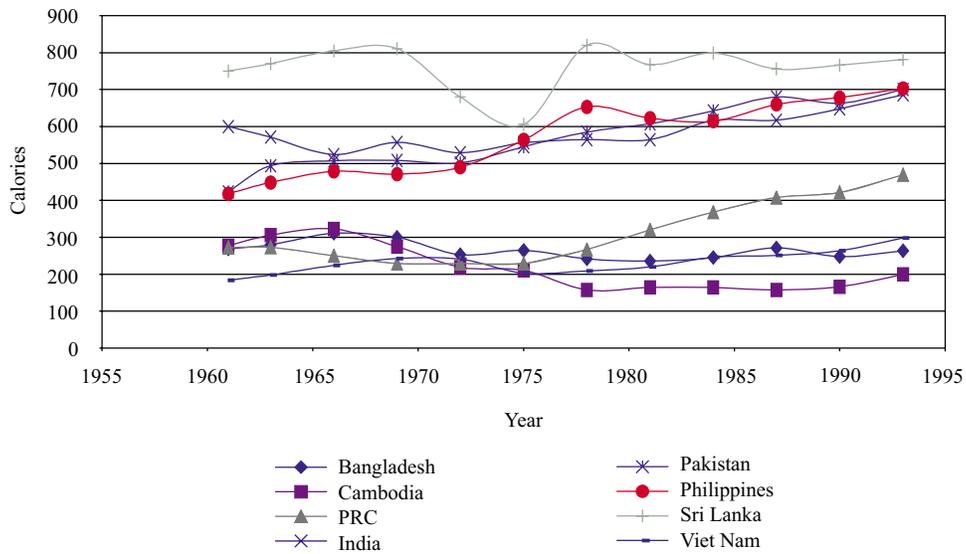
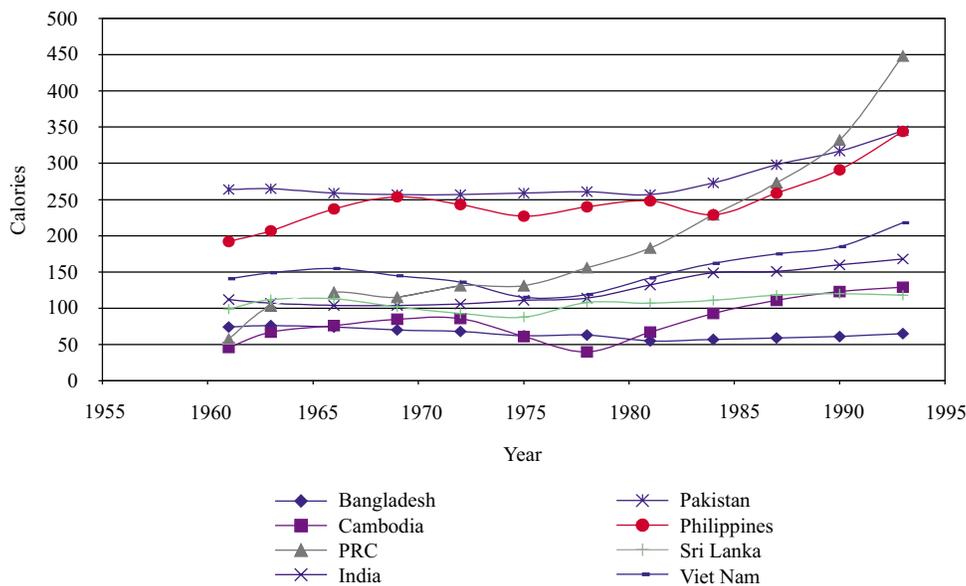
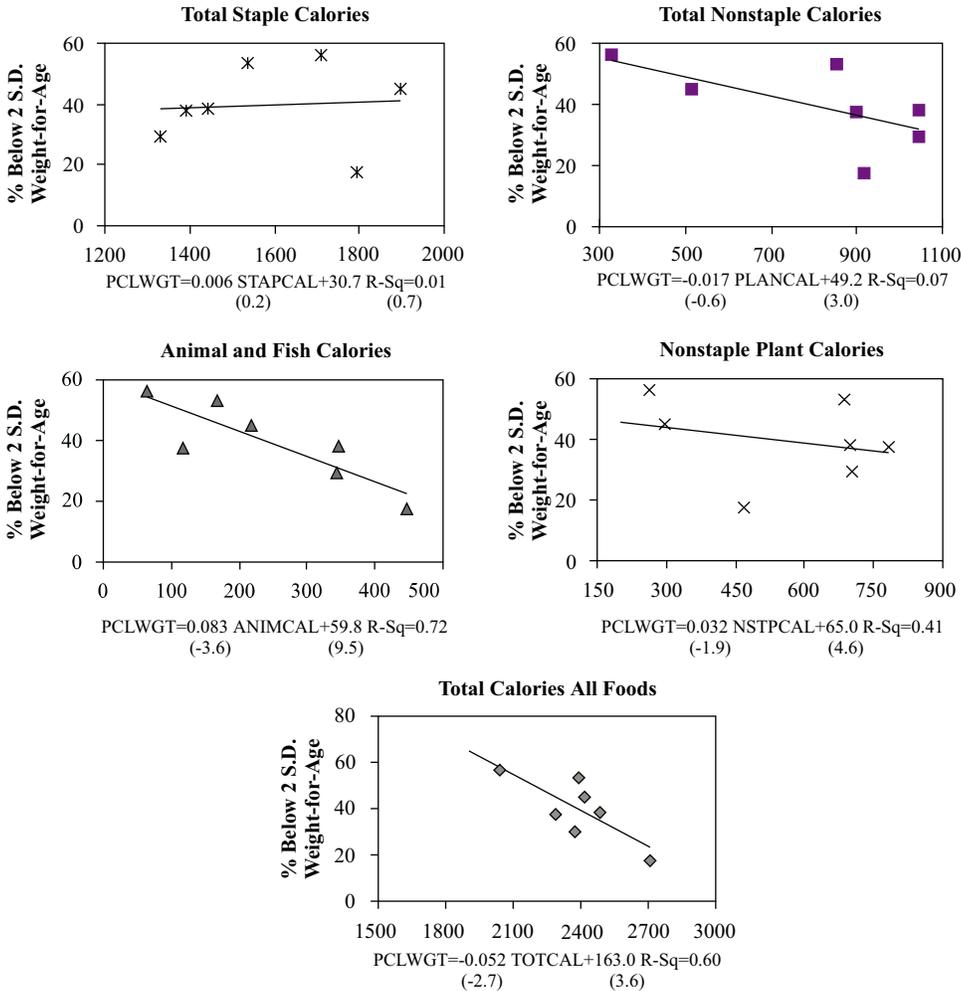


Figure 5: Calories from Animal and Fish Products



Except for Bangladesh and Sri Lanka, then, there have been improvements in some aspect of dietary quality over time in six of the eight study countries. How are levels of dietary quality correlated with anthropometry? Information is available from the World Health Organization (1999) on percentage of preschoolers below two standard deviations of weight-for-age in seven of the countries for various years from 1991-1995. These are graphed in Figure 6 against energy availability in 1993-1995 for staple, nonstaple plant, animal and fish products, total nonstaple, and all foods. The highest correlations are found for animal and fish products and for total energy availability.

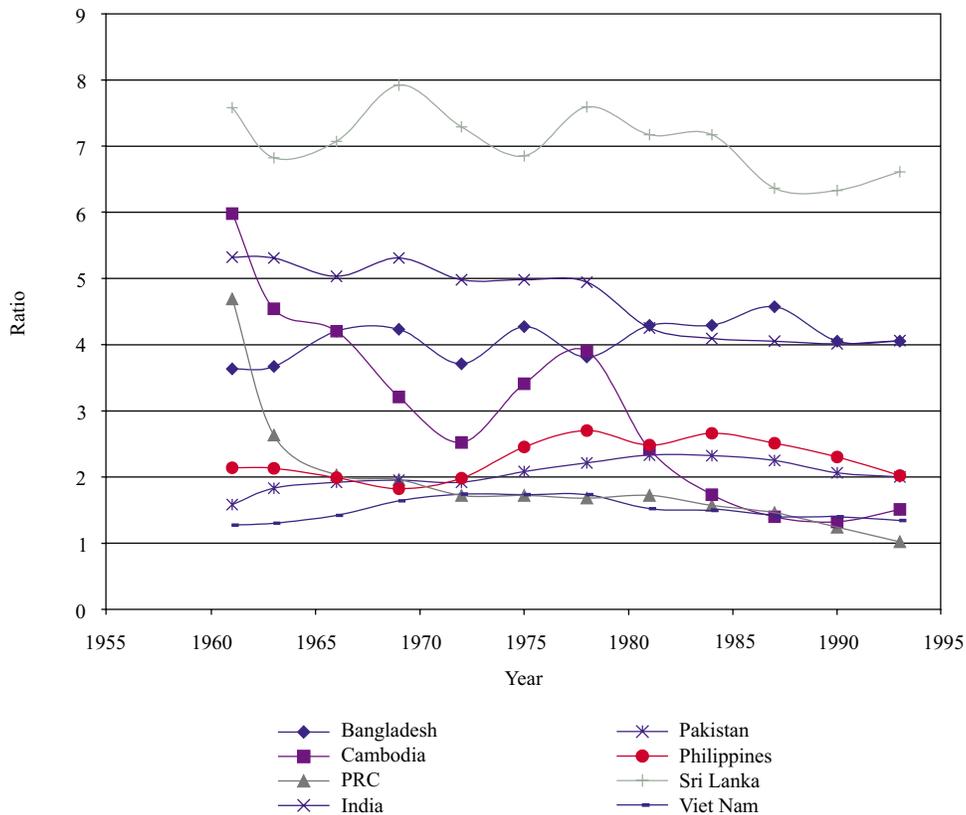
Figure 6: Percentage of Preschoolers (below 2 Standard Deviations Weight-for-Age) and Average Energy Intake



These relationships are merely suggestive because of the low number of observations and lack of control for other variables. From much more rigorous work by Smith and Haddad (1999) it is clear that increases in food availability have been responsible for much of the reduction in child underweight rates over the past 25 years. This contribution would be likely larger if dietary quality had been taken into account by Smith and Haddad. From the tables provided in the Appendix, although staple foods provide from two thirds to more than four fifths of total calorie availability across the study countries, more than half of the increase in calorie availability over the 30 years from 1963-1965 to 1993-1995 has come from nonstaple foods.

Figure 7 shows an interesting dichotomy in food demand preferences. This figure graphs the ratio of energy availability from nonstaple plant foods over animal and fish products. A well-established pattern of food demand behavior is that spending on nonstaple foods is much higher at the margin as income increases than for staple foods. Intuitively, at a given level of income, how consumers allocate their food budget between nonstaple plant foods and animal and fish products (after hunger is satiated through staple food consumption) demonstrates the strength of their preferences for either nonstaple plant foods or animal and fish products.

Figure 7: **Ratio of Nonstaple Plant Calories over Animal and Fish Calories**



A priori, one might expect this ratio to decline with increases in income. This is because nonstaple plant foods tend to be cheaper sources of energy than animal and fish products. Thus, poor consumers might spend relatively large amounts on nonstaple plant foods with the share of animal and fish products then increasing at higher incomes.

Figure 7 shows that Bangladesh, India, and Sri Lanka have ratios above four (relatively strong demand for nonstaple plant foods), while the remaining five countries have ratios between 1 and 2 (relatively strong preference for animal and fish products). Although the graph does not control income, the dichotomy is quite stark—the differences in demand preferences are quite substantial.

Interestingly, by 1985 these ratios were quite similar for Cambodia, PRC, and Viet Nam even though income levels are much higher in the PRC. Also, Bangladesh has a high and stable ratio, similar to India, even though availability of meat and fish is acceptable and desired in Bangladesh while it generally is not in India. The implication is that there should be strong demand for animal and fish products as income increases in Cambodia, PRC, Pakistan, Philippines, and Viet Nam, but much weaker demand in Bangladesh, India, and Sri Lanka.

Figures 8 through 11 present background information on trends in factors that influence demand for food and dietary quality. Figures 8 and 9 show indices of real rice, wheat, chicken, and milk prices. Note that real cereal prices have declined substantially since 1973-1975 in all countries except the PRC. The pattern for chicken and milk prices is a mix of price increases and price declines. These two figures suggest that, in general, nonstaple food prices have gotten to be more expensive relative to cereal prices. However, overall real food prices may have declined due to the high weight assigned to cereals. Lower cereal prices free up money in food budgets for purchase of more nonstaple foods, which has occurred in most of the study countries.

Figure 10 shows trends in real per capita GDP. In general, per capita GDP has increased, which is also consistent with generally rising intakes of nonstaple foods. Note that the increase in GDP for the PRC is quite substantial and can explain how animal and fish intakes increased so rapidly despite apparently large increases in real food prices.

Lower food prices and increases in income are generated in part through rapid domestic agricultural production. Figure 11 shows trends in per capita domestic agricultural production. In general, since 1973-1975 agricultural production has grown faster than population in the eight study countries. The only exception is Bangladesh.

Figure 8: Indices of Real Rice and Wheat Prices

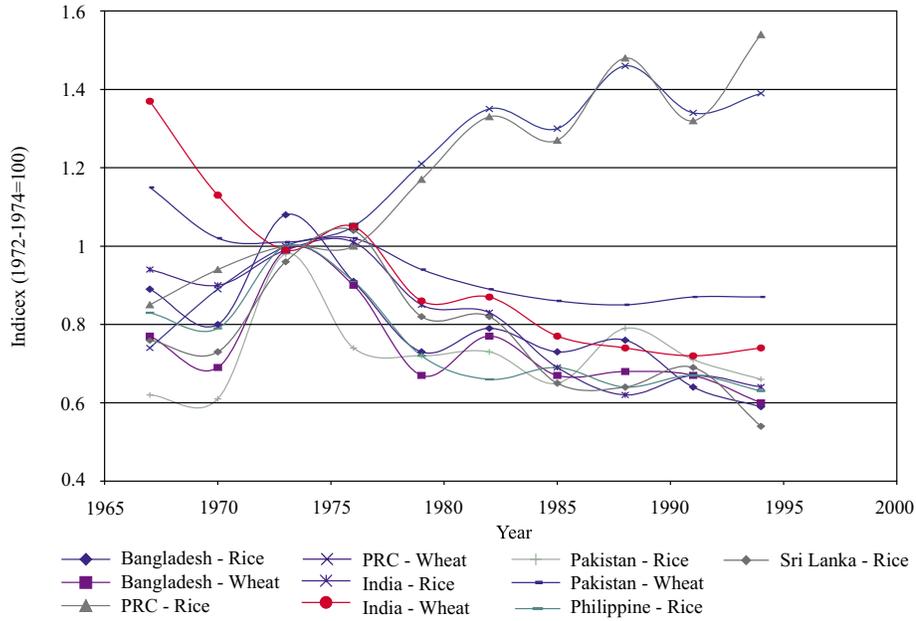


Figure 9: Indices of Real Chicken and Milk Prices

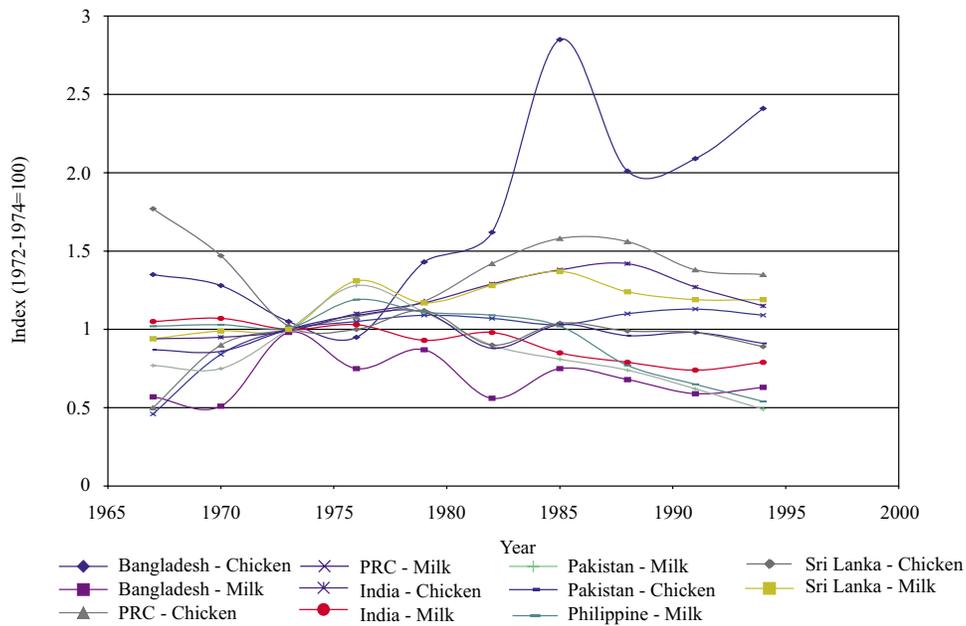


Figure 10: Index of Real GNP Per Capita

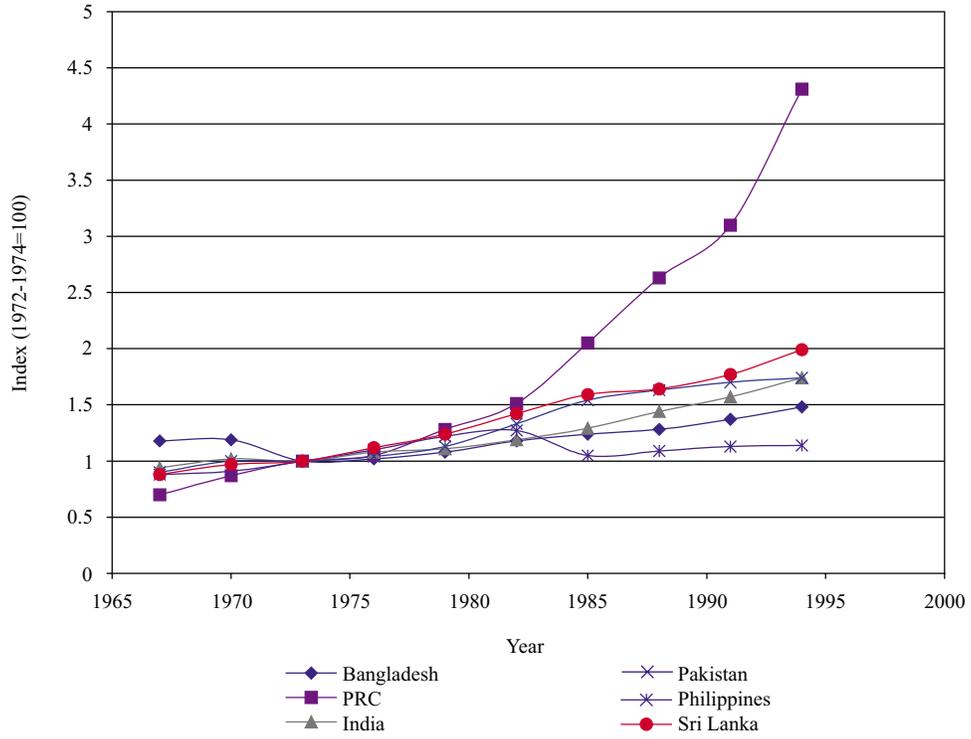
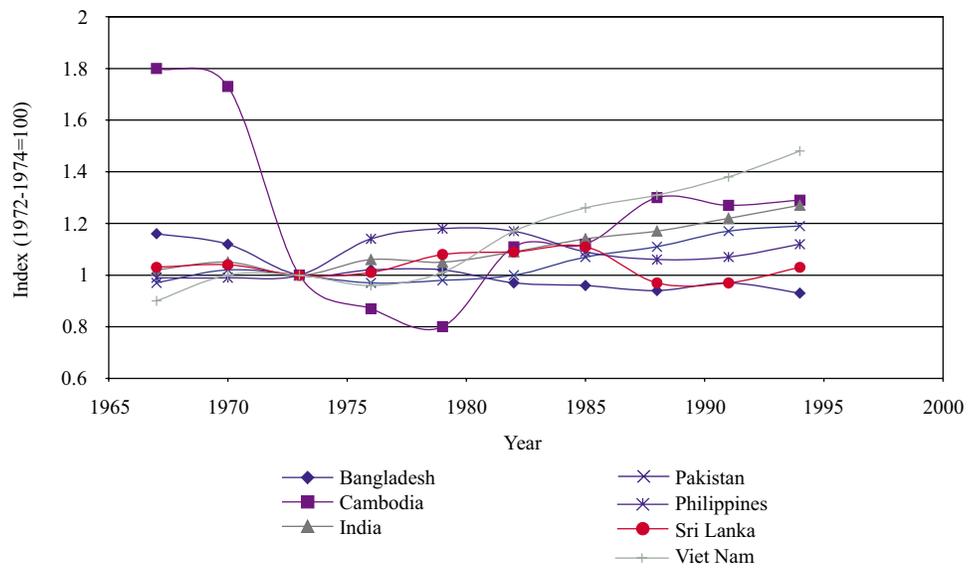


Figure 11: Index of Per Capita Total Agricultural Production



The overall picture at the aggregate national level, then, is one of gradual improvement in the quality of diets in the study countries as incomes have increased, cereal prices have fallen, and agricultural production has kept pace with population growth. Trends are headed in the right direction. However, dietary quality is still quite poor, especially for low-income groups and malnutrition rates remain high.

### **A Conceptual Framework for Analysis of Food Security**

We begin the description of the conceptual framework (see Figure 12), in line with the UNICEF model of food security (FAO/WHO 1992, UNICEF 1998) with the three basic inputs to better nutrition, which are food, care, and health. Food is disaggregated here into two components, the energy provided by food and vitamins and minerals, or dietary quality. The key role of dietary quality will be emphasized.

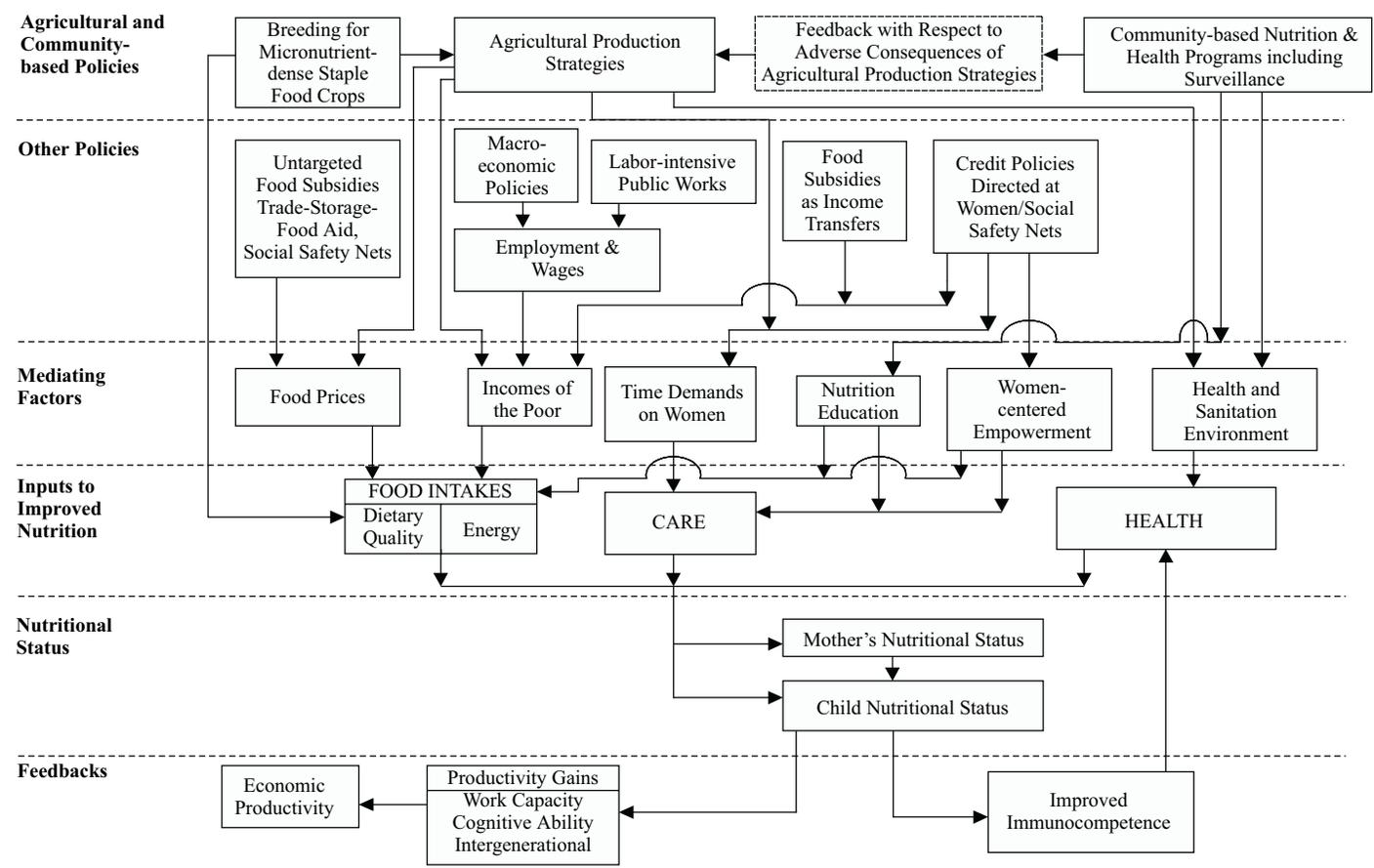
Nutritional status is divided into mother's nutrition and child nutrition to emphasize the importance to child nutrition of maternal nutritional status during pregnancy and lactation. Feedback loops are depicted at the bottom of the diagram. Better nutrition leads to improved immunocompetence, which means better health. In the short run, better nutrition results in improved work productivity for adults. In the long run, better nutrition during childhood means improved cognitive abilities for the present generation throughout their lives. The benefits of improved maternal nutrition are passed on to future generations through better nutrition and health of newborns (Barker 1998).

In the top half of Figure 12 are the policies and programs to be discussed in the paper, which could lead to improved nutrition outcomes. These policies and programs affect six mediating factors that determine food intake, care, and health. These factors are: (i) food prices, (ii) incomes of the poor, (iii) time demands on women, (iv) nutrition education, (v) women-centered empowerment, and (vi) health and sanitation environment.

Food prices, incomes of the poor, nutrition education, and the degree of control of women over household resource allocation decisions all affect the level and quality of food intake. Time demands on women, nutrition education, and women's empowerment affect the amount and type of care given. Finally, the health and sanitation environment affects health outcomes.

There are important differences in household food security issues in the rural and urban contexts. In urban areas, household food security is primarily a function of the real wage rate (that is, relative to food prices) and the level of employment. The unsanitary health environment in poor urban areas and high population densities makes the urban food security situation sometimes qualitatively different as compared with the rural situation. Asia will be the home of several of the world's largest cities in the decades ahead.

Figure 12: Food Security Conceptual Framework



In addition, informal safety nets are weaker in the more recently settled urban areas and women's work is more likely to be dislocated from their homes, making child care much less compatible with female unemployment. Although the prevalence rates of the food-insecure are, so far, lower in urban areas than in rural areas, this does not mean that the numbers of the urban food-insecure will not grow. On the contrary, *urban poverty, chronic food insecurity, and undernutrition are becoming increasingly important problems* due to higher rates of urbanization (Haddad et al. 1999, Ruel et al. 1999, UNICEF 1994).

Community-based nutrition and health programs (including surveillance) and agricultural production programs are emphasized in this paper. Community-based programs serve three essential functions in this framework: (i) they lead to improvements in the health and sanitation environment; (ii) they increase nutritional knowledge among women; and (iii) they monitor any adverse consequences of agricultural production strategies on the health and sanitation environment (e.g., contamination and amount of potable water for family use).

Agricultural production strategies recommended in this paper will emphasize the increased availability of minerals and vitamins in the diet through increased production of nonstaple food crops and breeding for micronutrient-dense staple food crops. Increased production of both staple and nonstaple foods will lower food prices (in general if production growth rates exceed population growth and the effects on demand of increased incomes). Depending on the specific agricultural strategy followed (specific foods which are emphasized and the particular investment policies undertaken), various agricultural growth strategies will differentially affect the incomes of the poor, time demands on women, and the health and sanitation environment. Thus, agricultural production is a powerful but complex tool (with some potential negative consequences) for affecting nutrition outcomes.

One specific food-based strategy is breeding for micronutrient-dense staple food crops (Graham and Welch 1996, Welch and Graham 1999). Note that in one respect this strategy bypasses all six mediating factors. To the extent that consumer characteristics remain unchanged (e.g., increased trace mineral content goes undetected by the consumer), getting the plants to fortify themselves relies on existing behaviors—a profit motive for farmers and high daily consumption of food staples by poor consumers.

In a second respect, however, this strategy also has direct impacts on agricultural productivity. Loading more trace minerals into seeds is good for plant nutrition as well. Productivity on trace mineral deficient soils is enhanced (adapting the plant to the soil rather than the soil to the plant). This targets poor farmers (those with less than optimal soils) and is good for the environment (greater root development and so less soil erosion, more drought tolerance, and more efficient use of fertilizers and water).

Other policies to be discussed are (i) untargeted food subsidies and trade-storage-food aid programs, policies that affect food prices; (2) macroeconomic policies, labor-intensive public works programs, and targeted food subsidy programs, all of which directly affect the incomes of the poor; and (3) micro credit programs directed at women, which increase incomes and may enhance nutritional knowledge and the control of women over household resource allocation decisions. These policies all serve to improve the access of the poor to food.

The policies discussed below focus on the rural poor and on undernutrition. Nevertheless, it is recognized that the study countries are rapidly urbanizing and that overnutrition, for example, obesity, is becoming a significant problem in some of the countries. In fact, economic growth, urbanization, shifts in food tastes, and overnutrition are closely intertwined.

In Asia as a whole, during 2000-2025 the urban population is projected to increase from 1.39 billion to 2.51 billion, while the rural population will remain constant at 2.30 billion (United Nations 1998). The absolute number of poor and undernourished individuals living in urban areas has increased, as has the share of overall poverty and undernourishment coming from urban areas (Haddad, Ruel, and Garrett 1999).

Urban diets show, among other trends, consumption of food higher in fat, of more animal products, and of more sugar, which are shifts in eating habits independent of price and income differentials between urban and rural areas (Popkin 1999, Huang and Bouis 1996). In general, obesity is far higher in urban areas than in rural areas. For example, in the PRC in 1992, 23 percent of the urban population and only 10 percent of the rural population had body mass indices greater than 25, the cutoff point indicating obesity (Popkin and Doak 1998).

Chronic health problems accompany the nutrition transition in urban areas. The most immediate is diabetes mellitus. Cardiovascular conditions are also on the rise. Recent literature indicates a strong correlation between reduced activity patterns (common to urban lifestyles), dietary changes such as those described above, and increased risk for cancer (Popkin 1999).

While these important trends related to urbanization must be kept in mind, most of the poor and malnourished in the eight study countries still reside in the rural areas.

### **Efforts to Overcome Food Insecurity in the Region**

Various private and public actors ranging from the food-insecure households themselves to communities, nongovernmental organizations, local governments, national governments, international agencies, and bilateral donors take actions for household food security improvement. However, governments play a key role in

food security policy in terms of strategy formulation, policy design and implementation, monitoring, and evaluation of progress.

Food security improvement must consider the linkages between food insecurity, disease, poor sanitation, and inadequate education. Otherwise, food security measures on their own will have a limited impact on nutritional improvement.

### **Agricultural Policies**

Recommended agricultural policies encompass both strategies for increasing the supply of nonstaple foods and improving the mineral and vitamin density of staple food crops.

#### *Agricultural Production Strategies*

Production-oriented programs that aim to increase food production and/or production of crops for sale can have favorable impacts on food security if they increase and/or stabilize the real incomes of the people facing food insecurity. The impact of these policies is mediated through changes in food prices and incomes and is influenced by trade policies. Growth in food supplies can have a dual effect on food security by reducing food prices, which benefits food-purchasing households in rural and urban areas, and, depending on the nature of growth, by promoting employment. As incomes of poor households increase, their absolute expenditure on food consumption also increases, although the relative share tends to decrease.

Technological innovation and commercialization in agriculture induce economic gains through stimulating agricultural growth, improving employment opportunities, and expanding food supplies, which involve and benefit the poor and help to alleviate poverty (Lipton and Longhurst 1989, Binswanger and von Braun 1991). A policy of self-sufficiency in food production or adoption of a “food first” policy that emphasizes food crops to the exclusion of cash crops is not necessarily desirable nor crucial for alleviating hunger and undernutrition, when market infrastructure and policies do not impair trade. The “green revolution”—irrigation, seed, fertilizer, and pest control package for rice and wheat, in particular—has expanded farm and nonfarm output, employment, and wages, and stimulated migration. Hence, it has contributed to both household and regional food security, especially in high-potential production areas, such as the Punjab of India (Bhalla 1983); the Muda Irrigation Scheme in Malaysia (Bell, Hazell, and Slade 1982); and Laguna province in the Philippines (Herdt and Ranade 1976). Of course, technological innovation and commercialization are not restricted to crops, but may also encompass livestock.

Commercialization of agriculture frequently contributes to improving household food security when the poor benefit from the increased income and employment generated by such activities (von Braun and Kennedy 1994). Gains in real income

from technological change or commercialization translate into gains in food consumption and nutritional welfare. In some instances, however, the poor have failed to reap the benefits, or have even lost, from technological change or commercialization. These adverse effects, where they have occurred, are mostly attributable to inelastic demand for the promoted commodities or to adverse institutional developments such as eviction of tenants,<sup>2</sup> coerced production, or forced procurement (Bouis and Haddad 1990, Binswanger and von Braun 1991).

The food-insecure who are subsistence farmers will benefit from their own increased food production for home consumption, which insures them against market risks. When subsistence-oriented farm households are given the option of adopting cash crops that offer higher returns, they tend to adopt these crops quickly, yet they also tend to maintain substantial resources in food production for home consumption as an insurance mechanism (von Braun and Kennedy 1994). Thus, in environments with risky markets, the joint promotion of food crops and cash crops is required in support of food security enhancement.

The employment effects for the poor that result from technological change and agricultural commercialization are a function of the local labor market and of crop-specific technologies that are newly introduced. The cultivation and capital-intensive processing of crops such as sugarcane may not result in much incremental employment and may even have an adverse effect on employment for smallholder households if field labor is reduced. However, in general, the commercialization of agriculture often entails a substantial expansion in demand for hired labor, and to the extent that wage-labor households rank among the food-insecure, this employment generation effect is of particular benefit to them.

In terms of women's role in agricultural production, there is now a fairly large set of evidence that demonstrates that the provision of equal opportunities for women in economic activities can lead to a net increase in economic gains for all household members, and, in particular, can lead to more resources directed to children. Some of the clearest evidence on the loss of economic productivity due to gender asymmetries in access to resources is found in the agriculture literature. Bamberger, Blackden, and Taddese (1994) state that the potential gains could add significantly to overall agricultural productivity in many regions and could improve the viability of countless agricultural project investments.

There are other, somewhat more indirect, effects of growth in agricultural production on food security that are noteworthy. First, off-farm nonagricultural activities often contribute a significant proportion of total household income. Much of this nonagricultural employment and income is derived from increased demand for local goods and services, which, in turn, is partly the consequence of multiplier effects of

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<sup>2</sup>For example, it was observed in an area of the Philippines in which contracts for sugarcane growing were given only to landowners and not to tenants, landlessness increased and the status of tenants around the sugar mill deteriorated (Bouis and Haddad 1990).

agricultural growth due to commercialization and technological change (Mellor 1986, Hazell and Roell 1983). Second, poor households build up their asset base out of incremental income. Agricultural growth permits an expanded asset base, which makes households less vulnerable to short-term disruptions in their income streams, as discussed earlier.

Sociocultural situations determine quite different effects of technological change and commercialization on women's work in agriculture, which can consequently have different implications for their household food security status. Scope for targeting technology toward specific groups is limited. The topic of technological change in agriculture and women's workload is much debated. A synthesis of case studies finds that women's work in agriculture is generally reduced not only relatively but also absolutely with rising incomes, which correlate with increased farm size (Leslie and Paolisso 1989). Increases in household income associated with increased commercialization can lead to a substitution of hired labor for family female labor (Bouis and Haddad 1990). When increased workload results in increased returns to women's labor, this may translate into improved household and child welfare, despite the increased work of women, when incremental income is spent, for instance, on child health and nutrition (Haddad 1992).

To fully tap the potentials of production-oriented programs for food security, rapid development of rural financial markets needs to parallel agricultural growth promotion. This will enable households to increase their ability to save and build up productive asset bases, and will help them to avoid investments and savings in the form of nonproductive assets. Rural financial markets are particularly needed in environments where commercialization of agriculture leads to payments in the form of large lumpy sums of cash a few times a year, to facilitate smoothing of consumption. Moreover, banking facilities should expressly be open to individuals and not just to (male) heads of households that are enrolled in a particular production scheme, so that the benefits of commercialization can be spread more widely across the community and not restricted solely to direct participants in a production scheme.

While landowning households benefit most from the direct income effects of agricultural growth, landless and small food-deficit farmers benefit most from the indirect effects on off-farm employment generation (Hossain 1988). These indirect employment effects of helping the poorest households are further facilitated by infrastructural development (Ahmed and Hossain 1990).

#### *Breeding for Micronutrient-dense Staple Food Crops*

Because trace minerals are important not only for human nutrition but for plant nutrition as well, plant breeding holds great promise for making a significant, low-cost, and sustainable contribution to reducing micronutrient, particularly mineral deficiencies in humans, and may have important spinoff effects for increasing farm

productivity in developing countries in a way that is environmentally beneficial (Ruel and Bouis 1998).

The strategy of breeding for mineral and vitamin enhancement of staple foods has several complementary advantages. No behavioral change on the part of consumers is required. Indeed the strategy seeks to take advantage of the consistent daily consumption of large amounts of food staples by all family members. Nevertheless, any intervention to improve micronutrient status targets women and children because of their elevated needs for minerals and vitamins.

Mineral-packed seeds sell themselves to farmers because, as recent research has shown, these trace minerals are essential in helping plants resist disease. More seedlings survive and initial growth is more rapid. Ultimately, yields are higher, particularly in trace mineral “deficient” soils in arid regions. Because roots extend more deeply into the soil and so can tap more subsoil moisture and nutrients, the mineral-efficient varieties are more drought-resistant and so require less irrigation. And because of their more efficient uptake of existing trace minerals, these varieties require fewer chemical inputs. Thus, the new seeds can be expected to be environmentally beneficial as well. After the onetime investment is made to develop seeds that fortify themselves, there are low recurrent costs—costs for supplementation, fortification, and nutrition education that remain constant year after year.

Results so far obtained under the CGIAR Micronutrient Project (Graham et al. 1999) indicate that breeding objectives are not difficult to meet and are likely to be low-cost as indicated by the following research findings:

- (i) adequate genetic variation in concentrations of b-carotene, other functional carotenoids, iron, zinc, and other minerals exists in the major germplasm banks to justify selection;
- (ii) micronutrient-density traits are stable across environments;
- (iii) in all crops studied, it is possible to combine the high micronutrient-density trait with high yield, unlike protein content and yield that are negatively correlated;
- (iv) genetic control is simple enough to make breeding economic;
- (v) it will be possible to improve the content of several limiting micronutrients together, thus pushing populations towards nutritional balance; and
- (vi) bioavailability of the extra nutrient in elite breeding lines is high for rats and where the density is high enough for the test, also to human colon cell lines. Tests on human populations are now a high priority.

Moreover, from a broader food–human nutrition systems perspective, the combination of benefits for human nutrition and agricultural productivity resulting from breeding staple food crops that are more efficient in soil trace mineral uptake and seed deposit of trace minerals has resulted in extremely high ex ante estimates of benefit-cost ratios for investments in agricultural research. This finding derives from the confluence of several complementary factors:

- (i) Rates of micronutrient malnutrition are high in developing countries, as are the consequent costs to human welfare and economic productivity.
- (ii) High trace mineral density in seeds produces more viable and vigorous seedlings in the next generation, while efficiency in trace mineral uptake improves disease resistance and agronomic characteristics that improve plant nutrition and productivity in trace mineral-“deficient” soils.
- (iii) A significant percentage of the soils in which staple foods are grown are “deficient” in these trace minerals, which has kept crop yields low. In general, these soils in fact contain high amounts of trace minerals. However, because of chemical binding to other compounds, these trace minerals are “unavailable” to staple crop varieties presently used.
- (iv) Adoption and spread of nutritionally improved varieties by farmers can rely on profit incentives, either because of agronomic advantages on trace mineral-deficient soils or incorporation of nutritional improvements in the most profitable varieties being released.
- (v) Because staple foods are eaten in large quantities every day by the malnourished poor, delivery of enriched staple foods (fortified by the plants themselves during growth) can rely on existing consumer behavior.
- (vi) Benefits to relatively small investments in agricultural research may be disseminated widely, potentially accruing to hundreds of millions of people and millions of acres of crop lands.
- (vii) Breeding advances are derived from initial fixed costs with low recurring costs, and thus tend to be highly sustainable as long as an effective domestic agricultural research infrastructure is maintained.

The findings in the rice component of the project are particularly encouraging. Iron density in rice varied from 7-24 mg kg<sup>-1</sup> and zinc density from 16-58 mg kg<sup>-1</sup>. A benchmark was established in that nearly all the widely grown “green revolution”

varieties were similar, about 12 and 22mg kg<sup>-1</sup> for iron and zinc respectively. The best lines discovered in the survey of the germplasm collection were therefore twice as high in iron and 1.5 times as high in zinc as the most widely grown varieties today. High iron and to a lesser extent, high zinc concentration, were subsequently shown to be linked to the trait of aromaticity. Most aromatic rices such as jasmine and basmati types are high in both iron and zinc, and as before, generally in most minerals (Senadhira and Graham 1999; Graham et al. 1997, 1999). The close linkage to aroma suggests iron density in rice expresses as a single gene trait since aroma is itself controlled at a single locus. In addition to genetic variation in nutrient density in rice grains, there are genotypic differences in the relative loss of iron and zinc in the milling process.

As in other crops, these micronutrient density traits have been combined with high yield. A high-yielding, disease-resistant, aromatic variety with twice the iron density of standard IRRI releases (after milling), designated IR68-144, has been identified. Bioavailability tests of IR68-144 using rats are encouraging. A human feeding trial is being planned and further agronomic tests are being pursued.

In treating iron deficiency in developing countries, Yip (1994) argues that if prevalence rates are above 25 percent, the best approach is to develop programs to improve the iron status of the entire population. In such situations, which for preschoolers and women in developing countries are the rule rather than the exception, this is cheaper than screening for iron-deficient individuals. By increasing the iron content of food staples through plant breeding, the entire iron status distribution curve can be shifted to the right, so that targeting a subsequently smaller group of iron-deficient persons could become feasible.

Unfortunately, much less is known about the prevalence of zinc deficiency in developing countries, or about the distribution curve for biochemical indicators of zinc status. Even less is known about the cost of interventions for the prevention and control of zinc deficiency simply because wide-scale testing of possible interventions awaits conclusion of the debate over whether zinc deficiency should be regarded as a major public health problem. Certainly, plant breeding is an option that should be exploited as quickly as possible to reduce zinc deficiency.

A plant breeding strategy, if successful, will not eliminate the need for supplementation, fortification, dietary diversification, and disease reduction programs in the future to combat micronutrient malnutrition. Nevertheless, this strategy does hold great promise for significantly reducing recurrent expenditures required for these higher-cost, short-run programs by significantly reducing the numbers of people requiring treatment. Cost is not a key issue in the decision to pursue a plant breeding strategy to improve human nutrition. A relatively modest level of resources is required and the potential payoff is quite high (Bouis 1999).

### Social Security Policies

The term “social security” encompasses a wide variety of social insurance and social assistance policies, programs, and strategies in both the public and private sectors. Table 1 outlines the dimensions of social security and characterizes these policies, programs, and strategies in terms of their main objective (insurance or assistance) and the nature of the institutions providing them (public or private). Social insurance initiatives typically include pensions, health and education services, various insurance markets, and unemployment benefits. In the more developed countries these are available in both the private and public sectors. In less developed countries these insurance schemes tend to be restricted to those employed in the formal sector—whether private or public—typically excluding households and individuals at the bottom end of the income distribution. Individuals unable to access formal sector insurance rely on a range of coping strategies to pool and manage risk.

Social assistance programs in the public sector range from the relatively untargeted and long-term (general food price subsidies) to the highly targeted and short-term (feeding in emergency relief situations). Private strategies include interfamily and intrafamily transfers and the formation of new community organizations.

This section will focus on the policies that are most relevant for household food security: food subsidies, labor-intensive public works, and microfinance schemes.

Table 1: **Dimensions of Social Security**

	<b>Private Sector</b>	<b>Public Sector</b>
Insurance	Pensions	Pensions
	Health care	Health care
	Insurance	Insurance
	Unemployment	Unemployment
	Diversification	
	Migration	
	Interfamily transfers Intrafamily transfers	
Assistance	Interfamily transfers	Child allowance
	Intrafamily transfers	General subsidies (producer/consumer)
	Voluntary contributions	Public works
		Microfinance schemes
		Cash transfers
		Social funds
		Relief programs

### Food Subsidies

Food income transfers are a widely used means of alleviating food insecurity. There are several favorable characteristics of food subsidy programs. In countries and regions that are frequently subject to serious food shortages, (subsidized) public distribution helps to move emergency supplies into them such as to improve the food security of the poorest groups. Availability of such food distribution programs is credited with maintaining food security and nutrition levels for the poorest population segments during droughts in India (Drèze 1988). Food subsidies increase the real incomes of households with access to the subsidies. In a number of programs surveyed, food subsidies accounted for 15-25 percent of the total real incomes of low-income households that received subsidies (Pinstrup-Andersen and Alderman 1988).

However, food price subsidies have come under attack for their potential adverse effects on markets and for their high fiscal costs. In implementing structural adjustment, there is additional pressure to eliminate these programs except for those that can be justified on strong humanitarian and/or developmental grounds. Food subsidies have existed for more than four decades in some Asian countries. Four broad types of programs are used: general subsidies open to everyone, quantity rationing, food stamps, and programs that address the nutritional deficiencies of specific groups, in particular pregnant and nursing mothers and preschool children.

Table 2 shows the types of food transfer programs implemented in South and Southeast Asia during the 1970s-1990s.

Table 2: Food Transfer Programs in Asia (1970s-1990s)

Country	General Price Subsidy	Quantity Rationing	Food Stamps	Feeding Programs	Food With Work Requirement
Bangladesh		✓			✓
India		✓		✓	✓
Pakistan	✓	✓		✓	
Sri Lanka		✓	✓		
Philippines		✓		✓	
Indonesia				✓	

Source: Subbarao et al. (1997, 47).

As seen in Table 2, quantity rationing is the most frequent form of intervention, but is often quite inefficient. Generally, price subsidies and quantity rationing result in the highest leakage to the nonpoor. For example, the Public Distribution System (PDS) is the major food subsidy program in India. The PDS provides cereals, sugar,

and kerosene to poor households at subsidized rates. The PDS covers 85% of the population. Problems with the program are that the following. One, it is not well-targeted within regions; a considerable proportion of the population benefitting from it belongs to the nonpoor category. Two, it is not well-targeted across regions; some of the poorer states do not get their due share. Three, there is considerable leakage from the system, and four, it has become a high-cost operation due to inefficiency and high storage and transportation costs (India country report).

Food stamps are the least distortionary of these programs in that they allow the consumer the widest choice of commodities without affecting relative food prices. Food stamp programs are expected to retain the higher food consumption effects of food-based income, as well as to reduce the administrative burden and costs imposed by food handling and transport. Experience with food stamp programs is mixed; they have not been as easy to administer as supposed. In Sri Lanka, the income verification procedure for food stamps has excluded wage-earning workers on tea plantations, although they appear to be a nutritionally needy group (Kennedy and Alderman 1987). These problems are not unique to food stamps, but are also encountered with in-kind transfers. However, little empirical information is available on food stamp programs in the developing world, even from Sri Lanka, which in 1979 replaced its decades-old food subsidy scheme with food stamps.

When the food stamp subsidy scheme began in 1979 in Sri Lanka, its benefits constituted 83 percent of the benefits from the price subsidies, but by 1981/1982, this share had been reduced to 43 percent by the diminishing real value of the stamps due to inflation (Edirisinghe 1987). The food stamp scheme was not successful in helping the bottom 20 percent of households whose per capita calorie consumption declined by about 8 percent between 1978/1979 and 1981/1982. The drawback to fixed, nominal-value food stamps is that they do not protect the consumer from short-term price fluctuations, even when periodically adjusted for inflation (Pinstrup-Andersen 1988).

Food stamps were also difficult to target. In the 1980-1982 consumption survey, nearly 30 percent of the poorest quintile did not participate in the program, while 45 percent of the fourth and 20 percent of the fifth quintiles were participating in the program. Food stamps are no panacea: only 20-25 percent of food needs of a family of four was provided in Sri Lanka. But the shift from general food subsidies to selective food stamps reduced the fiscal commitment by two thirds and buffered the government against macroeconomic imbalances.

A recent global review of food stamp programs (Castañeda 1999) concluded that food stamp programs are superior to cash transfers because they increase food consumption, generate significant savings compared to other price subsidy programs, and are an “efficient means to transfer support income to poor and vulnerable groups,” and are efficient mechanisms in social safety net programs to minimize leakage. The most impactful programs on nutrition outcomes combine food stamps

with nutrition education, designed for women and children and other vulnerable groups, often with conditionality that eligible families ensure school attendance by poor children to lower repetition rates and improve school performance.

Because they require less administrative effort, maternal and child feeding programs are relatively well-targeted (Subbarao et al. 1997, 49). In general, targeted nutrition programs aimed at mothers and children, and which include nutrition education and growth monitoring, have been highly cost-effective. Clinic-based programs that combine health inputs with nutrition supplements have lower administrative costs than school-based programs (Subbarao et al. 1997, 50).

For example, in Sri Lanka the Thripasha Supplementary Feeding Programme was introduced in 1973. Thripasha is a precooked food fortified with vitamins and minerals. The supplement is expected to help pregnant mothers to attain an essential body weight and to maintain full breastfeeding, and to prevent malnutrition in infants and preschool children. Preschoolers less than five years of age and pregnant and lactating mothers are eligible for the program. Criteria for selection of beneficiaries include underweight, anemia, inadequate birth spacing and multiple pregnancy, low income, unsanitary location, and dependence on food stamps.

Past evaluations have been positive on the whole and indicated that those participating in the program have benefitted significantly. The program serves approximately 600,000 persons at any given time, or 32 percent of those in the relevant age groups (Sri Lanka country report).

India also has some innovative and better-targeted programs such as the Integrated Child Development Services (ICDS) and the Tamil Nadu Integrated Nutrition Program (TINP). The ICDS reaches about 1.7 million preschool children and 0.6 million women 15-45 years of age, two thirds of whom are pregnant and lactating. Supplementary food, immunization, health checkups, and health and nutrition education are provided. The TINP provides short-term supplementary feeding to at-risk children (India country report).

#### *Labor-intensive Public Works*

Labor-intensive public works programs can address, simultaneously, three central problems facing many low-income countries: food insecurity, growing unemployment, and poor infrastructure. Public works activities are, in general, public programs that provide employment and generate public goods, such as physical and social infrastructure. Labor-intensive public works go a long way toward direct and sustainable poverty alleviation and strengthening of self-help capacities. Food aid can be, directly or indirectly (monetized), a component of the wage payments.

The household food security effects of labor-intensive public works programs are a function of program design. For instance, a short-term project may result in expenditure patterns by the poor that treat project income as “windfall profits.” Such

an explanation may be attributed to the small food consumption benefits observed during the short work season of the Bangladesh food-for-work program (Kumar and Chowdhury 1985, Osmani and Chowdhury 1983). In contrast, long-term benefits from improved rural infrastructure produce more secure income flows and substantial consumption improvements for the lowest-income households.<sup>3</sup>

Good public investment through public works programs and, thus, the creation of productive and sustainable assets need to be emphasized in policy. It is important to note, however, that income effects derived from public works programs for the poor also have favorable private savings and investments effects that improve household food security, as observed from experiences in Bangladesh (Kumar 1988). Strengthening financial institutions for the poor in tandem with public works programs is suggested in order to foster these positive effects. Public works programs can be a viable instrument for *famine prevention* as demonstrated by the Employment Guarantee Scheme (EGS) from Maharashtra, India. The employment guarantee feature of the EGS<sup>4</sup> also triggers “relief works” automatically at local levels.<sup>5</sup> A program such as the EGS that includes an employment guarantee as well as favorable employment stabilization and insurance effects stands out as a model.

The target group of labor-intensive public works programs, the food-insecure poor, are successfully reached through a variety of mechanisms and design features that include wage rate policy, regional targeting, and specific selection of households (displaced) and household members (women). Properly designed public works programs have a unique feature in favor of poverty alleviation with low administrative costs and effects: self-targeting. At properly defined wage rates, the working poor identify themselves by turning up at public works schemes. However, the self-targeting feature of public works programs only operates effectively with an appropriate (low) wage rate policy and a flexible absorption of applicants without rationing workplaces (Ravallion, Datt, and Chaudhuri 1993). Note that public works programs are not able to directly address the needs of food-insecure individuals who, for whatever reason, are unable to participate in the schemes. *Women* participate frequently to a high extent in public works programs.

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<sup>3</sup>For example, rural Bangladesh villages with better infrastructure development (gauged by a number of criteria) had 12 percent of their households that were food-insecure (that is, consuming less than 80 percent of caloric requirements) compared to 20 percent in villages with poor infrastructure (Kumar 1988). This difference is explained by higher incomes (18 percent more employment was available for the landless) and lower prices of marketed items in villages with better developed infrastructure.

<sup>4</sup>The scheme provides an unlimited guarantee of employment to all adults in rural Maharashtra who are willing and able to work at the given wage.

<sup>5</sup>Between 1972 to 1987, Maharashtra, as a whole, suffered from a serious crisis in only one year, 1979-1980, although different districts suffered from local crises at different times. The EGS responded automatically to crisis situations in affected districts, even when the overall situation in the state was above average (Ezekiel and Stuyt 1989).

The issue of payment in cash or (partly) in kind is related to the wider problem of wage rate determination and to the question of risk of food market failure.<sup>6</sup> Regularity of payments may be another critical requirement for workers. When increased demand for food is induced through a large public works scheme, food must be forthcoming locally or inflation may result, which also hits nonparticipating households. Food aid can play a role in mitigating such effects if it enables food supply to be expanded according to the demand induced by public works programs.

The institutional link between food security-related institutions and public works-related institutions has to be strengthened. Food security issues (for example, their regional and seasonal dimensions) do not fully enter policy formulation in many countries.

#### *Microfinance Policies to Relax Credit and Savings Constraints*

Food-insecure households tend to have poor access to formal financial institutions. This lack of access is only partially compensated for by informal institutions, because these institutions, relying importantly on personal networks, tend not to be sufficiently diversified by region (but also by sector). Hence they leave individuals vulnerable to shocks that affect entire regions. Formal services do not reach the food-insecure, because the food-insecure (i) are seen as poor credit risks in terms of conventional collateral (such as assets) and (ii) tend to be in remote locations and transact small amounts of cash, thereby increasing the unit cost of transacting. Many NGOs have overcome these obstacles via group-based microfinance schemes that introduce group liability, reputation, and peer pressure as a substitute for physical collateral, while establishing many branches and mobile banks to overcome transaction costs problems. The performance of these institutions is encouraging. While no panacea for poverty, they have high repayment rates, reach the poor, and allow the poor to smooth consumption and minimize disruption of income generation due to production shocks (Zeller and Sharma 1998).

In particular, they seem to be well-suited to women, given that the access problems they face tend to be worse than men and given a higher propensity for repayment. A number of NGOs in Bangladesh such as Grameen Bank, BRAC, and PROSHIKA have attempted to improve women's status and the status of children in their households by directing credit to women. How well have these programs worked? Pitt and Khandker's (1998) study on the differential impacts of NGO microcredit directed to men and women is particularly illuminating because it is well-designed and the data are carefully analyzed. Specifically, they test for the

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<sup>6</sup>In the Bangladesh Food-for-Work Programme, 37 percent of workers surveyed wanted only food payments and 8 percent wanted only cash payments, with the remainder wanting a combination of food and cash (Osmani and Chowdhury 1983). In a cash-for-work scheme in Ethiopia, a majority of the participants preferred to be paid in food as they observed an escalation of food prices just prior to the food payments.

differential impact of male and female borrowing from three NGOs on eight outcomes—boy's and girl's schooling, women's and men's labor supply, total household expenditure, contraception use, fertility, and value of women's nonland assets. They find that “the set of female credit variables is statistically significant in 7 of 8 cases at the 0.05 percent level. By contrast, the set of male credit variables is significant in 3 out of 8 cases” (p. 41). One of the implications of their results is that household consumption increases by 18 taka for every 100 taka lent to a woman and 11 taka for a man (Morduch 1997). Kabeer (1998) reviews the conclusions of the econometric studies of credit to women in Bangladesh and compares the results with her own participatory evaluation. She is more interested in the perspective of the women themselves as to whether they feel empowered by the receipt of credit. Despite increased workloads, the loanees clearly felt more self-fulfilled and valued by the other household members and the community.

### **Community-based Nutrition and Health Programs for Monitoring the Effects of Agricultural Programs and Policies**

Community-based programming for child nutrition lies at the heart of the country nutrition investment plans in Asia. As parents provide most of the resources needed to ensure the survival and development of their children, it is most important that they have a good monitoring system to track the development of their children, in order to identify the need for immediate actions when problems emerge. At the next level, it is important that the community has a monitoring system that will enable it to identify households with problems of malnutrition. These households will need some additional support in order to ensure the well-being of their children. At the community level, local leaders can then decide to what extent targeted support to specific families or more general actions that support large groups of families is required.

Through the use of a community growth chart and regular feedback sessions with community leaders and community mobilizers, community-level monitoring may be effectively carried out. At the district and higher levels, the monitoring system should help to identify communities that are not able to successfully control child malnutrition and to guide the authorities in setting priorities for resource allocations. Monitoring systems should not only identify problem households or communities, but also provide a means for reassessment, i.e., to measure the effect of various control actions that have been implemented.

In this context, community-based monitoring systems may be used to detect unwanted and unintended effects of agricultural programs and policies that may be detrimental to nutrition and health. For example, establishment of tubewells for irrigation may lower the level of the water table. This, in turn, may release harmful compounds into drinking water, such as arsenic in Bangladesh, or the incursion of

salt water in some coastal areas of Indonesia. Agricultural planners may be quite content with interventions that meet agricultural objectives. They need to be made aware, however, of their programs on the nutrition and health of the community.

### **Policies to Lower Food Prices: Storage, Trade, and Food Aid Policies**

Rapid growth in agricultural production, already discussed above, will serve to lower food prices. However, other strategies are available as well. There is a strong feeling among some policymakers—not only in low-income countries—that storage under public control is essential for food security. Stabilization needs to be attuned to a country's specific production risks (for example, whether it is prone to droughts or floods) and trade risks (for example, whether it is landlocked) (FAO 1983, Sarris 1985). The response of local-level and farm-level storage to public policies is an important consideration, especially in circumstances where postharvest losses are significant and where local market disruptions occur frequently. Upgrading of storage facilities to cut storage losses remains of high relevance in many countries.

There are benefits (including in terms of food security) and costs of price stabilization. Price stabilization is an expensive proposition and increasingly so the more stability is attempted. Frequently, low-income countries cannot afford it financially or administratively. Administrative and opportunity costs of the resources devoted to stabilization need to be accounted for. Benefits include a more stable investment climate and a reduced short-term stress on households to adjust.

Countries that operate under severe foreign exchange constraints find it difficult to increase commercial food imports in order to cope with food shortages. Having to allocate scarce foreign exchange to food imports (over and above their normal allocation) destabilizes their imports of investment goods, with consequent adverse effects on the economy.

Recent reviews of food aid's impact on improving nutrition have not been encouraging (Clay, Pillai, and Benson 1998). Globally, food aid has dropped in recent years to just 3-4 percent of overseas development assistance though higher in South Asia. Lack of donor coordination, weak attempts to conduct impact evaluations of programs, and a loss of confidence in all forms of food aid except emergency relief were the conclusions of the Overseas Development Institute study. While the detailed arrangements for reformulating the structure and character of food aid are beyond the scope of this paper, the inevitable conclusion is that both generic food subsidies in Asian countries and untargeted food aid poorly aligned to measurable nutrition outcomes carry with them a high opportunity cost when resources can be more effectively used by community-based and gender-based linkages of food and nutrition security.

## **Conclusion**

Ultimately, good nutrition depends, among other things, on adequate intakes of a range of nutrients and other compounds in combinations and levels that are not yet completely understood. Thus, one element in the final solution to malnutrition is to provide increased consumption of a range of nonstaple foods. To reach the poor, this will require informed government policies and a relatively large investment in agricultural research and other public and on-farm infrastructure over several decades. In the medium run, a much smaller investment in improving the nutrient content of food staples through plant breeding can make a major contribution to reducing deficiencies in selected micronutrients. The role of women is central to nutrition outcomes through child care, so that policies and programs must consider how to enhance women's decision-making power in the household, how they affect time demands on women, and how to increase women's education and nutritional knowledge. Finally, community-based programs are central to the Project strategy for improved nutrition. Community-based programs should be used to monitor the nutrition effects of agricultural policies and programs and to provide feedback to agricultural policymakers as to how to enhance the positive effects and minimize the negative effects of agricultural policies and programs.

Production-oriented programs that aim to increase food production and/or production of crops for sale can have favorable impacts on food security if they increase and/or stabilize the real incomes of the people facing food insecurity. The impact of these policies is mediated through changes in food prices and incomes and is influenced by trade policies. Growth in food supplies can have a dual effect on food security by reducing food prices, which benefits food-purchasing households in rural and urban areas, and, depending on the nature of growth, by promoting employment. As incomes of poor households increase, their absolute expenditure on food consumption also increases.

Technological innovation and commercialization in agriculture induce economic gains through stimulating agricultural growth, improving employment opportunities, and expanding food supplies, which involve and benefit the poor and help to alleviate poverty. The food-insecure who are subsistence farmers will benefit from their own increased food production for home consumption, which insures them against market risks. When subsistence-oriented farm households are given the option of adopting cash crops that offer higher returns, they tend to adopt these crops quickly, yet they also tend to maintain substantial resources in food production for home consumption as an insurance mechanism.

In terms of women's role in agricultural production, there is now a fairly large set of evidence that demonstrates that the provision of equal opportunities for women in economic activities can lead to a net increase in economic gains for all household members, and, in particular, can lead to more resources directed to children. Micro-

finance programs, in particular, seem to be well-suited to women, given that the access problems they face tend to be worse than men and given a higher propensity for repayment.

In treating iron deficiency in developing countries, Yip (1994) argues that if prevalence rates are above 25%, the best approach is to develop programs to improve the iron status of the entire population. In such situations, which for preschoolers and women in developing countries are the rule rather than the exception, this is cheaper than screening for iron-deficient individuals. By increasing the iron content of food staples through plant breeding, the entire iron status distribution curve can be shifted to the right, so that targeting a subsequently smaller group of iron-deficient persons could become feasible.

The strategy of breeding for mineral and vitamin enhancement of staple foods has several complementary advantages. No behavioral change on the part of consumers is required. Indeed the strategy seeks to take advantage of the consistent daily consumption of large amounts of food staples by all family members. Nevertheless, any intervention to improve micronutrient status targets women and children because of their elevated needs for minerals and vitamins.

Mineral-packed seeds sell themselves to farmers because, as recent research has shown, these trace minerals are essential in helping plants resist disease. More seedlings survive and initial growth is more rapid. Ultimately, yields are higher, particularly in trace mineral “deficient” soils in arid regions. Because roots extend more deeply into the soil and so can tap more subsoil moisture and nutrients, the mineral-efficient varieties are more drought resistant and so require less irrigation. And because of their more efficient uptake of existing trace minerals, these varieties require fewer chemical inputs. Thus, the new seeds can be expected to be environmentally beneficial as well. After the one-time investment is made to develop seeds that fortify themselves, there are low recurrent costs; costs for supplementation, fortification, and nutrition education remain constant year after year.

A high-yielding, disease-resistant, aromatic variety with twice the iron density of standard IRRI releases (after milling), designated IR68-144, has been identified. An intensified effort to further test this variety and adapt it to various growing environments, has the potential for reducing the incidence of iron deficiency anemia in low-income countries in Asia in the next five years.

Community-based programming for child nutrition lies at the heart of the country nutrition investment plans in Asia. In that parents provide most of the resources needed to ensure the survival and development of their children, it is most important that they have a good monitoring system to track the development of their children, in order to identify the need for immediate actions when problems emerge. At the next level, it is important that the community has a monitoring system that will enable it to identify households with problems of malnutrition.

At district and higher levels, the monitoring system should help to identify communities that are not able to successfully control child malnutrition and guide the authorities in setting priorities for resource allocations.

In this context, community-based monitoring systems may be used to detect unwanted and unintended effects of agricultural programs and policies that may be detrimental to nutrition and health. For example, establishment of tubewells for irrigation may lower the level of the water table. This, in turn, may release harmful compounds into drinking water, such as arsenic in Bangladesh, or the incursion of salt water in some coastal areas of Indonesia. Agricultural planners may be quite content with interventions that meet agricultural objectives. They need to be made aware, however, of any detrimental effects of their programs on the nutrition and health of the community.

Food income transfers are a widely used means of alleviating food insecurity. However, food prices have come under attack for their high fiscal costs and for their potential adverse effects on efficient functioning of markets. Generally, price subsidies and quantity rationing result in the highest leakage to the nonpoor. In general, therefore, such price subsidies and quantity rationing should be abandoned. Food stamps are the least distortionary of these programs in that they allow the consumer the widest choice of commodities without affecting relative prices. In general, targeted nutrition programs aimed at mothers and children and which include nutrition education and growth monitoring have been highly cost-effective.

Appendix: **Detailed Tables of Trends in Food Availability in the Eight Study Countries**Appendix Table 1: **Per Capita Calorie Availability by Calorie Source**

Country	Year	Calorie Source			Total Calories
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
Bangladesh	1961-62	1752	269	74	2093
	1963-65	1765	280	76	2119
	1966-68	1668	311	74	2054
	1969-71	1750	300	70	2119
	1972-74	1588	253	68	1908
	1975-77	1548	265	62	1876
	1978-80	1624	242	63	1928
	1981-83	1620	236	55	1910
	1984-86	1680	245	57	1982
	1987-89	1718	271	59	2049
	1990-92	1768	248	61	2078
1993-95	1711	264	65	2040	
Sri Lanka	1961-62	1230	750	99	2076
	1963-65	1315	770	112	2198
	1966-68	1388	805	113	2307
	1969-71	1334	811	102	2248
	1972-74	1415	680	93	2189
	1975-77	1499	606	88	2195
	1978-80	1380	820	108	2308
	1981-83	1414	768	107	2289
	1984-86	1391	799	111	2302
	1987-89	1380	756	118	2255
	1990-92	1333	766	120	2219
1993-95	1392	781	118	2291	
India	1961-62	1369	600	112	2081
	1963-65	1349	571	107	2026
	1966-68	1290	524	104	1919
	1969-71	1377	557	104	2038
	1972-74	1373	529	106	2008
	1975-77	1303	556	111	1970
	1978-80	1407	565	114	2086
	1981-83	1422	565	132	2120
	1984-86	1448	616	149	2214
	1987-89	1511	617	151	2279
	1990-92	1543	648	160	2351
1993-95	1535	686	168	2390	

Appendix Table 1. (cont'd).

Country	Year	Calorie Source			Total Calories
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
Pakistan	1961-62	1094	423	264	1782
	1963-65	1183	494	265	1944
	1966-68	1173	507	259	1941
	1969-71	1409	508	257	2176
	1972-74	1424	501	257	2182
	1975-77	1316	545	259	2119
	1978-80	1365	585	261	2212
	1981-83	1296	608	257	2162
	1984-86	1276	642	273	2191
	1987-89	1284	680	298	2262
	1990-92	1413	663	317	2394
	1993-95	1444	700	345	2490
Philippines	1961-62	1070	418	192	1682
	1963-65	1108	448	207	1764
	1966-68	1067	479	237	1786
	1969-71	1041	471	254	1766
	1972-74	1117	490	243	1851
	1975-77	1230	564	227	2022
	1978-80	1296	653	240	2190
	1981-83	1308	623	248	2181
	1984-86	1317	614	229	2160
	1987-89	1345	660	259	2264
	1990-92	1377	678	291	2346
	1993-95	1330	703	344	2378
Cambodia	1961-62	1662	277	46	1986
	1963-65	1673	306	67	2046
	1966-68	1612	323	76	2010
	1969-71	1689	275	85	2050
	1972-74	1737	219	86	2043
	1975-77	1239	211	61	1511
	1978-80	1383	158	40	1582
	1981-83	1566	164	67	1797
	1984-86	1495	164	93	1751
	1987-89	1588	158	111	1856
	1990-92	1602	166	123	1890
	1993-95	1571	200	129	1900

*continued next page.*

Appendix Table 1. (cont'd).

Country	Year	Calorie Source			Total Calories
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
Viet Nam	1961-62	1668	184	141	1993
	1963-65	1774	198	149	2122
	1966-68	1719	224	155	2098
	1969-71	1757	243	145	2147
	1972-74	1777	241	136	2155
	1975-77	1754	203	115	2074
	1978-80	1717	209	119	2045
	1981-83	1847	220	142	2211
	1984-86	1881	246	162	2288
	1987-89	1772	251	175	2199
	1990-92	1816	264	185	2266
	1993-95	1897	298	218	2414
PRC	1961-62	1270	272	58	1600
	1963-65	1489	273	103	1864
	1966-68	1611	250	122	1984
	1969-71	1640	229	115	1987
	1972-74	1681	229	131	2042
	1975-77	1713	229	131	2072
	1978-80	1856	267	156	2280
	1981-83	1963	320	183	2466
	1984-86	2010	368	229	2609
	1987-89	1931	408	273	2614
	1990-92	1913	421	332	2666
	1993-95	1792	469	448	2708

Source: <http://faostat.fao.org/cgi-bin/nph-db.pl?subset=nutrition>

Appendix Table 2: Per Capita Calorie Availability by Calorie Source

Year	Country	Calorie Source			Total Calories
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
1963-65	Bangladesh	1765	280	76	119
	Sri Lanka	1315	770	112	198
	India	1349	571	107	2026
	Pakistan	1183	494	265	1944
	Philippines	1108	448	207	1764
	Cambodia	1673	306	67	2046
	Viet Nam	1774	198	149	2122
	PRC	1489	273	103	1864
1993-95	Bangladesh	1711	264	65	2040
	Sri Lanka	1392	781	118	2291
	India	1535	686	168	2390
	Pakistan	1444	700	345	2490
	Philippines	1330	703	344	2378
	Cambodia	1571	200	129	1900
	Viet Nam	1897	298	218	2414
	PRC	1792	469	448	2708
Change 1993-95 minus 1963-65	Bangladesh	-54	-16	-11	-80
	Sri Lanka	76	12	5	93
	India	186	115	61	364
	Pakistan	261	206	80	546
	Philippines	223	255	136	614
	Cambodia	-102	-107	62	-146
	Viet Nam	122	100	69	292
	PRC	303	197	345	844

Source: <http://faostat.fao.org/cgi-bin/nph-db.pl?subset=nutrition>

Appendix Table 3: **Percentage Distribution of Calorie Availability**

Country	Year	Source of Total Calories (%)			Ratio of Nonstaple Plant Foods over Animal Foods
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
Bangladesh	1961-62	.84	.13	.04	3.66
	1963-65	.83	.13	.04	3.70
	1966-68	.81	.15	.04	4.23
	1969-71	.83	.14	.03	4.26
	1972-74	.83	.13	.04	3.74
	1975-77	.83	.14	.03	4.30
	1978-80	.84	.13	.03	3.84
	1981-83	.85	.12	.03	4.32
	1984-86	.85	.12	.03	4.32
	1987-89	.84	.13	.03	4.60
	1990-92	.85	.12	.03	4.08
	1993-95	.84	.13	.03	4.08
Sri Lanka	1961-62	.59	.36	.05	7.61
	1963-65	.60	.35	.05	6.85
	1966-68	.60	.35	.05	7.10
	1969-71	.59	.36	.05	7.95
	1972-74	.65	.31	.04	7.32
	1975-77	.68	.28	.04	6.88
	1978-80	.60	.36	.05	7.62
	1981-83	.62	.34	.05	7.20
	1984-86	.60	.35	.05	7.20
	1987-89	.61	.34	.05	6.39
	1990-92	.60	.34	.05	6.36
	1993-95	.61	.34	.05	6.64
India	1961-62	.66	.29	.05	5.35
	1963-65	.67	.28	.05	5.34
	1966-68	.67	.27	.05	5.06
	1969-71	.68	.27	.05	5.34
	1972-74	.68	.26	.05	5.01
	1975-77	.66	.28	.06	5.01
	1978-80	.67	.27	.05	4.97
	1981-83	.67	.27	.06	4.28
	1984-86	.65	.28	.07	4.12
	1987-89	.66	.27	.07	4.08
	1990-92	.66	.28	.07	4.04
	1993-95	.64	.29	.07	4.09

Appendix Table 3. (cont'd.)

Country	Year	Source of Total Calories (%)			Ratio of Nonstaple Plant Foods over Animal Foods
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
Pakistan	1961-62	.61	.24	.15	1.61
	1963-65	.61	.25	.14	1.86
	1966-68	.60	.26	.13	1.95
	1969-71	.65	.23	.12	1.98
	1972-74	.65	.23	.12	1.95
	1975-77	.62	.26	.12	2.11
	1978-80	.62	.26	.12	2.24
	1981-83	.60	.28	.12	2.36
	1984-86	.58	.29	.12	2.35
	1987-89	.57	.30	.13	2.28
	1990-92	.59	.28	.13	2.09
1993-95	.58	.28	.14	2.03	
Philippines	1961-62	.64	.25	.11	2.17
	1963-65	.63	.25	.12	2.16
	1966-68	.60	.27	.13	2.02
	1969-71	.59	.27	.14	1.85
	1972-74	.60	.26	.13	2.01
	1975-77	.61	.28	.11	2.48
	1978-80	.59	.30	.11	2.73
	1981-83	.60	.29	.11	2.51
	1984-86	.61	.28	.11	2.69
	1987-89	.59	.29	.11	2.54
	1990-92	.59	.29	.12	2.33
1993-95	.56	.30	.14	2.05	
Cambodia	1961-62	.84	.14	.02	6.01
	1963-65	.82	.15	.03	4.57
	1966-68	.80	.16	.04	4.23
	1969-71	.82	.13	.04	3.24
	1972-74	.85	.11	.04	2.55
	1975-77	.82	.14	.04	3.44
	1978-80	.87	.10	.03	3.93
	1981-83	.87	.09	.04	2.45
	1984-86	.85	.09	.05	1.76
	1987-89	.86	.09	.06	1.43
	1990-92	.85	.09	.07	1.35
1993-95	.83	.11	.07	1.54	

continued next page.

Appendix Table 3. (cont'd.)

Country	Year	Source of Total Calories (%)			Ratio of Nonstaple Plant Foods over Animal Foods
		Staple Foods	Nonstaple Plant Foods	Animal Foods	
Viet Nam	1961-62	.84	.09	.07	1.30
	1963-65	.84	.09	.07	1.33
	1966-68	.82	.11	.07	1.45
	1969-71	.82	.11	.07	1.67
	1972-74	.82	.11	.06	1.77
	1975-77	.85	.10	.06	1.76
	1978-80	.84	.10	.06	1.76
	1981-83	.84	.10	.06	1.55
	1984-86	.82	.11	.07	1.52
	1987-89	.81	.11	.08	1.43
	1990-92	.80	.12	.08	1.43
1993-95	.79	.12	.09	1.37	
PRC	1961-62	.79	.17	.04	4.72
	1963-65	.80	.15	.06	2.66
	1966-68	.81	.13	.06	2.06
	1969-71	.83	.12	.06	1.99
	1972-74	.82	.11	.06	1.75
	1975-77	.83	.11	.06	1.75
	1978-80	.81	.12	.07	1.71
	1981-83	.80	.13	.07	1.75
	1984-86	.77	.14	.09	1.60
	1987-89	.74	.16	.10	1.49
	1990-92	.72	.16	.12	1.27
1993-95	.66	.17	.17	1.05	

Source: <http://faostat.fao.org/cgi-bin/nph-db.pl?subset=nutrition>Appendix Table 4: Per Capita Calorie Availability with Selected Staple Foods  
(1993-1995)

Country	Rice	Wheat	Maize	Cereals	Tubers	Other Roots and Total Staple Calories
Bangladesh	1505	173	0	28	5	1711
Sri Lanka	945	363	28	46	9	1392
India	781	480	62	41	172	1535
Pakistan	174	1178	51	19	22	1444
Philippines	873	232	138	87	0	1330
Cambodia	1489	11	38	32	1	1571
Viet Nam	1632	41	83	140	0	1897
PRC	914	586	93	153	47	1792

Source: <http://faostat.fao.org/cgi-bin/nph-db.pl?subset=nutrition>

Appendix Table 5: **Per Capita Calorie Availability with Selected Nonstaple Plant Foods (1993-1995)**

Country	Plant Pulses	Oils	Sugar	Vegetables	Fruits	Spices	Other Non-staple Plant Foods	Total Non-staple Plant Calories
Bangladesh	43	110	74	8	15	11	2	264
Sri Lanka	53	402	198	23	71	27	7	781
India	126	206	240	40	46	16	12	686
Pakistan	48	300	266	18	52	10	7	700
Philippines	11	155	283	48	107	3	96	703
Cambodia	13	77	35	26	34	9	5	200
Viet Nam	23	70	86	31	70	7	11	298
PRC	14	189	59	89	36	2	81	469

Source: <http://faostat.fao.org/cgi-bin/nph-db.pl?subset=nutrition>

Appendix Table 6: **Per Capita Calorie Availability with Selected Animal and Fish Foods (1993-1995)**

Country	Fresh Water Fish	Marine Fish	Animal Flesh	Animal Fats	Milk and Dairy	Eggs	Total Animal Calories
Bangladesh	13	3	15	6	25	3	65
Sri Lanka	2	31	20	5	50	9	118
India	4	3	21	32	103	5	168
Pakistan	2	2	65	84	186	7	345
Philippines	9	69	190	32	24	20	344
Cambodia	13	4	87	12	8	5	129
Viet Nam	7	18	154	23	6	10	218
PRC	12	15	328	34	14	45	448

Source: <http://faostat.fao.org/cgi-bin/nph-db.pl?subset=nutrition>

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