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Food Security: A Global Perspective

INTRODUCTION

Although enough food is being produced today for nobody to have to go hungry, about 840 million people are chronically undernourished, around 185 million pre-school children are seriously underweight for their age, and illnesses resulting from, or exacerbated by, hunger and malnutrition are widespread (FAO, 1996a). As the world's population will also increase by an expected 80 million people every year over the next quarter-century (UN, 1996), attaining food security will be the central global challenge. Will there be enough food to meet the needs of current and future generations? And even if enough food is available, will all people have access to sufficient amounts to lead healthy and productive lives? Can, and will, global food security be attained or will food surpluses continue to coexist with widespread hunger and malnutrition, further destabilizing and polarizing the world? What will it take to ensure a world of food-secure people?

Following a brief discussion of food security concepts and an assessment of the current food security situation, this paper examines the major challenges to realizing a food-secure world, considers the prospects for global food security with special attention to whether Malthusian predictions may come true for sub-Saharan Africa and identifies key actions required to ensure global food security.

FOOD SECURITY CONCEPTS

The world would be food-secure when each and every person could be assured of access at all times to the food required for a healthy and productive life. Food security is jointly determined by availability of food and access to it. Availability does not guarantee access, but access to food is contingent on there being food available (von Braun *et al.*, 1992). National, regional or local availability of food is a function of food production, stockholding and trade. National access to food from international markets is determined by world food prices and foreign exchange availability. Household availability of food requires that food be available at local or regional markets, which is determined by market operations, infrastructure and information flows. The situation

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for households and individuals is usually conditioned by income: the poor commonly lack adequate means to secure their access to food.

Food security at one level does not guarantee food security at any other level (ibid., 1992). For example, household food security does not necessarily mean that all individuals in that household have access to the needed food; some members may be denied their full share. Intra-household inequality in distribution of food, with women in particular eating less than their share, is observed quite often. Similarly, regional or national food security does not necessarily lead to household or individual food security; the available food may not be distributed according to needs and households, or individuals may not have equitable access to it. And, of course, global food availability does not mean universal food security. There may be marked national, regional, household and individual differences in access to food.

THE CURRENT WORLD FOOD SECURITY SITUATION

Despite impressive food production growth in recent decades, which means that enough food is available to meet the basic needs of each and every person in the world, not all people are food-secure. If available food could be evenly distributed, each person would be assured of 2700 calories a day, 20 per cent more than in 1961–3 (FAO, 1997). However, available food is neither evenly distributed nor fully consumed among or within countries. In all, 42 countries were unable to assure minimum requirements of 2200 calories per person per day for their populations during 1992–4, even if available food had been evenly distributed within each one (ibid.). Of these countries, 29 were in Africa, six in Asia, three in Latin America and the Caribbean, three in Eastern Europe and the former Soviet Union, and one in the Middle East.

In the developing world as a whole, about 840 million people – 20 per cent of the population – were chronically undernourished during 1990–92, lacking economic or physical access to sufficient food to lead healthy and productive lives (FAO, 1996a). East Asia was home to 32 per cent of the world's undernourished, South Asia to 30 per cent, and sub-Saharan Africa to 26 per cent (Table 1). China and India together accounted for 45 per cent of the world's undernourished people (FAO, 1996d). Progress is being made in reducing the magnitude and prevalence of undernourished people. There were about 80 million fewer undernourished people in 1990–92, compared with 1969–71 (Table 1), while an additional 1.5 billion people were being adequately fed. The share of undernourished people in the population declined in more than 55 countries between 1969–71 and 1990–92 (FAO, 1996d), contributing to a reduction in the share of the developing world's population from 35 to 21 per cent during this period (Table 1). Most of the improvements in food security have taken place in East Asia, where there was a fall in the numbers undernourished from 475 million in 1969–71 to 268 million in 1990–92. Nevertheless, with two-thirds of the developing world being affected, South and East Asia remain key areas of food security concern. Furthermore, a new 'flash-point' or locus of hunger and food insecurity has emerged in sub-Saharan Africa, where the number of undernourished people doubled between 1969–71 and 1990–92

TABLE 1 *Chronic undernutrition in the developing world, 1969–71, 1990–92 and 2010*

Region	Number of chronically undernourished people* (millions)			Share of region's population (per cent)			Share of total undernourished population (per cent)		
	1969–71	1990–92	2010	1969–71	1990–92	2010	1969–71	1990–92	2010
East Asia	475	268	123	41	16	6	52	32	18
South Asia	238	255	200	33	22	12	26	30	29
Sub-Saharan Africa	103	215	264	38	43	30	11	26	39
Latin America and the Caribbean	53	64	40	19	15	7	6	8	6
Middle East and North Africa	48	37	53	27	12	10	5	4	8
Total	917	839	680	35	21	12	100	100	100

Note: *Chronically undernourished people are those whose estimated annual food energy intake falls below that required to maintain body weight and support light activity.

Source: FAO (1996a).

to 215 million, and the proportion of the population rose from 38 to 43 per cent.

Child malnutrition is another indicator of food insecurity. The number of malnourished children rose during the 1980s from 164 million to 184 million, although as a result of population growth their share of the pre-school children population declined slightly, from 37.8 per cent to 34.3 per cent. One-third of all pre-school children in the developing world are still underweight. About 101 million underweight children are in South Asia, 44 million in East Asia and 28 million in sub-Saharan Africa. About 60 per cent of the pre-school children in South Asia are underweight, compared to 30 per cent in sub-Saharan Africa and East Asia, respectively, and 8 per cent in Latin America and the Caribbean.

Micronutrient deficiencies are also widespread in the developing world, even where caloric consumption is adequate. Micronutrient deficiencies have detrimental effects on human health and productivity. About 2 million people are affected by iron deficiency, around 1.6 billion people are at risk of iodine deficiency and 40 million children suffer from Vitamin A deficiency (FAO, 1996b).

In addition to those who are already food-insecure and show symptoms or consequences of food insecurity, there are many others worldwide who live with the risk of being affected: their incomes are so low that any sudden shock, such as loss of employment or price fluctuations, could tip them into food insecurity. These vulnerable people must also be taken into account when considering the world food security situation.

Earlier, it was noted that food security is jointly determined by availability of food and access to it. With regard to availability of food, production growth in recent decades has been impressive. Between 1961–3 and 1994–6, output increased by 119 per cent worldwide, while it rose 200 per cent in developing countries as a group, with particularly large increases in the developing countries of Asia. Even in those of Africa, where the problems of food security are greatest, production increased by 120 per cent during the period. Between 1961–3 and 1994–6, cereal production worldwide more than doubled to 1.97 billion tons and almost tripled in developing countries to 1.14 billion tons; meat production almost tripled worldwide to 208 million tons and quintupled in developing countries to 107 million tons; and production of roots and tubers doubled in developing countries, increasing to 436 million tons.

Worldwide, food production more than kept pace with population growth; per capita supply increased by 40 per cent between 1961–3 and 1994–6. In the developing countries, as a group, the increase was marginally higher, at 47 per cent. However, performance varied widely among developing countries; while per capita food production increased by 67 per cent in the developing countries of Asia, less was produced per person in the developing countries of Africa in the mid-1990s than in the early 1960s. Between 1961–3 and 1994–6, cereal production per person worldwide increased by 20 per cent, to 350 kilograms, while it increased by 28 per cent, to 252 kilograms, in the developing world; and meat production per person worldwide increased by 55 per cent to 37 kilograms, with figures of 242 per cent and 24 kilograms in the developing world (FAO, 1997).

There are indications that growth in food production has begun to lag in recent years. The annual rate for global cereal production dropped from 2.6 per cent during 1967–82 to 1.3 per cent during 1982–94, while cereal yields slowed from 2.3 per cent to 1.5 per cent between these two periods (Rosegrant *et al.*, 1997). After steadily increasing during the 1960s and 1970s, world grain production per person has fallen by about 1 per cent annually over the past decade (Brown *et al.* 1995). Yields of rice and wheat have been constant over the past few years in Asia, which is a significant producer (Pinstrup-Andersen, 1994). It is becoming increasingly difficult to maintain the yield gains already achieved, let alone to increase yields, in the high-potential or more-favoured areas, while in the less-favoured areas, which are home to many of the world's food-insecure people, yields are low and variable (Hazell, 1995).

Gains in availability of food have not been matched by corresponding gains in access to it. There were significant reductions in poverty during the 1960s and 1970s, particularly in East Asia, but the record was somewhat mixed during the 1980s and early 1990s, with reductions in the number of poor people in East Asia mitigated by increases in sub-Saharan Africa, South Asia and Latin America (World Bank, 1990; 1996b; FAO, 1987). The number of absolutely poor people – those with incomes of a dollar a day or less to meet food, shelter and other basic needs – increased between 1987 and 1993 from 1.23 billion to 1.30 billion, 29 per cent of the developing world's population (Table 2).

TABLE 2 *Poverty in the developing world, 1987 and 1993*

Region	Number of poor people* (millions)		Share of region's population (per cent)		Share of total poor population (per cent)	
	1987	1993	1987	1993	1987	1993
East Asia	464	446	29	26	38	34
South Asia	480	515	45	43	39	40
Sub-Saharan Africa	180	219	39	39	15	17
Latin America and the Caribbean	91	110	22	24	7	8
Middle East and North Africa	10	11	5	4	1	1
Total	1 225	1 301	30	29	100	100

Note: *People living on $1 a day or less.

Source: World Bank (1996b).

CHALLENGES TO A FOOD-SECURE WORLD

Among the major driving forces influencing, or challenging, access to sufficient food are income levels and economic growth, human resource development, and population growth and movements. Investment in agricultural growth and development, timely and reasonably priced access to agricultural inputs, the condition of the natural resource base, existence of competitive markets and functioning infrastructure, and domestic resource mobilization and external assistance are among the key forces influencing or challenging availability of food (IFPRI, 1995).

Income levels and economic growth

As noted earlier, about 1.3 billion people in the developing world are absolutely poor, while another 2 billion are only marginally better off. Income levels vary considerably among developing regions, ranging from $320 per person on average in South Asia to $460 in sub-Saharan Africa, $860 in East Asia and $3340 in Latin America and the Caribbean (World Bank, 1996c). Similarly, income growth rates also vary considerably. While East Asia and the Pacific had an average growth in per capita GNP of 6.9 per cent during the most recent decade for which information is available (1985–94), sub-Saharan Africa and the Middle East and North Africa struggled with negative growth rates of –1.2 and –0.4 per cent, respectively. Growth rates have picked up very recently in sub-Saharan Africa (Sarbib, 1997; UN, 1997).

Prospects for improvements over the next 10 years appear favourable, with all regions projected to have positive and higher rates of economic growth (World Bank, 1996a). However, unless significant and fundamental changes occur in many developing countries, disparities in income levels and growth are likely to persist. Without concerted action, poverty is likely to remain entrenched in South Asia and Latin America and to increase considerably in sub-Saharan Africa. Only in East Asia is absolute poverty expected to decline substantially. Most of the world's poor are in rural communities and, even when they are not engaged in their own agricultural activities, they rely on non-farm employment and income that depend in some way or the other on agriculture (Pinstrup-Andersen and Pandya-Lorch, 1995). Agricultural growth and development must be vigorously pursued in low-income developing countries, not simply to produce more food but also to generate employment and incomes for poor people within and outside agriculture.

Human resource development

Poor people have low productivity and lack secure access to productive resources and remunerative employment. Investments in health care, education, clean water, sanitation and housing, which are essential for human resource development, are far below required levels, especially in rural areas of low-income developing countries. About 790 million people in the developing

world lack access to health services, 1.28 billion people to safe water and 2.53 billion people to sanitation services, while 850 million adults are illiterate. Public expenditures on health and education amount to 2 and 4 per cent, respectively, of the gross national product (GNP) of developing countries as a group. Underinvestment in the health and education of females is particularly severe. Poor nutrition and health in early childhood affect cognitive development, with consequent losses in productivity during adulthood. Poor, hungry, ill and uneducated people are handicapped in ensuring food security for themselves and others.

Population growth

During the next quarter-century, almost 80 million people are likely to be added to the world's population each year, increasing world population by 35 per cent to 7.67 billion in 2020 (UN, 1996). Most of this change (98 per cent) is expected to occur in developing countries, whose share of global population is projected to increase from 79 per cent in 1995 to 84 per cent in 2020. Over this period, the absolute population increase will be highest in Asia, at 1.15 billion, but the relative increase will be greatest in sub-Saharan Africa, where the population is expected to almost double from 0.59 billion to 1.12 billion.

Most of the population increase in developing countries during the next 25 years is expected in the cities. Rapid urbanization could double the developing world's urban population to 3.6 billion by 2020, by which time urban dwellers could outnumber rural dwellers (UN, 1995). Urbanization is associated with more diverse diets: increasing opportunity costs of women's time, changes in food preferences caused by changing lifestyles and changes in relative prices associated with rural–urban migration lead to shifts from basic staples such as sorghum and millet to cereals such as rice and wheat (which require less preparation), livestock products, fruits and vegetables, and processed foods. Changes in dietary patterns, particularly rapid increases in demand for livestock products, place strong pressures on the demand for cereals for feedgrain purposes. Rapidly growing urban populations also place severe pressures on food marketing systems, including transport, storage, processing and market information.

From its peak of 2.0 per cent in the late 1960s, the global annual population growth rate is expected to halve to 1.0 per cent by 2015–20 (UN, 1996). However, sub-Saharan Africa's projected annual population growth rate of 2.33 per cent will be more than double that in the other regions. Change of this magnitude will severely constrain efforts to increase income and improve welfare, while at the same time it will greatly increase the need for food. Should fertility rates not decline as expected in the next 25 years, and the annual population growth rate reach the United Nations high-variant projection of 1.3 per cent by 2015–20, there could be as many as 400 million more people by 2020 (UN, 1996).

Investments in agricultural growth and development

In most low-income developing countries, agricultural growth is a catalyst for broad-based economic growth and development (Pinstrup-Andersen and Pandya-Lorch, 1995). About 60 per cent of the developing world's labour force is engaged in agricultural activities (World Bank, 1996c). Moreover, agriculture's linkages to the non-farm economy generate considerable employment, income and growth in the rest of the economy. Very few countries have experienced rapid economic growth without agricultural growth either preceding or accompanying it. Economic growth is strongly linked to poverty reduction. While diversification out of agriculture will occur in the long term, in the short term many countries lack alternatives. Thus agricultural growth and development must be vigorously pursued in developing countries for at least four reasons: (1) to meet food needs driven primarily by population and income growth, (2) to alleviate poverty through employment creation and income generation, (3) to stimulate overall economic growth, and (4) to conserve natural resources since poverty forces many people to often overuse or misuse the natural resource base to meet their basic needs.

It is a matter for concern, then, that not only has the average annual growth rate for agriculture in low- and middle-income developing countries slowed down in the first half of the 1990s, to 2.0 per cent, compared to 3.1 per cent in the 1980s, but that in sub-Saharan Africa, a growing locus of food insecurity, the growth rate is low and falling, declining from 1.9 per cent in 1980–90 to 1.5 per cent in 1990–95. National investments in agriculture have declined in recent years, mainly because of structural adjustment (FAO, 1996c). In many countries, agriculture has been taxed implicitly and explicitly. As Figure 1 shows, international assistance to developing-country agriculture has also declined in recent years in real terms, driven primarily by reductions in bilateral assistance.

Agricultural research and technological improvements are crucial to increase agricultural productivity and returns to farmers and farm labour, thereby reducing poverty and meeting future food needs at reasonable prices without irreversible degradation of the natural resource base (Pinstrup-Andersen and Pandya-Lorch, 1995). Accelerated investment in agricultural research is particularly urgent for low-income developing countries, partly because they will not achieve reasonable economic growth and poverty alleviation without productivity increases in agriculture, and partly because appropriate technology is urgently needed. Low-income developing countries are grossly underinvesting in agricultural research compared to industrialized countries, even though agriculture accounts for a much larger share of their employment and incomes. Their public-sector expenditures on agricultural research are typically less than 0.5 per cent of agricultural gross domestic product, compared with about 1 per cent in higher-income developing countries and 2–5 per cent in industrialized countries (Pardey *et al.*, 1991; Pardey *et al.*, 1995). Growth has slowed considerably since the late 1980s, and research investments have begun to decline in real terms in many developing countries (Pardey and Alston, 1995). Low and declining levels of resources available per researcher are crippling agricultural research in many developing countries. In sub-Saharan Africa, which desper-

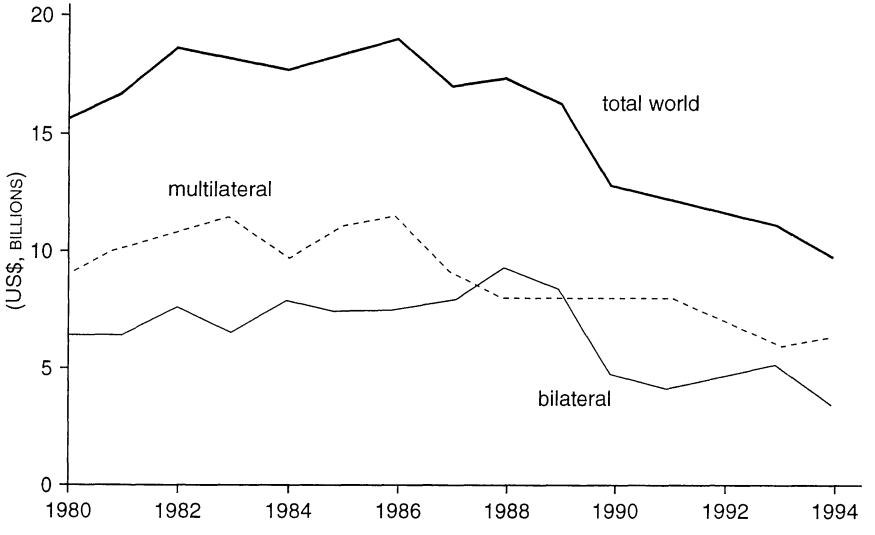

FIGURE 1 *External assistance to agriculture, 1980–94 (at 1990 constant prices)*

Source: FAO (1996c).

ately needs productivity increases in agriculture, real spending per researcher has fallen by 2.6 per cent per year sine 1961 (Pardey *et al.*, 1995). Similar trends are observed in Latin America (Echeverria *et al.*, 1996). Further reductions in public investment in agricultural research will have severe consequences for global food production by reducing yield growth. This, in turn, will result in increasing pressures to draw into agricultural production land that is less well-suited for agriculture, much of which is currently under forest. Failure to maintain high rates of yield growth will cause severe environmental degradation.

Very little investment in agricultural biotechnology is taking place in, or for, developing countries, although it is one of the most promising developments in modern science. It has considerable potential to raise productivity, increase resistance to pests and diseases, develop tolerance to adverse weather conditions, improve the nutritional value of some foods and enhance the durability of products during harvesting or shipping (Pinstrup-Andersen and Pandya-Lorch, 1996b). Most biotechnology research is occurring in private firms in industrialized countries and is geared towards the needs of farmers and consumers in those countries. It is essential that research, relevant to the needs of

smallholder farmers in developing countries and to the conditions in those countries, is undertaken, and that the benefits are transmitted to farmers and consumers at affordable prices. Otherwise, farmers in developing countries will not only fail to share in the benefits of agricultural biotechnology, but will be seriously hurt as synthetic alternatives to their products are developed in the laboratories of industrialized countries. That is already happening with cocoa and vanilla.

Natural resources and agricultural inputs

Natural resources and agricultural inputs are critical determinants of food supply. Degradation of natural resources, such as soils, forests, marine fisheries and water, undermines production capacity, while availability of and access to agricultural inputs, such as water, fertilizer, pest control measures, research and technology, determine productivity and therefore production.

Since 1945, about 2 billion of the world's 8.7 billion hectares of agricultural land, permanent pastures and forests and woodlands have been degraded (Oldeman, 1992). Much of the degradation is taking place on agricultural lands: soil degradation has affected 74 per cent of agricultural lands in Central America, 65 per cent in Africa, 45 per cent in South America and 38 per cent in Asia. Overgrazing, deforestation and inappropriate agricultural practices account for most of the degradation. To a large extent, these result from or are exacerbated by inadequate property rights, poverty, population pressure, inappropriate government policies, lack of access to markets and credit, and inappropriate technology. Crop productivity losses from degradation are significant and widespread. In the absence of efforts to protect non-degraded soils and to restore currently degraded soils, increasing population and persisting poverty will hasten soil degradation.

Availability of water to support current and future food production is emerging as a serious challenge (Rosegrant, 1997). Although enough fresh water is available worldwide to meet needs for the foreseeable future, water is poorly distributed across countries, across regions within countries, and across seasons. There is growing competition for water between countries and between sectors within a country. New sources of water are increasingly expensive to exploit because of high construction costs for dams and reservoirs and concerns about environmental effects and displacement of people. Efficiency of water use is generally low because of inappropriate incentives.

Securing timely, reasonably priced access to modern inputs such as fertilizer in order to engage in sustainable food production is a key challenge across the developing world. In many of the developing countries, especially those of sub-Saharan Africa, fertilizer applications on smallholder farms tend to be insufficient, untimely and unbalanced, primarily because of high fertilizer prices, insecure supplies, inadequate agricultural extension systems, insufficient access to credit and greater risks associated with agricultural production in marginal environments (Pinstrup-Andersen and Pandya-Lorch, 1997). While negative environmental consequences of fertilizer use and production must be avoided, in most developing countries the problem is not excessive, but insuffi-

cient, fertilizer use. In sub-Saharan Africa, for instance, fertilizer use amounts to 10 kilograms per hectare (Bumb and Baanante, 1996). Depletion of soil nutrients is a critical constraint on food production in the region and a serious cause of soil degradation.

Crop production losses from pests are significant; reduction of these losses would contribute notably to improving food supplies. However, past practices of pesticide use cannot be sustained. Concerns are multiplying that pesticides compromise human health, contaminate soils and water and damage ecosystems, exterminate species, and lead to pesticide resistance, pest resurgence and evolution of secondary pests. Moreover, overuse of pesticides leads to decreased food production. Environmentally sound alternatives must be developed and adopted.

Markets and infrastructure

In addition to production and environmental issues, there are infrastructural and marketing challenges to ensuring a food-secure world. In many regions, especially sub-Saharan Africa, food marketing costs are extremely high (Ahmed and Rustagi, 1987). Lowering these costs through investment in improved transport and storage infrastructure and marketing facilities (which may also facilitate increased competition) may be as important in lowering food prices to consumers as increasing agricultural productivity. Many countries have made considerable improvements in recent years, but investments in infrastructure, especially transport and communications, are far below needed levels. Road, rail, port and storage facilities are inadequate, while telecommunications, electricity, piped water and sanitation systems reach only certain segments of the population. Past investments have tended to favour urban areas. Investments in creating and maintaining basic infrastructure lag far behind in African countries relative to Asian and Latin American countries.

The efficient functioning of markets, especially agricultural input and output markets, supported by governments that have the capacity to perform their role, is of critical importance. In recent years, many governments have embarked upon market reforms to move away from state-controlled or parastatal organizations towards reliance on private firms operating in free markets. While clearly desirable, such reforms must be undertaken with care, taking into account the organizational structure of the affected markets. In many cases, inefficient parastatals are being replaced by oligopolistic or monopolistic private firms, with little or no improvement in performance. The current and unprecedented transition from controlled to market economies has generated confusion about the appropriate role of government and weakened the capacity of governments to perform needed functions.

Domestic resource mobilization and international assistance

Without increased mobilization of domestic resources, developing countries will not be able to accelerate investment in economic growth and human

resources. Many low-income countries are trapped in a vicious circle whereby low income leads to low savings, low investment, low growth, continued poverty and low savings. In sub-Saharan Africa, the share of GDP devoted to investment has fallen since 1980 from 23 to 17 per cent, while the domestic saving rate has fallen from 27 to 16 per cent (World Bank, 1996c). These levels are not high enough to have much effect in raising economic growth rates.

International assistance has an important role to play in supporting developing countries as they implement the actions required to ensure food security. Private flows to developing countries have increased substantially since the late 1980s (OECD, 1997). Most of these flows, however, go to a small number of medium-income, semi-industrial countries in Latin America and Asia. Poorer countries, especially in sub-Saharan Africa, are left out and depend much more on aid flows. However, official development assistance (ODA) to developing countries is slowing. At 1994 prices and exchange rates, bilateral and multilateral ODA from OECD countries has dropped, from $62.1 billion in 1992 to $53.6 billion in 1995 (OECD, 1997). Given observed trends in external assistance, developing countries are challenged to devise strategies to ensure food security with less aid.

In sum, there are several interconnected challenges to realizing a food-secure world: (1) widespread poverty and inadequate human resource development, which inhibit people's capacity to grow and/or purchase the needed food; (2) large increases in developing country populations, especially in urban areas, which will substantially increase food needs; (3) gross underinvestment in agricultural growth and development, particularly agricultural research, in developing countries; (4) inadequacies in availability of and access to agricultural inputs, such as water, fertilizer and pesticides, which leads to lagging yield increases, in more favoured areas and low and variable yields in less favoured areas; (5) degradation of natural resources, such as soils, forests and water, which undermines production capacity and productivity; (6) inefficient functioning of markets and inadequate infrastructure as well as weakened capacity of developing-country governments to perform their appropriate functions; and (7) insufficient domestic resource mobilization – savings and investment – and declining international assistance, which restrains economic growth and development.

PROSPECTS FOR GLOBAL FOOD SECURITY

Views differ about the prospects for future world food security (Brown, 1996; FAO, 1996a; IFPRI, 1995; Ingco *et al.*, 1996; Islam, 1995; Penning de Vries *et al.*, 1995; Rosegrant *et al.*, 1995; 1997). Some are complacent that future food needs will be met through technological advances that do not require any special effort, that the dangers of natural resource loss have been exaggerated and that global food surpluses are a sufficient guarantee of global food security, even for low-income countries and people. Others are cautiously optimistic that investment in agricultural development holds promise for ensuring global food security, not only by increasing food production but also by stimulating overall economic growth and raising incomes and employment, thereby en-

hancing economic access to food. And there are some who are convinced that the limits of food production are being reached, that new technologies will not be able to raise agricultural productivity and production sufficiently to keep up with growing food needs, and that natural resources are being degraded and lost at alarming rates.

Food insecurity is likely to continue to diminish rapidly in East Asia, but, without new and concerted action, it could persist in South Asia and, to a lesser extent, in Latin America, while it could accelerate substantially in sub-Saharan Africa and in the Near East and North Africa. FAO projections suggest that the number of chronically undernourished people could decline by 23 per cent between 1990–92 and 2010 to 680 million people, 12 per cent of the developing world's population (Table 1). By then, sub-Saharan Africans and South Asians could make up 70 per cent of the world's undernourished people, up from 56 per cent in 1990–92. In fact, sub-Saharan Africa's share of the world's undernourished population is projected to almost quadruple between 1969–71 and 2010, from 11 to 39 per cent. By 2010, every third sub-Saharan African is likely to be undernourished compared with every eighth person in South Asia and every twentieth person in East Asia.

Projections to the year 2020 suggest that, in the most likely or baseline scenario, the number of malnourished children could decrease to 155 million or 25 per cent of the population of pre-school children (Table 3). Large

TABLE 3 *Child malnutrition in developing countries, 1990 and 2020*

Region	Number of malnourished children (millions)			
	1990	2020		
		Baseline[1]	Low inv./ slow growth[2]	High inv./rapid growth[3]
Asia	137.62	97.64	128.12	70.27
Sub-Saharan Africa	28.61	42.67	52.75	33.61
Latin America and the Caribbean	11.71	8.12	13.23	3.12
West Africa and North Africa	6.76	6.30	11.05	1.87
Developing countries	184.33	154.73	205.14	108.88

Notes: [1]The baseline scenario incorporates the best assessment of future trends in population, income growth, urbanization, rate of increase in food production due to technological change and productivity growth, commodity prices and response of supply and demand to prices.
[2]The low investment/slow growth scenario simulates the combined effect of a 25 per cent reduction in the rate of non-agricultural income growth and reduced investment in agricultural research and social services.
[3]The high investment/rapid growth scenario simulates the combined effect of a 25 per cent increase in the rate of non-agricultural income growth and higher investment in agricultural research and social services.

Source: Rosegrant, Agcaoili-Sombilla and Perez (1995).

decreases in the number of malnourished children are expected in South and East Asia, but in sub-Saharan Africa their number could increase by 50 per cent, to reach 43 million. In South Asia, malnutrition rates are so high that, even with a projected reduction of 20 million in the number of malnourished children by 2020, two out of five pre-school children would remain malnourished. Simulations suggest that, under a scenario of more rapid income growth and higher investment in public goods such as education and health and in agricultural research, the number of malnourished children could decline by 40 per cent between 1990 and 2020, to 109 million children. However, reduced public investments in agricultural research and social services and slower income growth could lead to an increase in the number of malnourished children to 205 million in 2020. There are 'hot spots' of child malnutrition; South Asia is home to half of the developing world's malnourished children, and in sub-Saharan Africa, even under an optimistic scenario of more rapid income growth and investments in public goods such as education and health, the number of malnourished children is projected to increase between 1990 and 2020.

Meeting the increasing and changing food needs resulting from population growth, rising incomes and changing lifestyles will be a fundamental challenge. Global effective market demand for cereals is projected to increase by 40 per cent between 1993 and 2020, to 2.49 billion tons, for livestock products by 63 per cent to 306 million tons, and for roots and tubers by 40 per cent to 856 million tons (Table 4). These increases are large and will put tremendous pressures on agricultural production and marketing systems, particularly in developing countries, which are projected to increase their demand for cereals by 58 per cent, for meat by 118 per cent and for roots and tubers by 56 per cent. The changes in food demand vary considerably amongst developing-country regions, with the largest percentage increase in demand for cereals, and for roots and tubers, forecast for sub-Saharan Africa, with Asia leading for meat.

Per capita demand for cereals in developing countries as a group is projected to increase by 6.5 per cent to 255 kilograms, for meat by 47 per cent to 31 kilograms, and for roots and tubers by 5.4 per cent to 98 kilograms (Table 4). Because of more rapid population and income growth, market demand for food is projected to grow much faster in developing countries than in developed countries. Nevertheless, a developing-country resident is projected to demand only 40 per cent of the cereals and 38 per cent of the meat that a resident in a developed country is likely to demand by 2020, although developing countries will account for more than 80 per cent of the world's population.

To meet growing food needs, world cereal production is expected to grow on average by 1.3 per cent per year between 1993 and 2020, meat production by 1.8 per cent and production of roots and tubers by 1.3 per cent (Rosegrant *et al.*, 1997). Production growth rates are expected to be substantially higher in developing countries than in developed countries. Cereal production is projected to grow at an average annual rate of 1.5 per cent (compared to 1.0 per cent in developed countries), meat production at 2.7 per cent (compared to 0.8 per cent in developed countries), and production of roots and tubers at 1.7 per cent (compared to 0.4 per cent in developed countries) (ibid.).

Developing countries as a group are projected to increase their net imports of cereals (the difference between production and demand) from about 94

TABLE 4 *Total and per capita demand for cereals, meat, and roots and tubers, 1993 and 2020*

	Total demand (million tons)			Per capita demand (kilograms)		
	1993	2020	1993–2020 (per cent)	1993	2020	1993–2020 (per cent)
Cereals						
Developing countries	1 022.0	1 613.5	+58	239.1	254.5	+6.5
Asia	695.0	1 042.8	+50	237.7	261.9	+10.2
Sub-Saharan Africa	70.4	154.9	+120	137.1	147.9	+7.9
Latin America	128.8	199.1	+55	278.9	302.0	+8.3
West Africa and North Africa	127.1	215.4	+70	344.3	631.6	–2.1
Developed countries	751.0	877.2	+17	587.8	631.6	+7.5
World	1 773.0	2 490.7	+40	319.3	322.4	+9.7
Meat						
Developing countries	88.9	193.5	+118	20.82	30.56	+46.8
Asia	55.7	125.9	+128	19.07	32.54	+70.6
Sub-Saharan Africa	4.5	6.9	+53	8.84	10.65	+20.5
Latin America	21.2	37.6	+77	45.92	57.09	+24.3
West Africa and North Africa	7.3	14.8	+103	19.71	23.16	+17.5
Developed countries	99.3	112.4	+13	77.72	80.98	+4.2
World	188.2	305.9	+63	33.90	39.62	+16.9
Roots and tubers						
Developing countries	396.9	620.7	+56	92.9	97.9	+5.4
Asia	181.8	249.7	+37	71.1	71.7	+0.8
Sub-Saharan Africa	126.1	243.2	+93	245.4	232.1	–5.5
Latin America	45.9	65.0	+42	99.5	98.6	–0.9
West Africa and North Africa	14.1	22.0	+56	38.3	34.5	–9.9
Developed countries	213.9	234.8	+10	167.4	169.1	+1.0
World	610.8	855.5	+40	110.0	110.7	+0.6

Source: Rosegrant, Sombilla, Gerpacio, and Ringler (1997).

million tons in 1993 to 228 million tons in 2020 (ibid.). Maize is expected to constitute 27 per cent of net cereal imports in 2020 (compared to 19 per cent in 1993), wheat is expected to constitute 61 per cent (69 per cent in 1993), and rice is expected to constitute 0.2 per cent (0.22 per cent in 1993) (ibid.). All developing regions are projected to increase their net cereal imports between 1993 and 2020 – Asia by 425 per cent, primarily because of rapid income growth, and sub-Saharan Africa by 250 per cent, primarily because of continued poor performance in food production. During the same period, developing countries are projected to increase their net meat imports almost 20-fold. Rapid income growth is the primary driving force underlying the massive increases in demand for meat, especially in Asia. Net imports are a reflection of the gap between production and demand. The gap between production and need is likely to be even wider as many of the poor are priced out of the market, even at low food prices, and are unable to exercise their demand for necessary food. The better-off developing countries, notably those of Southeast Asia, will be able to fill the gap between production and demand through commercial imports, but the poorer countries will lack sufficient foreign exchange to import food in the necessary quantities. It is the latter group of countries, including most of those in sub-Saharan Africa and South Asia, that will remain a challenge and require special assistance to avert widespread hunger and malnutrition.

Where are world food prices headed? As expected, the recent rises in prices for wheat and maize were short-term blips, driven primarily by poor weather in North America, government set-aside programmes and reduced price subsidies in Western Europe and North America, declining food production in the former Soviet Union and large increases in food demand in China (Pinstrup-Andersen and Garrett, 1996). On average, world cereal prices are expected to decline by about 11 per cent between 1993 and 2020, meat prices by about 6 per cent, and prices for roots and tubers by 4 per cent (Rosegrant *et al.*, 1997). According to Rosegrant *et al.* (ibid.), 'these price declines are minuscule compared to the rate of decline in prices over the last several decades'.

SHADOWS OF MALTHUS

The writings of Malthus (1798) have been referred to frequently to argue that the world is headed towards global food shortages. Malthus' basic argument was that the world's natural resources would not be able to ensure expansions in food supply that would match population growth. As Figure 2 shows, there are no indications that Malthusian predictions will come true for Asia, where food production has increased at a rate much higher than the rate of population growth. The situation is quite different in sub-Saharan Africa where, as Figure 3 shows, the population growth rate has exceeded that for food production since the early 1970s. The gap is widening, resulting in declining food production per capita. Simple projections of the trends in population and food production growth since 1961 show a further increase in the gap between the two, which is exactly the type of thing predicted by Malthus. While he argued that the population would grow geometrically and food production would grow

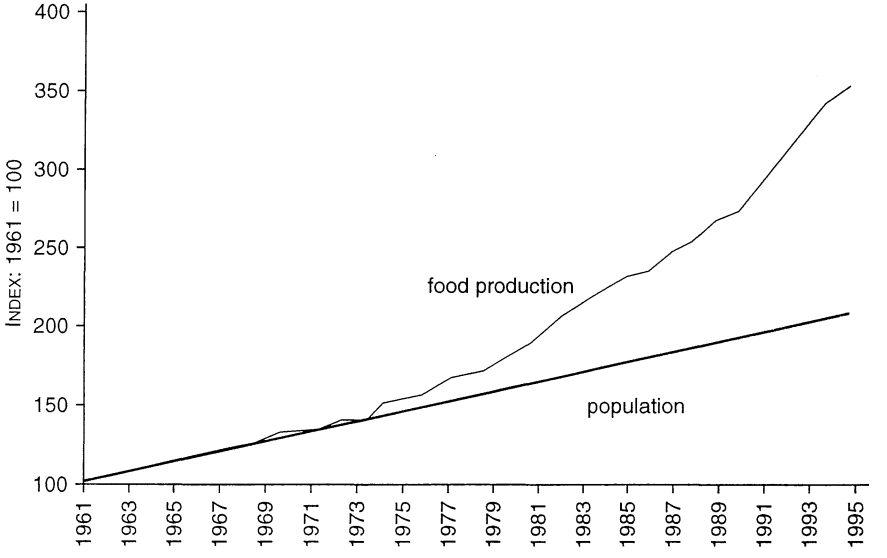

FIGURE 2 *Population and food production indices for developing countries in Asia, 1961–96*

Source: FAO (1997).

arithmetically, the projections shown in Figure 2 are both based on a regression equation with a square term. Such a function showed a better fit than linear functions for either of the two variables.

Malthus' predictions, made so long ago, grossly underestimated the potential of productivity-increasing technology. Where that has been effectively developed and utilized, as is the case in most of Asia, food production has expanded much faster than population. In sub-Saharan Africa, technological potential has yet to be realized. Maize yields for Africa, Asia and China were virtually the same in 1961, but since then they have tripled in Asia and quintupled in China, while they have remained at around 1 ton per hectare in Africa (FAO, 1997).

Does this mean that Malthus will eventually be proved correct in the developing countries of Africa? The answer lies in the extent of action taken to develop and ensure the use of appropriate technologies to expand the productivity of African soils and African farmers. There are encouraging signs that productivity-increasing technology is beginning to accelerate yield growth. For example, the introduction of improved maize varieties has resulted in productivity increases in West and Central Africa at rates as high as 4 per cent per year during the period

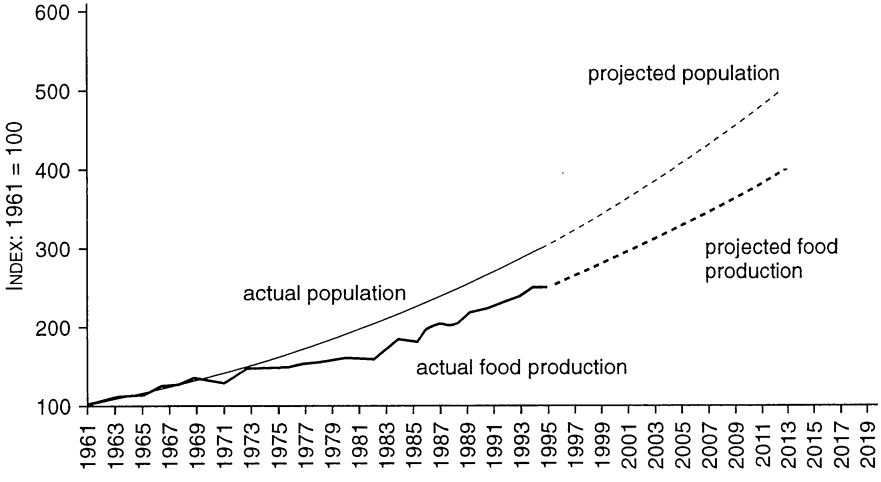

FIGURE 3 *Actual and projected population and food production indices for sub-Saharan Africa, 1961–2020*

Source: FAO (1997) and author's calculations

1983–92 (CGIAR, 1997). Some countries have experienced particularly high rates of growth in maize production during this period, including Burkina Faso (17.1 per cent), Ghana (8.3 per cent) and Mali (7.5 per cent). If Malthus is to be proved wrong, not only globally but also in Africa, a much greater effort must be made to ensure that farmers have access to appropriate production technology and that policies are conducive to expanded productivity in staple food crops. A continuation of the trends of the past 25 years will confirm Malthus' predictions. Therefore new initiatives and expanded support for agricultural development, including the development of appropriate technology and the implementation of appropriate policies, must be pursued.

REQUIRED ACTION

The action required to ensure a food-secure world is known. Much thought and effort has been expended to identify priority action at the individual, household, community, national, regional and global levels. Most recently, at the World Food Summit convened by the Food and Agriculture Organization of

the United Nations (FAO) in November 1996, leaders from around the world signed the Rome Declaration on World Food Security, reaffirming 'the right of every person to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger' (FAO, 1996e). They pledged their 'political will and [their] common and national commitment to achieving food security for all and to an ongoing effort to eradicate hunger in all countries, with an immediate view to reducing the number of undernourished people to half their present level no later than 2015'. To this end, they made seven commitments.

(1) To ensure an enabling political, social and economic environment designed to create the best conditions for the eradication of poverty and for durable peace, based on full and equal participation of women and men, which is most conducive to achieving sustainable food security for all.
(2) To implement policies aimed at eradicating poverty and inequality and improving physical and economic access by all, at all times, to sufficient, nutritionally adequate and safe food and its effective utilization.
(3) To pursue participatory and sustainable food, agriculture, fisheries, forestry and rural development policies and practices in high- and low-potential areas, which are essential to adequate and reliable food supplies at the household, national, regional and global levels, and combat pests, drought and desertification, considering the multifunctional character of agriculture.
(4) To strive to ensure that food, agricultural trade and overall trade policies are conducive to fostering food security for all through a fair and market-oriented world trade system.
(5) To endeavour to prevent and be prepared for natural disasters and man-made emergencies and to meet transitory and emergency food requirements in ways that encourage recovery, rehabilitation, development and a capacity to satisfy future needs.
(6) To promote optimal allocation and use of public and private investments to foster human resources, sustainable food, agriculture, fisheries and forestry systems, and rural development in high- and low-potential areas.
(7) To implement, monitor and follow up this plan of action at all levels in cooperation with the international community (ibid.).

A detailed plan of action seeks to achieve the goals included in these seven commitments.

The International Food Policy Research Institute (IFPRI), in its initiative, *A 2020 Vision for Food, Agriculture and the Environment*, has developed the vision of 'a world where every person has access to sufficient food to sustain a healthy and productive life, where malnutrition is absent and where food originates from efficient, effective and low-cost food systems that are compatible with sustainable use of natural resources' (IFPRI, 1995). Sustained action is required in six priority areas to realize the 2020 vision.

(1) Strengthen the capacity of developing-country governments to perform appropriate functions.

(2) Enhance the productivity, health and nutrition of low-income people and increase their access to employment and productive assets.
(3) Strengthen agricultural research and extension systems in and for developing countries.
(4) Promote sustainable agricultural intensification and sound management of natural resources, with increased emphasis on areas with agricultural potential, fragile soils, limited rainfall and widespread poverty.
(5) Develop efficient, effective and low-cost agricultural input and output markets.
(6) Expand international cooperation and assistance and improve its efficiency and effectiveness.

The first priority area of action is selectively to strengthen the capacity of developing-country governments to perform appropriate functions, such as maintaining law and order, establishing and enforcing property rights, promoting and ensuring private-sector competition in markets and maintaining appropriate macroeconomic environments. Predictability, transparency and continuity in policy making and enforcement must be assured. The efforts of the past decade to weaken developing-country governments must be turned around. More effective local and national governments are essential for other partners, such as individuals, households, communities, non-governmental organizations (NGOs) and the private sector to contribute to food security. Governments must also be helped to relinquish those functions that are better performed by others such as NGOs. Governments should facilitate food security for all households and individuals, not by physically delivering needed foods to all citizens but by facilitating a social and economic environment that provides all citizens with the opportunity to ensure their food security.

The second priority area is to invest more in poor people in order to enhance their productivity, health and nutrition, and to increase their access to remunerative employment and productive assets. Governments, local communities and NGOs should ensure access to and support for a complete primary education for all children, with immediate emphasis on enhancing access by female and rural children; ensure access to primary health care, including reproductive health services, for all people; improve access to clean water and sanitation services; provide training for skill development in adults; and strengthen and enforce legislation and provide incentives for empowerment of women to gain gender equality. Improved access by the rural poor, especially women, to productive resources can be facilitated through land reform and sound property rights legislation, strengthened credit and savings institutions, more effective rural labour markets and infrastructure for small-scale enterprises. Social safety nets for the rural poor are urgently needed. Direct transfer programmes, covering poverty relief, food security and nutrition intervention, are needed in many countries at least in the short term and must be better focused on the poor. Efforts must be made to lower fertility rates and slow population increases. Strategies to reduce population growth rates include providing full access to reproductive health services to meet unmet demand for contraception; eliminating risk factors that promote high fertility, such as high rates of infant mortality or lack of security for women who are dependent on their children

for support because they lack access to income, credit or assets; and providing young women with education. Female education is among the most important investments for ensuring food security.

The third area for action is to accelerate agricultural productivity by strengthening agricultural research and extension systems in and for developing countries. Agriculture is the life-blood of the economy in most developing countries; it provides up to three-quarters of all employment and half of all incomes. There are very strong links between agricultural productivity increases and broad-based economic growth in the rest of the economy; research from Africa and Asia shows that, for each dollar generated in agriculture, one to one-and-a-half dollars are generated in other areas of the economy (Hazell and Röell, 1983; Delgado *et al.*, 1995). Agriculture has long been neglected in many developing countries, resulting in stagnant economies and widespread hunger and poverty, yet there is considerable evidence, particularly from East Asia, that rapid economic growth is facilitated by a vibrant and healthy agricultural sector (World Bank, 1993). The key role of the agriculture sector in meeting food needs and fostering broad-based economic growth and development must be recognized and exploited. To make this happen, agricultural research systems must be mobilized to develop improved agricultural technologies, and extension systems must be strengthened to disseminate improved technologies.

While expanded agricultural research is urgently needed for all ecoregions, added emphasis should be placed on sustainable productivity increases in areas with significant agricultural potential but with fragile soils, low or irregular rainfall, and widespread poverty and natural resource degradation. Interaction between public-sector agricultural research systems, farmers, private-sector companies that conduct agricultural research, private-sector enterprises in food processing and distribution and NGOs should be strengthened to ensure relevance of research and appropriate distribution of responsibilities. Investments in strategic international and regional agricultural research with large potential international benefits should be expanded to better support national efforts. Biotechnology research in national and international research systems should be expanded to support sustainable intensification of small-scale agriculture in developing countries. Effective partnerships between developing-country research systems, international research institutions and private- and public-sector research institutions in industrialized countries should be forged to bring biotechnology to bear on the agricultural problems of developing countries. Developing countries can address funding and personnel constraints by providing incentives to the private sector to engage in such research, by collaborating with international research programmes, and by seeking private- and public-sector partners in industrialized countries. They should be encouraged to adopt regulations that provide an effective measure of biosafety without crippling the transfer of new products to small farmers.

The fourth priority area of action is to promote sustainable agricultural intensification and ensure sound management of natural resources. Public- and private-sector investments in infrastructure, market development, natural resource conservation, soil improvements, primary education and health care and agricultural research must be expanded in areas with significant agricultural

potential, fragile soils and large concentrations of poverty to address effectively their problems of poverty, food insecurity and natural resource degradation before they worsen or spill over into other regions. In areas of low current productivity, but significant agricultural potential, public policy and public-sector investment should promote sustainable use of existing natural resources to enhance the productivity of agriculture and other rural enterprises. Farmers and local communities should be given incentives to invest in and protect natural resources and to restore degraded lands. Clearly specified systems of rights to use and manage natural resources, including land, water and forests, should be established and enforced. Local control over natural resources must be strengthened and local capacity for organization and management improved. Farmers and communities should be encouraged to implement integrated soil fertility programmes in areas with low soil fertility through policies to ensure long-term property rights to land, access to credit, improved crop varieties and information about production systems; through effective and efficient markets for plant nutrients, and investments in infrastructure and transport systems; and through temporary fertilizer subsidies where prices are high owing to inadequate infrastructure or poorly functioning markets. Integrated pest management programmes should be promoted as the central pest management strategy to reduce use of chemical pesticides, remove pesticide subsidies and increase farmer participation in developing effective and appropriate strategies of pest management. Water policies should be reformed to make better use of existing water supplies by providing water users with appropriate incentives, improving procedures for water allocation and developing and disseminating improved technology for water supply and delivery.

The fifth priority is to develop effective, efficient and low-cost agricultural input and output markets. To obtain gains from improved efficiency and reduced costs of marketing agricultural inputs and outputs, governments should phase out inefficient state-run firms in agricultural input and output markets and create an environment conducive to effective competition among private agents in order to provide producers and consumers with efficient and effective services. Governments should identify their role in agricultural input and output markets and strengthen their capacity to perform this role better while disengaging themselves from functions that should be undertaken by the private sector. Policies and institutions that favour large-scale, capital-intensive enterprises over small-scale, labour-intensive ones should be removed. Market infrastructure of a public goods nature, such as roads, electricity and communications facilities, should be developed and maintained by direct public-sector investment or effective regulation of private-sector investment. Governments should develop and enforce standards, weights and measures, and regulatory instruments essential for effective functioning of markets. Development of small-scale credit and savings institutions should be facilitated. Technical assistance and training could be provided to create or strengthen small-scale, labour-intensive competitive rural enterprises in trade, processing and related marketing activities.

The sixth requirement is to expand and realign international assistance. The current downward trend in international development assistance must be reversed, and industrialized countries allocating less than the United Nations

target of 0.7 per cent of their gross national product (GNP) should rapidly move to that target. Official development assistance, which is only a small fraction of the resources required by developing countries, must be allocated to complement national and local efforts effectively. Official government-to-government assistance should be made available primarily to countries that have demonstrated commitment to reducing poverty, hunger and malnutrition, and to protecting the environment. International development assistance must be realigned to low-income developing countries, primarily in sub-Saharan Africa and South Asia, where the potential for further deterioration of food security and degradation of natural resources is considerable. In higher-income developing countries, concessional aid such as grants should be replaced by internationally available commercial capital, freeing resources for the low-income countries. To improve effectiveness of aid, each recipient country should develop a coherent strategy for achieving its goals related to food security, poverty and natural resources, and should identify the most appropriate uses of international assistance.

The action plans for the World Food Summit and IFPRI's 2020 vision are fully compatible and should be pursued to the fullest extent possible.

CONCLUSIONS

Food insecurity has long been perceived by some to be primarily a problem of insufficient food production rather than insufficient access to food. Yet, as enough food is being produced to meet the basic needs of every person in the world, it is evident that the persistence of food insecurity – with about 840 million chronically undernourished people and 185 million malnourished pre-school children – is increasingly attributable to difficulties in gaining access to sufficient food. Food-insecure people simply do not have the means to grow and/or purchase the needed food. Empowering every individual to have access to remunerative employment, to productive assets such as land and capital, and to productivity-enhancing resources such as appropriate technology, credit, education and health care is essential. Besides enabling every person to acquire the means to grow and/or purchase sufficient food to lead healthy and productive lives, ensuring a food-secure world calls for producing enough food to meet increasing and changing food needs and for meeting food needs from better management of natural resources.

With foresight and decisive action, we can create the conditions that permit food security for all people in the coming years. The action required is not new or unknown; for instance, we know that increased productivity in agricultural production helps, not only to produce more food at lower unit costs and make more efficient use of resources, but also to raise the incomes of farmers and others linked to agriculture and thus improve their capacity to purchase needed food. The action programme outlined earlier will require all relevant parties – individuals, households, farmers, local communities, the private sector, civil society, national governments and the international community – to work together in new or strengthened partnerships; it will require a change in behaviour, priorities and policies; and it will require strengthened cooperation between

developing and industrialized countries and among developing countries. The world's natural resources are capable of supporting sustainable food security for all people, if current rates of degradation are reduced and replaced by appropriate technological change and sustainable use of natural resources (Pinstrup-Andersen and Pandya-Lorch, 1996a).

We have the means to ensure a food-secure world; let us act to make it a reality for each and every person.

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