FOOD NEEDS FOR THE 21ST CENTURY[1]

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I. Introduction

I would like to redefine the topic assigned me as the challenge of providing food security for all in the 21st century. Food needs suggests to me, at least, the simple arithmetic of multiplying population by basic nutritional needs. Food security for the 21st century is much more complex and therefore much more difficult to predict. It is about more than adequate supplies. It is also about reducing undernutrition and enhancing development.

Food security means to me that every individual has access to enough food to maintain a healthy and active life. Ensuring food security for all is a challenge with many dimensions. These are outlined in Matrix 1. There are issues of food security at the household, national and international levels and the focus of policy intervention clearly changes as the time frame lengthens. In the short term, reducing hunger clearly must focus at the household level with enabling actions by nations. Globally there is little to do except provide emergency food aid if it is available. As the time frame lengthens, economic and social development at the national level to increase access of the poor households to food becomes paramount. The international role is to support that development, provide support for international agricultural research and provide a fair trading system. An effective and fair international market those nations who are better at other things than growing food assurance that global markets will be open to them. In the long term productivity enhancement, adequate global supplies and a well functioning trading system are critical.

Thus, it is clear that food security is much more complicated than projecting adequate global supplies for the next thirty years. Understanding the challenge begins on the demand side. Most projections of population suggest a global population of around 8 billion people in 2025, an increase of about 2-1/2 billion people from the 1990's. Population is one of the two drivers of aggregate food demand, income is the other. With modest income growth, food needs in developing countries could almost double in the next 30 years. The composition of aggregate

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Matrix 1 The dimensions of food security: Critical variables			
	short-term (1-3 years)	medium-term (5-15 years)	long-term (25-30years)
Household	Access to Food Nutrition And Health	Access to Income or means to produce food	Poverty eliminated Social infrastructure
National	Safety Nets Nutrition and health	Economic Development Sustainable Production Systems Agricultural Research	Rural and economic development Sustainable Production systems Agricultural Research
Global	Grain Stocks Food Aid	INTERNATIONAL RESEARCH FAIR TRADING SYSTEM Sustainable Global Supplies	INTERNATIONAL RESEARCH FAIR TRADING SYSTEM Sustainable Global Supplies

demand also changes with rising income levels and with where people live. Most of the growth in population over the next 30 years will occur in developing countries. Further in this same period, urban population in developing countries will increase by a number equivalent to global growth (2-1/2 billion). With rising incomes and urbanization, the composition and characteristics of food demand will be significantly altered. More of the food supply will have to be processed, transported and stored. In parallel, the share of the developing country dwellers who can depend on subsistence agricultural production will decline sharply. The implications of this are that a much larger share of food production will enter markets both within and between countries.

These developments on the demand side clearly raise challenges for the global food production system. The fundamental questions are: can the world produce enough food to feed 8 billion and at the same time hopefully reduce the number of undernourished below the current level of 800 million? If so, where will it be produced? Will we break away from the mental mind set of equating food security with national food self-sufficiency and ask where the food should be produced? And finally, does the world have a trading system that will allow increasing quantities of food to flow from surplus to deficit areas?

It is to these questions that the rest of the paper is addressed. I use the three aspects of food security - availability, access and effective utilization (nutrition) - as the framework for my discussion. I will look at four time frames - retrospective (1961-1990), recent past (1990's), and the current situation and the future both medium (2010-2015) and longer term (2020-2025). A summary of the case I shall make is presented in Matrix 2.

II. Performance to Date

1. Retrospective (1960s-1990)

a. Availability

Despite periodic predictions of imminent shortages (1965-66, 1972-74, 1988) the world did remarkably well in expanding food production over the 30 year period 1960-1990. World cereal production more than doubled, per capita food production increased 37%, calories supplied increased 35% and real food prices fell by almost 50%. Regionally average calories available per day increased significantly in the Near East and North Africa, East Asia and Latin America to levels of 2700 calories per day or higher. South Asia grew more slowly and still is a region with significant undernutrition. But Sub-Saharan Africa experienced a decline in per capita food availability. The increases in production came from three sources - biological yield increases, land use intensification (irrigated acreage in developing countries doubled) and expanded area.

b. Access

Yet despite an overall effective global performance, under nutrition remained a serious problem. In 1969-71, 920 million people were undernourished which represented 35% of

Matrix 2 - Elements of Food Security

Time Frame	Availability	Access	Utilization
Retrospective (1961-1990)	**Global** • World Cereal production doubled • Per capita food production increased 37% • Calories supplies increased 35% • real food prices fell by 50% **Regional difficulties** Sub-Sahara Africa - per capita food supplies declined South Asia - slow growth	**1969-71** 920 million people were under nourished. This was 35% of developing country population	Close to 1 billion suffered from deficiencies in one or more micronutrients
Recent Past	**1994-1996** > 70% increase in grain prices **1995** - harvested area down 10% almost all of it in 5 Major exporters and the FSU Stocks fell by 50% Stocks to use ratio fell to 13.2% lowest in history	**1990-1992** 840 million under nourished, 20% of developing country population	1.6 billion at risk of iodine deficiency about 2 billion people affected by iron deficiency (FAO 1996)
Current	• Prices have returned to pre 1994 levels • global production up 7% in 1996 • 5 Major exporters production up 15% in 1996	1996 -- 800 million under nourished	

developing country population. By 1990-1992, the FAO estimate was 840 million undernourished people, now 20% of developing country population. In relative terms there was progress though regional performance varied widely. In 1969-71, 76% of the undernourished lived in Asia (51% in East Asia) and 11% in Sub-Saharan Africa. In 1990-1992, 60% lived in Asia (30% in East Asia) and 25% lived in SSA. But in absolute terms the number diminished very little.

c. Utilization

Though firm data is unavailable it is likely that over 1 billion people suffered from a deficiency in one or more micronutrients (e.g. Vitamin A, iron, iodine, zinc & copper) in the 1960's. In the early 1990's, estimates are that 1.6 billion people are at risk of iodine deficiency and about 2 billion people are affected by iron deficiency (FAO 1996, Paper 5, pp. 6-7).

In sum, improved performance on the supply side, relative but not absolute improvements in reducing undernutrition and an apparent increase in the incidence of micronutrient deficiencies. Therefore, argue many, supply was not a constraint.

2. The Recent Past to the Present (1994-1996)

a. Availability

World grain prices experienced "a spike" in 1994-1996 with wheat, corn and rice prices increasing by 70-100% by April 1996. Since then prices of wheat have returned to 1994 levels. As prices escalated and the stock to use ratio plummeted to its historical low (13.2%) concerns about whether this was the beginning of the period when demand finally outruns supply or simply a short-term perturbation, broke out. Those arguing the case for a prolonged period of shortages and rising prices cited declining growth rates on yields in the 1990s, losses of land from production and water and environmental constraints as powerful indicators for the future. Others argued it was the market overacting to a bad U.S. crop in 1995 and policy changes in the EU and the USA which lowered farmers prices and reduced stocks. They argued production would expand in 1996 and prices would fall back and continue the long-term trend of declining real grain prices.

A more careful analysis of the events of the last two years suggest a more complex set of causes (Ingco, Mitchell and McCalla). Starting with the 1991 European Union (EU) Common Agricultural Policy (CAP) reform, followed by US policy changes in 1995 and continuing adjustments to lower prices in Australia and Canada caused harvested grain areas to decline and stocks to decrease significantly. Between 1981 and 1995 harvested area in the five largest exporters - U.S.A, EU, Canada, Australia and Argentina contracted by 34.5 million hectares accounting for 53% in the global decline in grain area harvested of 65.3 million hectares. Another 41% of the decline is accounted for by reduced grain area in the Former Soviet Union (FSU). This contraction represented an almost 10% reduction in global harvested area. The resulting

decline in output, coupled with policy changes which reduced public stock holding, contracted exporter stocks from 262 million metric tons to 58 million tons (88 percent of the decline in world stocks) and global stocks by 233 million tons, a more than 50% reduction. These trends coupled with lower 1995 production triggered a sharp run up in prices between May of 1995 and April of 1996. A 15% increase in production in these vie exporting countries and a 7-1/2% increase globally in 1986 caused wheat and corn prices to drop sharply to pre 1994 levels by early 1997. Rice prices remain however at close to peak levels. It will clearly take more time for stocks to rebuild. Thus for the moment those arguing that this was a spike, not a change in long-term trends, seemed to win the shortrun argument at least for wheat and corn. But what of the future?

III. The Future

Views of the challenge of food security for all diverge more strongly as the time frame is lengthened. Those using economic projection or simulation models, based significantly on history, tend to project sufficient global supplies at least until 2010. Those projecting on the basis of resource availability and environmental constraints (perhaps these could be called ecological models) all are generally much more pessimistic. The most extreme view combines resource constraints with biological pessimism and foresee serious problems ahead (Brown and Kane). Picking ones way through this mine field is fraught with difficulty and occasional danger. The very nature of projections using compounding growth rates of population and income compared to yield growth rates means that food gaps grow rapidly if the growth rate of demand exceeds supply. In the opposite case, if supply growth rates augmented by land expansion exceed demand growth, real food prices decline (the scenario of most of the last 100 years). Therefore, we look first at the medium term (10-15 years ahead) before turning to the more problematical longer term (20-25 years). Much of the analysis that follows comes from a recent Bank publication (Ingco, Mitchel and McCalla).

1. Medium Term (2010-2015)

a. Availability

Several recent simulation studies have projected global cereal or food balances to 2005, 2010 or 2015. Three studies done at IFPRI, FAO and the World Bank make projections to 2010 and come to similar conclusions (Agcaoili and Rosegrant, 1995; Alexandratos, 1995; and Mitchell and Ingco, 1993). All three studies project grain yields to increase 1.5-1.7% per year, area harvested is expected to increase modestly, global grain demand is projected to grow more slowly and trade in grains is expected to increase. All three studies expect real grain prices to remain constant or decline. Regional food problems are expected to persist in South Asia and especially Sub-Saharan Africa.

In reporting on a conference at IFPRI which reviewed the three projections to 2010, Islam (1995) concluded:

Matrix 2 - Elements of Food Security (cont)

Time Frame	Availability	Access	Utilization
Future: **Medium term** **2010-2015**	Most projections suggest adequate global supplies but some are concerned about resource constraints Differences between optimists and pessimists, focus on yield potential, land expansion/loss and water availability	World Food Summit target of 400 million undernourished by 2015 FAO projects 680 million in 2010	Forcast difficult, will be conditioned by success in poverty reduction and improved nutrition delivery systems
Longer Term **2020-2025**	Food needs in developing countries could nearly double Challenge is serious and will be impossible without appropriate polices and continued expanded investment in research for the development of new technology	Goal: to eliminate under nutrition This would increase projected food demand by 10%	

"There was general agreement the world food supply in 2010 would probably meet global demand but regional problems would occur. South Asia and Sub-Saharan Africa were recognized as the most vulnerable regions. The key to future food supplies was seen as increased productivity, that is, yields must continue to rise; to accomplish this, sustained support for investment in agriculture, including research expenditures, would be needed."

A contrary view is presented by Brown and Kane (1994) who argue that there is little backlog of unused agricultural technology, that fish production has reached its biological limits and that rangeland carrying capacity has been exceeded. They further argue that the demand for water is pressing hydrological limits, that fertilizer responsiveness is declining and that much cropland (especially in China) is being lost to degradation, urbanization and industrialization. The resulting conclusion is very pessimistic with the only possible solution being greatly expanded trade which they see as problematic.

I will return to discuss these striking differences after we discuss the longer term scenarios.

b. Access

Access to food in the future very much depends on success in reducing poverty, especially in Rural areas, and a stimulating widely shared employment intensive growth. The recently concluded World Food Summit set as its target, reducing the number of undernourished to 400 million by 2015. FAO projects, based primarily on a continuation of past trends, that the number of undernourished would be 680 million in 2010.

c. Utilization

Success in reducing nutritional deficiencies of all sorts in the future depends both on improvement in overall nutritional status (access) but also with expanded nutritional education programs and improved nutrition delivery systems. What can be said with assurance is that overall economic growth will not eliminate nutritional issues.

2. The Longer Term (2020-2025)

a. Access

IFPRI (1995) also makes projections to 2020 which show a relatively good global food supply and demand balance in 2020. Real grain prices continue to fall (20% between 1990 and 2020) and real meat prices fall by 10 percent. Trade expands substantially, with imports by developing countries doubling. Food problems persist in Sub-Saharan Africa where imports are projected to triple, likely beyond the region's capacity to pay for them.

IFPRI also reports an alternative scenario where there is lower investment in agricultural research combined with slower income growth. This decline in public investment in agricultural research has severe consequences for the global food situation as it causes real prices to rise and malnutrition to increase. The IFPRI scenario highlights how sensitive long term projection models are to small changes in a particular parameters, in this case research investment.

How then can the economic modellers and the ecological pessimists reach such different conclusions? The reason is found in but four critical projection parameters (assuming they generally agree on the demand side) (McCalla, 1994). These are:

1) the rate of increase in biological yields over the next 30 years
2) the amount of land to be added or lost from agricultural production
3) the amount of land subject to intensification through irrigation
4) the impact of environmental degradation on food production capacity

Being relatively optimistic by projecting even a modest decline in past growth rates on the first three, produces the optimistic scenario given declining population growth rates. Projecting the apparent decline in yield increase in the 1990s (less than 1%) to 2025 plus land loss, no new irrigation and severe resource constraints can lead one to be very pessimistic.

But there are also several things both sides agree on - the need for continued investment in technology generating agricultural research and that farming systems cannot degrade the environment and must increase the efficiency of resource use.

In my judgment the optimists are too optimistic and the pessimists are too pessimistic. Reality suggests that feeding 2-1/2 billion more people well is an enormous challenge. Growth in agricultural output in the long term must come primarily from rising biological yields rather than from area expansion or intensification through irrigation. Why? Because most fertile land is under cultivation and the really suitable and low cost areas for irrigation have already been used. With population growth and urban expansion there will be rising competition for land and water from urban and industrial uses.

Doubling yields in complex farming systems without damaging the environment is an enormous challenge. The challenge is worldwide and both technological and political in nature. We require new technology to allow the development of new, high productivity, environmentally sustainable production systems. It is not more of the same with purchased inputs intensive monoculture. "The political challenge can only be met if international and domestic policies, institutional farm works, and public expenditure patterns are conducive to cost-effective and sustainable agricultural development". (World Bank, 1996)

b. Access

Two general comments under the access heading. First, if the world is successful in eradicating poverty and malnutrition we should both rejoice and redouble our efforts to intensify sustainable production systems. Why? Because eliminating malnutrition would bring 800 million people into the commercial market increasing demand by at least 10%.

The second point to be made is that all of the projections - both optimistic and pessimistic - foresee greatly expanded international trade particularly in grains. Developing countries in particular are expected to substantially increase their dependence on international markets. Further, rising incomes which cause expanded consumption of livestock products to increase demand for feed grains. In this future model, a non-distorted and freely working international market is critical both for exporters such as the U.S. and for importers whose domestic food security will increasingly depend on a reliable and relatively stable international market.

IV. **Concluding Comments**

Let me summarize my conclusions. Future global, national and household food security in the long run can be accomplished if we can develop sustainable production systems capable of nearly doubling output; if we have in place domestic and international policies and institutions which do not discriminate against agriculture and provide appropriate incentive to hundreds of millions of farmers around the world; if we continue to invest in public agricultural research such as through the Consultative Group on International Agricultural Research (CGIAR) and if we stay the course with removing distortion to freer agricultural trade in all countries.

These are four big "ifs" but they must be met. For without them the long term prospects are not very pleasant to contemplate.

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