



Review

Determinants of Food Security in India

K.R. Ashok

Department of Agricultural Economics
Tamil Nadu Agricultural University, Coimbatore-641 003

The food security needs to be viewed in the context of slow growth in agriculture in the last decade and increasing population. In India, agricultural production growth declined to 2.09 per cent per annum in 1990s from 3.82 per cent in 1980s. The most recent figures showed that the growth of agriculture and allied sector declined to 1.6 per cent in 2008-09. In the 1970s food security was mostly considered in terms of food supplies. The modern concept of 'food security' goes beyond mere increase in food production and emphasis people's entitlement to food. "Entitlement" refers to the set of income and resource bundles over which households can establish control and secure their livelihoods. This paper traces supply side and demand side factors that influence the food security.

Agriculture has to double the global food production by 2050, when the global population is estimated to reach 9 billion from 6 billion at present. The challenge therefore is to achieve sustainable food production in the face of an ever-growing population. The high agricultural growth achieved in the 1970s and 80s in many developing countries has lost the steam. Indian agricultural production growth declined to 2.09 per cent per annum in 1990s from 3.82 per cent in 1980s. The most recent figures showed that the growth of agriculture and allied sector declined to 1.6 per cent in 2008-09. The contribution of agriculture and allied sector to the GDP fell from 56 per cent in 1950-51 to 17.8 per cent in 2007-08, though there is no appreciable reduction in the number of people who depend on agriculture. The food security should therefore be viewed in the context of slow growth in agriculture in the last decade and increasing population.

Evolving Concept of Food Security

In the 1970s, food security was mostly considered in terms of national and global food supplies. The modern concept of 'food security' goes beyond mere increase in food production. In mid 80s, it became quite clear that adequate food availability at the national level did not automatically translate into food security at the individual and household levels because of erosion to people's entitlement to food (Borton and Shoham, 1991). "Entitlement" refers to the set of income and resource bundles (e.g. assets, commodities) over which households can establish control and secure their livelihoods. Sen's (1981) theory on food entitlement had a considerable influence on this change in thinking, representing a paradigm shift in the way that famines were conceptualized. FAO defined food security as

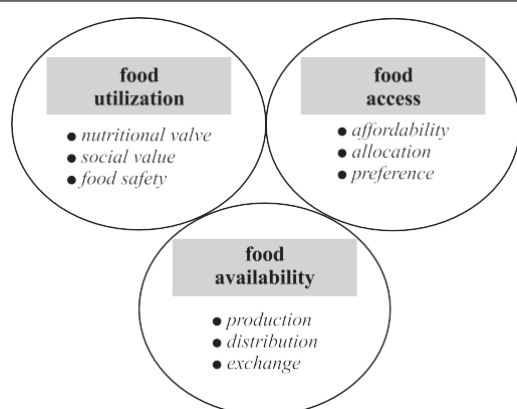
"Ensuring that all people at all times have both physical and economic access to the basic food they need" (FAO, 1983). The most-cited definition of food security is that 'Food security is access by all people at all times to enough food for an active, healthy life' (World Bank, 1986). These definitions stress the different dimensions of food security. Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life (World Food Summit, 1996). Three main dimensions of food security can be identified from this definition: physical availability of food, economic and physical access to food and food utilization. Food security is achieved when all the three dimensions are fulfilled simultaneously. The continuing evolution of food security as an operational concept in public policy has reflected the wider recognition of the complexities of the technical and policy issues involved. Food security analysts have defined two general types of food insecurity (FAO, 2008) (Table 1).

Ingram *et al.*, (2005) proposed the concept of food systems to denote the entire gamut of activities from production to consumption. Food systems are defined as a set of dynamic interactions between and within the biogeophysical and human environments which result in the production, processing, distribution, preparation and consumption of food. They encompass components of: (i) food availability (with elements related to production, distribution and exchange); (ii) food access (with elements related to affordability, allocation and preference) and (iii) food utilization (with elements related to nutritional value, social value and food safety (Figure 1).

*Corresponding author email: ashok10tnau@yahoo.com

Table 1. Chronic and transitory food security

	Chronic Food Insecurity	Transitory Food Insecurity
<i>is...</i>	Long- term or persistent	Short- term and temporary, transitory food insecurity is relatively unpredictable and can emerge suddenly.
<i>occurs when ...</i>	People are unable to meet their minimum food requirements over a sustained period of time.	There is a sudden drop in the ability to produce or access enough food to maintain a good nutritional status.
<i>results from...</i>	Extended periods of poverty, lack of assets and inadequate access to productive or financial resources.	Short-term shocks and fluctuations in food availability and food access, including year-to-year variations in domestic food production, food prices and household incomes.
<i>can be overcome with...</i>	Typical long term development measures such as education or access to productive resources, credit etc.	Early warning capacity and safety net programmes.

**Fig.1 Components of food systems (Ingram et al. 2005)**

Food systems, then, involve much broader considerations than productivity and production alone. They underpin food security, which is the state achieved when food systems operate such that 'all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life' (FAO 1996). Food security is diminished when food systems are stressed. This can be caused by a range of factors in addition to climate and other environmental changes. (Gregory et al 2005).

From the concept of food security and food systems, various components/ activities which ensure food security could be delineated. Broadly these components can be discussed as supply side issues and demand side issues. Supply side issues include production of food grains, role of technology in increasing production, stock levels, price stability, net trade in food grains etc. The demand side issues include increase in per capita income, increase in population, change in tastes and preferences, price of food grains, etc

Supply Aspects

Food grain production

Early paradigms of food security focused on aggregate food supplies and advocated production self-sufficiency as a strategy for nations to achieve

food security. The global production of cereals has increased by 133 per cent since 1961, production of meat rose by 233 per cent. Despite population growth during this period, per capita food availability has increased by 24 per cent to almost 2,800 calories per day. Production increases were driven by improvements in productivity; for instance, cereal yields worldwide rose from 1.4 tons per hectare in the early sixties to 3 tons in the late nineties. Yet while yields increased rapidly-in China, for example, from 1.2 tons to 4.7 tons during this period-they remained stagnant at around 1 ton in sub-Saharan Africa.

Table 2. Food grain production in India

Year	Production (million tonnes)
1966-67	74.23
1970-71	108.42
1980-81	129.59
1990-91	176.39
2000-01	196.81
2005-06	208.60
2006-07	217.28
2007-08	230.78
2008-09 (AE)	229.85

AE=Advance estimate;

Source: Indiastat, June 2009 and Economic Survey, 2009.

The green revolution of the late 60s increased wheat and rice productivity many fold and helped India achieve self sufficiency in food grain production. Between 1950-51 and 2006-07, production of food grains increased at an average annual rate of 2.5 per cent compared to the growth of population which averaged 2.1 per cent during this period. The rate of growth of foodgrain production, however, decelerated to 1.2 per cent during 1990-2007, lower than annual rate of growth of population, averaging 1.9 per cent. Spatially, there was wide variation in productivity across crops and states. For example, the rice productivity ranged from 3510 kg per ha in Punjab to 759 kg per ha in Orissa. It is also interesting to note that Tamil Nadu with second highest productivity in rice only contributed 7.86 per cent of the total production and on the other hand, West Bengal which ranks fifth in productivity contributed the largest share of 19.81 per cent in total rice production of the Country. Uttar Pradesh with third largest share in total production of rice stands at eighth place in productivity.

Recently (2005-06 to 2007-08), the foodgrains production recorded an average annual increase of over 10 million tonnes. The total foodgrains production in 2007-08 was estimated at 230.78 million tonnes as against 217.3 million tonnes in 2006-07 and 208.60 million tonnes in 2005-06 (Table 2). However, food security also includes nutritional security. Domestic production of pulses and oilseeds are still below the domestic requirements. So it is important to undertake new research initiatives and more investments for increasing the production of pulses and oilseeds.

Incentivising production: Minimum support prices

The two important instruments for food management by the Government of India are the Minimum Support Price (MSP) and Central Issue Price (CIP). The main objective of the MSP is to incentivise farmers by ensuring fair value for their produce. The MSP of Rice and Wheat is given in Table 3.

Table 3. Minimum support price (Rs per Quintal)

Year	Rice		Wheat
	Common	Grade 'A'	
2003-04	550	580	630
2004-05	560	590	640
2005-06	570	600	700
2006-07	620	650	850
2007-08	745	775	1000
2008-09	900	930	1080

Note: Including incentive bonus

Source: Agrl Statistics at Glance 2008 & <http://www.dacnet.nic.in/eands/msp/msp-090409.pdf>

The MSP is announced by the Government considering the recommendations of Commission on Agricultural Costs and Prices (CACP). CACP takes into account the cost of cultivation, changes in input prices, input-output price parity, trends in market prices, inter-crop price parity, effect on general price level, parity between prices paid and prices received by the farmers and effect on issue prices, implications for subsidy etc.,. It is pertinent to look into how far MSP succeeded in achieving its stated objective of incentivising farmers in adoption of modern technologies and inputs and increasing the production.

Technology

The agricultural productivity growth witnessed in the late 70s and early eighties was propelled by the green revolution technologies. But the productivity gains from green revolution technologies in Asia and particularly in India have essentially ended (USAID 2003, Sharma 2003, and Ramasamy 2004). Schultz (1964) suggested that agricultural development policies should adopt an approach that expands the smallholder's production frontiers through technological change, as this would be the most cost-effective means to increase low income farmers' welfare. Expansion of production frontier of the Indian agriculture at present depends on technological breakthrough in crop production, which scientists and policy makers often refer to as

'second green revolution' or 'ever green revolution'. Biotechnology offers powerful new tools for improving agricultural productivity, environmental quality, and the nutritional quality of staple foods. But establishment of biotechnology capacity is relatively capital and human resource intensive. Given the number of public and private institutions involved, there is much potential for forging public-private linkages to enhance productivity. These include sharing of costs and benefits, joint ventures, and management and ownership of intellectual property. Although India has developed relatively good capacity in the area of biotechnology, it has also raised number of challenges like development of research capacity, biosafety and IPR regulations, and management of public dialogue on controversial issues.

Precision farming is an integrated agricultural management system which incorporates several technologies. The technological tools often include the global positioning system, geographical information system, yield monitor, and remote sensing. At farm level, precision farming techniques need to be popularized to increase the input use efficiency and to reduce environmental pollution from agrochemicals. System of Rice Intensification (SRI), an innovative method of rice cultivation that relies exclusively on changing agronomic practices is another promising technology. SRI involves no new seed or purchased inputs. Studies on SRI show that farmers' yields under SRI are nearly double on an average and that labor productivity gains likewise appear high, on an average (Barrett et al 2004, Randriamiharisoa, 2002).

Questions are often raised in recent years about the effectiveness and impact of the research system, despite its success in leading technological innovation in the agricultural sector. Many studies have examined the impact of agricultural research in India by estimating internal rates of return to investments. Although there is considerable variation, the average return was about 70 per cent, with a median value in excess of 50 per cent. Interestingly, there is no evidence that the rate of return has declined since the Green Revolution. The studies have also shown that returns to public research investments have been higher than those for public extension or private research (Evenson, Pray, and Rosegrant 1999). These results provide a convincing case for enhancing public funding to agricultural research. This point has been made repeatedly by research leaders to build the case for higher budget allocations for agricultural research.

International trade

The role of international trade in food security under the WTO regime has generated a great deal of debate. Food security under pro liberalization argument implied availability of food products on domestic markets at an affordable price for local consumers. This concept is quite different from the notion of national self sufficiency. Trade has always been used to compensate for a mismatch between

supply and demand among countries. It helps increasing supply and reducing the domestic price for importing countries, and to reduce price volatility due to supply shocks.

The new world order under the WTO regime changed the incentive structure of farmers across the globe. The WTO negotiations on agriculture should concentrate on a concrete timetable to phase out subsidies and create a level playing field among farmers worldwide. Globalisation process has to address issues involving restructuring of tariffs, elimination of trade barriers, export subsidies and sovereignty over plant genetic resources for food and agriculture.

Resource degradation

FAO has emphasized that there are close causal linkages between reducing hunger and the sustainable management of natural resources and ecosystems. With world population expected to reach 8 billion by 2030, pressure on the environment will continue to mount. Use of renewable resources—land, forests, fresh water, coastal areas, fishing grounds, and air—has now exceeded the capacity for regeneration in many regions.

In India nearly 45 per cent of the geographical area is under various kinds of degradation (Table 4). Water erosion, water logging, salinity, acidity, wind erosion are some of the important ecological problems that restrict the sustainability of the food production systems.

Table 4. Land degradation in India in 2007

Type of degradation	Affected area (million ha)
Water erosion	93.68
Wind erosion	9.48
Water logging	14.30
Salinity/alkalinity	5.95
Soil acidity	16.03
Complex problems	7.38
Total degraded area	146.82
Total geographical area	328.60
Per cent of degraded area	44.68

Source: Indiastat accessed on June, 2009

Climate change

More scientific evidences are coming up to the fact that global climate is changing and that the social and economic costs of slowing down global warming and of responding to its impacts will be considerable. However, there remain considerable uncertainties as to when, where and how climate change will affect agricultural production. Even less is known about how climate change might influence other aspects that determine food security, such as the accessibility of food for various societal groups and the stability of food supply. Studies indicate that the developing world would experience an 11 per cent decrease in cultivable rainfed land, with consequent decline in cereal production. Wheat production potential in the sub-tropics is expected

to be the worst affected, with significant declines anticipated in Africa, South Asia, and Latin America. Changes in production potential indicate an increasing stress on resources induced by climate change in many developing countries. India needs to devise responses in the face of uncertainties on the timing, location and severity of climate impacts. The scale of these impacts will be contingent upon global mitigation efforts undertaken in the next few decades. Delayed or limited emission stabilization will necessitate considerably greater investment in risk management and climate change adaptation. Responses to climate change need to occur on several levels, including crop and farm-level adaptations, national-level agriculture-related policies and investments, and regional and global policies and investments. Adaptation strategies include infrastructure investment, water-allocation reform, altered land use, and changes in food trade. With appropriate policy, governance, and management reforms, climate mitigation strategies such as carbon-offset and carbon-trading projects in developing countries, combined with sustainable land use and forestry, can improve rural livelihoods and promote sustainable rural development.

Biofuel production

The emerging biofuels market is a new and significant source of demand for some agricultural commodities such as sugar, maize, cassava, oilseeds and palm oil. The increase in demand for these commodities has been one of the leading factors behind the increase in their prices in world markets which, in turn, has led to higher food prices. A recent report by the World Bank has concluded that 65 per cent of the rise in prices is due to biofuels and factors related to their rapid increase in demand for feedstocks. IMF assessments have also concluded that rising biofuel production, largely due to biofuel policies, is responsible for a significant part of the jump in commodity prices.

Government intervention

The National Food Security Mission (NFSM) is being implemented in 312 identified districts of 17 states of the country. The interventions are covered under NFSM-Rice, NFSM-Wheat and NFSM-Pulses. The interventions under these programmes include demonstrations on improved practices, System of Rice Intensification, promotion of hybrid rice-production and distribution, distribution of HYV seeds, seed minikits, micro-nutrients, zero till seed drills, multi-crop planters, seed drills, rotavators, diesel pump sets, power weeders, knap sack sprayers, plant protection chemicals and bio-pesticides, farmers' field schools, local initiatives, assistance in the form of production and purchase of breeder seeds and foundation and certified seeds; distribution of certified seeds; strengthening of seeds certification agencies etc. The Rashtriya Krishi Vikas Yojana (RKVY) was launched with the objective of integrated development of food crops,

including coarse cereals, minor millets and pulses; agriculture mechanization, soil health and productivity, development of rain-fed farming systems, integrated pest management, market infrastructure, horticulture, animal husbandry, dairying and fisheries etc. During the year 2007-08 an outlay of Rs. 1,500 crore and for the year 2008-09, an outlay of Rs. 2,891.70 crore have been earmarked for this project.

Demand Aspects

Population growth

Population growth is the single most important reason for the growing food insecurity concerns at different points of time and in different countries. The challenge is to achieve sustainable food security in the face of an ever-growing population. India and China the two most populous countries in the world account for nearly 38 per cent of the world population (Fig.2)

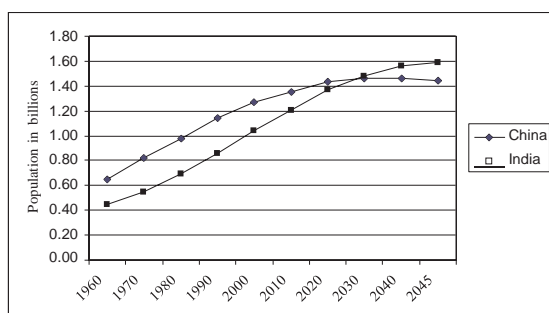


Fig. 2. Population growth in India and China

Source: Department of Economic and Social Affairs of the United Nations Secretariat, World Population Prospects: The 2008 Revision, <http://esa.un.org/unpp>, June 23, 2009.

India overtakes China as the most populous country in the world by 2030. High population levels translate into increased resource demands on an already stressed and largely degraded natural resource base. With limited cultivable land and stagnating yields, ensuring food security in India in the coming decade is a big challenge.

Increasing national income

The per capita net national product has increased from Rs. 16173 in 2000-01 to Rs. 24295 in 2007-08 at constant prices registering an annual growth rate of 5.74 per cent per annum (Table 5). The increased income induces higher demand for food grains especially by people with low levels of income.

Dietary habits are redefined by new driving forces like income growth, globalization, urbanization and corporatised food retailing chains. These forces increase the domestic demand for high-value products in India. The composition of food consumption is shifting from the consumption of grains and other staple crops to vegetables, fruits, dairy, and fish. While the cereal consumption remained more or less constant around 400 g/person/day since 90s, consumption of milk and milk products increased from 148 g/person/day in 90-

Table 5. Per capita net national product

Year	Per capita NNP (Rupees at 1999-00 prices)
1950-51	5708
1960-61	7121
1970-71	8091
1980-81	8594
1990-91	11535
2000-01	16173
2001-02	16769
2002-03	17109
2003-04	18301
2004-05	19331
2005-06	20868
2006-07	22580
2007-08	24295

Source: Economic Survey, 2009

92 to 182 in 01-03. While vegetable oil and vegetable consumption have also increased, pulse consumption has declined in the same period.

Food prices

According to FAO, sharp increases in food prices, particularly for cereals and oilseeds, have been causing concern around the world. Overall food prices are up more than 75% since 2000, and in mid 2008 prices were at their highest since the 1970s. This has serious implications for food security and poverty, particularly for people in developing countries where it impacts on nutrition and health. During the last three years, due to the soaring food and energy prices, the number of hungry people has increased by another 75 million at the end of 2007. This crisis is due to decreasing investments in agriculture in the poorest countries during the last 30 years. The share of agriculture in public development aid declined from 17% in 1980 to 3% in 2006. International community needs to take urgent and coordinated action to combat the negative impacts of soaring food prices on the world's most vulnerable countries and populations. Actions by national governments, with the support of the international community, are required in the short, medium- and long-term, to meet global and household food security needs.

Provision of minimum nutritional support to the poor through subsidized food grains and ensuring price stability are the twin objectives of the food security system in India. The poor are protected from rising foodgrain prices through an elaborate network of Public Distribution System (PDS). The important objectives of public distribution system in India are to distribute foodgrains to the consumers particularly the vulnerable sections of the society at affordable prices and maintenance of food buffer stocks for food security and price stability. The years 2001-03 witnessed high levels of stock in the central pool, reaching a peak of 58.11 million tonnes, an all-time record, in 2002 (Table 6). The stock position in the last decade was above the minimum bufferstock norm and adequate for meeting the requirements under targeted public distribution system and welfare

Table 6. Buffer stock of food grains in India

as on	In million tonnes
1.7.1999	24.40
1.7.2000	31.90
1.7.2001	45.80
1.7.2002	58.11
1.7.2003	48.20
1.1.2004	25.02
1.1.2005	21.70
1.1.2006	19.26
1.1.2007	17.49
1.1.2008	19.19
1.1.2009	35.79

Source: India stat and Economic Survey 2009

schemes.

The difference between economic cost of foodgrains and the issue price is reimbursed to Food Corporation of India (FCI). Food subsidy provided to FCI and states/ UTs undertaking DCP operations showed an annual increase of above 30 per cent during the period from 2000-01 to 2002-03. The food subsidy in 2007-08 was Rs. 312600 million (Table 7).

Table 7. Food subsidy in India

Year	In million Rs
2000-01	120100
2001-02	174940
2002-03	241760
2003-04	251600
2004-05	257460
2005-06	230710
2006-07	238280
2007-08	312600

Source: Economic survey 2009

Conclusion

The first Millennium Development Goal aims at reducing the proportion of people whose income is less than 1 dollar a day by half between 1990 and 2015. The Rome Declaration on World Food Security reaffirms the right of everyone to have access to safe and nutritious food. At the global level, the South Asian region is more chronically food insecure than any other region in the world and India ranks 65th out of 84 countries in the Global Hunger Index for 2009. Food security in India is an important milestone in achieving the Millennium Development Goal of reducing global hunger as much of the population in South Asia is in India. The green revolution of the late 60s and 70s increased wheat and rice productivity many fold and today India is one of the largest producers of food grains in the world. But the challenge is to feed the growing population, improving the people's entitlement to food and diversified production to meet the demands of the income-induced diet diversification. On the supply side, improving agricultural productivity is one of the most effective means to improve food security. But strategies for increasing productivity has to be

viewed in the context of scarcity and degradation of land and water resources, greater intensity and frequency of extreme weather such as floods and droughts, increasing small and marginal farms and declining public investments.

Although the gloomy forecasts of Malthus proved wrong, still there is lot to learn from the Malthusian wisdom. Population growth threatens global food security and the earth's finite natural resources. Increasing food prices, 'fatigue' in green revolution technologies and degradation of natural resource have brought food security once again to the centre stage of the policy arena and it is the duty of the international community to address the issue earnestly.

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